Influence of software development processes on organisational performance: Case study of a petroleum company in South Africa

by

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DECLARATION

I, Keagaletse Portia Motshware, student number 205211402, declare that the content of this dissertation represents my own unaided work, and that the dissertation 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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ABSTRACT

Business requirements and needs continue to change rapidly. Thus, many organisations depend on their IT for enablement and support as their needs change through software. Organisational culture plays a significant role in IT implementation and influences organisational performance. Organisational culture manifested in beliefs and assumptions, values, attitudes, and behaviours of employees, is a valued source of an organisation's competitive advantage. In today's rapidly changing environment, the achievement of IT enablement through standardised software development processes is vital for the organisation's sustainability and support as their needs continue to change through software. Furthermore, effective teamwork is essential for the achievement of IT enablement.

Software development is a challenging task performed by humans. It includes interactions between humans, methods, and tools to develop a complete quality-oriented software system. The study aimed at exploring the nature of factors associated with software development processes within a case study context, whilst taking cognizance of the impact they have on the performance of the organisation itself. A subjectivist philosophical stance was followed, and epistemology lay within the interpretivist paradigm. The study is qualitative. To address the aim and meet the objective of this study, two main questions were asked: 1) What factors are associated with the software development processes evident in organisational culture in an IS/IT department of a petrochemical company in the Western Cape? 2) How do the factors that are associated with software development processes impact organisational performance?

An inductive research approach was followed, while a case study conducted in a real-world, privately owned petrochemical organisation context was used as a research strategy. The research design included a non-probabilistic, purposively, and conveniently selected sample, comprised of technical and non-technical participants in the IT/IS department within the selected organisation. This formed the unit of analysis, while eight selected participants in the organisation formed the unit of observation. The participants were selected to answer research questions ensuring an adequate sample size for the thematic analysis.

Data was collected, employing a semi-structured protocol through interviews, and these were digitally recorded via Microsoft Teams. The study employed ATLAS.ti 9 as a qualitative data analysis tool to encode both relevant literature sources and empirical data in the search for thick and rich data leading to emergent themes.

After synthesizing the empirical data, the study outlined six emergent themes. Thus, Table 4.1 in the study illustrates the relationship between emergent themes and associated factors. Thus, Figure 5-2 in the study concretised a proposed framework of guidelines to an approach that could mitigate some of the challenges faced by the selected organisation as well as other similar organisations in the industry. The framework addressed findings of the study associated with research questions MRQ1 and MRQ2 with respective objectives MRO1 and MRO2 as outlined in Table 5-1.

This study addressed a gap in published literature sources regarding the identification and characterisation of relevant factors associated with software development processes. Additionally, it acknowledged a need to explore the impact of these factors on perceived operational quality and organisational performance.

Thus, it is recommended that the guidelines presented in this research are followed and that automated business processes be introduced and adopted by the other eight role-players involved in the software development process. Furthermore, the organisation should invest in software quality tools and standards for support to improve the process. Ethical requirements as requested by CPUT are fulfilled.

ACKNOWLEDGEMENTS

I wish to formally recognize the support I have received during the duration of this project.

Firstly, I would like to thank the God Almighty for giving me life, wisdom, courage, love and strength. Secondly, I would like to extend my sincere gratitude to Prof. Ephius Ruhode and to my supervisor Dr Patricia Harpur for their constant guidance and mentorship throughout these years. Your wealth of knowledge has enabled me to challenge my academic capabilities, while further gaining valuable experience to equip me with the necessary skills that are relevant to my future endeavours.

I would like to thank the Department of Information Technology (IT) at CPUT and a petrochemical organisation for allowing and supporting me in carrying out this research. I would like to thank my late mother, Outsonkane Motshware, for her support while she was still alive. I will always love you and may your soul rest in peace. The completion of this dissertation would not have been possible without my support group the 5Ms. Thank you for sharing your knowledge Chiedza, Emmanuel, Marvin and Mputi.

A REFLEXIVE JOURNEY

I struggled with this research at the worst time of my life. I was just about to complete my dissertation when my mother's health began to deteriorate. Almost 15 years ago, I left my family in Gauteng (Soweto) and North West (Vryburg). They are the people who had given me everything to be where I am today in Cape Town in the Western Cape . As the only daughter, I felt obligated to take care of my mother. To be closer to her, I decided to take a trip during the Coronavirus pandemic outbreak. However, her condition deteriorated and she passed away after a few weeks of being in a vegetative state. To say that I was in a state of turmoil is an understatement.

My mother graduated from several universities across South Africa, thus, she understood the value of education. She worked very hard to support us and never asked us to help her. In her mind our only job was to go to school and obtain degrees. My master's degree is my greatest tribute to my mother's sacrifices for her children's education, but unfortunately, she did not live long enough to see it.

My grief made me lose my motivation temporarily. Grief is a very uncomfortable place to be stuck in. It is so easy to get trapped in that numbing sadness. Many times I had to convince myself not

to give up. With the help of my life partner Gideon Kella and academic advisors, Dr Patricia Harpur and Prof. Ruhode, I was able to deal with my sadness in my way to be able to move on. Their understanding and patience allowed me to feel, say and think for me to heal. In the end, my dissertation saved me and gave me back my focus.

When I started my master's program, I was extremely excited, but I was also very intimidated. I felt extremely inferior to the other students, because they all appeared smarter and better educated than I was (PhD candidates). With English being my second language, academic writing did not come easy. My drive and determination helped me to overcome my fear of failing. Writing my dissertation has been the most challenging, exhausting, yet extremely rewarding endeavor in my life. It was a long and difficult journey for me.

From my experience, it is easy to get lost along the way and to give in to distractions. But with perseverance and hard work, the finishing line is achievable. The experience made me realize that I am more than I ever thought I was. It changed me. I came out stronger and better. Although it was mainly an academic endeavor, the physical strength to multitask and the emotional resilience to continue when life-changing events happened, were vital necessities that made my dream a reality. Because I overcame my fears and limitations, I came out more optimistic of what the future might bring.

DEDICATION

This research is dedicated to:

- Mrs Revelation Motshware, my late mother, for encouraging me to study. May her soul rest in peace.
- Mr Tolo, my later brother, gone too soon ntwana May his soul rest in peace.
- Mr Gideon Kella, my love, thank you for all your support. I would not have been able to do this without your encouragement.
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GLOSSARY

Abbreviations/Acronyms	Full word/Term
BCIS	Bachelor of Computer Information Systems
BInfoSys	Bachelor of Information Systems
BSc Hons	Bachelor of Science Honours
BTech	Bachelor of Technology
CPUT	Cape Peninsula University of Technology
DipIT	Diploma in Information Technology
HF	Human Factor
IT	Information Technology
IPR	Interview Protocol Refinement Framework
M.Sc.	Master of Science
MRO1	Main Objective 1
MRO2	Main Objective 2
MRQ1	Main Research Question 1
MRQ2	Main Research Question 2
OC	Organisation Culture
SDLC	Software Development Cycle
SQ	Software Quality
TW	Teamwork

1 CHAPTER ONE: INTRODUCTION

1.1 Introduction

Strategies are enabled by modernizing and digitizing operations in many locations around the continent (Ernst & Young, 2018). For this organisation to benefit from their IT investments, software quality must remain high. Improvement in process automation potentially improves how this organisation does business. Consequently, operational efficiency may expand.

Business requirements and needs continue to change and do so rapidly (Matharu, Mishra, Singh, & Upadhyay., 2015). Thus, many organisations depend on their Information technology (IT) for enablement and support as their needs change through software (Mkhomazi & Iyamu, 2014). Furthermore, effective software development processes are most imperative for many organisations (Sekgweleo, 2015). Software quality is critically important, because of its significant impact on the value generated by the investment in IT (Sekgweleo, 2018).

Software development is a challenging task performed by humans (Nagappan, Murphy & Basili 2008). It includes interactions between humans, methods and tools to develop a complete software system (Calp & Akcayol, 2015). Human factors such as problem-solving, cognitive skills, and social interaction, play a significant part in software development and quality (Cleland-huang & Capretz, 2014). For the software project to be successful, each company adopts the best suitable framework that their software development team must follow, to ensure that the designed solution meets the requirements that support business strategic goals and objectives (Sekgweleo, 2018). A petroleum organisation emphasized that investment in digital technology provides opportunities for competitive advantage (Ernst & Young, 2018).

1.2 Statement of the Research Problem

Within a petroleum organisation, there is little evidence of standard software development processes. Consequently, the quality aspects of the final products are too low as indicated by a persistent failure to meet the expectations of the target users. Due to a lack of standard development methods and processes within the organisation, the factors element becomes difficult to assess, and this has been proved to affect the quality of the software (Ernst & Young, 2018).

1.3 Background to the Research

The background is sourced from the consultancy work of various consultancy institutions that were commissioned by the organisation and which is the focus of the study.

1.4 The Current Situation:

Downstream oil and energy dealers are agile. They focus on digital innovation, data analysis and the rapid and regular deployment of technology. Consequential digitalisation enables improvements to customer experience (Ernst & Young, 2015). These factors define an ever-changing and completive landscape. A certain petroleum organisation found itself to be falling behind the competition, and hence started to lose the market share, and this put a financial strain on the business (Ernst & Young, 2018).

As mentioned by Ernst and Young (2018), the organisation saw that all metrics, such as customer service feedback, cost base, the economic environment, and employees' response proposed changes. The decision makers consulted to create the case for change. The organisation recognized that it was difficult to get different outcomes without changing the way they operated, therefore they implemented the new approach that boosted business growth, while providing a higher customer experience driven by technological innovation (Ernst & Young, 2017).

The organisation seeks to explore the IT capabilities which comprise its competitive advantage, by automating business processes and modernizing operating environments (production and office automation). These should take place at an unprecedented rate to save the company from losing more market share and sustainable competitive advantage (Ernst & Young, 2017). The

organisation needs to change the rate at which new software is released, to enable the company strategy that is premised around agility and responsiveness.

The effect of human factors in their software development process becomes even more critical to ensure that the quality aspects of their IT enablement is attained, and thereby facilitate greater process automation (Ghafir et al., 2018).

The organisation prides itself with its human capital – they embrace the people-focused culture that espouses teamwork, collaboration, and shared success amongst some of their values. An emphasis on relevant factors supports the achievement of improvements through IT innovations that are associated with high-quality software development capabilities.

1.5 Aim of the Study

This study explores the nature of factors associated with software development processes within a case study context, whilst taking cognizance of their impact on the performance of the organisation itself.

1.6 Preliminary Literature Review

This section presents the acknowledgement and recognition of existing studies (Denney & Tewksbury, 2013). Emergent themes from literature sources: Organisational Culture (OC), Human Factors (HF), Software Development Process (SDP), Teamwork (TW), IT as an Enabler of Organisational Performance (IT) and Software Quality (SQ).

1.6.1 Organisational Culture

Organisational Culture (OC), is the way people think, act and react to process improvement missions, therefore it creates the foundation for an organisation (Smith, 2011). Accordingly, Atiku Chitakunye and Fields (2014) added that the organisational culture incorporates the implicit values, beliefs and rules that guide and nurture employees' attitudes and behaviours. OC affects the level of collaboration amongst employees (Lee, Shiue & Chen, 2016), while argued that organisational performance is intricately intertwined with organisational cultures. Because of this belief, Pinho, Rodrigues and Dibb (2014) add that, OC has accrued much interest in the literature.

As noted by Morcos (2018), capitalizing on the organisational culture can have an undeniable influence on productivity.

Types of Organisational Culture

As identified by Mashile, Munyeka and Ndlovu (2021), there are four types of organisational culture: clan, adhocracy, market and hierarchical culture. These are discussed below.

Accordingly, Wanjiku and Lumwagi (2014) defined clan culture as the type of OC that puts emphasis on human relations and espouses flexible operation procedures, focusing on internal relationships. For example, employees in clan culture value participatory engagement, teamwork, and consensus-building. Adhocracy is the OC type that is most lively, thus, employees are empowered and risk-taking is encouraged (Atiku et al., 2014). Market culture employees are assigned with goals that they give their all to achieve. Their performance is closely monitored and therefore it is not unusual for employees to be rewarded and punished (Alshamrani & Bahattab, 2015). Hierarchy culture is defined as the type of culture that believes in the formality, rules, standard operating procedures and hierarchical coordination. This culture may be found in large and small, formal or informal, public or private organisations, such as government, corporations, churches, schools, political parties, and even in households (Felipe, 2017).

1.6.2 Human Factors

Human factors (HF), as simplified by Cleland-huang and Capretz (2014), are the study of how humans act physically and psychologically regarding skills, limitations and other factors, such as the design of tools, systems, tasks, jobs and environments for being productive. Calp and Akcayol (2015) state that to make a workable and successful software product, skilled people are required to understand the business area and requirements.

Thus, collaboration and interaction are to be encouraged among individuals to enable knowledge-sharing (Kaur, 2015). Many software projects produce artefacts with poor quality, or they go beyond the budget. This happens not only because software development technologies and methodologies still need further investigations, but also because of human factors (Dubois & Tamburrelli, 2013; Sekgweleo, 2018).

1.6.3 Software Development Process

Software development process (SDP) is a framework that ensures that the designed solution meets the user requirements that support business strategic goals and objectives (Matharu et al., 2015). SDP includes collaborations amongst humans, processes and tools to create a finished product (Wagner & Ruhe 2018). This process is achieved by teams consisting of several people. Usually, these people work through an organisational structure, reporting to a manager or a couple of managers (Sekgweleo, 2018). Wagner and Ruhe, 2018 add that SDP is a sociotechnical system that entails human and technical entities, and that when working together they can address a wide range of issues that may be too difficult to address by either individuals or technologies that are working alone.

There are different software development models available to systematize and define the software development process, e.g. Waterfall model, Iterative development, Prototyping, Spiral model and Rapid application development (RAD) (Kaur, 2015). Even though there are several models, each company adopts the best suitable model, which will help facilitate the software development process and that could ensure that the designed solution meets the user requirements that support business strategic goals and objectives (Sekgweleo, 2018). Software development life cycle can be separated into small sections called phases, which are described as requirements gathering and analysis; designing; coding; testing; and maintenance and support (Matharu et al. 2015).

1.6.4 IT as an Enabler of Organisational Performance

Information technology (IT) is a computer-based tool that is used to systematize responsibilities such as basic information processing that is needed for an organisation, and advanced processes such as production, development and logistics (Nikoloski, 2014). IT has a great impact on the organisation's success or failure (Wagner & Ruhe, 2018). In many organisations, business and IT divisions are working closely together (Yeow, Soh and Hansen, 2018).Successful companies provide evidence of alignment of IT elements with business strategies and plans. Some organisations implement strategies to efficiently support their activities and operations, leading to greater profitability (Iyamu, Nehemia-Maletzky and Irja, 2016). Therefore, IT empowers businesses to function efficiently and profitably (Sekgweleo, 2018).

1.6.5 Software Quality

Software quality (SQ) is the level at which an organisation defines a set of desired features that are combined into a product to advance its lifespan performance (Kaur & Sengupta, 2013). To remain competitive in the ever-evolving market, a better software quality that is more manageable should be developed (Calp & Akcayol, 2015). As explained by Gupta, Ahlawat and Sagar, (2017) a high-quality product is one that can be associated with its several quality factors.

Software quality factors

The common software quality attributes are: functionality, reliability, usability, efficiency, maintainability, and portability (Miguel, Mauricio & Rodríguez, 2014).

- Functionality explains the level to which the software product delivers functions that meet specified requirements (Miguel et al., 2014).
- Reliability discusses the level at which the software product can maintain an indicated level of performance Gupta et al. (2017)
- Usability discusses usability of the software product (Salvador, Nakasone & Pow-Sang, 2014).
- Efficiency is the level of accuracy with which the software product can deliver (Miguel et al., 2014).
- Maintainability is the competence of the software to be modified. This may include the improvements of the software to changes in functional and non-functional specifications (Gupta et al., 2017).
- Portability is the design and implementation of applications for supporting their use in systems other than the initial target system (Kaur, Sengupta & Ork, 2011).

1.7 Research Questions and Objectives

Concerning the petrochemical organisation introduced earlier in the background section, this study poses two main research questions (MRQs) and two main research objectives (MROs). These are listed below in Table 1 as follows:

Table 1-1 Mapping research questions and objectives to chapter sections

Research Questions and Objectives	Chapter sections
MRQ1: What factors are associated with the software development processes evident in organisational culture in an IS/IT department of a petrochemical company in the Western Cape? MRO1: To explore the factors associated with the software development processes associated with an IS/IT department.	2.2, 2.3, 2.4, 2.5
MRQ2: How do factors associated with software development processes impact organisational performance? MRO2: To examine the potential impact of factors associated with software development processes on organisational performance.	2.6, 2.7

1.8 Research Design and Methodology

The purpose of this study was to explore the nature of factors associated with software development processes within a case study context, whilst taking cognizance of their impact on the performance of the organisation itself. To achieve this goal, various methods and approaches underpinning the study are discussed. These include a qualitative research approach, case studies and data collection approaches.

1.8.1 Research philosophy

As mentioned by Guba and Lincoln (1994), the question of the use of research methods is secondary to the research paradigm in the research. Thus, a research paradigm is defined as "the basic belief system or worldview that guides the investigator, not only in choices of the method but in ontologically and epistemologically fundamental ways" (Guba & Lincoln, 1994, p 105). Therefore, it can be inferred that the selected research philosophy encompasses assumptions which reinforce the research strategy and methods chosen as part of that strategy (Creswell, 2009).

1.8.2 Epistemology

Epistemology searches for information and facts that can be proved undoubtedly in the field of research. Therefore, epistemology can follow several paradigms such as constructionist, interpretive and post-positivist (Ihuah & Eaton, 2013). The study employs the inductive and interpretivism approach to explore participants' subjective views of their experience in their environments.

Interpretivist research is “guided by the researcher’s set of beliefs and feelings about the world and how it should be understood and studied” (Miskon, Bandara & Fielt, 2015). Furthermore, it helps in understanding people, how things are happening, and what can happen in the future. It makes use of observations, interviews and analysis of current literature to get a meaningful reality (Thanh & Thanh, 2015).

1.8.3 Research method

Research methodology is described as procedures, ways, methods and techniques used to collect the required information relating to the research objective (Given, 2008).This study is qualitative in nature. The qualitative approach can dig deeper into peoples' experiences, behaviours, thoughts and beliefs. By engaging directly with participants and allowing them to give their understanding, will help the researcher to explore why things occur the way they do during the production of the software within the organisation (Sutton & Austin, 2015). As mentioned by Creswell (2009), we conduct qualitative research, because we want to understand the context or setting in which participants of a study address a complex problem or issue.

1.8.4 Research context

An exploratory case study underpins this study. The intent to employ a case study strategy is because it involves the study of a case within an existing real-life context or setting (Yin, 2003). Furthermore, the case study strategy simplifies questions such as the ‘how’ and ‘why’ of an event or phenomena (Yin, 2013). Exploratory research allows people to use their experiences, perceptions and skills to suggest different and new ways to understand and interpret the fact (Reiter, 2013). One organisation, a privately-owned petroleum organisation with a history dating back to 1881, is selected as a case. It has over 1000 employees, of which 35 are in the computing environment.

1.8.5 Data collection methods

The study employed semi-structured interviews and documentation in the data-collection process. Data collection is a method of gathering data from participants during a scientific investigation period (Bhattacherjee, 2012). It assists the researcher to set boundaries for the study. Data can be gathered through several data-collection techniques such as interviews, questionnaires, observations and documentation, as indicated by Creswell (2007). Data collection methods impact the trustworthiness and validity of the outcomes (Yang, Wang & Su, 2006).

Semi-structured interviews based on a custom-designed protocol were used for the interviewer to explain the questions that may not be understood by the respondent, and this allowed the interviewer to ask follow-up questions when needed. The strategy was to gather an understanding

of participant approaches, views and actions (Harris & Brown 2017). The researcher will record interviews digitally and transcription will occur thereafter.

Organisational documents such as user manuals, business requirements, functional specifications and reports are used in the study to supplement the data gathered during interviews. There are two kinds of documentation – found documents and research-generated documents, as indicated by Creswell (2007). Found documents are those found in the organisation before the research was conducted, whereas research-generated documents are those prepared for research (Saunders & Thornhill, 2015).

1.8.6 Data analysis methods

The study employed ATLAS.ti as a qualitative data analysis tool. The intention is for encoding both relevant literature sources and empirical data in the search for thick and rich data, leading to emergent themes (Romero, 2016). The use of specialized software such as ATLAS.ti, assists and supports analysis, extending the mental capacity for organizing and being systematic (Friese, 2014). The study did not depend on a pre-existing codebook, however, it used open and axial coding. Thus, the study was not based on existing theory, but it was only based on the meaning that emerged from the data (Romero, 2016).

1.8.7 Sample

The research design included a non-probabilistic, purposively and conveniently selected sample, comprised of technical and non-technical participants in the IT/IS department within the selected organisation, which formed the unit of analysis – a selected eight participants within the organisation formed the unit of observation.

In determining samples for this qualitative research, it was not so much whether the sample size was small or large, but the relevance to the research topic that determined how participants were selected(Fusch & Ness, 2015)

Units of Analysis

The sample consisting of six technical (IT) participants and two non-technical (Business) participants. Participants are clarified in the table below. Units of analysis are the main objects that are observed in a study. Bhattacherjee (2012) defines the units of analysis as a person, group or object that are studied to be understood. Table 1-2 below illustrates the sample used for the study.

Table 1-2: Units of Analysis

Case	**Technical (IT)**	**Non-Technical**
Privately held petroleum organisation	Analyst Developer	System Business Analyst
	Intermediate Developer	Project Manager
	Team Lead	
	Senior System Specialist	
	Junior Developer	
	Senior Developer	

1.9 Delineation of the Research

Research is often accompanied by many limitations (Bhattacherjee, 2012), thus, the study has identified the following limitations:

- This study is restricted to a petrochemical organisation in the Western Cape.
- The study concerns the identification of factors associated with software development processes.
- It did not concern the evaluation of software quality.
- Although the impact of factors and processes will not be measured, perceptions were explored.

1.10 Significant Contributions to the Study

Appropriate to the study, the researcher intends making significant contributions to the body of knowledge practically, methodologically and theoretically. The practical contributions of the study are particularly aimed at assisting decision makers within the organisation, as well as the managers at large in the petrochemical industry, in deriving essential information for identifying the key factors linked to the production of software, whilst endeavoring to prioritize the critical factors pertinent to the software development process. The overall intention underpinning this contribution links to the achievement of improved software quality for the betterment of the organisational performance in the petrochemical industry in the Western Cape.

The study will contribute knowledge to qualitative research design and methods. For example, it employed extensive use of ATLAS. ti, a qualitative data analysis tool to analyse literature and empirical sources to produce a synthesized, crystalized and focused perspective. Thus, working knowledge of thematic analysis contributes to methodological perspectives. Study outputs potentially include journal article and conference paper publications.

Finally, the study contributes theoretically to the body of knowledge by extending theoretical perspectives associated with software development processes in large development contexts.

1.11 Ethical Considerations

The researcher will abide by the Research Code of Ethics of CPUT. The researcher provided the consent form and requested the respondents to complete it as a guarantee that their identities will not be revealed. Participants were informed about their right to withdraw from the study. The study will not publish participants' names and anonymity and confidentiality will be emphasized in briefings. Participants will receive information on the study if required.

1.12 Expected Outcomes

Study outputs potentially include journal article and conference paper publications.

1.13 Structure of the Dissertation

The study is divided into five chapters as summarized in Figure 1-1 below:

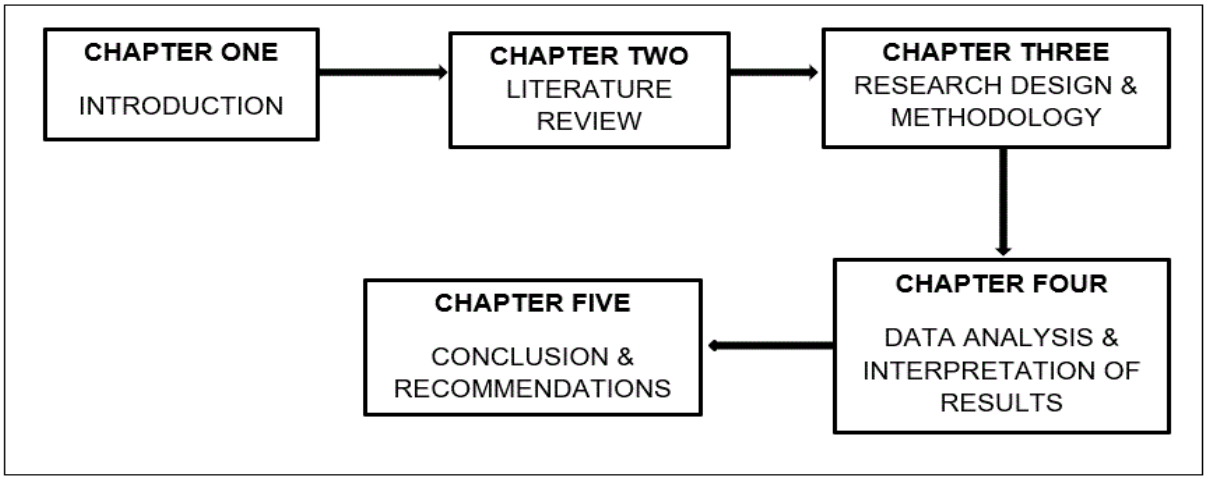


Figure 1-1: outlines the structure of the study.

CHAPTER ONE: Introduction

This chapter provides the introduction to the study, including the research problem, research objectives and research questions. This chapter also covers the literature review that relates to the study and the research methodologies applied. Thus, this chapter is an overview of the entire study – explaining how the study is organised.

CHAPTER TWO: Detailed literature review

This chapter presents the acknowledgement and recognition of existing studies to support the objectives of the research. The second chapter solely focuses on the six themes that emerged from the literature review, founded upon empirical groundings, which aimed at assisting the researcher to explore and gain an in-depth understanding about the nature of factors associated with software development processes, whilst taking cognizance of their impact on the performance of the organisation itself.

Themes that emerged: Organisational Culture (OC), Human Factors (HF), Software Development Process (SDP), Teamwork (TW), Information Technology as an Enabler of Organisational Performance (IT) and Software Quality (SQ) .The themes were then discussed in chronological order.

CHAPTER THREE: Research design and methodology

It explains that the methodology was appropriate for the research at hand. It clearly described reasons for the methodology selection as well as how, when and where the researcher performed the research and selected the population sample of a triangulation of respondents, with the professional craft of knowledge, personal practical knowledge and the understanding about the software production practices, also answering research questions to ensure an adequate sample size for the thematic analysis.

CHAPTER FOUR: Data analysis and Interpretation of results

The following section summarizes the degree to which the results of this study will analyse data gathered and interpret the results.

CHAPTER FIVE: Conclusions and recommendations

This chapter draws on the previous chapters for information, and it provides a conclusion and recommendations of the research study. The conclusions have been drawn from the analysis of the data, findings from the analysis and interpretation of the findings. The findings became the results from the answers to the research questions. To conclude the research report, this chapter is further characterized as follows: the overview of the research, research contributions, conclusion, recommendation, delimitations of the study, limitation of the study, further research, and summary. It develops a conceptual model, based on the results.

1.14 SUMMARY OF CHAPTER ONE

The study emphasizes each of the concepts mentioned in the literature concerning the petroleum organisation case as introduced earlier in Section 1.4. The study acknowledged and recognized the existing studies to support the literature of the study. Appropriate to the study qualitative and exploratory methods are chosen within the case study context to construct questions of clarity by engaging in conversations with the participants thorough a semi-structured interview approach.

2 CHAPTER TWO: DETAILED LITERATURE REVIEW

2.1 Introduction

The previous introductory chapter outlined the structure of the research study conducted and the research context. The aim of the study was to explore the nature of factors associated with software development processes within a case study context, whilst taking cognizance of their impact on the performance of the organisation itself. The overall intention underpinning this contribution links to the achievement of improved software quality for the betterment of the organisational performance in the petrochemical industry in the Western Cape.

The second chapter of the study encapsulates a comprehensive literature review founded upon empirical groundings (Denney & Tewksbury, 2013). From numerous, literature sources six themes emerged that were explored: Organisational Culture (OC), Human Factors (HF) Software Development Process (SDP), Teamwork (TW), Information Technology as an Enabler of Organisational Performance (IT) and Software Quality (SQ). The themes are then discussed in chronological order as mentioned above. The first theme to be discussed is Organisational Culture (OC).

2.2 Organisational Culture

Due to the dynamic nature of business activities currently, the global economy needs an adaptive culture for sustainability and productivity (Atiku et al., 2014). Notwithstanding this, the authors further explained that one of the determinant factors responsible for the accomplishment of business sustainability, is organisational culture through its innovative orientation (Atiku et al., 2014). Sokro (2012) defined organisational culture (OC) as a system of shared values and beliefs that interact with the employees, the organisation's structures, and to produce behavioural norms.

Ng'ang'a and Wesonga (2012) support the viewpoints by stating that beliefs are assumptions about reality, and they are derived and strengthened by experience and values as assumptions about ethics that are required and that are worth striving for. Notwithstanding this, the authors further explained that OC can be one of the most important means of improving organisational performance. OC serves as a guideline to nurturing and shaping employee attitudes and behaviours to accomplish organisational goals and objectives (organisational performance) (Suppiah & Sandhu, 2011).

Therefore, OC studies have proliferated in the management literature in recent years as noted by (Felipe, Roldán& Leal-Rodríguez 2017).OC is being stressed as a key component of a business strategy, and research shows that getting it wrong can be an expensive mistake (Khan & Khandaker, 2016). Similarly, as noted by Joseph and Kibera (2019), having the right culture is critical to sustainably achieving the desired results. Emerole (2013) ascertained that although OC is vital, it may not guarantee success, but organisations with solid cultures have almost always done better than their competitors.

As noted by Suppiah and Sandhu (2011), based on the works of Cameron and Quinn (2011), attention to the notion of OC began seriously in the 1980s when organisation theorists began referring to organisations as "socially constructed systems of meanings". Thus, Emerole (2013) noted that OC has an influence on the communications, coordination and teamwork of members in an organisation. Each organisation though is different and will need to implement a unique type of culture to suit the business goals and strategy (Motilewa, Agboola & Adeniji 2015).

Furthermore, Sokro (2012) based on the works of Schein and Night (2009), also backed this thought by suggesting that it is tempting to highlight the significance of OC for performance, growth and success. Even though some authors were against the link between the OC and performance, most of the theorists have come up with adequate pieces of evidence, describing the link between the OC and the performance of the company. For instance, Joseph and Kibera (2019) suggest that performance can be understood better by exploring the OC, as organisations respond to changing settings based on their established culture.

Thus, Khan and Khandaker (2016) ascertain that OC matters, because organisations experience its impact on performance every day. Therefore, it should be managed with the same skill and attention that organisations give to their strategy, financials and other key performance measures. On the contrary, Motilewa et al. (2015) posit that the objective of studying OC is to help understand organisational life better. Understanding organisational life is thus significant, as it is generally acknowledged that organisational cultures have an impact on organisational performance.

According to Emerole (2013), OC has an important and direct influence on the behaviour of the employees of an organisation. In furtherance to this argument, OC can either inspire employees to give their best for the benefit of organisational goals, or it can discourage people which can be risky for the performance of the organisation (Lee +et al., 2016).

As noted by Lazarova (2020) based on the works of Coleman (2013), in analysis for Harvard Business Review, six successful components of the OC are defined. Thus, a brief discussion of these component types of OC follows:

- Vision: Great and successful organisations start with a company vision and mission statement. The vision speaks of a company's purpose, and values offer a set of guidelines on the behaviour and mindsets needed to reach that vision.
- Values: An organisation's values are the core of its culture. Therefore, they are helpful in aligning how the processes are communicated within the organisation, and how the employees should assist the customers and set some guidelines for appropriate behaviour.
- Practices: The practices of the organisation highlight the importance of values, for instance, if the organisation has a statement that states that they capitalize and value their people, the organisation should have suitable practices to demonstrate that.
- People: There is no successful organisation that can build a comprehensible culture without having people sharing the same ideas and vision. Hence, the greatest organisations in the world also have some of the most rigorous recruiting policies.
- Narrative: Each organisation has a unique history and the ability to unearth that history and craft into a story, is a core element of culture creation. These stories aid organisations to rearrange the past and attract more followers to build the future.
- The company location and building are another important part of the culture.

As noted by the authors, most of the companies in Silicon Valley have unique and remarkable office buildings such as Pixar and Google. As noted by Alshmemri,Shahwan-Akl & Maude (2017) based on the works of Herzberg (1959), the office building is part of the hygiene factors of motivation, but the open architecture of the new offices enhances open communication and collaboration among employees.

2.2.1 Types of organisational culture

Cameron and Quinn (2011) ascertained that, the organisations can typically be recognised to have one, or a combination of four culture types". Suppiah and Sandhu (2011) found that organisational culture types influence tacit knowledge sharing behaviour positively or negatively,

depending on the culture type. Thus, each of these cultures demonstrates their characteristics and are defined below:

- Clan
- Adhocracy
- Market
- Hierarchical culture

Clan Culture

This type of OC emphasizes human relations and espouses flexible operation procedures, focusing on internal relationships as identified by Motilewa et al. (2015). Thus, its core values consist of co-operation, consideration, agreement and fairness. Joseph and Kibera (2019) described clan culture as homely and a family-like setting, thus, employees in clan culture value participatory engagement, teamwork and consensus-building. Notwithstanding this, the authors further noted the drawback of a family-style organisational culture as being difficult to maintain as the company grows.

Adhocracy Culture

According to Martinez, Beaulieu, Gibbons, Pronovost, and Wang (2015), this type of OC is most lively, employees are empowered and risk-taking is encouraged. Thus, it is an inspiring place to work where employees are daring and very entrepreneurial. The organisation's core values entail creativity, experimentation, risk, autonomy, responsiveness and value-creating change (Motilewa et al., 2015). Furthermore, adhocracy cultures can also foster competition among employees as the pressure to come up with new ideas mounts, and this has been defined as one of the drawbacks, as noted by (Misigo, 2020).

Market Culture

The market culture is regarded as the most aggressive of the four common types of culture. This type of culture is most common in larger businesses where leaders are ruthless, tough and have very high expectations of their teams (Suppiah & Sandhu, 2011). Employees are assigned with goals that they exert themselves to achieve, and their performance is closely monitored. It is not unusual for these employees to be rewarded and punished (Martinez et al., 2015). The purpose

to work for a company with this culture, is to make as much profit and capture as much market share as possible (Cameron & Quinn, 2011). Amazon is a great example of this type of company culture (Delfanti, 2021).

Hierarchy Culture

A study conducted by Atiku et al. (2014) states that hierarchy culture is usually defined as extremely bureaucratic, a more formal approach to relationships, by-the-book and directed top-down. Thus, with the hierarchical culture leaders need to be good coordinators, thereby placing a high value on economy, formality, rationality, order and obedience. Similarly, Emerole (2013) ascertains that the hierarchical culture emphasises internal maintenance and emphasises stability and control through clear task setting and execution of strict rules. Accordingly, Felipe (2017) posits that hierarchy culture normally prevents people from speaking up.

2.2.2 The importance of organisational culture

Von- Meding, McAllister, Oyedele, and Kelly (2013) based on the works of Schein (1985), defined the importance of OC as a substantial, powerful and mostly unconscious force that influences the behaviours of those within an organisation. Thus, Cameron and Quinn (2011) ascertain that the human aspect of an organisation outlines the way that projects are perceived and undertaken. It also impacts how customers; stakeholders and the public see an organisation. Thus, the need to improve business image has caused many organisations to examine their culture, thereby changing strategies to evolve and improve upon them (Olanipekun, Aje & Abiola-Falemu, 2013). Similarly, Lazarova (2020) ascertains that the solid organisational cultures postulate that employees are like-minded and hold similar beliefs and ethical values.

2.3 Human Factors

Even though there has been a substantial advance in technology over the last decade, software development typically still depends on human hard work and human interaction to make economic contributions (Saeed, Bajwa & Mahmood, 2014). Furthermore, Capretz and Ahmed (2010) posit that human factors are the determining factors that affect most software projects, as they combine human activities such as problem-solving abilities, cognitive characteristics, and social interaction.

Accordingly, Dastoli,Bolzan, Bianchini, Curto and Maffei (2019) ascertain that, the study of human factors has usually focused on human beings and how they interact with products, devices, procedures and the situations encountered at work and in daily living. Consequently, as noted by Krueger (2003) based on the works of a pioneer Chapanis (1996), human factors are “a body of knowledge about human abilities, human limitations, and other human characteristics that are relevant to design of tools, machines, systems, tasks, and jobs, and environments for productive, safe, comfortable, and effective human use”.

Abrahao, Baldassarre, Caivano, Dittrich, Lanzilotti, and Piccinno (2015) simplified the explanation as he tasks that humans perform the technology they use, the work environment in which they work, and the organisational policies that outline their actions that may or may not be suitable to their strengths and limitations. Furthermore, Amrit, Daneva and Damian (2014) ascertain that when the human strengths and limitations are not considered in the design process, devices can be ineffective. In this regard, Felipe-Amorim, Marinho, and Sampaio (2020) argue that if software development is an activity that depends on people, most results will be impacted by social and human factors as well.

Years of scientific research have formed a plethora of empirical data and theories on human factors. As noted by Amrit et al. (2014), these theories mainly use human factors in the analytical models and the individual aspect of the software development personnel, such as analyst competence, applications experience, programming language knowledge, etc. Then again, Amrit et al. (2014) pointed out that the human factors facets usually studied in software engineering research, consist of coordination, teamwork in the development process, trust, expert endorsement, knowledge management and culture.

Furthermore, Spichkova, Liu, Laali and Schmidt (2015) ascertain that human factors can be found throughout the software development process. Thus, it begins with gathering of requirements and it ends with customer testing. In this regard, Goncalves, de Almeida, de Araújo, Ferraz, Xandú, and de Farias (2017) ascertain that in software organisations the human factor signifies the central investment capital to achieve productivity and quality. Additionally, Pirzadeh (2010) posits that in this manner it can be perceived that the influence of human factors in the work environment is directly associated with the quality and productivity of the product that is developed.

Additionally, Spichkova et al. (2015) state that the study of human factors is vital for all software managers, as they must be acquainted with how their employees interact with one another.

Software products are used by different people, thus it is needed to consider the capabilities and limits of such a group to make the software more useful and popular (Goncalves et al., 2017). Similarly, Dastoli et al. (2019) posit that human factors must be considered in software development teams, as software engineers could benefit from greater awareness of themselves and others to develop their soft skills, that can influence their work.

2.4 Software Development Process

Unquestionably, there is a need for software systems to continue to meet today's competitive and costly business demands (Aydan, Yilmaz, Clarke & O'Connor, 2017). Accordingly, Sommerville (2007) extends the notion by highlighting that: "We can't run the modern world without software". Thus, in today's world, we cannot sustain all the work around us without proper software. Therefore, many organisations rely on software for support and enablement (Sekgweleo, 2018). Accordingly, Sekgweleo (2015) defined software development as a sociotechnical system comprised of human and technical entities which, when functioning as a coordinated unit, can address many problems that are too complex to be addressed by individuals or technologies working alone.

A study by Amlani (2013) postulated that software development consists of various steps such as long periods of planning large releases of software to be developed, followed by the analysis of user requirements ,the implementation of these user requirements and pushing it iteratively to live. Similarly, Aydan et al. (2017) explain this process as the software development life cycle (SDLC). Therefore, the main goal for SDLC is to produce high-quality software that meets customer expectations and that reaches completion within times and cost estimates (McLeod & MacDonell, 2015). Furthermore, Alshamrani and Bahattab (2015) suggest that software are developed for different purposes of which the most common are:

- To meet the specific needs of a business to solve a real-world problem, thus, a custom software can be used as an example.
- For personal use a billing software can be used as an example.

As mentioned by Umbreen, Abbas & Shaheed, (2015) the demand for better quality management of the software development process has required the discipline of software production, which emphasises applying the systematic approach demonstrated in the engineering paradigm to the

process of software development. Although there are techniques and methodologies to help systemize the development process to improve software quality, some organisations may still rely on undisciplined approaches and ultimately produce faulty software products that may be unreasonably expensive and incompetent (Aydan et al., 2017). Figure 2-1 below reflects the traditional software development life cycle as noted by (Sekgweleo, 2015).

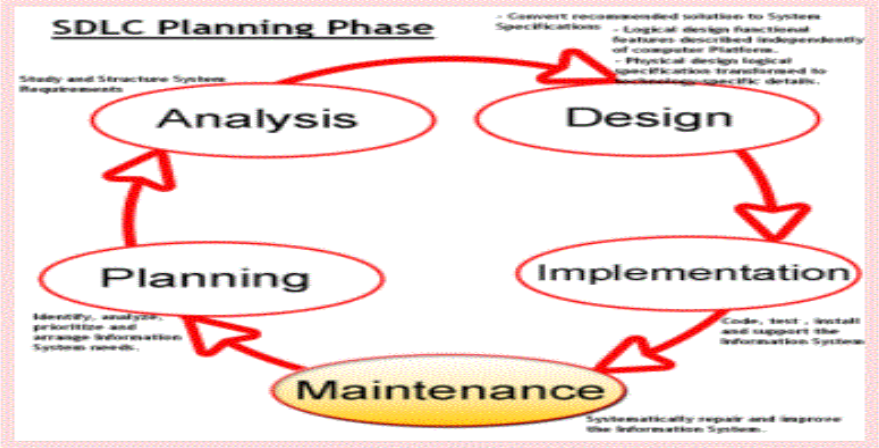


Figure 2-1: The 'Traditional Software Life Cycle (SDLC) (Sekgweleo, 2015)

2.4.1 Types of Software Development Process

As noted by Amlani (2013), there are several methodologies available for software project management like the waterfall model, spiral model, incremental model, rapid prototyping model and Agile model, which are the few most successful SDLC models. Equally, Kaur (2015) ascertains that even though there are several models, each organisation adopts the best-suited model which facilitates the software development process and boosts the productivity of its team members.

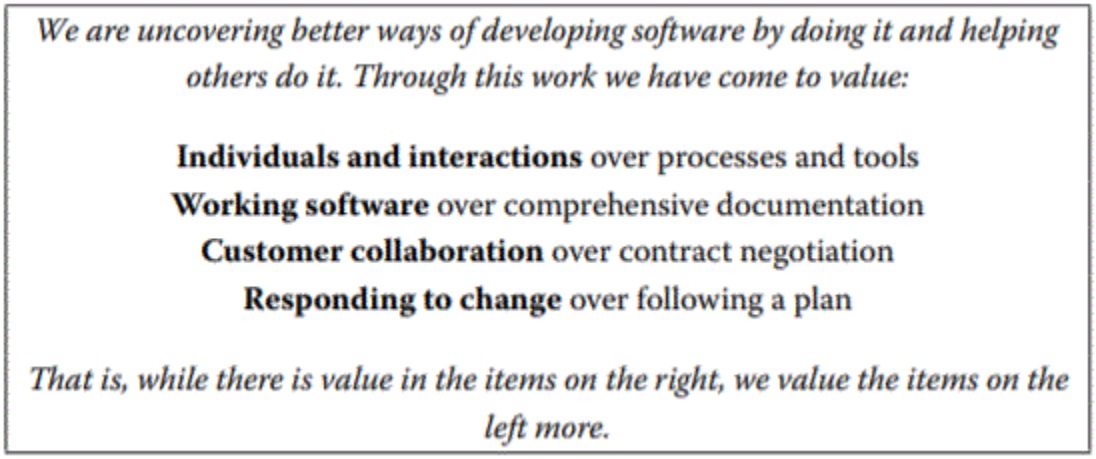
Furthermore, all methodologies have a different level of risk, budget, estimated completion timeline and benefits to manage the project requirements (McLeod & MacDonell, 2015). Methodologies can either be traditional or agile, and they are comprised of a sequence of stages that need to be followed by software development teams to produce and deliver the software requested (Alshamrani & Bahattab, 2015).

The classifications of software development methodologies are therefore discussed as follows:

Agile development methodology

A study by Gandomani , Zulzalil, Ghani, Sultan and Sharif (2014) postulated that attention to the concept of Agile practices has been emerging since the late 1990s. Furthermore, Amaral et al. (2013) noted that the Agile momentum in the software industry originated with the Agile software development manifesto, which was first introduced in 2001 by a group of seventeen software practitioners from different areas of software development projects.

As noted by Hohl, Klünder, van Bennekum, Lockard,Gifford, Münch, Stupperich, & Schneider (2018), the intention behind this manifesto was that these practitioners wanted to define values and basic principles for improved software development. Furthermore, Lalsing (2012) noted that in addition to being brought into focus, the manifesto has been extensively espoused by developers in software-developing organisations and beside the world of IT . Thus, the manifesto is usually referred to each time developers aim at conducting Agile development (Beck, Beedle, Van Bennekum, Cockburn, Cunningham, Fowler, Grenning, Highsmith, Hunt, Jeffries & Kern 2001). Figure 2-2 below reflects the Agile manifesto which states:


We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

Individuals and interactions over processes and tools
Working software over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more.

Figure 2-2: The 'Agile Manifesto' (Beck et al., 2001)

Agile software development methodologies have come about to help organisations to quickly develop and change their products and services, thereby providing the ability to adapt to dynamic market conditions, which were some of the adverse drawbacks of traditional waterfall software development practices (McLeod & MacDonell, 2015). Moniruzzaman and Hossain (2013) noted that according to Agile principles, the emphasis should be on adding value rather than following the plan. Furthermore, Agile software development emphasizes people and their interactions

(Amaral et al., 2013). Thus, the emphasis is on teams and the intense dynamics of team interactions (Matharu et al., 2015).

Similarly, Lalsing (2012) extends the notion by highlighting that customer partaking is vital throughout Agile software development. Delivering regular releases of working software and welcoming the changes in the requirements, depend greatly on the participation of customers (Hohl et al., 2018). Thus, customer collaboration and commitment are believed to influence the effective execution of Agile software (Gandomani et al., 2014).

Although traditional methods advocate for documentation of requirements, a comprehensive requirements specifications, and no design work before all the requirements and analysis are completed, Agile methods advocate quicker iterations with short-term planning (Sekgweleo, 2018b). Many methods of Agile software development have been created, including Extreme Programming (XP), Lean, Scrum, Kanban and feature-driven development (FDD) (Gandomani et al., 2014). These methods vary in what they prescribe and what they leave to the discretion of the software development team (Amaral et al., 2013).

According to Hohl et al. (2018), the advantages associated with Agile development are:

- People and interactions are stressed rather than process and tools, thereby customers, developers and testers continuously interact with one another;
- Agile methodologies attempt and foster software development practices which allow flexibility and adaptability to change settings; and
- Agile methodologies favour a functional working software over the time taken to document the requirements within analysis documents (Moniruzzaman & Hossain, 2013).

Then again, Fustik (2017) highlighted the disadvantages, limitations, and risks associated with Agile development as follows:

- In terms of some software deliverables, particularly with the large-scale projects, it is hard to evaluate the effort required at the beginning of the software development life cycle;
- Agile methodologies lack emphasis on necessary designing and documentation; and
- More time and dedication – it is burdensome and time-consuming for all involved.

Waterfall Model

Akbar, Sang, Khan, Shafiq, Hussain, Hu, Elahi and Xiang (2017) notice, however, that a plethora of literature exists that explains the origin of the waterfall model, also known as the cascade model, which was initially recognized by Benington in 1956. Since then modified and made public by Royce in 1970, and it has been followed extensively in software development to ensure the success of the project.

In this regard Morgan (2018) argued that the waterfall model has underpinned all other models, since it formed a strong foundation for requirements to be well-defined and analysed before any design or development. Similarly, Alshamrani and Bahattab (2015) state that the key advantages contributing to the acceptance of the model include a firmly defined model that is characterised by standardised events and defined in detail in all development phases.

Furthermore Allison et al. (2015) posit that the whole process of software development in a waterfall model is divided into separate process phases. The phases in the waterfall model are: Requirement Specifications phase, Software Design, Implementation and Testing and Maintenance (Afif, Noviyanto, Sunardi, Akbar & Aribowo, 2020). Thus all these phases are cascaded together so that the second phase is started as and when a defined set of goals is completed for the first phase and it is signed off, hence the name waterfall model (Kaur, 2015).

As noted by Morgan (2018), the phases associated with the waterfall model are:

- Requirement specifications: During this phase requirements are gathered following the end user consultation.
- Software Design: In this phase, the requirement specifications are studied in detail and the design of the system is prepared.
- Implementation and Testing and Maintenance: In this phase the work is shared into various modules and the coding is started. Additionally, every unit is tested for its functionality, and finally the issues that are related to the system are solved after deployment of the system.

2.4.2 Advantages of the Waterfall Model

As mentioned by Kramer (2018), the advantages associated with the waterfall model are:

- It is simple and easy to understand and use;
- It is easy to manage, due to its inflexibility in nature; and
- Each phase has specific deliverables and a review process.

2.4.3 Disadvantages of Waterfall Model

Contrary to the above mentioned advantages, Fustik (2017) posits that the disadvantages, limitations, and risks associated with the waterfall model are:

- The main limitation associated with the waterfall model is that it cannot ensure fast changes of stakeholders' requirements until the project is completed;
- The waterfall development does not allow much, thus, as soon as an application is in the testing phase, it is not easy to go back and change something that was not well documented or thought through in the initial phase; and
- The waterfall model does not include the customer in the process of software development. Thus, this may be an issue, since the customer is the only person who estimates the quality of the final product.

2.5 Teamwork

The phenomenon of teamwork in organisations is essentially used to describe the coordination and collaboration amongst the team members that constitutes a business. Scientific evidence identified that the importance of teamwork in business is always felt, because of the demand for efficiency and timely execution (Tripathy, 2018). Thus, today business organisations globally have recognized that the key factor to achieve more and better results at work is when individuals of diverse abilities form a team (Sanyal & Hisam, 2018).

In this regard, Samwel (2019) ascertains that by integrating the distinctive skills and characteristics of team members, better performance is expected to achieve the common goal when compared to individuals working independently. Thus, a team comprises of different

individuals with different views, ideas, talent, abilities and cultural background, as noted by (Sanyal & Hisam, 2018). Hence, it is essential that everyone in a team should accept one another and recognize each other's abilities and work equally (Ghaferi, Dimick, & Arbor, 2017). Accordingly, Miguel, Pedro, David and José (2017) notice that well-organized teams have high levels of communication to improve situation awareness and track other team members' activities.

Scientific evidence highlights that one of the important elements of a team is its aim towards a common goal and a clear purpose (Bel, Brown, Colaneri & Outland, 2018). Similarly, Luca (2016) posits that several attributes are needed for effective teamwork:

- Commitment to team success and shared goals – effective teams are driven, involved and aim to achieve at the highest level.
- Interdependence – Individuals encourage and inspire their fellow team members to contribute and learn; and
- Open communication and positive feedback – team members must be willing to give and receive positive criticism and give authentic feedback.

2.5.1 Advantages of Teamwork

According to Sanyal and Hisam (2018), the advantages associated with teamwork for organisational performance include, better employee well-being and positive attitudes through a process of perceived organisational support. Thus, to include social interaction and collaboration is vital. Therefore, teamwork aids and offers an opportunity for both personal and professional growth. Similarly, Luca (2017) point out that when leveraged, effective teamwork determines company growth and increases performance and success by tapping into everyone's unique strengths and qualities. Teamwork ensures that there is an equal and fair distribution of work within teams and that deadlines are met.

2.5.2 Disadvantages of Teamwork

Alternatively Roskosa and Rupniece (2016) argue that the absence of teamwork perceptions and strategies can cause disappointment and poor productivity, which threatens the entity of the organisation. Furthermore, Tripathy (2018) posits that the employees who work in an organisation

that does not have a strong concept of teamwork, generally fail to deliver the expected results and achieve the goals and visions of that organisation.

2.6 IT as an Enabler of Organisational Performance

Dewett and Jones (2001) point out that the information systems and information technology are normally inextricably and therefore conventionally linked. In this study, the terms will jointly be referred to as information technology (IT). Ricciardi , Zardini & Rossignoli (2018) point out that in the last decades, the growth of IT has enabled a unique combination of processes and information flows, both inside and across organisational boundaries.

Amaral et al. (2013) posit that nearly no company nowadays, whether small or very big, can grow or remain competitive and profitable without the support of an (IT). In this regard, Nikoloski (2014) ascertains that IT, internet connectivity and applications on the web, are becoming the enablers for improved utilization of organisation resources. Generally IT enablement comprises all forms of technology used to create, store, exchange, and utilize information in its various forms, including business data and conversations (Nikoloski, 2014).

Decades of scientific research have formed a plethora of empirical data where researchers maintained that IT management influences strong performance by enabling key organisational capabilities through IT (Ping-Ju, Wu Straub, Liang, Lindh, Dahlin & Hadjikhani, 2015). Thus, to create a sustainable advantage, organisations must meet the marketplace, respond to it and influence it (Schrader & Droegehorn 2017). In this regard, Amaral et al. (2013) ascertain that consequently they need to be considered pertinent, and on a comprehensive scale that usually means being agile as the world evolves.

IT has been defined in many ways by many authors. However, Amaral et al. (2013) give a comprehensive definition of IT as “computers, software, services, and interrelated resources as applied to support business processes”. As noted by Tannady et al. (2020), IT usage is to support business processes in accomplishing one or more of the following objectives:

- Increased efficiency of business processes;
- Reduced cost of business processes; and
- Increased accuracy of the data that are related to business processes.

Similarly, Aliahmadi, Mahmoodi, Mohammad and pour, (2011) ascertain that information technology helps businesses to identify the changing of customer's requirements faster than traditional research. Additionally, Chirani and Tirgar (2013) posit that IT ultimately helps the business to respond fast, according to the change in the external environment.

As noted by Sekgweleo (2015), organisations invest a significant amount of money in new IT systems and an underlying infrastructure that is needed to support their business operations. Additionally, Iyamu et al.(2016) extend the notion by highlighting that many studies have been conducted on the value of IT investment and strategic alignment, and they reveal that the alignment between business strategy and IT strategy has a positive effect on organisational performance. Therefore, understanding the business value from these IT investments, involves aligning – if not intertwining – business and IT strategies.

2.7 Software Quality

Over the years, authors and organisations have clarified the term 'quality' differently. According to Goncalves et al. (2017), quality in an organisation is well defined in terms of "quality as excellence, quality as a value, quality as conformity to specifications, and quality as meeting customer expectations". However, Gorla et al. (2016) notice that quality is the most significant factor in software development, as it typically outlines customer satisfaction that is associated with the success of a software project. Thereby, the quality of the software typically relies on the software development life cycle (SDLC), as noted by Nagappan et al. (2015).

Literally, software quality is the "degree to which a system, component, or process meets customer or user needs or expectations". This is also how the international standard bodies and academic experts define it, as phrased in IEEE, (1991) as noted by Montagud, Abrahão & Insfran (2012). Similarly, Akbar et al. (2017) ascertain that the business value of a software product results from its quality as perceived by both acquirers and end users. While Nakai et al. (2017) extend the notion that quality is progressively seen as a critical feature of the software, since its absence results in a financial loss as well as unhappy users, and it may even endanger lives.

Therefore, Elish and Alshayeb (2012) argue that today there are problems in the software quality assurance field. Large projects still have cost and time overruns, and developed software often does not have the required functionalities, its performance is low, and its quality does not satisfy consumers.

There are several software qualities factors. Table 2-1 below summarises these factors.

Table 2-1: The 'Factors of Software Quality' (Adapted from Babar et al., 2017)

Software Quality Factors	Description
Extensibility	Ability of software components to be added, modified, and removed easily without affecting existing system.
Maintainability	Ability to make change for error corrections, supported by defined interfaces.
Performance	Related to acceptable response time.
Scalability	The ability to respond in an acceptable time to increased load.
Robustness	The ability of software to keep working and remain available in failure status by backup plans and data.
Usability	The user ability to easily interact with the system using interface.
Testability	Maximum and efficient code coverage by testing.
Correctness	The software should conform with the requirements or specification.

2.8 SUMMARY OF CHAPTER TWO

As stated in the introduction, the second chapter solely focused on the six themes that emerged from the literature review, founded upon empirical groundings, which aimed at assisting the researcher to explore and gain an in-depth understanding of the nature of factors associated with software development processes, whilst taking cognizance of the impact they have on the

performance of the organisation itself. It aided in identifying potential areas of research, the knowledge gaps that require further investigation, as well as similar work conducted regarding factors associated with software development processes.

The themes were discussed in the following chronological order: Organisational Culture (OC), Human Factors (HF), Software Development Process (SDP), Teamwork (TW), IT as an Enabler of Organisational Performance (IT) and Software Quality (SQ). The concepts explained in this study influenced the following chapter and helped in extracting significances in Chapter Five. The following chapter outlines and describes the research methodology.

3 CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The previous chapter reviewed the literature supporting this study, which included the Organisational Culture (OC), Human Factors (HF), Software Development Process (SDP), Teamwork (TW), Information Technology as an Enabler of Organisational Performance (IT) and Software Quality (SQ).

In this chapter, the use of a qualitative methodology is described and justified. The thematic analysis technique employs the research questions and emergent themes from the literature that were discussed in Chapter 2. Accordingly, an exploratory approach related to the interpretivist paradigm is discussed and outlined (Creswell, 2009). The interpretive case study is used to have deep understanding of the research problem by exploring the experiences of the participants in their own settings (Saunders et al., 2015).

Data collection is clarified and information pertaining to the sampling techniques is justified. Examples are quoted from participant interviews to highlight important parts of the data set related to the research questions. Specifics relating to the administration of the data are described and discussed. This chapter highlights the use of ATLAS.ti 9 as the key to analyse, explore and organize the data according to recognized qualitative research techniques. This enabled the researcher to explore several repetitions of data sorting and analysis related to the research questions, until saturation was reached. Issues of validity and generalizability are discussed.

Finally, the research is reviewed in terms of the ethical compliance with the Cape Peninsula University research standards that relate to identifying the actions and processes espoused throughout the research. The chapter is presented as follows: Section 3.2 presents the research process; Section 3.3 outlines the philosophical assumptions that underpin this research; and Section 3.4 describes the research methodology, comprising of the research purpose, timeframe, research strategy, sampling, data collection and data analysis techniques used in this study. This chapter concludes with a summary of the research design.

3.2 The Research Methods

Suitable research methods need to be selected to address the research problem. This study adopted Saunders' research onion in Figure 3.1 below. As illustrated in Figure 3.1, the different layers of the onion demonstrate the variety of choices, paradigms, strategies and steps followed by the researcher during the research process (Mafuwane, 2012). All these events will be based on primary and secondary sources from which recommendations are formulated.

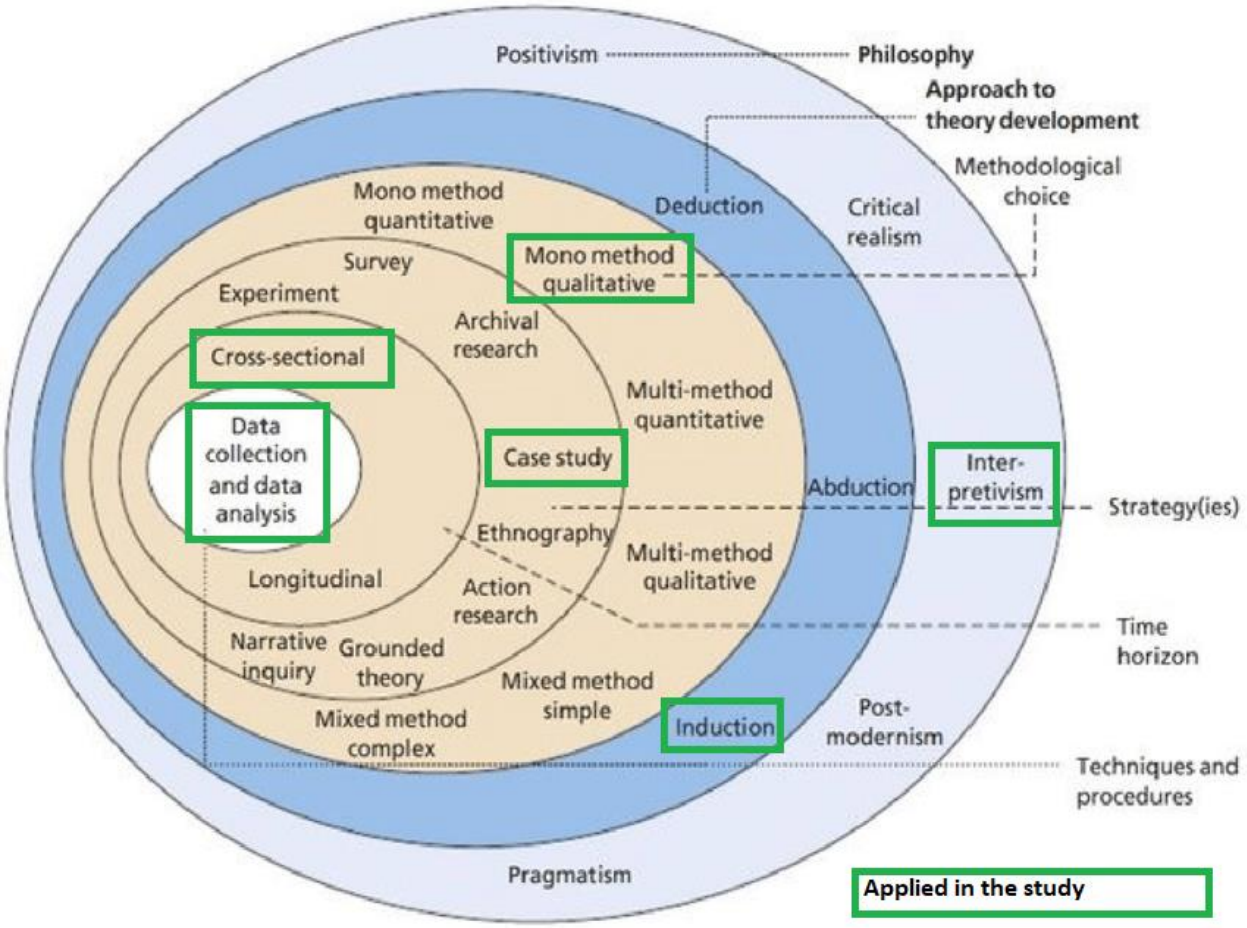


Figure 3-1 The research 'onion' (Adapted from Saunders, Lewis, Thornhill, et al., 2016)

3.3 Research Philosophy

In research there are some philosophical assumptions that need to be taken into consideration for a study to be effective. Thus, it is important for these assumptions to be known (Creswell, 2003). Accordingly, Bhattacherjee (2012), defined research philosophy as the development of assumptions that underpin the creation of knowledge and nature in the field of research.

As mentioned by Guba and Lincoln (1994), the question of the use of research methods is secondary to the research paradigm in the research. Thus, a research paradigm is defined as "the basic belief system or worldview that guides the investigator, not only in choices of the method but in ontologically and epistemologically fundamental ways" (Guba & Lincoln, 1994, p 105). Therefore it can be inferred that the selected research philosophy encompasses assumptions which reinforce the research strategy and methods chosen as part of that strategy (Creswell, 2009). This clarification then directed the discussion of ontological and epistemological approaches.

3.3.1 Ontological Approach

Similarly, Kivunja and Kuyini (2017) state that ontology defines a view concerning the claims of reality or the nature of being. Equally, Creswell (2009) posits that ontology influences the selection of research objectives, questions and even the methodology.

3.3.2 Epistemological Approach

According to Rehman and Alharthi (2016), epistemology is described as the basis of knowledge, or the relationship between reality and the research. Thus, epistemology describes how humans come to know something and how they know the truth or reality (Creswell, 2009). Epistemology intensely shapes the researcher's conceptualization of the participant in data collection and analysis (Silverman, 2017).

Accordingly, the epistemological stance taken in this study was interpretivism, which is focused on the understanding phenomenon from an individual's perspective, thereby exploring the interaction among individuals as well as the historical and cultural settings which people inhabit (Levers, 2013). This is how knowledge is known through the subjective experiences of people

(Rehman & Alharthi, 2016). Thus, the researcher's view is that reality is subjective, socially formed and may change (Scotland, 2012).

This research was classified as interpretive as it does not predefine dependent or independent variables and does not test hypotheses, rather it aims at producing an understanding of the social context of the phenomenon and the process whereby the phenomenon influences and is influenced by the social context. As noted by Rehman and Alharthi (2016), the interpretive concept is generally inductive, thus not produced from prior data, thereby new layers of understanding are uncovered as phenomena are thickly described.

Thus, interpretative research is a suitable approach for a study that requires techniques such as textual analysis, case studies and observation to be examined in detail (Creswell, 2009). While Miskon et al. (2015) based on the works of Klein and Myers (1999), pointed out that there are seven well-known principles of interpretive field research which are discussed in the works of many authors. Thus, to date, these principles are held firmly amongst IS researchers to guide and evaluate interpretative research. Listed below are the seven principles followed by how the study espoused them:

- The hermeneutic circle;
- Contextualization.
- Interaction between researchers and the subjects;
- Abstraction and generalization;
- Dialogical reasoning;
- Multiple interpretations;
- The principle of suspicion. and

The principle of the hermeneutic circle

This principle of human understanding is important to all the other principles. In simple terms, the hermeneutic circle is about understandings and making sense of meanings (Miskon et al., 2015). The thick and richness of data in the current study are in subjective experiences and encounters relating to the factors associated with software development processes evident in an IS/IT department in the organisational culture of a petrochemical company.

The principle of Contextualisation

To assist researchers to understand and justify the subject under investigation, the principle of contextualisation wants a clear reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation occurred (Goldkhul, 2012). This study has applied the principle of contextualization by creating a strong understanding of the study field through a detailed literature review and a case study. This enabled the researcher to better understand the phenomena of interest, thereby exploring the nature of factors associated with software development processes within a case study context, whilst taking cognizance of their impact on the performance of the organisation itself.

The principle of Interaction between researchers and the subjects

This principle entails clear reflections on how the data was created through the interaction between researchers and the research subjects (Gichuru, 2017). Thus, the importance of data collection considerations is stressed in this principle. This principle was found appropriate for strengthening the depth of the research tool (interview protocol) before the collection of data, and subsequently the semi-structured interviews were conducted in this study. The example of an interview protocol is attached under Appendices – Appendix 7 .3 C. Additionally, the detailed process of how data was collected is outlined in Chapter 3, Section 3.9.1.

The principle of Abstraction and generalisation

The principle of abstraction and generalisation stresses the use of proper theoretical lenses to understand the subject under investigation. This allows some level of generalisation that helps in the development of concepts that describe the nature of human understanding (Gichuru, 2017). While interpretive research does test this hypothesis, a theory still plays an important role in this paradigm of enquiry (Creswell, 2007). Accordingly, the study followed the inductive approach which aimed at generating meanings from the data set collected, to identify patterns and relationships to build a theory (Babbie, 2014). Thus, the results from the interviews and the documentation were then inductively analysed and presented as outlined in Chapter 4, Sections 4.2– 4.7.

The principle of Dialogical reasoning

This principle requires the need to apply objective rather than biased reasoning in an investigation. Hence, the researcher ensures that they do not allow personal preconceptions and bias to deter the real meanings of phenomena in an investigation (Walsham, 1995). It is this line of reasoning that semi-structured interview discussions were conducted with the participants in this study. Thus, the sampling process was undertaken in an unbiased manner.

The principle of Multiple interpretations

In the principle of multiple interpretations a researcher needs to understand multiple viewpoints in an inquiry among the respondents and seek clarity regarding their motivations for the study under investigation (Rowlands, 2005). Since the historical, social and cultural settings need to be investigated to understand the respondent's motivation for a specific point of view, the principle of multiple interpretations was found suitable for the study. As participants hold different perceptions, interpretations, and motivations as to how factors associated with software development processes impact organisational performance, it enabled probing of responses that seemed to have multiple interpretations.

The principle of suspicion

This principle requires an understanding of possible preconceptions and systematic misrepresentations in the narratives collected from the respondents (Miskon et al., 2015). Accordingly, this study employed the interpretivism approach to explore participants' subjective views of their experience in their settings. The choice of the interpretive paradigm for this research allowed a focus on finding contextualized, professional craft knowledge, personal experiential knowledge, and understandings about the phenomenon of inquiry in software production practice from those who are most likely to know and understand this phenomenon. The study used research methods whereby the researcher could remain a detached external observer, and therefore ensured researcher independence of what was being researched.

Seven principles of interpretive research simplify the appropriateness of this approach for addressing the research questions and the phenomenon under investigation (Gichuru, 2017). Thus, exploring the nature of factors associated with software development processes evident in the IT/IS department within a petroleum organisation, the researcher could subjectively interpret the qualitative data that were collected for this study.

3.4 Research Methodology

The research methodology consists of the methods and strategies applied in gathering and analysing of data. This process aims to answer the research question of this study. The next sections, therefore, discuss the approach to theory, research strategy, sampling, research instrument, data collection and analysis techniques.

3.5 A Research Approach to Theory Development

Usually a deductive approach is aimed at testing an existing theory, and an inductive approach aims at producing meanings from the data collected to identify patterns and relationships to build a theory (Lee et al., 2016). The research approach used for this study was inductive. The inductive approach is based on learning from experience (Bhattacherjee, 2012). The study used research methods whereby the researcher could remain a detached external observer, and therefore it ensured researcher independence of what was being researched. The results from the interviews and the company documents were then inductively analysed and presented.

3.6 Methodological Choice

Qualitative research encompasses the study of phenomena in its natural setting to draw meaning. The rationale behind qualitative research is that it determines individual experiences (Sutton & Austin, 2015). Although there are several research methods, the mono qualitative approach was adopted in this study as it followed inductive methods of inquiry, which tied in with the epistemological stance of subjectivism (Maxwell, 2016).

The reason for choosing a mono qualitative research approach, was because it produces holistic understandings of rich, appropriate and usually unstructured, non-numeric data by engaging in discussions with the research participants in a natural setting (Miskon et al., 2015). Thereby, gaining insights into the thoughts and feelings of research participants, which enabled the development of an understanding of the meaning that people ascribed to their experiences (Sutton & Austin, 2015). In this study, the raw data are the voice recordings of the interviews.

3.7 Research Strategy

Similarly, Yin (2013), the guru in research design, ascertains that the research strategy incorporates sections that will comprehensively discuss the research philosophy, research design and the research approach techniques the study will adopt to ensure the attainment of the goal and objectives set out in Chapter One. Although espousing different research strategies is possible and well-known in the field of IS research, the case study method of investigation – a purposive method of sampling to select the units of analysis – was adopted as the research strategy in this thesis.

Therefore, this clarification then engaged the discussion of the case study strategy.

3.7.1 Case study strategy

Accordingly from Yin's (2003) perspective, there are numerous strengths for using a case study approach in research, which include the ability to use a variety of research methods, and to attain an adequately rich description that can be transferred to similar situations, and eventually an in-depth perception. In response, as noted by Yazan (2015) based on the works of Yin (2013), he advocates measuring the quality of the case studies against four principles that are common in an empirical research study: construct validity, internal validity, external validity, and reliability.

Similarly Bhattacherjee (2012) ascertains that case studies can be viewed in three categories: the exploratory, the descriptive and the explanatory. Although there are three possible approaches to case studies, this study adopted the exploratory as it is tasked to formulate problems, illuminate concepts, gain explanations and insights and create a hypotheses. Thus, adopting different exploratory research methods is possible and well-known in the field of IS research, accordingly, a semi-structured interview approach and empirical literature were adopted to collect data from a predefined subject(s) in this thesis.

The data were obtained from both organizational documents and from a triangulation of respondents with the professional craft of knowledge, personal experiential knowledge, and understandings about the phenomenon of inquiry in software production practice, thus, from those who are most likely to know and understand this phenomenon to answer research questions. Accordingly, Creswell (2007) ascertains that the research method must be selected to align with the research aim of the study.

3.7.2 Research site

The case study concerns a privately-owned South African petrochemical organisation with a history dating back to the early 1880s. It has over 3500 employees, of which 35 (this number includes both permanent and non-permanent employees) are in the computing environment. It is to gain a deeper understanding of the nature of factors associated with the software development processes evident in organisational culture in an IS/IT department of a petrochemical company in the Western Cape, thus, within a case study context, whilst taking cognizance of the impact they have on the performance of the organisation itself.

A private company is defined as a privately-owned company, usually owned by entrepreneurs or shareholders, thus it is prohibited from offering its shares to the public and the transferability of its shares are restricted, but it may have more than 50 shareholders (Uyar, 2020) .Thus, Khan and Khandaker (2016) argue that private companies, owners and shareholders have a direct financial incentive to monitor and control the behaviours of managers. Also, managers themselves are to be expected to benefit from better performance, either because they own company dividends, or because their salary is linked to financial success (Amaral et al., 2013). Private organisations follow a single goal of profit, thus the their main objective is generally to make money for its shareholder owners (Uyar, 2020).

The organisational structure of the IS/IT Department

The authority to develop and implement IT strategy and processes in the organisation was assigned from the Executive Committee of the organisation to the Chief Information Officer (CIO) and the IT management team. The IT managers, including the rest of the employees, were by advantage of their employment supposed to support the CIO initiative completely. The IT structure indicates the hierarchy within the petrochemical organisation and the roles of those involved in the computing environment and business.

The computing environment was divided into different components. Members of the IT management team were responsible and accountable for these components, which included software development and applications, infrastructure and architectural components. The main purpose of the components was to assign roles and responsibilities as guided by the rules of the organisation. Another reason was to ensure balanced resources for the different IT management team members. The allocation of tasks have an impact on how employees relate to one another,

and their subsequent interaction in performing their ultimate tasks. Thus, everyone in the computing environment reports to the their various managers, who subsequently report to the Chief Information Officer (CIO).

Communication

The effect of the organisational policies shaped and influenced how information was communicated and construed by employees as well as the stakeholders. Within the computing environment, the most popular and value-adding communication platform was the departmental workshop called IT forum. This platform is used to communicate the various matters happening in the computing space.

3.7.3 Population under study

The population for this study was predetermined. It comprised of the technical and non-technical participants. The participants were identified from these teams with the organisation's consent to interview them (see Appendix E). In compliance with the ethical codes of conduct, consent to conduct interviews with subjects at their points of work were requested and authorized by the organisation's legal and compliance department and the IT manager, supported by chief information officer (CIO).

3.7.4 Sampling methods

The research design included a non-probabilistic, purposively, and conveniently selected sample, comprised of technical and non-technical participants in the IT/IS department of the selected organisation. This formed the unit of analysis, while eight selected participants within the organisation formed the unit of observation. Thus, they were the people who were likely to have the required information and also likely to share that information (Babbie, 2014). This is also known as judgmental sampling. For qualitative studies, a non-probabilistic sampling approach is the norm and a purposive sample is generally recommended (Waldron, 2019).

Thus, the purposive technique is used according to the researchers' judgment and according to the aim of the study (Etikan, 2016). Accordingly, it is usually used in qualitative research to identify and select the information-rich cases for the most suitable use of available resources (Amaral et al., 2013). Therefore, a purposive technique was considered, because of the availability, willingness, experience, and the ability of the participants to communicate effectively on the phenomenon that is investigated.

Since the sampling method was constructed greatly on the interpretive epistemology, importance was placed on the purpose of the participant characteristics, instead of the quantitative approach. The choice of the organisation, therefore, was based on convenience for the researcher. The researcher understood non-probabilistic, purposive sample of convenience sampling could lead to distortion in findings, due to bias (Taherdoost & Group, 2016). However, it was not possible to obtain the same information richness via random sampling as the sample would not possess the necessary characteristics required for this research.

3.7.5 Sample Selection and Size

In determining samples for this qualitative research, it was not so much whether the sample size was small or large, but the relevance to the research topic that determined how participants were selected. This research is restricted to a petrochemical organisation in the Western Cape. In a qualitative study, there are general guidelines of how many interviews should be conducted to ensure data quality. Accordingly, Aliff et al. (2018) based on the works of Creswell (2007), recommend five to 25 interviews. According to Fusch and Ness (2015), emphasis should be placed on the rich quality of the data, instead of the quantity and size of the sample, especially if the emphasis of the study is to explore and describe issues of the phenomenon in determining new evidence.

Similarly, Burmeister and Aitken (2012) agree that the number of participants are not the main concern, but the depth of the data and a sample size that has the best opportunity for research questions to be answered, brings forth a quality research project. Although the number of participants play an important part, a point of saturation should be prioritised in qualitative research. Thus it is important to ensure data is saturated rather than the number of participants (Aliff et al., 2018). According to Creswell (2009), a point of saturation is reached when the data collected no longer offer new insights.

The study targeted a predetermined number of ten participants. A triangulation of respondents with the professional craft of knowledge, personal practical knowledge, and understandings about the software production practices, were selected to answer research questions. This was also to ensure an adequate sample size for the thematic analysis of the software developers, systems analyst, project manager, system specialist, and a business analyst within the petrochemical organisation in the Western Cape that were interviewed between December 2020 February 2021.

All ten participants were requested to partake, however, only eight participated. The data were collected during the global Coronavirus pandemic, which led to the subsequent reluctance of participant participation. Partaking was sorely based on willingness. Table 3.1 below illustrates the sampling of participants selection.

Table 3-1: Selection of Participants' Samples

Job title of participants	**Years of service**	**Qualifications**	**Interviews**	
			Date: Dec'20–Feb 2021	Time
[D01]	Three	DipIT	2020/12/10	24mins 37secs
[D02]	Two	BTech	2020/12/04	26mins 44secs
[D03]	Four	BTech	2020/12/15	43mins 38 secs
[D04]	Three	M.Sc.	2021/01/29	46mins 10secs
[D05]	Three	BInfoSys	2021/01/15	27mins 27secs
[D06]	Two	BCIS	2020/12/04	18mins 20secs
[D07]	Two	BSc Hons in progress	2021/02/12	20mins 58secs
[D08]	Twelve	PMIS Cert	2020/12/04	40mins10secs

Table 3.1 explains the participants' interview sessions. Each participant links to their years of service with the organisation at the time of interview in column two, together with their qualifications in column three. Job descriptions are used to identify the participant. Full names withheld for confidentiality (ethical) reasons.

3.8 Time horizons

According to Saunders Lewis and Thornhill (2016), there are two-time frames which a researcher may choose to adopt – longitudinal or cross-sectional. As noted by Creswell (2009), research is cross-sectional when investigating the study of a particular phenomenon at a particular time. Therefore, the benefit of using cross-sectional studies is that many findings and results can be examined to create new theories/studies or in-depth research (Kosow & Gaßner 2008).

Accordingly, in the context of this study, cross-sectional study was chosen as a time horizon, as the definition fits the time in which data were gathered – over a period of weeks and from a specific group of people. This research was restricted to a specific time frame and hence, the cross-sectional time horizon was used. Longitudinal research, on the other hand, mainly practices the

method of observation, which requires that they do not include interfering with the subjects in any way (Belsky et al., 2018).

3.9 Techniques and procedures

This section covers aspects relating to the data-collection methods used by this study. Data-collection instruments and sampling techniques will be covered.

3.9.1 Data collection

The research interview protocol was developed from the work of Castillo-Montoya (2016), who indicate that the interview protocol refinement framework (IPR) is suitable for clarifying structured or semi-structured interviews (see Appendix C). Through the lens of IPR, the researcher created an interview protocol that assisted in acquiring thick and comprehensive interview data significant to address the research questions and to provide direction that is important to the study.

Qualitative data-collection methods were used for gathering data; data was collected using semi-structured one-on-one interviews to collect primary data. The initial plan had been to conduct all interviews face-to-face, however, due to the global Coronavirus pandemic (Covid 19) this was not possible. Accordingly, Showkat and Parveen (2017) posit that the researcher should have some pre-planned questions to ask during the interview. The specific type of interview was chosen to allow the expert practitioners to fully express their views on the topic, while the researcher maintained control of the flow of conversation (Creswell, 2007) with open-ended questions.

This allowed essential areas to be covered while allowing a degree of flexibility in response. This approach then allowed the interviewer to probe with additional questions into areas that deserved supplementary discussion (Creswell,2009). Secondary data which inform perceptions, methodologies and background are drawn from the existing literature in the field.

The audio responses were digitally recorded by using Microsoft Teams, which is an integrated communication and collaboration platform that combines determined workplace ‘chat’, ‘video’ ‘meetings’, ‘file storage’, and ‘application integration’, and accompanied by written notes (Whiting, 2013). Before interviewing participants, the researcher introduced herself and the topic of the study, explaining the code of ethics and requesting the choice to record the discussions. Participants freely approved, and semi-structured interviews started. The interviews were conducted in English as it is a common language in the information technology field. The stretched

interview lasted for 46 minutes and the shortest interview lasted only 27 minutes. At the end of each interview the researcher thanked the participant for the contribution in the study. Therefore, the qualitative data-collection methods used for this study were interviews and documentation. See Appendix C for Interview Protocol.

3.9.2 Documentation

Documents can be classified as either ‘found’ or ‘researcher-generated’ documents (Mkhomazi & Iyamu, 2014). Sekgweleo (2015) posits that 'found' documents exist before the research and can be found in most organisations, whereas research-generated documents are put together uniquely for research.

The secondary sources included documents about organisational hierarchy, business and IT strategic alignment, intranet, company postings, publicly articulated mission statements and value statements, and organisational communications to both staff and the public. The materials were used to develop the background information regarding the technical and non-technical settings of the organisation and its hierarchy, which helped to construct the structure of the computing environment. It helped in understanding the organisational hierarchy policies relating to the organisation. The structure of the computing environment can be found in Section 3.7.2.

3.9.3 Data analysis method

Steps included during thematic analysis included:

- Transcription;
- Theme identification;
- Application of ATLAS.ti – a qualitative data analysis tool;
- Evolution of a custom-designed codebook; and
- Codes linked to extricated interview quotations.

Upon the conclusion of all interviews ***the researcher transcribed the interviews*** word-for-word, thereby reading and re-reading the interview transcripts and listening to the recordings to make sense of what was said and going back and forth between data. After transcribing the data, the researcher prepared the data to be readable. The interviews were transcribed and then analyzed

using thematic analysis. Inductive thematic analysis was chosen as a method of discourse and extraction of information from the data as it provides a way of looking for patterns in the data and joins them into meaningful groups and themes that capture the subject that is examined (Braun & Clarke, 2012).

Taking a thematic analysis approach with an interpretive epistemological stance, ***important themes were identified*** in the voice recordings, using the inductive process described earlier. Thematic analysis is considered to be a creative process, subsequent from the relationship between the researcher's logical and interpretive skills and the data itself (Brough, 2018).

The study applied ***ATLAS.ti 9 as a qualitative data analysis tool***. The intention was to encode both relevant literature sources and empirical data in the search for thick and rich data that could lead to emergent themes (Romero, 2016). The use of specialized software such as ATLAS.ti 9, assists and supports analysis, extending the mental capacity for organizing and to be systematic (Friese, 2014).

The study did not depend on a pre-existing codebook; it ***evolved open and axial coding***. Thus, the study was not based on existing theory, but on the meaning that emerged from the data (Romero, 2016). The thematic analysis provided the opportunity to find new themes by taking into consideration all the varied and rich data gathered from the interviews. As the new themes emerged, they were combined into data. To preserve the anonymity and confidentiality of the identities, the responses are stated without reference to the job titles of the participants.

Encoded data snippets expressed as interview quotations were then presented in a codebook-format within the corresponding themes with their associated factors and the description is in Chapter Four. The synthesized codebook is attached in Appendix D.

In accordance with the principles of grounded theory outlined by Corbin and Strauss (2008), the application of tenets of qualitative data analysis capitalizing on the affordances of ATLAS.ti. Manual rather than automatic encoding of raw data interview occurred, applying open, axial and selective. Establishment of groups of codes as nodes which labelled data and served as collective themes for interpretation addressed quizzical outcomes. Patterns of cohesion and conflict were sought, further supporting the extrication of categories of information. ATLAS.ti facilitated the creation of a frame of codes used to make sense of the collected data.

3.10 Research Quality

Throughout the data-collecting process in this study – through semi-structured interviews and company documentations – the researcher ensured to keep both notes of the events as well as recordings of all interviews. Consequently, it was possible to check if the researcher might have missed something significant (Litman, 2019).

The validity and reliability of this study was confirmed by carrying out the study in line with qualitative research techniques and full consent of the participants (Anney, Dar & Salaam 2014). To ensure the validity and reliability of the collected data, the non-probabilistic, purposive sample of convenience ensured that the most suitable interviewees were selected for the study which added internal validity to the work.

For this study, data validity and reliability were done by verifying the content of the interviews with the participants. Additionally, by listening to the participants responses during the interviews and asking probing questions to ensure clarity of understanding, it further increased the validity of the approach. The way in which the researcher articulated interpretations, implications and conclusions, were made obvious by ensuring that a clear audit trail of the research exists. This includes why decisions were made and conclusions reached.

Recording all the interviews also provided extra reliability in the study. Despite the capabilities of a petrochemical organisation, the data cannot be generalized outside of the company's context, and therefore added transferability to the work. The researcher was helped by the supervisor, thereby confirming the authenticity and the possibility of errors in the research method. Data, findings, interpretations, and recommendations were verified and validated, therefore it added conformability.

3.11 Ethical Consideration

This research was conducted ensuring that codes of ethics were adhered to. The rights, anonymity and welfare of the participants were encouraged and protected. Informed consent protocol was employed to ensure that all participants were aware of the research intentions and were comfortable with partaking in the study. Anonymity was stressed in the consent form and at the briefings.

As mentioned by Babbie (2014), ethical consideration of research is recommended to ensure the confidentiality and anonymity of participants during the research period. Therefore, participants were assured that their names and the name of their company would not appear in the published research. It would be treated as highly confidential. The issue of confidentiality was treated very seriously and it was emphasized before and during interviews. To protect the rights and identity of the participants, fictitious names were used for anonymity and confidentiality.

Ethical consideration was in accordance with the CPUT University Research Code of Ethics that protects all parties that are involved in a research. The researcher had to abide by these ethics, thereby an ethical clearance letter was obtained from CPUT's ethics review committee and permission from the petrochemical organisation was provided for the data collection. The selected research design was examined to ensure that the design would enable the research objectives to be achieved. The researcher also adhered to an ethical code of a petrochemical organisation.

Participants were aware that they could ask the researcher questions after partaking in the research, and that a summary of the results of the research would be made available to them on request. The voice recordings collected are recognizable by the researcher, though the information that is reported in this research is non-identifiable. Storage of the voice recordings in this research is digital. Copies of the recordings and the data collected are held within the ATLAS.ti tool, only accessible to the researcher. CPUT also holds copies of the audio files securely, thus the data collected will be kept in accordance with the university policy.

3.12 SUMMARY OF CHAPTER THREE

This chapter delineated how the pursued investigation is to take place. The introductory section links the research instrument with the process of answering the research questions. The approaches that are usually used in applying information systems/technology research are then discussed in detail. The case study method of inquiry that is used in this thesis is a non-probabilistic, purposive sampling of convenience as a technique to select the units of analysis and observation (participants). One petrochemical organisation in the Western Cape is selected as a representative sample of the population in the IS/IT department. These are presented as the units of observation. Semi-structured interviews and documentation with eight triangulations of respondents with the professional craft of knowledge, personal practical knowledge, and

understandings of the software production practices, are the primary-data collection techniques used in this study.

Data analysis methods in qualitative research were also discussed. The study employed ATLAS.ti as a qualitative data analysis tool to encode both relevant literature sources and empirical data, in search of thick and rich data that could lead to emergent themes. Therefore, thematic analysis is selected as an appropriate method to analyze data in this thesis. The ethical standing of the research process followed in this study was official.

4 CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION OF RESULTS

This chapter outlines an analysis and interpretation of results. At first, Section 4.1 introduces the contents of the chapter. Thereafter, five key themes of the study (A to F) are addressed. These themes are:

- A. Organisational Culture (Section 4.2);
- B. Human Factors (Section 4.3);
- C. Software Development Processes (Section 4.4);
- D. Teamwork (Section 4.5);
- E. IT as a Business Enabler of Organisational Performance (Section 4.6); and
- F. Software Quality (Section 4.7).

Finally, the chapter concludes with a summary of the results of the study.

4.1 Introduction

This chapter presents the results of the research data collected by utilizing the methodology described in Chapter Three. Following Chapter Two, six research themes emerged for investigation, which led to two main research questions. Chapter Three then described how the research questions that relate to the aim of the study would be explored. The results are presented for the two main research questions. Sample extracts are included from participant interview recordings to analyse various data items.

After synthesizing the empirical data, the study outlined six emergent themes. Thus, a brief discussion of these themes linked with associated factors follows: A. Organisational Culture (OC), B. Human Factors (HF), C. Software Development Process (SDP), D. Teamwork (TW), E. IT as an Enabler of Organisational Performance (IT); and F. Software Quality (SQ).

Table 4.1 below illustrates the relationship between emergent themes and associated factors.

Table 4-1 Summary of Results from Thematic Analysis of Empirical Data

Emergent Themes	Associated Factors	Sources	Interview Protocol Questions *[IQ]	Associated Research Questions
Section 4.2 Organisational Culture (OC)	• Company Goals • Cultural Sensitivity • Diversity • Organisations Cultural Belief • Perceptions of Organisational Culture	Sull, (2018); Lutz, (2017); Kundu & Mor (2017); Pieterse & van Eekelen (2021).	[IQ1] and [IQ2]	MRQ1: What factors are associated with the software development processes evident in organisational culture in an IS/IT department of a petrochemical company in the Western Cape?
Section 4.3 Human Factors (HF)	• Ability • Awareness • Change Fatigue • Integrity • Personality	Gren, (2017) ; Halupa & Bolliger, (2020); Ernst & Young, (2017 ; Varona et al., (2011).	[IQ3]	
Section 4.4 Software Development Process (SDP)	• Client Orientation • Creative Problem-solving • Development Method • Process Documentation • Project Planning	Sekgweleo, (2018) Kaur (2015); Matharu et al. (2015); Amaral et al. (2013)	[IQ6]	
Section 4.5 Teamwork (TW)	• Cohesiveness • Communication • Decision-making • Knowledge-sharing • Workload	Buchwald et al. (2014); Eidizadeh (2017)	[IQ9]; [IQ10] and [IQ13]	

Section 4.6 IT as an Enabler of Organisational Performance (IT)	• Alignment • Automating Processes • Competitiveness • Digitization • Effectiveness	Alghamdi & Sun (2017); Kayikci (2018); Zaky et al. (2018)	[IQ7]	MRQ2: How do the factors associated with software development processes impact organisational performance?
Section 4.7 Software Quality (SQ)	• Data Security • Functionality • Maintainability • Impact	Paullet et al. (2017) Gupta & Chug (2020)	[IQ4]	

Table 4.1 indicates Sections 4.2– 4.7 that address emergent themes (A to F). Each section links to the associated factors contained in column two. *Abbreviations of interview protocol questions. Full interview questions can be found in Appendix C.

4.2 A. Organisational Culture

Organisational culture (OC) emerged as a theme. This theme encapsulated participants' perceived understanding about the phenomenon in their workspace. A combination of feelings encompassing distress and enragement resulted in frustrations for some participants.

4.2.1 Company goals

Productivity, competitiveness, and sustainability are relevant attributes associated with achieving company goals. Thus, the alignment between business and IT strategies is crucial as many organisations rely on IT for enablement.

Divisions within the organisation make use of software that is developed inhouse by the software development team, to aid them in performing their day-to-day tasks, which in this case improves the overall performance and the working methods in the company, as noted by a participant [D01].

For the participants, incorporating IT strategy into business strategy is vital, because then both IT and business will be working towards achieving one goal. Accordingly, it gives team members an opportunity to understand what they need for the betterment of the business [D03 & D05]. In this sense one respondent asserted:

> By so doing it'll definitely drive a commitment to service delivery and improving our processes so, yeah, just making IT working together with the business to reach sort of joint set goals [D08].

4.2.2 Cultural sensitivity

In today's global marketplace it is common to do business with people from all over the world. Thus, it is crucial to be aware of the cultural norms of the people within a team. A mutually satisfying work environment for all appreciates differences in values. Learning from cultural diversity, introduces factors sensitive to business growth (Lutz, 2017).

One participant demonstrated positive behaviour as evident with the response:

> Everyone has a different culture, whether it's from a religious point of view, whether it's from an ethnic point of view, it doesn't really matter, but bring those people together under one umbrella, which is that organisation [D04].

In addition, D04 and D05 ascertain that they have not heard of any culture discrimination and people respect one another's diverse culture within the organisation.

4.2.3 Diversity in Relation to Culture and Performance

As evident in the data about the organisation, the organisation was created in the 1800s. There was solid cultural diversity in the computing environment of the organisation. Instead of espousing this diversity, prevalent elements of open-mindedness contradicted the advantages that could have been gained from the diversity.

Diversity in software development teams impacts the effectiveness and ultimate success of a software project (Pieterse & van Eekelen, 2021). Some reports highlight the positive aspects of such team structures, while others mention difficulties in comprising culturally diverse software development teams.

In this sense one respondent asserted:

> You'll see multiple teams working together – project managers across different partners – which is always a good thing. And the learning and sharing of information which I think demonstrates diversity [D07].

Combining the diverse skills and knowledge of culturally diverse employees, can benefit the company by strengthening the openness and success of the team to adapt to the ever-changing conditions [D02].

Contrary to the above-mentioned, D03 expressed concerns around working in a diverse team by mentioning:

> You get to have that weird feeling when working with other team members within the organisation such as retail and other as if their team is higher than other divisions.

Although managing diversity comprises of building specific skills and creating policies that improve the best work behaviours and attitudes from each employee, D03 stated that by working in a diverse team one gets to work with different types of people. These types can be attributed

to friendly and not-so-friendly people, people who know how to communicate and those who cannot communicate. Moreover, it is always challenging to work in diverse teams, but it is good, as it teaches one to interact with different people across the organisation.

A diverse environment can be professionally enriching and exposing to new employees. However, that was not the case for one of the junior participants, as he mentioned his encounters with adjusting to the environment was to the point of being too scared to introduce himself to the team [D06].

4.2.4 Organisation's Cultural Belief

The key to a successful organisation is to have a culture created on a powerfully held and widely shared set of beliefs that are reinforced by strategy and structure. Most organisations have established principles that define the aspirational features in the culture and such features can be attributed to integrity, teamwork, customer focus, accountability and innovation (Joseph & Kibera, 2019). The participants began to share their experiences as evident with responses like:

> There is a gap, an opportunity for the team to grow or to improve to make sure that they're in line with the company's cultural beliefs and that goes against the organisational cultural beliefs, which are teamwork and collaboration, amongst others [D03].

Additionally D08 indicated:

> To be honest there's no direction, we do meet as if we're agile … we … but the way we do things we just make up things as we go along and change as and when management wants, so I can't really say which cultural belief to be honest – it's very frustrating and confusing.

Contrary to the above-mentioned statement, D01 mentioned:

> We get along with my colleagues. There are some challenges but overcome them. We communicate, which I think speaks to some the cultural beliefs.

4.2.5 Perceptions of Organisational Culture

Organisational culture (OC) outlines the way people behave and the way things are done in an organisation, thus it consists of four effective categories: Clan, Adhocracy, Market, and Hierarchy

(Atiku et al., 2014). The participants began to share their perceived knowledge of organisational culture in their settings, as is evident in some responses.

One participant defined OC as guidelines that influence behaviour of employees in the organisation [D02]. While D03 added by saying OC helps employees with the understanding of the company vision and mission. Thus, most cases the vision aligns with the goals that the company wants to achieve, and in turn, it leads to growth, or success, or improved performance.

> My understanding around organisational culture is all about values of the company … the expectations, how the company operates and how the people in the organisation behaves [D06].

Furthermore, the participants had different opinions on how they viewed their organisation, based on the four types of culture presented to them. D06 indicated that:

> It's leaning towards hierarchal which the decisions start from the CEO and gets passed down to different org levels.

In 2017 the organisation found itself to be falling behind the competition, hence beginning to lose the market share, and this put a financial strain on the business (Ernst & Young, 2018). The organisation recognized that it was difficult to get different outcomes without changing the way they did things, and they implemented the new approach that boosted business growth while providing a higher customer experience driven by technological innovation (Ernst & Young, 2015).

It was due to these changes that participants recognized that the organisation had moved from a family-oriented to hierarchical approach. Thus, in the order of hierarchy, the responsibilities are delegated from the executive team to managers in the organisation. The organisation is driven by formal policies [D08 and D03]. Additionally, D04 and D05 ascertain that there are many policies and strict rules, and that the organisation is very traditional, thus it has old ways of doing things.

In summary, organisational culture comprised of company goals, cultural sensitivity, diversity, organisational cultural belief, and perceptions of organisational culture. Figure 2 below illustrates the findings of this section.

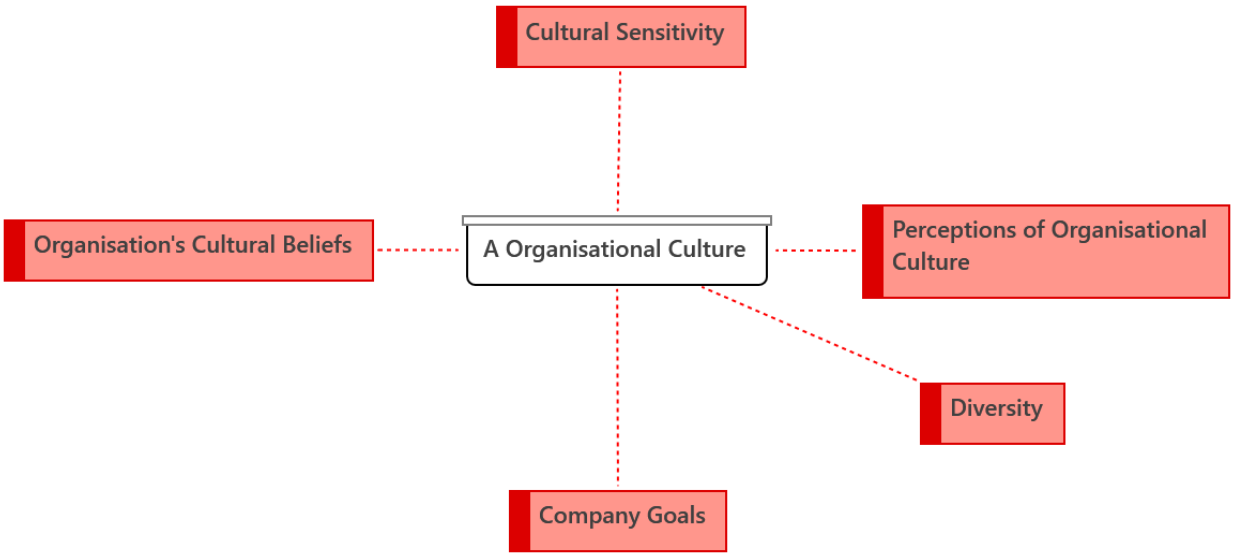


Figure 4-1 A. Organisational Culture

4.3 B. Human Factors

Human factors (HF) emerged as a theme. The theme encapsulated a complete analysis of the participants' experience and knowledge about the phenomenon in their own settings. Thus, in the context of this study, human factors are described as the use of knowledge about human abilities and limitations for the design of systems that are safe, effective and comfortable for human use. Thus, such determining factors can be attributed to combined human activities such as problem-solving abilities, cognitive characteristics and social interaction (Cleland-huang & Capretz, 2014).

4.3.1 Ability

Quality-oriented software development abilities are imperative for good performance [D01]. mentioned:

> Employees should be able to interact and feel comfortable with each other, for example, juniors should be able to interact with managers and managers with juniors in a team to produce a good quality software. Also, a person that can plan, the person that's organized, that would think out of the box, and be able to work alone [D01].

But also highlights that:

> I think if people don't have those abilities, the quality of the developed software will be poor, it'll have poor performance [D01].

Some of the factors associated with human abilities can be attributed to the understanding of another human being's behaviour, thus their ways of thinking. To be able to work alone, aids in seeing the full potential of a person, as working alone allows the person to step in different shoes, as alluded by D07 and D08. In this sense D02 ascertains:

> How you interact and treat people around is a vital skill but not determining factor, however, having the right attitude, good work ethics and how you communicate with others, has a lot of impact towards the product.

Similarly, D08 pointed out that to produce an effective software

> You need people that can try and uncurl and unravel all these kind of mysteries by working collaboratively with every individual in that specific software development team in need, thus, people that can become that glue that becomes that sort of a team.

4.3.2 Awareness

This code captured participants' intense feelings of discontentedness about their understanding of different aspects of an organisation, both through its formal fundamentals as well as through the informal patterns that occur in the organisation. Although the benefits of awareness in the organisation could be attributed to many factors, such as improving decision-making, team building, communication, culture, and leadership effectiveness, resulting in increased revenue, organisation productivity, competitiveness and sustainability (Halupa & Bolliger, 2020), participants emphasized that the organisation is struggling to fulfil such requirements. Moreover, the organisation's strategy premised around agility and responsiveness.

Due to a lack of knowledgeable resources to enforce the awareness and the implementation of agility within the organisation, people resort to old ways of doing things [D03]. Conversely, D04's experience has been that:

> Within that division they do have the business partner which makes things a lot easier as he has both technical and business knowledge. It makes the communication a lot easier as opposed to human resource division, which don't have that kind of a go-in-between people.

While D06 voiced that he is unaware of any organisational processes or culture that he follows – culture and principles he grew up with.

> Again, this organisational culture is not clear to me. I still don't know what the company values and beliefs are, so they're not spoken about, so we just go with the flow. So, I can't say they're reinforced, we just respect each other, basically following our own personal believes and culture even in our meetings the organisational cultural beliefs and processes are never mentioned. So, myself I'm not even aware of what's happening.

4.3.3 Change Fatigue

Change in organisations is ubiquitous, because of the degree and fastness of change in the external environment (Cameron & Quinn, 2011). Change fatigue tends to manifest over a reluctant response by accepting the organisational change that impacts the employee's daily work life (Halupa & Bolliger, 2020).

Although individual factors are relevant, they are also valuable to assess organisational contributing factors as they are easier to improve. Thus, such factors can be attributed to "how different parts of an organisation's focus", "alignment", and "processes" may impact the occurrence of change fatigue as experienced by employees and noted by Nunnelly (2016). This code encapsulates concerns from participants about their experiences within the organisation.

In this sense D03 pointed out that:

> Even though the organisation is trying to make it clear that they're trying to be agile, we still have some individuals who still don't want to change. So, it's the attitude, as they've been with the company for almost 30 years, and they're very comfortable with they've been doing things. You come across some individuals who don't want to change and they're very comfortable on what they know, and they used to do things in their old ways. And for them it is difficult to change, or they don't want to change.

In addition, D08 had similar thoughts stating that:

> You know, maybe it's because of a culture thing as well. Like you have someone who is been sitting there for the last 20 years and he probably for the last for the last 10 years been doing the handwritten report. But now you can come in and say, 'but hang on brother, I can give you a sort of process or a small little application where you can press

> one button and it will give you the same report at your fingertips'. That is the kind of promotion that I think people should have. A lot of people struggled now with the Covid-19.

4.3.4 Integrity

This code demonstrates the participants' perceived knowledge of consistency in upholding and promoting the values and cultural beliefs of the organisation in actions and decisions, in line with the organisation's Code of Conduct.

Accordingly, D01 detailed how they uphold the organisational cultural beliefs and values in their team:

> We always have like weekly chats, like to just to give a feedback on how things have been, and this speaks to one of the organisational cultural beliefs which is, 'Tell me', which means providing feedback. So, this ties to that cultural beliefs.

D04 supported this notion by saying:

> I always look forward to coming back to my team and share what I've learned, and I know they'll have some fun, no matter the situation and that due the organisational laid-back environment in general, sometimes there is pressure, but in my department, I'd say we are flexible, we are self-managed. We structure our work if you deliver, which demonstrates the organisational cultural beliefs which is own it, meaning taking full responsibility of your tasks.

Contrary to the aforementioned, D03 expressed concerns about lack of professionalism and work ethics from other teams:

> Undermined by other teams because we are not a software house, we are undermined by other divisions such as sales, because they think they're bring in money and we as a development team are not.

4.3.5 Personality

This code encapsulates the participants' experiences regarding human performances and behaviours at work. Experts in the field of personality are of the understanding that the individuals

in fact have a constant and long-term trait that affects behaviours and performances at work (Gren , 2017).

Thus, D01 stated that:

> It's been nice working different divisional teams. It exposed me to work with different personalities and the people I've worked with as a junior developer, they would understand, they were very accommodating.

Creativity and working collaboratively as a team demonstrate attributes of good human behaviour and are substantial factors in an organisation, as noted by D02.

Some of the employees in the petrochemical organisation were not pleased with the attitudes that were shown by other employees. D04 mentioned that some customers within the business can be very rude towards the software development team members.

While D04 advocates for the right attitude in a workplace:

> How you interact and treat people around is a significant skill, but not a determining factor, as I've seen most senior people gurus in the field with big ego, very bad attitude and those people got fired because they didn't know how to interact with their teammates and with clients. They've always played like 'I know better than all of you'. So I'd say attitude, whether most junior or a guru. So, for me attitude is everything.

On the other hand, D04 points out some human behaviour in his team:

> Within my space we have people who likes to share and people who don't like to share information.

In summary, human factors comprised of ability, awareness, change fatigue, integrity and personality. Figure 2 below illustrates the findings in this section.

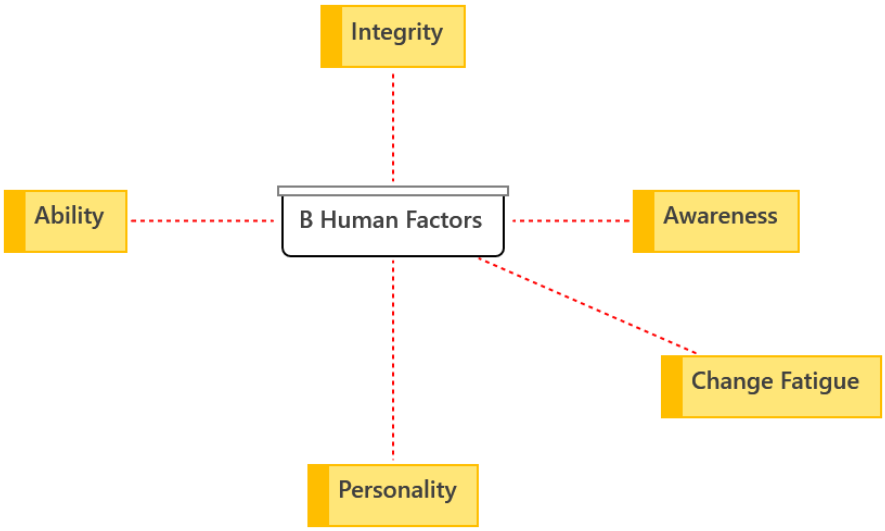


Figure 4-2: Human Factors

4.4 C. Software Development Processes

Software development processes (SDP) emerged as a theme; this theme encapsulated a full analysis of the participants' experience and knowledge about the phenomenon in their own settings. SDP is a framework that ensures the designed solution meets the user requirements that support business strategic goals and objectives. Software development process is a human-centered activity, therefore it involves interactions between humans, processes, and tools to develop a complete product (Sekgweleo, 2015).

4.4.1 Client Orientation

Customer-driven development abilities are imperative for maintaining a strong relationship with customers to continuously receive feedback that influences development. The participants began to share their experiences as evident with responses like:

> Put yourself in the position of the end user of that software and then you in that position can imagine what would the person using the software do with it and which areas of the software would they be interested, and where would be click 1st and so on [D02].

Furthermore, D02 indicated that to avoid customer dissatisfaction before doing any development work, he contacts the customer to verify his understanding of the specification – if it is in line with

what they need, and it keeps the customers involved until the product is completed. Though D04 maintained that he only moves the final product to production environment when the customer is completely happy. That is determined when the client has signed off and a change ticket will then be logged. Thus, D03 ascertains that to improve the customer experience, both the developer and customer must be comfortable with each other.

4.4.2 Creative Problem Solving

There is a lot of creativity in software development, and it is related to how we approach solving the problems. Thus, problem-solving in software development is the process of trying to solve a problem area, using theoretical knowledge and research, best practices and testing out ideas.

Consequently, D08 acknowledged one of the team members by saying that:

> He looks at things from a different angle. I always tell him that he's not just a developer. He's analytical developer because he thinks about things in ways that will be much better at the end of the day. You know something like that.

Accordingly, D04 ascertains that as a developer one should not think of just one method to resolve an issue, but to recommend looking at other alternatives.

4.4.3 Development Method

Adding more structure to the software development plan, thereby selecting the suitable software development methodology for the organisation, depends typically on the team size and goals. To manage a project efficiently, the development team must choose the software development method that will work best for the project at hand. To achieve these methods the waterfall mode, spiral model, incremental model, rapid prototyping model and Agile model have been identified, which are the few most successful methods (Akbar et al., 2017). The participants gave different interpretations on the types of methods they used for development with responses like:

> The company previously used waterfall model and working in silos, and now the company is trying to adopt Agile methodology D03.

Therefore, D03 highlighted that even though the organisation is trying to adopt Agile, there is a lack of knowledgeable resources who can help facilitate the implementation of Agile. He further

stated that because the organisation is not a software development house, there is a hesitation and the teams do what suits them at that time.

Consequently, D07 and D04 mentioned that if the organisation can fully adopt Agile, they will get ROI because the development team will start with the most critical features and then move to the less critical ones in a few months, and during that time Agile does address all the significant features and gives the flexibility to change as we are living in an ever-changing world. We need to be able to adapt, so Agile helps in that sense.

4.4.4 Process Documentation

Process documentation exists to represent all documents produced during software development. Therefore, documentation is a glue between software development phases and among the people working together at different artifacts, but with the same project goal (Todorović et al., 2021). Documentation influences the analysis and development phases as well (Chomal & Saini, 2015). The participants presented different explanations on process documentation within the organisation with responses like:

> We don't always document our process unless it's a complex requirement. Even that we don't do much documentation as we don't have enough resources to document all that [DO4].

Similarly, D03 added that there is no evidence of documentation for a formal process intended for best practice, and requirements are verbally communicated to developers by customers, some of which are incomplete and poorly articulated. D05 mentioned that what the software development team build, match what is required and is only as good as the requirements associated with it.

4.4.5 Project Planning

Project planning is a key area for improvement in overcoming poor performance of software projects. The participants shared their experiences on project planning within their settings.

D04 mentioned that planning a project depends on the complexity of the task at hand, thus, if it is a small development project, they develop without having a big discussion and a project plan. Furthermore D07 and D03 state that in their settings, creating detailed plans can waste time and resources and lead to false expectations. Thus, they tackle requirements as they come. As noted

by D03, some of the project planning challenges include resource limitations, delaying the release of the software product, because there is not enough time to test.

In summary, software development comprised of client orientation, creative problem-solving, development method, process documentation, and project planning. Figure 3 below illustrates the findings of this section.

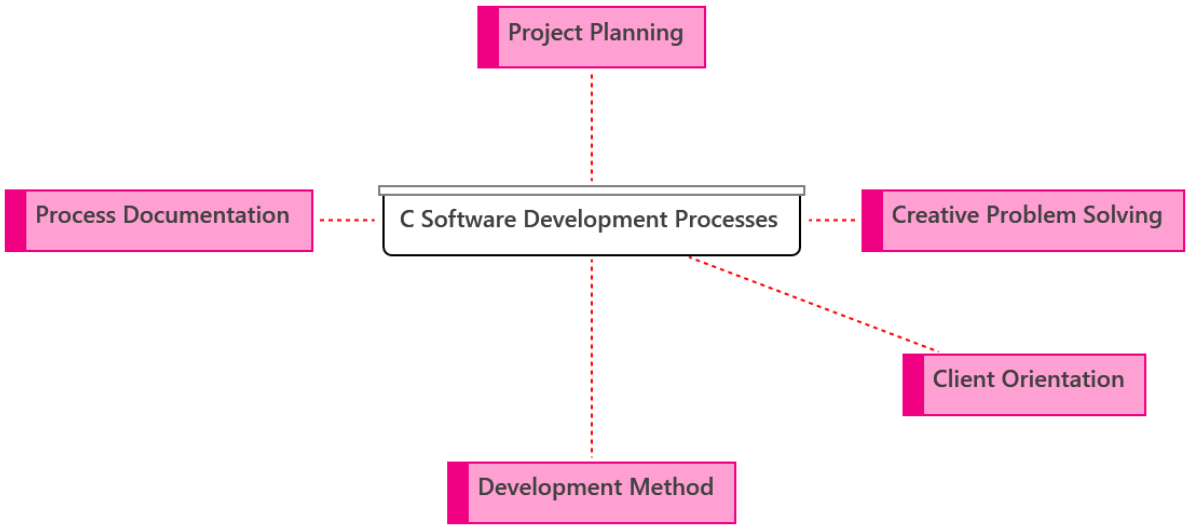


Figure 4-3: Software Development Processes

4.5 D. Teamwork

Teamwork (TW) emerged as an additional theme; this theme summarized an analysis of the participants' experience and knowledge about the phenomenon in their own settings. Capitalizing on the talents and hard work of team members requires teamwork (Bell et al., 2018). The importance of teamwork in an organisation is always felt because of the demand for efficiency and timely implementation of work. Thus, it is significant for any organisation to work, not as a group of people with different motives and objectives, but as a unity to achieve one goal for economic benefit.

4.5.1 Cohesiveness

Team cohesion displays the degree to which members are dedicated to one another in the achievement of team goals. Group performance is a vital factor and is often used as an indicator of organisational outcome (Amaral et al., 2013). The participants began to share their experiences as evident with responses like:

> For me that culture of cohesiveness, that collaboration sort of attitude that these guys have is of vital importance [DO8].

Similarly, D02 stated that working in a team allows people to collaborate and share ideas and skills and it eliminates the blind of when working alone you might miss something. Therefore, D01 says that with the help of teamwork you complete the work on time, and you produce a high-quality output product.

4.5.2 Communication

Communication between diverse members improves understanding of responsibilities and it simplifies the process of delivering the required product faster and more efficiently. This includes ensuring that there is someone to liaise between IT staff, customer and management.

Thus, D04 shared her experience:

> Now that we are working from home, we sometimes have network connectivity issues, but the important part is to keep the team and customer in the loop, communicating and negotiating timelines with them.

Additionally, D05 stated that because there's no business partner in some divisions, communication with some customers proves to be difficult, as they do not have a good knowledge and understanding of technology. Instead, D06 shared his bad experience about the team's lack of communication with the customer, which resulted in animosity.

Furthermore, D06 said that the team was running behind schedule on a piece of work they were working on, and that the team lead did not inform the client, however, the way the client talked to the team lead was unprofessional – the tone was very rude, which resulted in the team lead dropping the project and that was bad for the business. Some of the senior participants

acknowledged that there was a problem with communication in the computing environment [D03 and D07].

Thus, those who were concerned said that they would prefer a two-way communication between the junior and senior employees in the computing environment. Two of the junior employees that were interviewed, emphasized that such communication could enhance their knowledge [D02 and D06].

4.5.3 Decision-making

Decision-making is the process where an individual, group or organisation reaches conclusions about what future actions to follow, given a set of objectives and limits on available resources (Buchwald, Urbach & Ahlemann , 2014). Some of the employees were not satisfied with the level of decision- making within the computing environment. This was attributed because the organisation is hierarchically structured with several teams. Within the hierarchy, roles and responsibilities were given and authorized, respectively, based on the rules and regulations of the organisation.

Similarly, D08 described how decisions were made in the organisation:

> No doubt the company is hierarchical with the decisions starting from the CEO and gets passed down to different org levels.

Additionally, D04 mentioned that people that are not able to make decisions on their own, because they are afraid of what their bosses will say in terms of service delivery, has an enormous negative impact on the organisation, and it can be very frustrating at times.

Conversely, D05 asserted that the decisions are always made from the top and the people at the bottom just do as they have been told. Consequently, D05 gave an example of a recent situation that happened in their division, by mentioning that senior management implemented a new software without involving the end users, purely because they thought it is a good solution for the business. That resulted in many stakeholders to be frustrated, as they thought there were better tools in the market, but they could not voice their opinions.

4.5.4 Knowledge Sharing

Knowledge sharing means the exchange and transfer of experience within several organisational units (Eidizadeh, 2017).Through sharing, teams can successfully increase their understanding to identify and fulfil potential improvement needs of the processes in achieving organisational goals and increasing the overall performance (Maxwell, 2016). An individual factor like personality, influences knowledge-sharing behaviour, which manifests from the human factor. The participants began to share their understandings as is evident with the following responses:

> It helps in building up your knowledge, because throughout the development when you're interacting with those people will be sharing information and then in some cases you are able to discover new things which will be helpful as time goes on [D02].

Hence, D01 mentioned how grateful she is for her senior developer that is always willing to share knowledge and he always motivates, which makes her work a lot better. Contrary to the above-mentioned, D04 expressed concerns about some team members who do not like to share, thereby pointing out that by not sharing knowledge, deprives junior members who look up to them, from learning [D04].

4.5.5 Workload

Work distribution ensures that every person accomplishes any task at hand with the best possible efficiency. The division of work ensures that the work is done on time and deadlines are met. As mentioned by D01 and D02, sharing workload makes the service delivery faster and knowledge transfer amongst the team expands.

In summary, teamwork comprises of cohesiveness, communication, decision-making, knowledge sharing and workload. Figure 6 below illustrates the findings of this section.

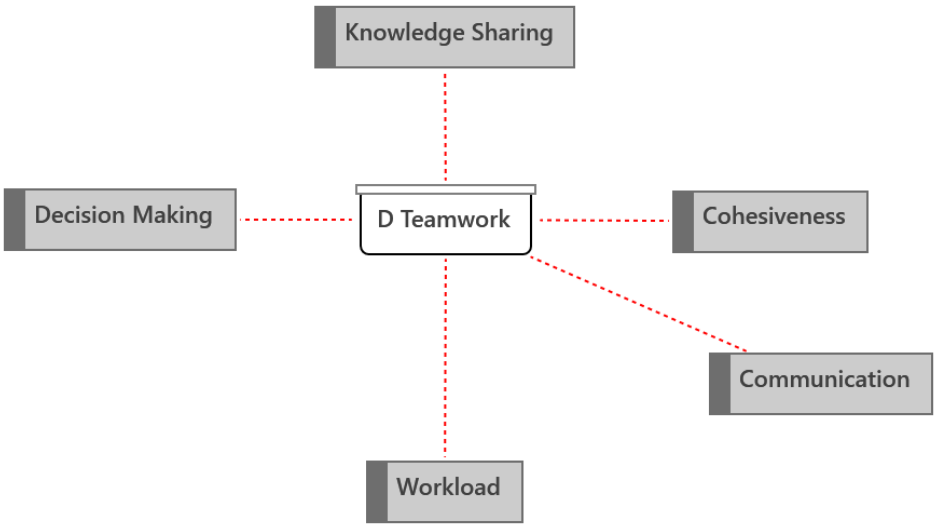


Figure 4-4: D. Teamwork

4.6 E. IT As A Business Enabler of Organisational Performance

IT as a business enabler of organisational performance emerged as a theme; this theme summarized an analysis of the participants' experience and knowledge about the phenomenon in their own settings. Business requirements and needs continue to change and do so rapidly. Many organisations depend on their Information technology (IT) for enablement and support as their needs change through software (Mkhomazi & Iyamu, 2014).

4.6.1 Alignment

Organisations that are able to strategically align their business and IT, have proven to be more successful than their counterparts (Alghamdi & Sun, 2017.) The participants in this study began to share their experiences, as is evident in the following responses:

As noted by D04, aligning business and IT strategy helps with information flow and accessibility to everyone in the organisation. IT is attributed to improved efficiency of business processes and communication between business units and partner organisations. Consequently, the alignment between IT and business is significant [D02]. Additionally, D02 stated that if business and IT divisions are not working closely together or their strategies are not aligned, then they will be pulling in different directions and not working towards a common goal.

Thus, D05 noted the importance of aligning employees with cultural beliefs as they set out the expectations and practices that employees should follow, thereby serving as a guide. He pointed out:

> Need to be alignment, thus the policies and an even the projects that IT is taking on must be to address or to be linked or related to a strategic business objective for to add value [D07].

4.6.2 Automating Processes

Improvement in process automation potentially improves how this organisation does business. Consequently, operational efficiency may expand. Automating processes aids in minimizing manual work, thereby improving efficiency [D01]. Additionally, D04 mentioned that:

> Automated process results in savings of time and better alignment of.

4.6.3 Competitiveness

Due to the evolving competitive landscape, organisations strive to stay profitable and overtake their competitors [D02]. One participant [D04] mentioned that to stay ahead of their competitors by accomplishing sustainable competitive advantage, organisations are strongly embracing technology as the world evolves. Contrary to the above-mentioned, D08 said that although technology provides a competitive advantage to the business, some people in the business are only seeing the value of technology now in the pandemic, as they are now forced to use technology at home.

4.6.4 Digitization

Businesses are leveraging data to improve customer experiences, make employees and processes more productive, and finding adequate ways to respond to the new opportunities of sustainable and competitive advantage through digitization (Kayikci, 2018). The participants began to share their experiences as is evident in the following responses:

D07 pointed out that some of the organisation's goals are to be agile, customer-centric, and data-driven and they have since invested in digital technology, however, he feels that for the organisation to benefit from their IT investments, it is imperative for all divisions to adopt to new ways of doing things.

Additionally, D07 mentioned that some divisions within the organisation are stuck in their old ways like doing handwritten reports and ways that can be related with comfortability, as most of these employees have been with the organisation for over three decades and are doing the same manual tasks. Thus, D04 pointed out that:

> Doing it manually is time-consuming – just imagine sitting there calculating, So I think with digitization then they just enable and simplifies the way business does day-to-day job.

4.6.5 Effectiveness

IT is regarded as a vital tool to simplify tasks and enhance the communication process. Simplifying tasks and improving the communication process are major steps in ensuring that the organisation makes effective and accurate decisions. As a result, high performance is achieved in an

organisation (Zaky, Transport, Ragab, Transport & Soliman, 2018). The participants began to share their experiences as evident with the following responses:

D07 ascertains that the applications they developed are to support the business, as they offer solution to business problems. Additionally, D08 highlighted the effectiveness of IT by mentioning that:

> IT act as a servant, you know, to the rest of the business. We serve business and the business areas, like your retail and HR – they are our customers.

Additionally, D04 said:

> Nowadays everything is navigating towards technology. So, if the business doesn't involve IT into their strategies, they'll be setting themselves up for failure.

In summary, IT as a business enabler of organisational performance comprises of alignment, automating processes, competitiveness, digitization, and effectiveness. Figure 4 below illustrates the findings of this section.

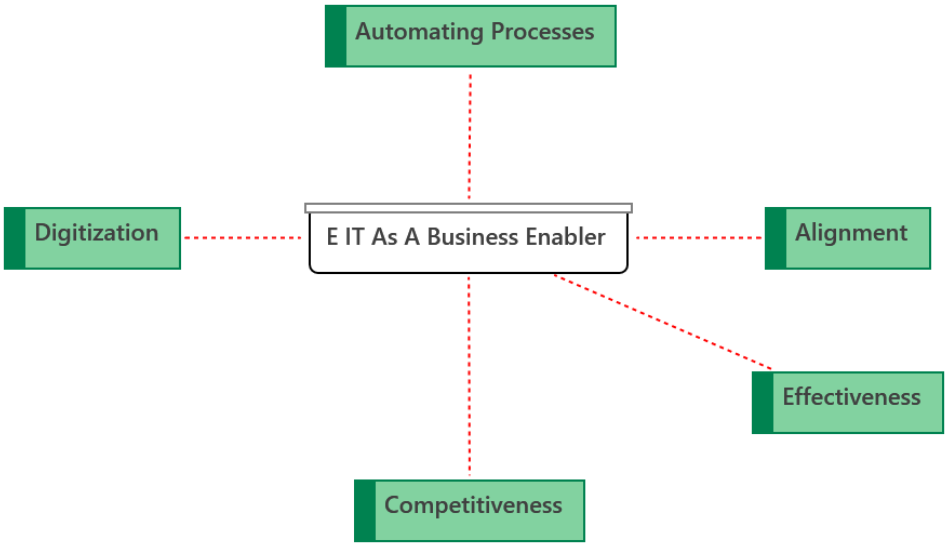


Figure 4-5: E. IT as A Business Enabler of Organisational Performance

4.7 F. Software Quality

Software quality (SQ) emerged as a theme; this theme summarized an analysis of the participants' experience and knowledge about the phenomenon in their own settings. SQ is the degree to which a process, component, or system achieves a specific requirement, thereby fulfilling the customer needs or expectations through product or service, thus providing customer satisfaction (Hovorushchenko, 2018).

4.7.1 Data Security

Data security describes the collection, use and disclosure or personal data, in addition to its secure storage. Furthermore, data security reduces the number of data cracks that an organisation can suffer in the office and at the employees' hands, while reducing the vulnerabilities that hackers can exploit (Mcgeveran, 2019). The participants began to share their experiences as evident with the following responses:

> Security of data helps in terms of cutting down all the manual work such as spreadsheets and filing papers that can easily get misplaced or gets stolen. So for storage, IT plays a vital role [D05].

.Additionally, D04 said data security is crucial, especially with regards to cyber security and protecting the business against the attacks.

4.7.2 Functionality

As the level of functionality expectation for a software application becomes greater, the users basically expect more interactions with the application (Paullet, Douglas, Compimizzi & Sharp, 2017). D05 highlighted some of the challenges they once faced as a team when they could not meet the customer's expectations for developing the software product while learning the new tool, and that was a challenge, as they could not meet the deadline and produced an unsatisfactory product.

4.7.3 Maintainability

Software evolves continuously as the business needs to change continuously; thus, it gets modified and new requirements constantly arise. Furthermore, software maintainability has

become one of the important quality-assessing attributes for any software system (Gupta & Chug, 2020).

Therefore, D05 stated that software should be developed creatively, as creativity leads to continuous improvement and maintainable software products have a high quality. Furthermore, D03 mentioned that the major consequence not to have adequate software process in place, leads to producing a software with many defects. A software product that is not maintainable, leads to more time, effort and cost to implement a change.

4.7.4 Impact on Quality

Software can impact the organisation either negatively or positively. These influences can be attributed to challenges and factors such as skills, collaboration and communication, which manifest from human factors and dysfunctionality of processes (Paullet et al., 2017). The participants began to share their experiences as follows:

> If the skill is not there, our coding standard will be bad and that will affect the quality of the final product and the client will not be happy [D03].

Additionally, D03 highlighted that impact on the quality of the software, as indicated by a persistent failure to meet the expectations of the target users, is due to a lack of compromise and communication, as some users will not take the developers' suggestions into consideration but will only demand, and as a result the product will not satisfy their needs and will thus not be used.

Thus, D04 ascertains that by not collaborating with the team and not taking other members' suggestions into consideration because you know it all, will end up by affecting the software quality negatively, and potentially it will affect the business performance.

In summary, software quality comprises of data security, automating, functionality, maintainability, and impact on quality. Figure 5 below illustrates the findings of this section.

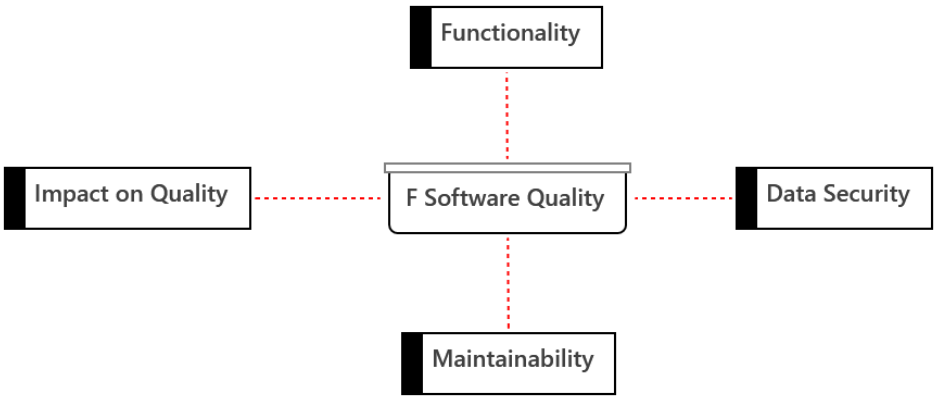


Figure 4-6: F. Software Quality

4.8 SUMMARY OF CHAPTER FOUR

Chapter Four outlined the results and interpretation of the findings generated from the qualitative approach. The data was analysed using thematic analysis. Furthermore, it presented a foundation for Chapter Five which summaries the Discussions, Recommendations, Contributions of the study to the body of knowledge, Limitations of the study, Ideas for future research, and Self-reflection by the researcher.

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5 CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

While the previous chapter presented the analysis and the interpretation of the findings, the major topic discussed in this chapter is the contribution that this thesis makes to the body of knowledge in relation to the research problem identified in Chapter One.

The study aimed at exploring the nature of factors associated with software development processes within a case study context, whilst taking cognizance of their impact on the performance of the organisation itself. A subjectivist philosophical stance is followed, and the epistemology lies within the interpretivist paradigm.

An inductive research approach is followed, while a case study conducted in a real-world, privately owned petrochemical organisation context is used as research strategy. The research design included a non-probabilistic, purposively and conveniently selected sample comprised of a triangulation of eight respondents with the professional craft of knowledge, personal practical knowledge, and understandings about the software production practices, such as the software developers, analyst developer, project manager, senior system specialist and business analyst.

The participants were selected to answer research questions and to ensure an adequate sample size for the thematic analysis. In this chapter, the themes and their associated factors are discussed and the RQs are answered. From the theme discussions, it is illustrated that the aim of this study is addressed. The study offers guidelines which propose the improvement of the quality-oriented software development process of software projects, thereby meeting the objectives of this study.

Chapter Five presents the conclusions, recommendations, contributions and limitations of the study. Future research ideas are presented. The chapter concludes with a self-reflection by the researcher.

To conclude the research report, this chapter is characterized as follows:

- Introduction
- Overview of the research
- Conclusion
- Recommendations
- Research contributions
- Delimitations of the study
- Limitations of the study
- Suggestions for further research
- Summary

5.2 Overview of the research

The study is divided into five chapters summarized in Figure 5.1 below:

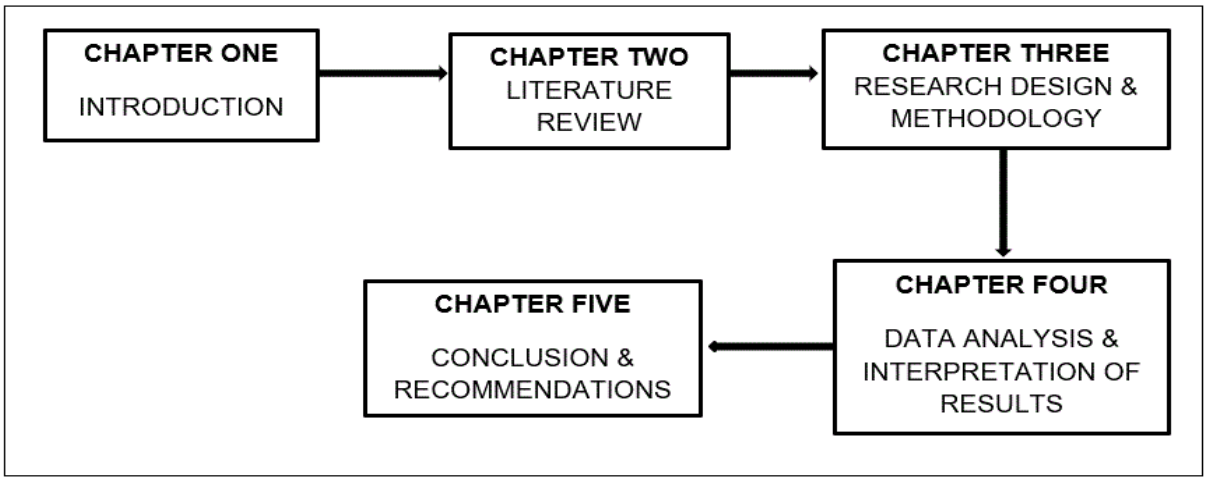

Figure 5-1: Thesis Summary

Chapter One as the introductory chapter, outlined the structure and the research context of the research study. The aim of the study was to explore the nature of factors associated with software

development processes within a case study context, whilst taking cognizance of the impact they have on the performance of the organisation itself.

This chapter placed emphasis on factors to help in achieving improvements through IT innovations, supported by high-quality software development capabilities. Additionally, it acknowledged a need to evaluate the impact of the factors on perceived operational quality and organisational performance. The overall intention underpinning this contribution, links to the achievement of improved software quality for the betterment of the organisational performance to use in the petrochemical industry in the Western Cape.

The intent of this study was to produce a guideline to an approach that can mitigate some of these challenges faced by the selected organisation, as well as other similar organisations in the industry. Following the research aim was the research problem, literature review and research methodology overviews, ethical considerations, contributions and limitations.

Chapter Two addressed literature related to the research problem. This chapter solely focused on the six themes that emerged from the literature review, founded upon empirical groundings, which aimed at assisting the researcher to explore and gain an in-depth understanding about the nature of factors associated with software development processes, whilst taking cognizance of the impact they have on the performance of the organisation itself.

Themes that emerged were: Organisational Culture (OC), Human Factors (HF), Software Development Process (SDP), Teamwork (TW), Information Technology as an Enabler of Organisational Performance (IT) and Software Quality (SQ). The themes were then discussed in chronological order.

Chapter Two aided in identifying potential areas of research and the knowledge gaps in published literature sources regarding the identification and characterization of factors and their effect on software development processes. Additionally, it acknowledges a need to evaluate the impact of these factors on perceived operational quality and organisational performance.

Chapter Three explained that the methodology was appropriate for the research at hand. It clearly described reasons for the methodology selection and how, when and where the researcher performed the research. It selected the population sample of a triangulation of respondents with the professional craft of knowledge, personal practical knowledge, and understandings about the

software production practices, also answering research questions to ensure an adequate sample size for the thematic analysis.

In Chapter Four results were presented, and therefore conclusions were reached about the research questions posed and the themes that were developed in Chapter Two. The following section summarizes the degree to which the results of this study will identify research contributions within the context of each theme.

Chapter Five draws on the previous chapters for information and it provides a conclusion of and recommendations for the research study. The conclusions have been drawn from the analysis of the data, findings from the analysis and interpretation of the findings. The findings became the results from the answers to the research questions. To conclude the research report, this chapter is further characterized as follows: the overview of the research, research questions revisited, research contributions, conclusion, recommendations, limitations, further research and summary. It develops a conceptual model based on the results.

5.3 Conclusion

This study aimed to explore the nature of factors associated with software development processes within a case study context, whilst taking cognizance of their impact on the performance of the organisation itself. Based on this aim, Section 5.3 revisits the two main research questions and associated research objectives in Table 5-1 as outlined earlier in Chapter One (Table 1-1).

Table 5-1: Mapping research questions and objectives to chapter sections

Research Questions and Objectives	Chapter sections
MRQ1: What factors are associated with the software development processes evident in organisational culture in an IS/IT department of a petrochemical company in the Western Cape? MRO1: To explore the factors associated with the software development processes associated with an IS/IT department.	2.2, 2.3, 2.4, 2.5
MRQ2: How do factors associated with software development processes impact organisational performance? MRO2: To examine the potential impact of factors associated with software development processes on organisational performance.	2.6, 2.7

The aim was to explore the nature of factors associated with software development processes within a case study context, whilst taking cognizance of their impact on the performance of the organisation itself.

5.3.1 MRQ1

MRQ1: What factors are associated with the software development processes evident in organisational culture in an IS/IT department of a petrochemical company in the Western Cape?

This section identifies factors associated with the following themes:

- Organisational Culture
- Human Factors
- Software Development Process
- Teamwork

Organisational Culture

Unquestionably, as it has already been noted in various studies, organisational culture, to some degree, has a strong link to productivity in an organisation, because of how it influences an individual's outlook and resultant engagement at work (Morcos, 2018). This theme was extensively discussed in the literature that was reviewed in Chapter Two.

Factors which can influence organisational culture and were identified in the study, include company goals, cultural sensitivity, diversity, an organisation's cultural belief and perceptions of organisational culture.

Company goals

Scientific evidence identified company goals as strategic objectives that decision makers create for future-expected outcomes, and to guide employees' efforts (Singh, Bawa & Sharma, 2015). The importance of setting goals is to help define a company's determination, support its business growth and attain its financial objectives (Sull, 2018).

In reference to a petrochemical organisation, some of the employees were not satisfied with the level of transparency, and they mentioned that decision makers should share organisational goals on platforms that everyone can access, so that all teams have the visibility of how their efforts are supporting company goals. Thus, when employees can see the most important goals, they can align their individual and team objectives with the company's overall direction. Additionally, the decision makers must ensure that employees are equipped with the suitable tools and resources required for their work to help meet the overall organisational goals.

Cultural sensitivity

Cultural sensitivity is the determination an individual makes to try to understand the aspects of culture that are hidden, but form the base and the main culture (Lutz, 2017). To attain cultural sensitivity, one must have knowledge of cultural differences, norms and values of other individuals. As noted by Lutz (2017), knowledge can be learned through training, education, or experience with a culture in a variety of settings.

In reference to a petrochemical organisation, participants highlighted that if employees were properly trained to become interculturally sensitive, it would improve the organisation's likelihood of accomplishing its business goals.

Diversity

Kundu and Mor (2017) defined diversity as the co-existence of people from several social, cultural and ethnic backgrounds within the organisation. While Hekman and Johnson, (2017) ascertains that diversity also signifies the differences between individuals regarding any personal attributes that determine how people perceive one another.

Accordingly, Kundu and Mor (2017) further add that achieving sustainable competitive advantage and the need to become an employer of choice, have influenced organisations globally to embrace the idea of diversity. This research considered only the cultural diversity within a software development team. All other diversifying factors such as age, etc., were ignored.

Scientific evidence identified how diversity in software development teams impacts the effectiveness and ultimate success of a software project (Pieterse & van Eekelen, 2021). Some reports highlight the positive aspects of such team structures, while others mention difficulties in comprising culturally diverse software development teams.

While the different views of the individual team members in culturally diverse teams may inspire better reasoning and decision-making about the software tasks and encourage knowledge sharing (Pieterse & van Eekelen, 2021) within a petrochemical organisation, this is not the case, as poor communication in teams in turn leads to reduced trust, which hinders individual performance and overall team effectiveness and morale.

Participants also mentioned that a major percentage of the high-ranking jobs were allocated to the upper class, and the environments do not allow everyone to be comfortable enough to share their ideas.

Organisation’s cultural belief

Scientific evidence identified that shared beliefs are often considered an important part of organisational culture. Beliefs are subtle and usually invisible, but they can be very influential when it comes to guiding group behaviour. Thus, if the organisation’s culture is going to improve the organisation's overall performance, the culture must offer a strategic competitive advantage, and beliefs and values must be shared extensively and be strongly maintained, as noted by Felipe (2017).

About a petrochemical organisation, they embrace the people-focused culture that espouses teamwork, focused recognition, and shared success amongst some of their cultural beliefs. However, it was discovered that some individuals do not uphold such beliefs, as their attitude and behaviour contribute to software development project failure, as highlighted by some participants.

Perceptions of organisational culture

OC has mainly been seen as an internal phenomenon, having an impact on employees' behaviour and attitudes, and eventually influencing organisational performance and effectiveness (Joseph & Kibera, 2019). When there is ambiguity and a lack of cultural consensus in a petrochemical organisation, it is thought to be detrimental to the organisation in most instances, because the entire organisation's method for guiding employee behaviour is not available.

Thus, an employee's intent to leave the organisation was significantly and inversely related to the extent to which they perceived certain organisational values, namely innovation, trust and communication that were manifested in the organisation, as highlited by some participants.

Innovation is one of the values of the petrochemical organisation, however, there seems to be a culture gap between what the decision makers intended and what employees perceived to value, expected and experienced in the organisation. Some participants noted that although being innovative is one of the organisation's values, they do not think they are allowed to come up with new ways of doing things, and this is due to the hierachichal and bureaucratic settings of the organisation.

Communication is also one of the organisation's values, however, communication is only from top down, thus, from decision makers down to the employees. Therefore, participants revealed that they are not listened to and not heard in the organisation. Furthermore, they revealed that even if they give feedback via survey channels, they feel as if management do their own thing anyway.

Human Factors

Scientific evidence identified several human factors associated with the software development process that have empirically proved to influence productivity and quality. Consequently, it is recommended that the adoption of such factors are incorporated into the competences achieved

within a petrochemical organisation for improved organisational performance and an overall development process.

Thus, Chagas, Santos,Santana and Vasconcelos, (2015) based on the works of Cleland-huang and Capretz (2014), posit that failures in software development ultimately come down to the people working with it. Conversely, Chagas et al. (2015) based on the works of Pirzadeh (2010), further add that human factors are connected to different aspects of the human being, and that they could impact the final software product.

The organisation prides itself with its human capital; they embrace the people-focused culture that espouses teamwork, collaboration and shared success, among some of their values. Thus, emphasis should be placed on the identified factors for the organisation to benefit from their IT investment, which comprises its competitive advantage.

These factors were defined as individual ability, awareness, change fatigue, integrity and personality.

Individual ability

With human factors having so much potential impact on the outcome of a project, it makes sense for leaders to learn what they can do to have a positive influence in this area. Since software development is a labor-intensive activity, it is vital for the leaders to know their project team members' real competences and abilities. This could potentially affect the software quality and productivity, and this will also indicate that the team members are fully committed.

The individual ability has two parts, specifically: competence of the individual, and the knowledge in the technical area. Lack of understanding regarding the technical area can result in low productivity and poor quality of the end product, as noted by Gren (2017).

Awareness

Although the benefits of awareness in the organisation could be attributed to many factors, such as improving decision-making, team building, communication, culture, and leadership effectiveness that result in increased revenue, organisational productivity, competitiveness and sustainability, participants emphasized that the organisation is struggling to fulfil such requirements (Halupa & Bolliger, 2020).

Consequently, some employees within the computing environment were not aware of the developed IT strategy and IT processes. According to some of the employees, the communication platform method was the departmental workshop called the IT forum, which only happens twice a year where the strategy and processes are never discussed.

Some of the employees were not pleased with the level of awareness created by the IT decision-making team. Furthermore, employees thought that the IT decision-making team could do more to create awareness about IT strategy and processes in the organisation.

Change fatigue

Change fatigue tends to manifest over a reluctant response by accepting the organisational change that impacts the employee's daily work life (Halupa & Bolliger, 2020). It was revealed in a petrochemical organisation that in 2017 the organisation found itself to be falling behind the competition and therefore beginning to lose the market share, and this put a financial strain on the business.

The decision makers consulted to create the case for change. The organisation recognized that it was difficult to get different outcomes without changing the way they did things. They implemented the new strategy that boosted business growth, while providing a higher customer experience driven by technological innovation (Ernst & Young, 2015).

However, many in the organisation found it difficult to adapt to new habits and ways of thinking, as some had been with the organisation for almost three decades and are used to the old ways of doing things. They struggled to keep up and insisted that things should be done the way they have did.

Integrity

In the petrochemical organisation there is a need for consistency in upholding and promoting the values and cultural beliefs of the organisation in actions and decisions, in line with the organisation's code of conduct, as revealed by the participants.

Personality

Scientific evidence identified that personality is an important factor for both quality and productivity that might also be related to professional ethics codes (Varona et al., 2011). Some of the

employees in the petrochemical organisation were not pleased with the level of attitudes demonstrated by other employees, such as some stakeholders within the organisation and within the computing environment. They mentioned that this could potentially affect strategic objectives of the company. They regarded some people in other divisions, such as retail, as rude and they regarded their divisions as better than the computing team, as they bring money into the business.

Software Development Process

The software development process is a road map which guides project teams to the requirements to successfully complete the project (Sekgweleo, 2018). The aim of a software development process is to produce high-quality software within the budget and on time. This theme in this study was extensively discussed in the literature that was reviewed in Chapter Two.

Analysis and interpretation of the data identified and categorized factors which can influence software development processes, include client orientation, creative problem-solving, development method, process documentation and project planning.

These factors were defined as client orientation, creative problem-solving, development method, process documentation and project planning.

Client orientation

Customer-driven development abilities are important for maintaining strong relationships with customers to continuously receive feedback that influences development. Consequently, some employees within the computing environment were not satisfied with the relationship they have with their customers, which are divisions within the organisation. They highlighted that this could be improved if divisions can treat them to be part of the organisation and that they should all be working together for the betterment of the company.

Creative problem-solving

A creative problem-solving process within the computing environment is finding ways to solve a problem area by using theoretical knowledge and research, best practices and testing out ideas. Thus, if customer requirements are well documented to present the problem and its probable solution, the development team will be able to develop a robust and scalable software product to automate the system and this can solve the problem.

Proper planning, customer interaction, customer involvement in testing, and a clear product specification can increase both customer and development team understanding of the problem. The software development team mentioned that due to a lack of standardized software practices, they must be creative to solve issues to meet customers' needs.

Development method

Scientific evidence identified software development method as the set of tools and practices used to produce a software product. Consequently, some employees within the computing environment were not aware of any standardized development method. According to some in the development team, they follow any method they see suitable for the project at hand. Some mentioned a hybrid software development model where both waterfall and Agile principles are employed, but they stressed that this could be because it is a petrochemical organisation and not an IT development house.

Process documentation

By properly planning and documenting a software project duration and release cycles, will help to improve the development team's productivity and software quality, however, this is not currently happening as this needs time and effort. Due to a lack of resources within the development team, finding time to document is never their priority, as mentioned by some senior development.

Project planning

The process of planning a software project is when the team, including the customer, prioritizes and conducts effort estimation on the requirements that are often written as business requirements. The development team mentioned that unless it is a big project, they do really sit and discuss it, but they just assign and share tasks amongst team members and revert to the customer once the tasks are completed.

Teamwork

Scientific evidence shows that teamwork can be defined as working collaboratively with colleagues, thereby sincerely valuing others' ideas and expertise, willing to learn from others and putting the team agenda before personal agenda to attain organisational goals. The team's success is measured in terms of the quality of the software project they produce, as well as the extent of the collaboration in the team while working on the project.

Analysis and interpretation of the data identified and categorized several factors associated with the teamwork that has proved to influence productivity and software development processes empirically. Consequently, it is recommended that the adoptions of these factors are incorporated into the competences achieved in the computing environment within a petrochemical organisation for improved organisational performance and the overall development process.

These factors were identified and categorized as cohesiveness, communication, decision-making, knowledge-sharing and workload.

Cohesiveness

Scientific evidence shows that cohesiveness in a team is important for successful software development. A team entails individuals, and it is important that they see themselves as a unit. If there is no team cohesiveness and some team members separate themselves from others, this will undoubtedly make the teamwork difficult.

Analysis and interpretation of the data identified that some of the employees were not satisfied with the level of effort towards working together that was created by the IT executive team. These employees thought silo mentality, attitudes, and ego are the contributing factors and that the IT executive could do more to create awareness for working together. It is important for any organisation to work as a unity to achieve one goal for economic benefit and not as a group of people with different motives and objectives.

Communication

Scientific evidence shows that communication amongst the project team members is vital for success for any type of software project and achieving valuable performance, thus, good team communication enhances the achievement of goals and the cooperation among team members.

Analysis and interpretation of the data identified that some of the employees in the computing environment were concerned with the flow of information. Those who were concerned mentioned that they would prefer a reciprocal information flow between the junior and senior employees. Most of the junior employees that were interviewed, highlighted that such a flow of information could improve their understanding as they are just fresh from university and have limited knowledge.

Some of the senior employees acknowledged that there was a problem with communication in the computing environment, but they also mentioned that the hierarchical organisational culture is the main attribute contributing to this.

Decision-making

Analysis and interpretation of the data identified that decisions about technology are taken by the CIO through the rules of the organisation. In the order of hierarchy, the decision-making responsibilities were further delegated to the IT Executive team and other IT managers.

Some of the employees were not satisfied with the level of decision-making that was created by the IT managers. Some employees mentioned that people are not able to make decisions on their own, because the organisational culture and structure, impacts service delivery negatively, and that can be very frustrating at times. Thus, simple tasks require a long process for approval.

Knowledge sharing

Scientific evidence shows that knowledge sharing is vital in retaining valuable knowledge resources and in strengthening the ability of organisations to compete in an increasingly complex, dynamic and comprehensive business environment. Some employees were concerned with the lack of willingness from other team members to share knowledge, and they mentioned that some people work in silos and that they like to be recognized sorely. These employees thought that the IT Executive team could do more to create awareness regarding knowledge-sharing in the computing environment and in the organisation.

Workload

To ensure efficiency, the individuals in the computing environment distributed project tasks and used the resources within their reach to carry out their responsibilities in the development, thus, share responsibilities accordingly.

The research objective of MRQ1 was: To explore the factors are associated with the software development processes evident in organisational culture in an IS/IT department of a petrochemical company in the Western Cape. Based on analysis and interpretation of the data this research objective (MRO1) was achieved.

5.3.2 MRQ2

The second research question, MRQ2, is:

How do factors associated with software development processes impact organisational performance?

The four themes identified in Section 5.3.1 addressed MRQ1. These themes encompassed factors which potentially influence software development processes. However, Section 5.3.2 explores the way in which these two additional themes potentially impact organisational performance:

- IT as an Enabler
- Software Quality

The Impact of IT as an Enabler of Organisational Performance

Changing competitiveness in the global market has created challenges for many organisations as well as individuals. Thus, to manage this rapidly changing environment, organisational cultures and IT practices are expected to play a more vital role in firm performance improvement and effectiveness (Ozigbo, 2013). IT is seen as a significant tool to simplify tasks and enhance the communication process. Thus, simplifying tasks and improving the communication process are key steps in ensuring that the organisation makes effective and accurate decisions, resulting in achieving high performance and sustainability for the betterment of the organisation.

Drawing from the literature and results of the study, it was evident that organisational culture plays a significant role in IT implementation and it influences organisational performance. Organisational culture manifested in beliefs and assumptions, values, attitudes and behaviours of its employees, is a valued source of an organisation's competitive advantage. In today's rapidly changing environment, the achievement of IT enablement through standardized software development processes, is vital for the organisation's sustainability and support as their needs continue to change through software. Furthermore, effective teamwork is essential for the achievement of IT enablement.

The Impact of Software Quality on Organisational Performance

Software has become pervasive in the modern world. Effectively all businesses use software for their support and to perform tasks, thus, software quality is vital for businesses. Therefore, it is important for every organisation to have its own internal standards that provide a guideline for measuring and monitoring quality. In addition to standards, organisations need clearly defined quality models to effectively meet the demands from customers. Such models outline the most important attributes that a high-quality software product should have, like reliability and maintainability.

Accordingly, drawing from the literature and results of the study, having effective software quality standards and models will ensure that the organisation produces quality products that meet customers' needs and potentially improve organisational performance. Thus, software maintenance must be carried out and implemented thoroughly to ensure the optimum quality of software throughout its life cycle.

Figure **5-2** below concretises a proposed framework of guidelines to an approach that can mitigate some of the challenges faced by the selected organisation as well as other similar organisations in the industry. The framework addresses findings of the study associated with research questions MRQ1 and MRQ2 with respective objectives MRO1 and MRO2 as outlined in Table 5-1.

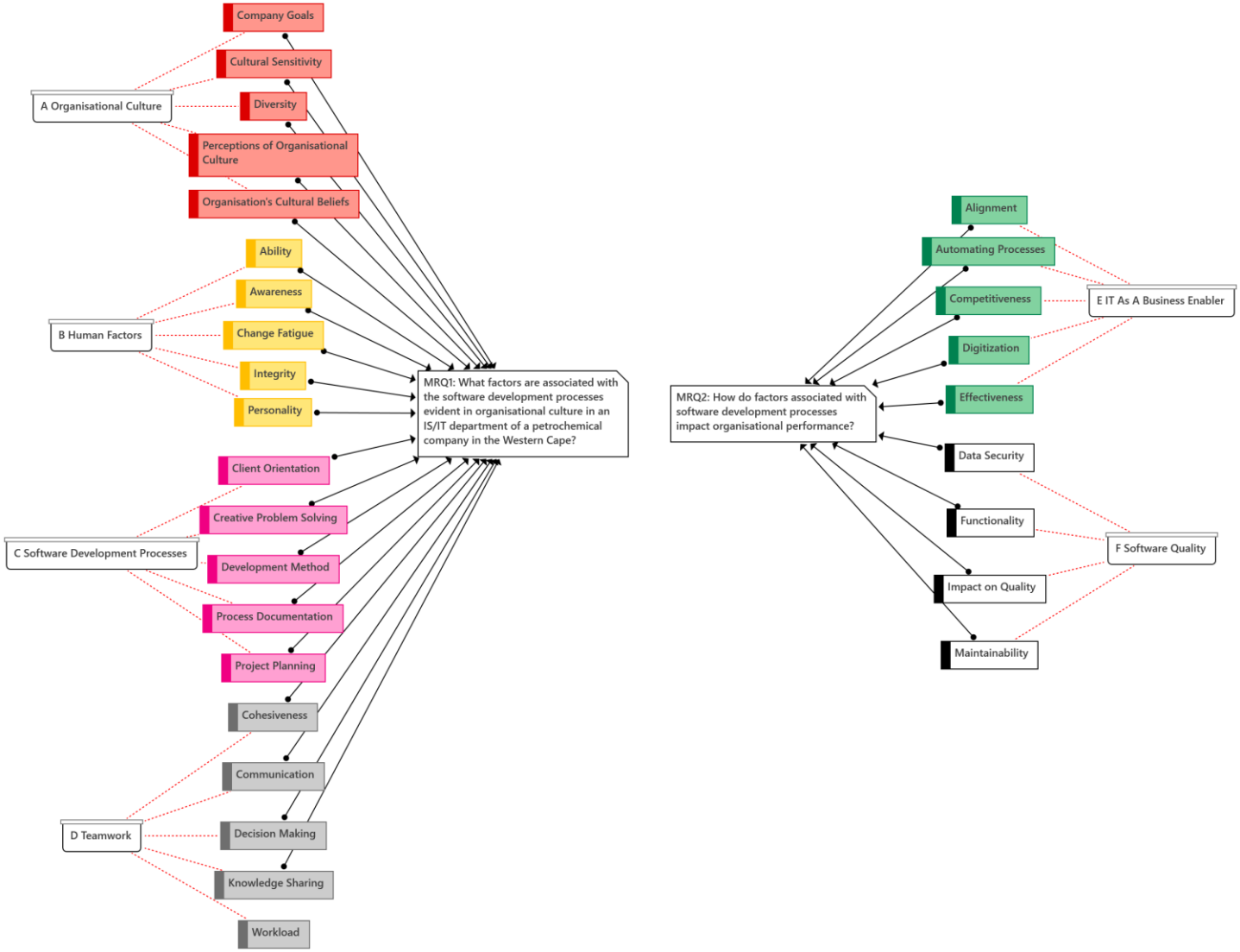

Figure 5-2: Summary of Themes and Associated Factors Derived During Analysis

5.4 Recommendations

In this section the recommendations are presented to provide a set of guidelines to assist decision makers in a petrochemical organisation to make informed decisions about their computing environment. These recommendations are guided by the answers to MRQ1 (Section 5.3.1) and MRQ2 (Section 5.3.2). These recommendations were derived from further synthesising the themes from Chapter Four. The recommendations are recorded below.

5.4.1 Culture Awareness Programs

The management should work on developing the encouraging organisational culture that requires honesty, collaboration and trust. Thus, it would be beneficial to have an espoused culture that promotes working with others and enables decision-making that is comprehensive, thereby avoiding a hierarchical management process. Teams need to go through cultural awareness programs where employees will be educated about the organisational cultures and other cultures. In these programs, matters of cultural discrimination and stereotypes are addressed. This process will benefit both the organisation and employees as it will create an opportunity for team members to share their experiences and learn about cultural diversity as they will develop a good understanding of cultures other than their own. The decision makers should undertake cultural audits, conducted by external operators to focus on values and behaviours to determine the health of the organisation as seen from the employee's perspective. Noted by participants is the importance of flexible working conditions.

5.4.2 Team Building through Social Gatherings

The management should have team building sessions at least once a year. These gatherings should happen outside of their employees' work environment. These gatherings will inspire teamwork by simulating work situations where each employee needs the other to achieve a specific outcome. These situations allow the employees to participate, communicate, disagree, learn new skills and work together to achieve a common goal and possibly break the silo mentality that might happen when they get back to their work environment. Communicating on workload and timelines in advance is essential. The outcome will be improved employee performance, which will directly impact the performance of the whole organisation.

5.4.3 Human factors associated with software development process

The team members should be given training in developing confrontation abilities and approaches for creative problem-solving. The study identified several human factors associated with the software development process that have proved to influence productivity and quality empirically. It is recommended that the adoption of these factors are incorporated into the competences achieved within a petrochemical organisation for improved organisational performance and overall development process. Additionally, the guideline presented in this research is followed.

5.4.4 Improved software quality

To remain competitive in the global market, management is encouraged to invest in software quality standards that will serve as guidelines, and to have a team dedicated for testing final product to avoid customer dissatisfaction that may result in revenue loss. Investments in software quality standards can help to make an organisation's operational processes substantially more efficient and its managerial processes much more effective. Additionally, by implementing these standards, the organisation will be espousing the internationally recognized guidelines.

IT teams should have consultations with the customer to sign off the work that will be performed. This will indicate that the customer is aware and committed to the software product about to be created. Internal IT auditors need to be involved from the planning phase of the project to perform risk identification to mitigate risks prior to the implementation. Similarly, a culture should be created where processes are clearly documented and easily accessed by the relevant team members. Additionally, business processes should be automated and operating environments modernized through digitization. The advantage will be to help achieve some of the organisation's goals about agility, to be data-driven and customer-centric. Also, by making such improvements to its business processes, an organisation may be able to improve the quality and customer service and potentially develop innovative products to remain competitive in the market.

5.5 Research Contributions

This study has contributed significantly on no less than three levels to the body of knowledge: practically, methodologically and theoretically.

5.5.1 Practical Contributions

The practical contributions of the study are particularly aimed at assisting decision makers in the organisation, as well as the managers at large, in the petrochemical industry in deriving the necessary essential information for identifying the key factors for the software development process. The overall intention underpinning this contribution links to the achievement of improved software quality for the betterment of the organisational performance.

5.5.2 Methodological Contributions

The methodological contributions in this study are the methods of taking a subjectivist philosophical stance and the epistemology within the interpretivist paradigm. An inductive research approach was followed, and a case study was used as research strategy to address the research problem to serve as a guide for other researchers. The additional methodological contribution is the type of data analysis methods used in this study. Thematic analysis was used to analyse the data generated from the qualitative approach.

The empirical nature of this study required interpretive inquiry, as data analysis required both the researcher's own interpretations, as well as participants' understanding. Since the study was based on one privately owned petrochemical organisation, a thorough investigation and analysis was required, which made a case-study approach appropriate.

As indicated in the methodology section in Chapter Three, the interviews took place during extraordinary times when a pandemic forced most employees to work from home. This affected the way how teams worked together and performed. Thus, the interviews had to be held digitally, using Microsoft Teams. The study will contribute knowledge to qualitative research design and methods. For example, it employed the extensive use of ATLAS.ti 9, a qualitative data analysis tool, to analyse literature sources and empirically produce a synthesized, crystallized and focused perspective. Thus, a working knowledge of thematic analysis contributed to methodological perspectives. Study outputs included a journal article and conference paper publications.

5.5.3 Theoretical Contributions

Prior to this study, little was known about the guidelines regarding the identification and characterization of factors and its effect on software development processes. Additionally, little was known about the impact of these factors on perceived operational quality and organisational performance. Thus, this study identifies and address this gap in published literature sources regarding the identification and characterisation of factors associated with software development processes. Additionally, it acknowledges a need to explore the impact of these factors on organisational performance. The study also contributes scientifically to the body of knowledge by extending theoretical perspectives associated with software development processes in large development contexts. Furthermore, the study will produce a guideline to an approach that can

mitigate some of the challenges faced by the selected organisation as well as other similar organisations in the industry.

5.6 Delimitations of the Study

Several delimitations emerged from the study:

The findings, conclusions and recommendations of this study are not reflective of all South African petrochemical organisations, but only one petrochemical organisation in the Western Cape. However, the study provides a general framework which will consequently make a valuable contribution to all petrochemical organisations across the globe.

One methodological decision that creates a limitation is the decision to collect data at only one organisation. Thus, taking a multi-case study approach could also have diversified the participants represented in the sample, thus, adding to the generalizability of the findings. The findings of this study reflect a specific period of the study. A change in settings may produce different results and recommendations.

5.7 Limitations of the Study

Several limitations emerged from the study:

The data were collected during the global Coronavirus pandemic, which led to the subsequent reluctance of participants' participation. An approach to overcoming this constraint would entail early ethical applications and therefore early ethical approvals. Thus, potentially it would include an earlier start in the data collection process and would have increased the time needed to interview more participants. The future research could be conducted using a larger sample size. Although the sample size for this study provided a good representation of the population group, it will be interesting to see if results change with a larger sample group.

The quality of the study implies that the findings are totally dependent on the veracity of respondent feedback. The possibility that the data collected from another petrochemical organisation could elicit completely different outcomes, is a topic for future research study.

5.8 Suggestions for Future Research

It is recommended that the research be extended to a broader group, since this is a one case study. For further research, the guideline presented in this research can be tested with other organisations and in other regions to test its applicability.

5.9 SUMMARY OF CHAPTER FIVE:

In this chapter, the core discoveries of this work are concluded. The research followed a case study approach, limited to a specific petrochemical organisation in South Africa. The results are accurate and based on the eight participants that were interviewed. However, these results cannot be generalized as they are unique to this specific case study.

Finally, the findings reflected in Chapter Five are pertinent to the success of software development processes, hence competitiveness of the case study company. Furthermore, the study highlighted two key impacts, namely the role played by IT as an enabling force, and the awareness of the necessity to focus on quality of final deliverables and outputs. Therefore, the study represents a considerable contribution to an identified gap. Of particular significance are the guidelines contained in Figure 5-2. This framework offers potential validity for the success of software development processes of other petrochemical institutions, and it is worthy of future research.

6 REFERENCES

Abdul Majid, M.A., Othman, M., Mohamad, S.F. & Abdul Halim Lim, S., 2018. *Achieving data saturation: evidence from a qualitative study of job satisfaction*. Social and Management Research Journal (SMRJ), 15(2), pp.65-77.

Abrahao, S., Baldassarre, M.T., Caivano, D., Dittrich, Y., Lanzilotti, R. & Piccinno, A., 2015. *Human factors in software development processes. In Proceedings of the Product-Focused Software Process Improvement*: 16th International Conference, PROFES.

Afif, A.N., Noviyanto, F., Sunardi, S., Akbar, S.A. & Aribowo, E., 2020. *Integrated application for automatic schedule-based distribution and monitoring of irrigation by applying the waterfall model process*. Bulletin of Electrical Engineering and Informatics, 9(1), pp.420-426.

Akbar, M.A., Sang, J., Khan, A.A., Shafiq, M., Hussain, S., Hu, H., Elahi, M. & Xiang, H., 2017. *Improving the quality of software development process by introducing a new methodology–AZ-model*. IEEE Access, 6, pp.4811-4823.

Alghamdi, H. & Sun, L., 2017. *Business and IT alignment in higher education sector*. International Journal of Technology and Engineering Studies, 3(1), pp.01-08.

Alshamrani, A. & Bahattab, A. 2015. *A Comparison Between Three SDLC Models Waterfall Model, Spiral Model, and Incremental/Iterative Model*. IJCSI International Journal of Computer Science Issues, 12(1): 106–111.

Alshmemri, M., Shahwan-Akl, L. & Maude, P., 2017. *Herzberg's two-factor theory*. Life Science Journal, 14(5), pp.12-16.

Amlani, R.D., 2013. *Analysis and comparative study of various software development process models* (Doctoral dissertation, Saurashtra University).

Amrit, C., Daneva, M. & Damian, D. 2014. *Human factors in software development: On its underlying theories and the value of learning from related disciplines. A guest editorial introduction to the special issue*. Information and Software Technology, 56(12): 1537–1542.

Anjum, H., Babar, M.I., Jehanzeb, M., Khan, M., Chaudhry, S., Sultana, S., Shahid, Z., Zeshan, F. & Bhatti, S.N., 2017. *A comparative analysis of quality assurance of mobile applications using automated testing tools*. International Journal of Advanced Computer Science and Applications, 8(7), pp.249-255.

Anney, V.N., Dar, P.O.B. & Salaam, E. 2014. *Ensuring the Quality of the Findings of Qualitative Research : Looking at Trustworthiness Criteria*. , 5(2): 272–281.

Arasteh, A., Aliahmadi, A., Mahmoodi, H.S. & Mohammadpour, M.O. 2011. *Role of information technology in business revolution. International Journal of Advanced Manufacturing Technology*, 53(1–4): 411–420.

Atiku, S.O., Chitakunye, P. & Fields, Z. 2014. *Consensual and Entrepreneurial Culture: Insights from Organisational Culture and Human Resource Development Policy in Nigerian Banks*. Mediterranean Journal of Social Sciences, 5(20): 101–113.

Aydan, U., Yilmaz, M., Clarke, P.M. & O'Connor, R. V. 2017. *Teaching ISO/IEC 12207 software lifecycle processes: A serious game approach*. Computer Standards and Interfaces, 54: 129–138.

Azzolini, E., Ricciardi, W. & Gray, M., 2018. Healthcare organizational performance: why changing the culture really matters. Annali dell'Istituto superiore di sanita, 54(1), pp.6-8.

Babbie, E., 2014. *The basics of social research*: International edition. Belmont, CA: Thomson/Wadsworth.

Beck, K., Beedle, M., Van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., Jeffries, R. & Kern, J., 2001. *Manifesto for agile software development.*

Bell, S.T., Brown, S.G., Colaneri, A. & Outland, N., 2018. *Team composition and the ABCs of teamwork*. American Psychologist, 73(4), p.349–362.

Belsky, D.W., Domingue, B.W., Wedow, R., Arseneault, L., Boardman, J.D., Caspi, A., Conley, D., Fletcher, J.M., Freese, J., Herd, P. & Moffitt, T.E., 2018. *Genetic analysis of social-class mobility in five longitudinal studies.* Proceedings of the National Academy of Sciences, 115(31), pp.E7275-E7284.

Bhattacherjee, A. 2012. *Introduction to Research, Social Science Research: Principles, Methods, and Practices*.

Braun, V. & Clarke, V. 2012. *Thematic analysis, APA Handbook of Research Methods in Psychology*. APA handbook of research methods in psychology, Vol 2: Research designs: Quantitative, qualitative, neuropsychological, and biological., 2: 57–71.

Brough, P. ed., 2018. *Advanced research methods for applied psychology: Design, analysis and reporting.* Routledge.

Buchwald, A., Urbach, N. & Ahlemann, F. 2014. *Business value through controlled IT: Toward an integrated model of IT governance success and its impact.* Journal of Information Technology, 29(2): 128–147.

Burmeister, E. & Aitken, L.M., 2012. *Sample size: How many is enough?* Australian Critical Care, 25(4), pp.271-274.

Calp, M.H. & Akcayol, M.A. 2015. *The importance of human-computer interaction in the development process of software projects*. Global Journal of Information Technology, 05(1): 48.

Cameron, K.S. & Quinn, R.E., 2011. *Diagnosing and changing organizational culture: Based on the competing values framework*. John Wiley & Sons.

Cao Thanh, N. & Thi Le Thanh, T. 2015. *The Interconnection Between Interpretivist Paradigm and Qualitative Methods in Education.* http://www.aiscience.org/journal/ajeshttp://creativecommons.org/licenses/by-nc/4.0/.

Capretz, L.F. & Ahmed, F. 2010. *Making sense of software development and personality types.* IT Professional, 12(1): 6–13.

Castillo-Montoya, M. 2016. *Preparing for interview research: The interview protocol refinement framework.* How To Article, 21(5): 811–831.

Chagas, A., Santos, M., Santana, C. & Vasconcelos, A., 2015, August. The impact of human factors on agile projects. In 2015 Agile Conference (pp. 87-91). IEEE.

Chirani, E. & Tirgar, S.M. 2013. *Information Technology's Role in Organizations' Performance.* Kuwait Chapter of Arabian Journal of Business and Management Review, 3(1): 16–22.

Chomal, V. S., & Saini, J. R. (2015). *Software Project Documentation-An Essence of Software Development.* International Journal of Advanced Networking and Applications, 6(6), 2563.

Cleland-huang, J. & Capretz, L.F. 2014. *Bringing the Human Factor to Software Engineering*. IEEE Software, 31: 104.

Connors, R. & Smith, T., 2011. *Change the culture, change the game: The breakthrough strategy for energizing your organization and creating accountability for results*. Penguin.

Corbin, J., & Strauss, A. 2008. *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed.). Sage Publications, Inc. https://doi.org/10.4135/9781452230153

Creswell, J.W. 2007*. Philosophical, Paradigm, and Interpretive Frameworks. Qualitative inquiry & research design*: choosing among five approaches. 2nd ed. Sage Publications, Thousand Oaks CA.

Creswell, J.W. 2009. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.* 3rd ed. Sage Publications, Thousand Oaks CA.

Dastoli, C., Bolzan, P., Bianchini, M., Del Curto, B. & Maffei, S., 2019, February. *Approaches to Digital Manufacturing: Designing Through Materials*. In International Conference on Intelligent Human Systems Integration (pp. 628-633). Springer, Cham.

Denney, A.S. & Tewksbury, R., 2013. *How to write a literature review*. Journal of criminal justice education, 24(2), pp.218-234.

Denney, A.S. & Tewksbury, R., 2013. *How to write a literature review.* Journal of criminal justice education, 24(2), pp.218-234.

Dewett, T. & Jones, G.R., 2001. *The role of information technology in the organization: a review, model, and assessment.* Journal of management, 27(3), pp.313-346.

Dingsøyr, T. & Dybå, T., 2012, *Team effectiveness in software development: Human and cooperative aspects in team effectiveness models and priorities for future studies.* In 2012 5th international workshop on co-operative and human aspects of software engineering (chase) (pp. 27-29). IEEE.

Dubois, D.J. & Tamburrelli, G., 2013. *Understanding gamification mechanisms for software development*. In Proceedings of the 2013 9th Joint Meeting on Foundations of Software Engineering (pp. 659-662).

Eidizadeh, R., Salehzadeh, R. & Esfahani, A.C., 2017. *Analysing the role of business intelligence, knowledge sharing and organisational innovation on gaining competitive advantage.* Journal of Workplace Learning.

Elish, K.O. & Alshayeb, M., 2012. *Using Software Quality Attributes to Classify Refactoring to Patterns.* J. Softw., 7(2), pp.408-419.

Emerole A. 2013. *Implications of Organisational Culture on Performance of Business Organisations*. IOSR Journal of Business and Management, 11(1): 11–18.

Ernst & Young, 2015 Integrated Report.. Our Core Business.

Ernst & Young, 2018 Integrated Report. Final Division Structure.

Etikan, I. 2016. *Comparison of Convenience Sampling and Purposive Sampling*. American Journal of Theoretical and Applied Statistics, 5(1): 1.

Felipe - Amorim, L., Marinho, M. & Sampaio, S. 2020. *How (UN) Happiness Impacts on Software Engineers in Agile Teams?* International Journal of Software Engineering & Applications, 11(3): 39–57.

Felipe, C.M., Roldán, J.L.& Leal-Rodríguez, A.L., 2017. *Impact of organizational culture values on organizational agility. Sustainability*, 9(12), p.2354.

Fitzgerald, T.H. 1988. *Can change in organizational culture really be managed? Organizational Dynamics,* 17(2): 5–15.

Friese, S., 2019. *Qualitative Data Analysis with ATLAS.ti*. Los Angeles, CA: Sage Publications

Fusch, P.I. & Ness, L.R., 2015. *Are we there yet? Data saturation in qualitative research*. The qualitative report, 20(9), p.1408–1416.

Fustik, V., 2017. *The advantages of agile methodologies applied in the ICT development projects*. International Journal on Information Technologies & Security, 9(4), pp.p51-62.

Gandomani, T.J., Zulzalil, H., Ghani, A.A., Sultan, A.B.M. & Sharif, K.Y., 2014. *How human aspects impress Agile software development transition and adoption.* International Journal of Software Engineering and its Applications, 8(1), pp.129-148.

Ghaferi, A.A. & Dimick, J.B., 2016. *Importance of teamwork, communication and culture on failure-to-rescue in the elderly*. Journal of British Surgery, 103(2), pp.e47-e51.

Ghafir, I., Saleem, J., Hammoudeh, M., Faour, H., Prenosil, V., Jaf, S., Jabbar, S. & Baker, T., 2018. *Security threats to critical infrastructure: the human factor*. The Journal of Supercomputing, 74(10), pp.4986-5002.

Gichuru, M.J., 2017. *The interpretive research paradigm: A critical review of is research methodologies.* International Journal of Innovative Research and Advanced Studies (IJIRAS), 4(2), pp.1-5.

Given, L.M. (2ed.) (2008), *The Sage Encyclopaedia of Qualitative Research Method*: Volumes 1 & 2, Sage Publications,

Goldkhul, G. 2012. *Pragmatism vs interpretivism in qualitative information systems research*. European Journal of Information Systems, 21(2): 135–146.

Gonçalves, W.F., de Almeida, C.B., de Araújo, L.L., Ferraz, M.S., Xandú, R.B. & de Farias, I., 2017, *The influence of human factors on the software testing process: The impact of these factors on the software testing process.* In 2017 12th Iberian conference on information systems and technologies (CISTI) (pp. 1-6). IEEE.

Gorla, N., Somers, T.M. & Wong, B. 2010*. Organizational impact of system quality, information quality, and service quality.* Journal of Strategic Information Systems, 19(3): 207–228.

Gren, L., 2017. *Psychological group processes when building agile software development teams.*

Guba, E.G. & Lincoln, Y.S., 1994. *Competing paradigms in qualitative research*. Handbook of qualitative research, 2 (163-194), p.105.

Gupta, D., Ahlawat, A.K. & Sagar, K. 2017. *Usability Prediction & Ranking of SDLC Models Using Fuzzy Hierarchical Usability Model*. Open Engineering, 7(1): 161–168.

Gupta, S. & Chug, A., 2020. *Software maintainability prediction using an enhanced random forest algorithm. J*ournal of Discrete Mathematical Sciences and Cryptography, 23(2), pp.441-449.

Halupa, C. & Bolliger, D.U. 2020. *Technology Fatigue of Faculty in Higher Education*. Technology, , 11(18): 16–26.

Harris, L.R. & Brown, G.T., 2010. *Mixing interview and questionnaire methods: Practical problems in aligning data*. Practical Assessment, Research, and Evaluation, 15(1), p.1.

Hekman, D.R., Johnson, S.K., Foo, M.D. & Yang, W., 2017. *Does diversity-valuing behavior result in diminished performance ratings for non-white and female leaders*? Academy of Management Journal, 60(2), pp.771-797.

Hohl, P., Klünder, J., van Bennekum, A., Lockard, R., Gifford, J., Münch, J., Stupperich, M. & Schneider, K., 2018. *Back to the future: origins and directions of the "Agile Manifesto"–views of the originators*. Journal of Software Engineering Research and Development, 6(1), pp.1-27.

Hovorushchenko, T., 2018. *Methodology of evaluating the sufficiency of information for software quality assessment according to ISO 25010*. Journal of Information and Organizational Sciences, 42(1), pp.63-85.

Ihuah, P.W.& Eaton, D., 2013. *The pragmatic research approach: A framework for sustainable management of public housing estates in Nigeria*. Journal of US-China Public Administration, 10(10), pp.933-944.

Iyamu T., Ph D 2010. *Human Interaction with Structure in the Computing Environment.*

Iyamu, T., Nehemia-Maletzky, M. & Shaanika, I., 2016. *The overlapping nature of business analysis and business architecture: What we need to know*. Electronic Journal of Information Systems Evaluation, 19(3), pp.pp169-179.

Joseph, O.O. & Kibera, F. 2019. *Organizational Culture and Performance: Evidence From Microfinance Institutions in Kenya*. SAGE Open, 9(1). p.2158244019835934.

Kaur, R., Sengupta, J. & Ork, B.A.W. 2011. *Software Process Models and Analysis on Failure of Software Development Projects.* , 2(2): 1–4.

Kaur, S., 2015. *A review of software development life cycle models*. International journal of advanced research in computer science and software engineering, 5(11), pp.354-60.

Kayikci, Y., 2018. *Sustainability impact of digitization in logistics*. Procedia manufacturing, 21, pp.782-789.

Kivunja, C. & Kuyini, A.B. 2017. *Understanding and Applying Research Paradigms in Educational Contexts.* International Journal of Higher Education, 6(5): 26.

Kosow, H. & Gaßner, R., 2008. *Methods of future and scenario analysis: overview, assessment, and selection criteria* (Vol. 39, p. 133). DEU.

Kramer, M., 2018. *Best practices in systems development lifecycle: An analyses based on the waterfall model*. Review of Business & Finance Studies, 9(1), pp.77-84.

Krueger, G.P. 2003. *Obituaries: Alphonse Chapanis (1917-2002).* American Psychologist, 58(3): 235–236.

Kundu, S.C. & Mor, A., 2017. *Workforce diversity and organizational performance: A study of IT industry in India.* Employee Relations.

Lalsing, V., Kishnah, S. & Pudaruth, S., 2012. *People factors in agile software development and project management.* International Journal of Software Engineering & Applications, 3(1), p.117.

Lazarova, T., 2020. *Leadership practices for enhancing group efficiency*. Leadership, 26(27).

Lee, J.C., Shiue, Y.C. & Chen, C.Y., 2016. *Examining the impacts of organizational culture and top management support of knowledge sharing on the success of software process improvement.* Computers in Human Behavior, 54, pp.462-474.

Levers, M.J.D., 2013. *Philosophical paradigms, grounded theory, and perspectives on emergence.* Sage Open, 3(4)

Litman, T., 2012*. Evaluating research quality*: Guidelines for scholarship. Victoria Transport Policy Institute. p.2015.

Lutz, S.A., 2017. *Cultural sensitivity: Importance, competencies, and public relations implications*.

Mafuwane, B.M., 2011. *The contribution of instructional leadership to learner performance (*Doctoral dissertation, University of Pretoria).

Martinez, E.A., Beaulieu, N., Gibbons, R., Pronovost, P. & Wang, T. 2015. *Organizational culture and performance.* American Economic Review, 105(5): 331–335.

Mashile, D.A., Munyeka, W. & Ndlovu, W., 2021. Organisational culture and turnover intentions among academics: a case of a rural-based university. Studies in Higher Education, 46(2), pp.385-393.

Matharu, G.S., Mishra, A., Singh, H. & Upadhyay, P., 2015. *Empirical study of agile software development methodologies: A comparative analysis.* ACM SIGSOFT Software Engineering Notes, 40(1), pp.1-6.

Maxwell, J.A., 2016*. Expanding the history and range of mixed methods research. Journal of mixed methods research*, 10(1), pp.12-27.

McGeveran, W., 2018. *The Duty of Data Securit*y. Minn. L. Rev., 103, p.1135.

McLeod, L. & MacDonell, S.G., 2011. *Factors that affect software systems development project outcomes: A survey of research*. ACM Computing Surveys (CSUR), 43(4), pp.1-56.

Miguel, C., Pedro, S., David, A. & José, J. 2017. *Gathering big data for teamwork evaluation with microworlds.* Cluster Computing, 20(2): 1637–1659.

Miguel, J.P., Mauricio, D. & Rodríguez, G. 2014. *A Review of Software Quality Models for the Evaluation of Software Products.* , 5(6): 31–53.

Misigo, G.K. 2020. *Influence of Organizational Culture on Performance of Public Water Companies in Kenya*. , 3(5): 84–103. http://ir.jkuat.ac.ke/handle/123456789/5314.

Miskon, S., Bandara, W.& Fielt, E., 2015. *Applying the principles of interpretive field research: An example of an IS case study on shared services.* In 4th International Conference on Research and Innovation in Information Systems (ICRIIS 2015).

Misra, S.C., Kumar, V. & Kumar, U., 2006. *Success Factors of Agile Software Development*. Software engineering research and practice, 1, pp.233-239.

Mkhomazi, S.S. & Iyamu, T., 2014,. *Human Interaction in the Regulatory of Telecommunications Infrastructure Deployment in South Africa.* In International Working Conference on Transfer and Diffusion of IT (pp. 324-333). Springer, Berlin, Heidelberg.

Mlitwa, N. & Belle, J.-P. 2010. *A Proposed Interpretivist Framework to Research the Adoption of Learning Management Systems in Universities*. *Communications of the IBIMA*, 2010: 1–11.

Moniruzzaman, A.B.M. & Hossain, D.S.A., 2013. *Comparative Study on Agile software development methodologies.* arXiv preprint arXiv:1307.3356.

Montagud, S., Abrahão, S. & Insfran, E. 2012. *A systematic review of quality attributes and measures for software product lines*. Software Quality Journal, 20(3–4): 425–486.

Morcos, M., 2018. *Organizational Culture: definitions and trends. Project: Creating Structure and Culture for Innovation.*

Morcos, P., 2018*. Effective organizational culture strategies for a firm operating in foreign countries.*

Morgan, J.D., 2018. *Applying 1970 Waterfall Lessons Learned Within Today's Agile Development Process*. PM World Journal, 7.

Motilewa, D.B., Agboola, M.G.& Adeniji, C.G., 2015. *Organizational Culture and Performance a case study of Covenant University, Nigeria.* Covenant Journal of Business & Social Sciences 297–300.

Nagappan, N., Murphy, B. & Basili, V., 2008. *The influence of organizational structure on software quality.* In *2008 ACM/IEEE 30th International Conference on Software Engineering* (pp. 521-530). IEEE.

Nakai, H., Tsuda, N., Honda, K., Washizaki, H. & Fukazawa, Y. 2017. *A Square-based software quality evaluation framework and its case study*. IEEE Region 10 Annual International Conference, Proceedings/TENCON: 3704–3707.

Ng'ang'a, M.J. & Wesonga, J.N., 2012. *The impact of organisational culture on performance of educational institutions*. International Journal of Business and Social Science, 3(8): 211–217. http://www.ijbssnet.com/journals/Vol_3_No_8_Special_Issue_April_2012/24.pdf.

Nikoloski, K., 2014. *The role of information technology in the business sector. International Journal of Science and Research* (IJSR), 3(12) 303–309. https://www.ijsr.net/archive/v3i12/U1VCMTQzMjA=.pdf.

Nunnelly, L., 2016*. Minimizing change fatigue amongst directors and managers through introducing an authentic leadership style at a small university in the southwest United States.* The University of Liverpool (United Kingdom).

Olanipekun, A.O., Aje, I.O. &Abiola-Falemu, J.O., 2013. *Effects of organisational culture on the performance of quantity surveying firms in Nigeria*. International Journal of humanities and social science, 3(5), pp.206-215.

Ozigbo, N.C., 2013. *Impact of organizational culture and technology on firm performance in the service sector.* Communications of the IIMA, 13(1), p.6.

Paullet, K., Douglas, D.M., Compimizzi, J. & Sharp, J. 2017. Information Systems Applied Research. , 10(2).

Pieterse, V. & van Eekelen, M.C.J.D., 2018. *Cultural diversity and the performance of student software engineering teams.*

Pina Tarricone, J.L., 2016. *Successful teamwork: A case study.*

Ping-Ju Wu, S., Straub, D.W., Liang, T.-P., Lindh, C., Dahlin, P. & Hadjikhani, A. 2015. *How Does Information Technology Impact on Business Relationships ? The Need for Personal Meetings*. 24th IMP-conference, 39(2): 1–14. https://www.impgroup.org/uploads/papers/6732.pdf.

Pinho, J.C., Rodrigues, A.P. & Dibb, S. 2014. *The role of corporate culture, market orientation and organisational commitment in organisational performance: The case of non-profit organisations.* Journal of Management Development, 33(4): 374–398.

Pirzadeh, L. 2010. *Human Factors in Software Development : A Systematic Literature Review.* Master of Science Thesis in Computer Science and Engineering:

Ponelis, S.R., 2015. *Using interpretive qualitative case studies for exploratory research in doctoral studies: A case of information systems research in small and medium enterprises.* International Journal of Doctoral Studies, 10(1), pp.535-550.

Rahman Khan, A. & Khandaker, S. 2016. *Public and Private Organizations: How Different or Similar are They*. Journal of Siberian Federal University. Humanities & Social Sciences, 9(12): 2873–2885.

Rashid, M.Z.A., Sambasivan, M. & Johari, J. 2003. *The influence of corporate culture and organisational commitment on performance.* Journal of Management Development, 22(7–8): 708–728.

Rehman, A.A. & Alharthi, K., 2016. *An introduction to research paradigms*. International Journal of Educational Investigations, 3(8), pp.51-59.

Reiter, B. 2013. The Epistemology and Methodology of Exploratory Social Science Research : Crossing Popper with Marcuse. *The dialectics of citizenship: exploring privilege, exclusion, and racialization*: 1–17.

Ricciardi, F., Zardini, A. & Rossignoli, C., 2018. *Organizational integration of the IT function: A key enabler of firm capabilities and performance*. Journal of Innovation & Knowledge, 3(3), pp.93-107.

Romero, R.A.M., 2016. *Qualitative Data Analysis with ATLAS. ti*, Qualitative Research in Education, 5(2), pp.226-228.

Roskosa, A. & Rupniece, D., 2016. *Advantages and drawbacks of using group work in translator training.* Procedia-Social and Behavioral Sciences, *231*, pp.244-250.

Rowlands, B.H., 2005. *Grounded in practice: Using interpretive research to build theory*. The electronic journal of business research methodology, *3*(1), pp.81-92.

Saeed, S. ed., 2014. *Human factors in software development and design*. IGI Global.

Salvador, C., Nakasone, A. & Pow-Sang, J.A., 2014, April. A systematic review of usability techniques in agile methodologies. In *Proceedings of the 7th Euro American Conference on Telematics and Information Systems* (pp. 1-6).

Samwel, J.O., 2019. *The importance of teamwork on employees 'performance–evidence from selected manufacturing companies in lake zone regions of Tanzania* 3(05): 1–13.

Sanyal, S. & Hisam, M.W., 2018. *The impact of teamwork on work performance of employees*: A study of faculty members in Dhofar University. IOSR Journal of Business and Management, 20(3), pp.15-22.

Saunders, M.N, Lewis P, Thornhill, 2007. *Research methods*. Business Students 4th edition Pearson Education Limited, England.

Saunders, M.N., Lewis, P., Thornhill, A. & Bristow, A., 2015. *Understanding research philosophy and approaches to theory development*. 7th ed. Pearson Education Limited.

Schein, E.H., 2010. *Organizational culture and leadership* (Vol. 2). John Wiley & Sons.

Schrader, I. & Droegehorn, O., 2017. Digitization of companies-understanding IT as an enabler. In *Proceedings of the International Conference on e-Learning, e-Business, Enterprise Information Systems, and e-Government (EEE)* (pp. 83-87). The Steering Committee of The World Congress in Computer Science, Computer Engineering and Applied Computing (WorldComp).

Scotland, J., 2012. *Exploring the philosophical underpinnings of research: Relating ontology and epistemology to the methodology and methods of the scientific, interpretive, and critical research paradigms.* English language teaching, 5(9), pp.9-16.

Sekgweleo, T., 2015 . *Critical Analysis of the Roles of Actors in the Deployment of Software. In Strategic Information Technology Governance and Organizational Politics in Modern Business* (pp. 135-152). IGI Global.

Sekgweleo, T., 2018 . Understanding Traditional Systems Development Methodologies. International Journal of Advances in Agriculture Sciences.

Showkat, N. & Parveen, H., 2017. In-depth interview. Quadrant-I (e-Text).

Silverman, D., 2017. How was it for you? The Interview Society and the irresistible rise of the (poorly analyzed) interview. Qualitative Research, 17(2), pp.144-158.

Singh, S., Bawa, J. & Sharma, G.D., 2016. The Goal of Business-A Review Paper. Global Journal of Management and Business Research.

Sokro, E., 2012. Analysis of the relationship that exists between organisational culture, motivation and performance. Problems of Management in the 21st Century, 3, p.106. 106–119. http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=77427040&site=ehost-live.

Sommerville, I., 2011. *Software engineering 9th Edition*. U.S: Addison-Wesley

Spichkova, M., Liu, H., Laali, M. & Schmidt, H.W., 2015. *Human factors in software reliability engineering.* arXiv preprint arXiv:1503.03584.

Sull, D. & Sull, C., 2018. *With goals, FAST beats SMART. MIT Sloan Management Review, 59*(4), pp.1-11.

Sun, H., Ha, W., Teh, P.L. & Huang, J. 2017. *A case study on implementing modularity in software development.* Journal of Computer Information Systems, 57(2): 130–138.

Suppiah, V. & Sandhu, M.S., 2011. *Organisational culture's influence on tacit knowledge-sharing behaviour.* Journal of knowledge management. 15(3): 462–477

Sutton, J. & Austin, Z., 2015. *Qualitative research: Data collection, analysis, and management.* The Canadian journal of hospital pharmacy, 6*8*(3), p.226–231.

Swanepoel, E., Strydom, J.W. & Nieuwenhuizen, C., 2010. *An empirical analysis of a private company's corporate social investment in SMME development in South Africa*. Southern African business review, 14(1) Vol 14(Issue 1): 58–78.

Taherdoost, H., 2016. *Sampling methods in research methodology; how to choose a sampling technique for research*. How to Choose a Sampling Technique for Research.

Tannady, H., Andry, J.F., Gunawan, F.E. & Mayseleste, J. 2020. *Enterprise architecture artifacts enablers for it strategy and business alignment in forwarding services.* International Journal of Advanced Trends in Computer Science and Engineering, 9(2): 1465–1472.

Todorović, M., Ivanišević, Đ., Vještica, M., Dimitrieski, V. & Luković, I., 2021. *An Automatic Generation of Production Documentation from MultiProLan Models*. In *Proc. 11th Int. Conf. Inf. Soc. Technol. ICIST 2021* (pp. 96-101). Society for Information Systems and Computer Networks Kopaonik, Serbia.

Tripathy, M., 2018. *Building quality teamwork to achieve excellence in business organizations*. International research journal of management, IT and social sciences, 5(3), pp.1-7.

Umbreen, M., Abbas, J. & Shaheed, S.M., 2015. *A Comparative Approach for SCRUM and FDD in Agile*. International Journal of Computer Science and Innovation, 2, pp.79-87.

Uyar, A., Kuzey, C.& Kilic, M., 2021. Sustainable stock market and sustainability reporting propensity of the public sector: Mediating role of the private sector. International Journal of Public Administration, 44(4), pp.322-335.

Varona, D., Capretz, L.F. & Piñero, Y., 2011. Personality types of Cuban software developers. *Global Journal of Engineering Education*, *13*(2), pp.77-81.

von Meding, J., McAllister, K., Oyedele, L. & Kelly, K. 2013*. A framework for stakeholder management and corporate culture*. Built Environment Project and Asset Management, 3(1): 24–41.

Wagner, S. & Ruhe, M., 2018. *A systematic review of productivity factors in software development. arXiv preprint arXiv:1801.06475*.

Walsham, G., 1995. *Interpretive case studies in IS research: nature and method*. European Journal of information systems, 4(2), pp.74-81.

Wanjiku, N.A. & Lumwagi 2014. *Effect of organisation culture on employee performance in non govermental organizations*. International Journal of Scientific and Research Publications, 4(1): 2250–3153. www.ijsrp.org.

Whiting, L.S., 2013. *Semi-structured interviews: guidance for novice researchers. Nursing Standard 22*(23), p.35.

Yang, Z., Wang, X. & Su, C. 2006. A review of research methodologies in international business. *International Business Review*, 15(6): 601–617.

Yazan, B., 2015. *Three approaches to case study methods in education: Yin, Merriam, and Stake. The qualitative report*, *20*(2), pp.134-152.

Yeow, A., Soh, C. &Hansen, R., 2018. Aligning with new digital strategy: A dynamic capabilities approach. The Journal of Strategic Information Systems, 27(1), pp.43-58.

Yin, R.K., 2003. *Design and methods*. *Case study research*, *3*(9.2).

Yin, R.K. 2013. Validity and generalization in future case study evaluations. *Evaluation*, 19(3): 321–332.

Zaky, A.H.M., Ragab, A.A., Soliman, M.M. & Ragheb, M.A., 2018*. Information technology governance effectiveness in organizations*. The Business & Management Review, 9(3), pp.281-289.

7 APPENDICES

7.1 Appendix A: Institution Ethical Clearance Certificate

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Room 2.09
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Cape Town
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Secretary: Mziyanda Ndede

11 February 2021

Ms Keagaletse Portia Motshware
c/o Department of Information Technology
CPUT

Reference no: 205211402/2021/03

Project title: Impact of human factors associated with software development processes on organisational performance: A case study

Approval period: 10 February 2021 – 31 December 2022

This is to certify that the Faculty of Informatics and Design Research Ethics Committee of the Cape Peninsula University of Technology approved the methodology and ethics of Ms Keagaletse Portia Motshware (205211402) for the MTech in Information Technology.

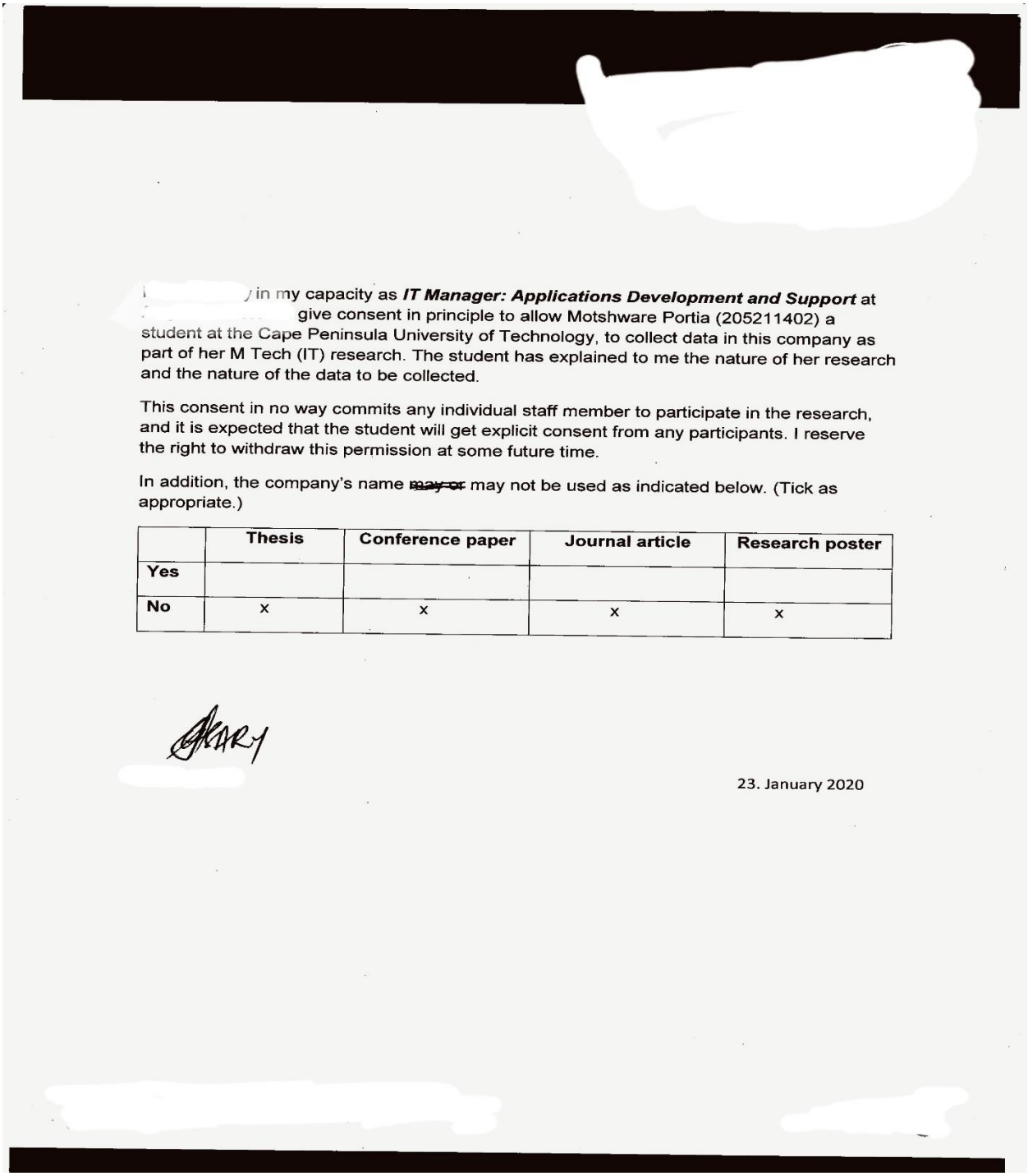
Any amendments, extension or other modifications to the protocol must be submitted to the Research Ethics Committee for approval.

The Committee must be informed of any serious adverse event and/or termination of the study.

A/Prof I van Zyl
Chair: Research Ethics Committee
Faculty of Informatics and Design
Cape Peninsula University of Technology

7.2 Appendix B: Consent Letter from Company X to Conduct The Research

Company and IT manager's full names withheld for confidentiality (ethical) reasons.



[redacted] in my capacity as ***IT Manager: Applications Development and Support*** at [redacted] give consent in principle to allow Motshware Portia (205211402) a student at the Cape Peninsula University of Technology, to collect data in this company as part of her M Tech (IT) research. The student has explained to me the nature of her research and the nature of the data to be collected.

This consent in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants. I reserve the right to withdraw this permission at some future time.

In addition, the company's name ~~may or~~ may not be used as indicated below. (Tick as appropriate.)

	Thesis	Conference paper	Journal article	Research poster
Yes				
No	x	x	x	x

[redacted]

23. January 2020

7.3 Appendix C: Interview Protocol

Interview Questions	MRQ1	MRQ2
	What factors are associated with the software development processes evident in an IS/IT department in organisational culture of a petrochemical company in the Western Cape?	How do the factors associated with software development processes impact organisational performance?
1. People have different ways of viewing the organisational culture, how would you describe the organisational culture?	×	
2. In your opinion do you think organisational culture has an influence on organisational performance?	×	
3. In your opinion, what do you consider significant factors in the development of software?	×	
4. What do you think are the implications of those factors on software quality?		×
5. What do you think are the implications of those factors on organisational performance?	×	
6. How would you describe the method in which software's are developed and released within the organisation?		×
7. How would you describe the role of IT in the business?	×	
8. Do you think alignment of IT elements with business strategies and plans is important?	×	
9. Do you prefer working alone or in a team and why?		×
10. Could you please share some of your experiences working in a diverse team pertaining to the development of software within the organisation?		×
11. What do you think are the challenges encountered during software development process?	×	

12. Why do you think those challenges are there?	×	

7.4 Appendix D: Introductory Letter for Data Collection

Introductory Letter for data collection

My name is Portia Motshware a registered student at CPUT, currently studying MTech. My research title is: ***Impact of Human Factors associated with Software Development Processes on Organisational Performance: A Case Study.*** I'd like to thank you once again for agreeing to partake in the interview aspect of my study.

Our interview today will last roughly 30 minutes during which I will be asking you about your experience in this organisation as a (developer, BP, etc), you're understanding and experience about factors associated with the production of software in your organisation

You completed a consent form showing that I have your approval (or not) to audio record our conversation. Are you still ok with me recording (or not) our conversation today? ___Yes ___No If yes: Thank you! Please let me know if at any point you want me to turn off the recorder or keep something you said off the record. If no: Thank you for letting me know. Before we begin the interview, do you have any questions? If any questions (or other questions) arise at any point in this study, you can feel free to ask them at any time. I would be more than happy to answer your questions

Thank you,

7.5 Appendix E: Data Transcripts from Senior System Specialists

Due to the sensitivity of the concerns on organisation's dealings discovered by the participants, the researcher anonymised raw transcripts. Table 7-1 reflects data collected during interviews with senior system specialists. Additional interviews were transcribed in a similar manner.

Table 7-1 Data Transcribed After Interviews with [D01]

People have different ways of viewing the organisational culture , how would you describe the organisational culture? Response: My understanding around OC neh, is all about values of the company the expectations, how the company operates and how the people in the organisation behaves and in terms of this particular Engen culture I'd say it's very diverse in terms of there are different types of people so friendly people and not so friendly people how knows how to communicate and those who can't communicate that 've met. But in general, OC culture is laid back environment, sometimes there is pressure but in my dept I'd say we are flexible we are self-managed; we structure our work if you deliver.
Out of the 4 types of organisational culture where will you place your organisation? Response: It's a hierarchal culture no doubt which the decisions starting from the CEO and gets passed down to different org levels.
In your opinion do you think organisational culture has an influence on organisational performance? Response: Uum the answer will be yes ,for instance some of the things because of those decisions and people not being able make decisions on their own because they're afraid of what my boss will say so in terms of delivering things that sort of structure has a very big negative impact on the organisation as a whole because a simple decision such as turning off the server or can you take down the system because of all these channels and hierarchical structure that you have to follow its very difficult its very for people to make decisions and because of that a simple task takes longer to accomplish because of all those protocols than what they should at the end of the day the performance of the person responsible for doing that gets affected as it may look like it took them forever to resolve a simple task even though the person is waiting for decision from higher powers sometimes even higher powers sometimes aren't sure who supposed to make decisions so it's a bit frustrating at times.
In your opinion, Do the experiences created by the development team consistently reinforce the organisational cultural beliefs? Response: Uum I think it depends there's within my space we have people who likes to share and people who don't like to share information and they as that goes against the organisational cultural beliefs which are teamwork and collaboration amongst other and that affects the junior who are looking up to those senior to learn from them, so the guys hold information .but luckily for me my team my teams tries to share information.
In your opinion, what do you consider significant human factors in the development of software? Response: Knowledge sharing is the most factor, because you preventing others growth by holding information to yourself that's one of most vital factory, secondly having the right attitude, how you interact and treat people around is very important skill is important but not determining factor, as I've seen most senior people gurus in the field with big ego very bad attitude and those people got fired because they didn't know how to interact with the team mates and with client they've always played like I know better than all of you so I'd say attitude whether most junior or a guru.
What do you think are the implications of those factors on Software Quality? Response: Look, if coming into an organisation with big ego like I know it all I've been in the industry for long no one can tell me nothing at the end of the day you'll end up impacting the team especially the juniors or people with no

skill set like yours it's like you're depriving others the opportunity to learn from you or to experiment because you undermine their opinions forgetting that even as a guru you were once a junior ,and also not collaborating with the team not taking other members suggestions because you know it all, like they say GIGO. .and that ends up affecting the software quality

What do you think are the implications of those factors on organisational performance?
Response: With all mentioned earlier it'll affect the business negatively because the business relies on the software to be more efficient and productive so if you've giving them something that they can't use they'll be negatively affected and that will affect their performance and the organisational performance, for an example imagine a finance dept asked the development teams and they don't produce what they've asked they'll end up going back to doing spreadsheet.

How would you describe the method in which software's are developed and released within the organisation?
Response: Ok so its all about getting the requirement from the client and the client being internal divisions/dpt then we discuss the requirement with team after that then we go into the design phase but we usually do that if it's a big project, if it's a small development project we just develop without having to have a big discussion and a project plan for it from there we do the development then testing and UAT for testing to check if it meets the requirement if the client is happy then we log a change ticket with all the requirements attached to it and signed off for us to move it into our production environment which usually we deploy Thursday evenings and then from there it goes to maintenance phase and support that comes after but bear in mind we don't always document our process unless it's a complex requirement even that we don't do much documentation as our tools are very flexible and we don't have enough resources to document all that.

How would you describe the role of IT in the business?
IT plays a huge role interns of digitization and automation thereby ensuring productivity and efficiency within teams for the betterment of the organisational performance, and security of data to helps in terms of cutting down all the manual work such as spreadsheets and filing papers that can easily get misplaced or gets stolen so for storage IT plays a vital role as role, also for things such as reporting for business analytics teams.

Do you think alignment of IT elements with business strategies and plans is important?
I think so because IT basically can't operate on their own without having to take the organisational strategy which I think is a driver of all things into consideration, so IT should serve as an enabler to the organisation and both strategies should be aligned.

Do you prefer working alone or in a team and why?
Id say both , I can work well individually but working in a team makes me look at thing differently as I get more ideas from the team more being part of the team is better but I can also work by myself.

Could you please share some of your experiences working in a diverse team pertaining to the Development of software within the organisation?
Look working in a diverse team is always challenging because there are people within certain divisions such as HR and procurement if I can name them that especially HR because if they want something, they want it and their way regardless of whether you as a developer or analyst think it'll work or maybe looking at other alternatives its always their way

What do you think are the challenges encountered during software development process?
.Its not easy to convince them and we also have teams such as procurement because within that division they do have the systems specialists/business partner which makes things a lot easier as he understands the systems capabilities and business and makes the communication a lot easier

Why do you think those challenges are there?
HR which doesn't have that kind of a go in between person and we also have facilities dept which are the guys that are not computer savvy so it's always challenging work on diverse teams but its good as its teaching me how to handle or interact with different people across the organisation.

7.6 Appendix F: Synthesized Codebook

The codebook presents the code, the description of the code and an example of a quotation.

Factor (Code)	Description	Quotation
Ability	Quality-oriented software development abilities are imperative for good performance	"… you need people that can actually try and on curve and unravel all these kind of mysteries by working collaboratively…"[D07]
Alignment	Organisations that can strategically align their business and IT have proven to be more successful than their counterparts	:"…need to be alignment, thus the policies and an even the projects that IT is taking on must be to address or to be linked or related to a strategic business objective for to add value"[D05].
Automating Processes	Improvement in process automation potentially improves how this organisation does business	Automating processes aids in minimizing manual work thereby improving efficiency [D01].
Awareness	Awareness in the organisation could be attributed to many factors such as improving decision making, team building, communication, culture, and leadership effectiveness, resulting in increased revenue, organisation's productivity, competitiveness, and sustainability	…"due to lack of knowledgeable resources to enforce the awareness and the implementation of Agile within the organisation, people resort to old ways of doing things…" [D03].
Change Fatigue	Change fatigue tends to manifest over a reluctant response by accepting the organisational change that impacts the employee's daily work life.	"…even though the organisation is trying to make it clear that they're trying to be Agile we still have some individuals who still don't want to change, so it's the attitude as they've been with the company for…"[D05].

Factor (Code)	Description	Quotation
Client Orientation	Customer-driven development abilities are imperative for maintaining strong relationship with customers to continuously receive feedback that influences development.	"…put yourself in the position of the end user of that software and then you in that position are able to imagine what would the person using the software…"[D01]
Cohesiveness	Team cohesion displays the degree to which members are dedicated to one another in the achievement of team goals.	"…for me that culture of cohesiveness, that collaboration sort of attitude that these guys have is of vital importance…".[D08].
Communication	Communication between diverse members improves understanding of responsibilities and simplifies the process of delivering the required product quicker and more efficiently	"…now that we are working from home, we sometimes have network connectivity issues, but the important part is to keep the team and customer in the loop, communication and negotiating timelines with them..."[D04].
Company Goals	Company goals are strategic objectives that a company's management creates to outline expected outcomes and guide employees' efforts. Goals aid in defining a company's purpose, assist its business growth, and achieve its financial objectives.	"…everyone will be working towards one goal which is to achieve the company strategy and objective…"[D02].
Competitiveness	Organisations strive to stay profitable and overtake their competitors	One participant [D04] mentioned that, to stay ahead of their competitors by accomplishing sustainable competitive advantage organisations are embracing technology a lot as the world evolves.

Factor (Code)	Description	Quotation
Creative Problem Solving	it's related to how we approach solving the problems thus problem solving in software development is the process of trying to solve a problem area using theoretical knowledge and research, best practices, and testing ideas out.	:"…looks at things from a different angle I always tell him that he's not just a developer is analytical developer because he thinks about things in ways that will be much better at the end of the day you know something like that…".[D08]
Cultural Sensitivity	Demonstrate an appreciation of the multicultural nature of the organisation and the diversity of its staff.	"…appreciating difference in values and learning from cultural diversity…"[D04].
Data Security	Data security describes the collection, use, and disclosure or personal data in addition to its secure storage	"... security of data helps in terms of cutting down all the manual work such as spreadsheets and filing papers that can easily get misplaced or gets stolen so for storage IT plays a vital role…"[D07]
Decision Making	The process where an individual, group or organisation reaches conclusions about what future actions to follow given a set of objectives and limits on available resources	[D05] asserted that the decisions are always made from the top and the people at the bottom just do as they've been told.
Digitization	Businesses are leveraging data to improve customer experiences, make employees and processes more productive, and finding adequate ways to respond to the new opportunities of sustainable and competitive advantage through digitization.	[D07] pointed out that some of the organisation's goals is to be Agile, customer centric and data driven and have since invested in digital technology.

Factor (Code)	Description	Quotation
Diversity	Diversity in the workplace take careful consideration, and with a similarly thoughtful implementation yield positive results when there is organisational commitment and awareness of the impact of diversity.	"…it's always challenging work on diverse teams but its good as its teaching me how to handle or interact with different people across the organisation…"[D04].
Effectiveness	Simplifying tasks and improving the communication process are major steps in ensuring that the organisation makes effective and accurate decisions	[D07] ascertains that the applications they developed are to support the business as they offer solution to business problems[D06].
Functionality	The ability to perform a task or function; As the level of functionality expectation for a software application becomes greater, the users basically expect more interactions with the application	"…team when they couldn't meet the customer's expectations as developing the software product…"[D03].
Impact on Quality	Software can impact the organisation either negatively or positively: These influences can be attributed to challenges and factors such as skills, collaboration and communication which manifest from human factors and dysfunctionality of processes.	" ...if the skill is not there our coding standard will be bad and that will affect the quality of the final product and the client will not be happy..."[D05].

Factor (Code)	Description	Quotation
Integrity	This code demonstrates the participants' perceived knowledge of consistency in upholding and promoting the values and cultural beliefs of the organisation in actions and decisions, in line with the organisation Code of Conduct.	"… we always have like weekly chats like to just to give a feedback on how things have been, and this speaks to one of the organisational cultural beliefs which is "Tell me" which means providing feedback so this ties to that cultural beliefs…"[D04].
Knowledge Sharing	Means the exchange and transfer of experience within several organisational units.	:" …it helps in building up your knowledge because throughout the development when you're interacting with those people will be sharing information and then in some cases you are able to discover new things which will be helpful as time goes on..."[D03]
Maintainability	Software evolves continuously as the business needs continues to change; thus, it gets modified and new requirements constantly arise	[D05] stated that software's should be creatively developed as creativity leads to continuous improvement and that maintainable software products have high quality
Organisation Cultural Beliefs	Beliefs are subtle and usually invisible, but they can be very influential when it comes to guiding group behaviour.	"…one of our cultural beliefs is provide feedback…"[D08].
Perceptions of Organisational Culture	Organisational culture (OC) outlines the way people behave and the way things are done in an organisation.	:… I'd say it's a set of rules or guidelines which influence the behaviour of employees in the company..." [D05].

Factor (Code)	Description	Quotation
Personality	Human performances and behaviours at work.	"… It's been nice working different divisional teams. It exposed me to work with different personalities…"[D07]
Process Documentation	Process documentation is a glue between software development phases and among the people working together at different artifacts but with the same project goal.	" …we don't always document our process unless it's a complex requirement even that we don't do much documentation as we don't have enough resources to document all that…" [D03].
Project Planning	Project planning is a key area for improvement in overcoming software projects' poor performance	"…we tackle requirements as they come, planning waste time…"[D07].
Workload	Work distribution ensures that every person accomplishes any task at hand, with the best possible efficiency	As mentioned by [D01] and [D02] sharing workload makes the service delivery faster and knowledge transfer amongst the team expands.