

Exploring factors that influence digital adoption in the South African Oil and Gas Industry

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ABSTRACT

The purpose of this research was to provide insight into the factors that impact the adoption of digital tools in the Oil and Gas industry in South Africa, with the focus on digital enterprise resource planning (ERP).

The research data for the study was collected by conducting semi-structured interviews with the people who were directly involved with the scoping, designing, implementation and adoption of the digital ERP system in the focal organisation. This was done by way of finding answers to three research questions, which were structured to determine the overall factors affecting adoption, then determining the impact of these factors on the implementation of the ERP system.

The Technology Organisation Environment (TOE) conceptual model was used in developing proposed relationships, after which a data modelling and analysis tool Atlas.ti was used to rank the factors. The interview guide was developed in conjunction with the conceptual model and factors for the study identified. The factors identified for the study were confirmed by the existing literature, with some new ones identified through discussion with participating respondents in the interview phase of the study.

The study established that all T-O-E aspects are important when implementing the digital ERP in the Oil and Gas industry. One of the important recommendations is that the organisation performs a full assessment before the decision to adopt, making sure that the implementation is supported entirely by the business that will use the tool, and that all other T-O-E aspects are in place.

KEYWORDS

Enterprise Resource Planning (ERP), Digitalisation, Implementation, Adoption, Data Storage, Technology, Business Process.

DECLARATION

I, Dumisani Zuma, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management in the field of Digital Business at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Name: Dumisani Zuma

Signature:



Signed at Brakpan

On the 25th day of February 2022

DEDICATION

This research dissertation is dedicated to my Wife, Sesani I cannot thank you enough for the support both emotionally and physically and encouragements. Ngiyabonga Sithandwa Sami.

To my children Hlobisile, Nomcebo, Zuko and Wandile, always know that you are able and capable to contribute in your own special way in this world. I hope you are inspired to pave your own path and achieve whatever goal you set for yourself.

To my parents especially my mother who brought me to this world and taught me to always reach for the stars. Your teachings did not go to waste. Thank you.

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To my Wife and children, thank you for sacrificing our time as a family and supporting my personal growth and development.

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LIST OF ABBREVIATIONS AND ACRONYMS

ERP - Enterprise Resource plan

GDP – Gross Domestic Product

IM – Information Management

IT – Information Technology

MRP – Material Requirement Planning

SAPIA – South African Petroleum Industry Association

TAM – Technology Acceptance Model

TOE – Technology Organisation Environment

TPB – Theory of Planned Behaviour

TRA – Theory of Reasoned Action

CHAPTER 1. INTRODUCTION

1.1 Purpose of the study

The purpose of this study is to Apply a conceptual framework to identify and explain factors or determinants that influence digital innovation adoption, particularly of the Enterprise Resource Planning (ERP) system in the Oil and Gas Industry. The context of this study is South African experiences in the Oil and Gas Industry.

1.2 Background of the study

Global markets today have high competition no matter which industry one looks at. The demand for high profits is a never-ending expectation from the shareholders even though the environment has changed. Therefore the organisation must invest in dependable Information Technologies and software solutions (Stefanou, 2001).

The Oil and Gas sector is one of the oldest industries with a footprint in every country in the world. Its operations and processes are clearly defined as complex industrial machinery which requires significant capital investments (Kohli & Johnson, 2011). These factors and others below are some of the factors that make it difficult for the industry to make digital changes to its operations, specifically digital ERP. literature, was used to first identify the factors and the study through the respondents was also used to determine the specific factors to

the industry. These factors have affected the industry and pushed it to be a latecomer to digital innovation adoption (Kohli & Johnson, 2011).

Daily changes to the crude oil price, fluctuating exchange rates, and changing customer needs that are not in the industry control require that a digital tool capable of optimising operations and profit margins, based on the factors mentioned above is critical for the industry (Hamilton, 2009). These factors indicate that participants in the Oil and Gas industry have no choice but to adopt digital innovation tools (Hawash et al., 2020).

Having all these different processes and complicated operations digitising and visualising the all the activities which are happening within the organisation assist senior management to making the decisions quicker. A digital ERP system has a capability to integrate and streamline all the processes together, this study will understand all the factors that will assist in a decision to adopt the digital ERP system.

With the industry integrating many different processes from the upstream where crude oil is delivered all the way where final products are sold to the customer it is clear that a robust system that will be able to integrate all these processes is required and ERP plays a big role in solving this problem. Although other industries are having their own complications in South Africa energy is the heart beat of the economy it is therefore important that an understanding on the factors affecting are known and addressed where possible.

The increase in Oil prices will affect the entire petroleum products price structure and, consequently, commodity prices and this becomes a big factor in oil-

importing countries such as South Africa. The differential impacts on activity production depend primarily on the oil products and this then affect negatively the entire goods that are transported (Fofana et al., 2009), this it is important to understand all the component that impact the entire value chain and ERP system has capability to pull everything together.

The Oil and Gas industry is part of the Manufacturing Sector in the Gross Domestic Product (GDP) basket calculation for South Africa, contributing approximately 14% (Stats SA, 2020). Manufacturing is one of the essential drivers of employment in the country, providing about 10% of the total working population (Stats SA, 2020). These factors show how critical the Oil and Gas Industry is to the South African economy. The sector also impacts other industries such as Transport, Agriculture and Mining, to name just a few. The impact on these industries also proves the industry's vital role in the economy.

The oil and gas industry comprise three main segments, namely: Upstream, Midstream and Downstream. South Africa has limited oil reserves, and all the crude oil it processes is imported. As much as 60% of the crude oil is imported from the Middle East and the balance from different parts of the world, mainly the African continent (SOUTH AFRICA YEARBOOK, 2013). South Africa is home to six oil refineries that transform different feedstock types into final petroleum products. Many other organisations support the industry with logistics and other industry requirements (SAPIA, 2019). Conducting a study on the South African Oil and Gas industry will offer a perspective on the Midstream and Downstream segments.

It is critical for organisations that have deployed digital ERP to understand the systems impact on their operations and overall performance (Sun & Bhattacharjee, 2011). The ERP systems help business to integrate their operations within the organisation, allowing for process control and data integration. By implementing the ERP system, firms have a software solution that is efficient for controlling functional processes, operations, planning and consolidating company resources (Gajic et al., 2014).

The Oil and Gas Industry is critical in the South African economy. It is, therefore, vital that the implementation or adoption factors of digital tools are well understood to ensure that it is proactive, efficient, and responsive to delivering products to their customers.

1.3 Research problem

The challenges that face global organizations grow increasingly severe and complex day by day. Operating businesses in a highly competitive environment is challenging; to enhance competitiveness and to satisfy customer needs, organizations seek to improve efficiency and agility (Motwani et al., 2005; Rouyendegh & Erkan, 2011; Stanciu & Tinca, 2013), this is also expected to be the same for Oil and Gas Industry has implemented digital ERP systems over the years to optimise its operations and increase margins. With this implementation, there is insufficient evidence on the determining factors influencing the Oil and Gas Industry to adopt digital innovations in South Africa, especially the ERP system. Secondly, those factors that impact the implementation during the adoption phase need to be investigated.

This gap needs to be addressed to ensure that future digital technologies such as industry ERP systems are implemented to understand possible problems before they happen.

Some studies have been conducted in the Oil and Gas Industry. However, these studies have been focused primarily on Upstream operations and experiences from other parts of the world with limited to no evidence in the context of South Africa.

The Midstream and Downstream segments have not been well researched. Therefore, there is a need to recognise those determining factors that influence the adoption of ERP digital innovations in the South African Oil and Gas Industry. Additionally, it is essential to understand the impact of these factors on the successful implementation of new digital technology and performance in the industry.

1.4 Research questions and objectives

1.4.1 Research questions

What are the factors that determine the adoption of digital ERP systems in the South African oil and gas industry?

Different factors can influence the successful adoption of digital ERP systems in the Oil and Gas industry. Therefore, explaining potential effects will help improve overall decision-making based on factors influencing the adoption of the ERP system. Understanding critical challenges and applying them successfully during

an ERP implementation is important to make sure that implementation is always a success (Laukkanen et al., 2007; Stanciu & Tinca, 2013)

Which of these factors have a high impact on the successful adoption of digital ERP systems?

This question will help understand the impact of each factor on the overall adoption of the digital system in the Oil and Gas Industry in SA. There could be other sub-factors that form part of each factor that can only be understood through the impact each factor has on the overall adoption of the ERP system.

The recommended method used in this assessment is one that "establishes a correlation between a process-based method, a scorecard model and ERP critical success factors", as proposed by (Gajic et al., 2014)

How do the factors that have a high impact affect operational and financial performance?

This question seeks to understand if there is a benefit in adopting the digital ERP system in the industry. It seeks to explain the improved contribution of these factors to operational performance, leading to improved financial performance.

1.4.2 Research objectives

The study's research objectives are to:

- Determine factors that influence digital ERP innovation adoption in the South African Oil and Gas Industry

- Identify which factors have a significant influence or impact on the successful adoption and implementation of the digital ERP system.
- Determine the benefit of the ERP adoption in the Oil and Gas Industry to operational and financial performance.

1.5 Study Significance

South Africa is a country that can be regarded as strategic. It sits at the bottom of the continent, which is about halfway to Europe, Asia, and America on the sea route. The Oil and Gas sector is one of the critical sectors in many countries. Many developing countries have focused on the industry for income generation. Although these countries generate a considerable volume of Oil and Gas, they still sometimes find it difficult to manage information created and rely on digital tools to optimise better supply and demand (Hawash et al., 2020).

Producing products at the right time and the right place requires an integrated system that links all the inputs that allow this to happen optimally. To achieve this, the deployment of the ERP is critical. Leaders of companies and organisations need to know if the digital tools they are implementing or considering in their companies are fit for purpose and add value. Many companies around the world have implemented the ERP system to optimise their operations.

This study will help more companies anticipate problems they may encounter during the implementation process, which will help the overall adoption of the system. This study will add to existing knowledge through focus on digital ERP adoption in the South African local context. There are studies conducted in the

field of ERP adoption, but continued research will help companies and add more knowledge and information to this area of study when considering digital tool adoption.

1.6 Study Delimitations

The scope of the study will be on the Midstream and Downstream sectors of the Oil and Gas Industry with a focus on digital ERP technology adoption. The technology is used to integrate all the Oil and Gas Industry operations, ensuring that all processes are rapid and efficient. This will be enabled correctly using data generated every second.

The study is limited to South African Oil and Gas companies that have implemented or are implementing a digital ERP system, which will limit the generalisation of the results.

Respondents will also be limited to those companies in South Africa that have implemented or are implementing the ERP system.

Another delimitation will be the exclusion of the Upstream sector of the Oil and Gas Industry and its associated operations, including production, importing and exporting crude oil and final petroleum products. The companies that only import crude oil and other petroleum associated products will not form part of the study.

The physical plant operations and its technical processes will also be excluded from the study as it carries more sensitive information that will not be easy to obtain. Only members of the digital ERP system's implementation and initial testing teams were interviewed and requested to participate in the study.

1.7 Definition of terms

The Oil and gas Industry/company: involves any company that produces, processes and sells all types of petroleum products.

Enterprise Resource Planning (ERP) System: “is defined by Bradford (2014) as the business systems that integrate and streamline data across the company into one complete system that supports the needs of the entire enterprise”.

Upstream The “recovery, production and gathering of natural gas and petroleum oil from the source” (BC Oil and Gas Commission, 2020).

Midstream The processing of “natural gas or crude oil, including transportation by pipeline of a raw product to a processing facility. The midstream infrastructure including primarily gas processing plants and significant pipelines transporting the raw product (crude oil, natural gas, or natural gas by-products) to a processing facility” (BC Oil and Gas Commission, 2020).

Downstream The “selling and distribution of natural gas and the refining of petroleum products which includes petrol and diesel” (BC Oil and Gas Commission, 2020).

1.8 Assumptions

Below are some of the assumptions associated with this study

1. All Oil and Gas companies in South Africa have implemented similar digital ERP technologies. These companies will, therefore be likely to have similar factors influencing ERP adoption.
2. The digital ERP system is a tool used to optimise demand and supply in oil and gas operations, leading to better performance.
3. The respondents will respond in a standard way based on their experience without being influenced by any other factors.
4. The respondents have the appropriate expertise to correctly state the key drivers and obstacles to implementing and adopting the digital ERP system.

1.9 Chapter Outline

Chapter 1: Provides an overview and introduction of the study; it includes the purpose, problem statement, research questions and objectives, significance of the study, delimitations, assumptions, and closes with the definition of terms used in the study.

Chapter 2: A review of the existing literature on ERP adoption in the Oil and Gas Industry in general. The review focuses on different industries worldwide that have implemented the digital ERP and the challenges they encountered during the implementation of the system.

Chapter 3: Covers research methodology, which includes a method of collecting the data, the procedures to be used in collecting and analysing the data, type of population and size. The chapter closes with ethical considerations.

Chapter 4: A Presentation and summary of the results from the interviews with the participants and align these findings with the research propositions of the study.

Chapter 5: A discussion of the results as presented in Chapter 4 and linking to the existing literature. The discussion also links the results to the objectives of the study.

Chapter 6: This is the conclusion of the study, which also covers recommendations and future research opportunities.

CHAPTER 2. REVIEW OF LITERATURE

2.1 Introduction

This chapter provides literature and review of theory on the digital ERP system, its history, uses, benefits and critical implementation factors. The key themes found in the literature are highlighted. The chapter is a review of the technology adoption models to determine which model can determine the implementation factors. In addition to these discussed factors from the literature, the study's propositions will be discussed in the section. The variables identified as initial measurement indicators to be employed study are also discussed.

2.2 Background

2.2.1 History and description of digital ERP

Enterprise Resource Planning (ERP) system is used to integrate the organisation's data and process. The data is stored centrally in a single database that functions as a hub that stores, shares, makes basic calculations and circulates it between different departments and business functions (Elragal & Haddara, 2012).

The first technology that ERP was developed from was Material Requirement Planning (MRP) which was developed in the 1960s. The Gartner Group originated the term ERP as an upgrade from the MRPII in 1990 (Jacobs & Weston, 2006). Their definition included the extent to which the software can

evaluate and integrate both across and within different silos of the organisation (Jacobs & Weston, 2006).

The ERP system was officially termed that way in the 1990's and was extended in the year 2000's. before that it was known as Material requirements planning (MRP) in the 1970's which was improved in the 1980's, originally in the 1960's there was Inventory control package. This history of the ERP is discussed in details by Menon et al. (2019)

2.2.2 How does *digital ERP* work?

ERP is the solution designed and orientated as a solution to manage organisations resources in an integrated way (Azevedo et al., 2012). It is one of the most adopted Information Technology (IT) solutions due to its potential cost-saving ability. Another main driver of the tool adoption is its benefit, which stems from its ability to seamlessly integrate technology and operations data into the supply chain system and financial system (Elragal & Haddara, 2012).

Transparency in the IT system can be regarded as one of the ethical features in the current world and organisational standards (Fernandez-Feijoo et al., 2012). The ERP system helps keeping all operations data transparent and visible to everyone in the organisation. All the data and information are automatically transferred to all relevant areas of the organisation that need to use it and fulfil their functions.

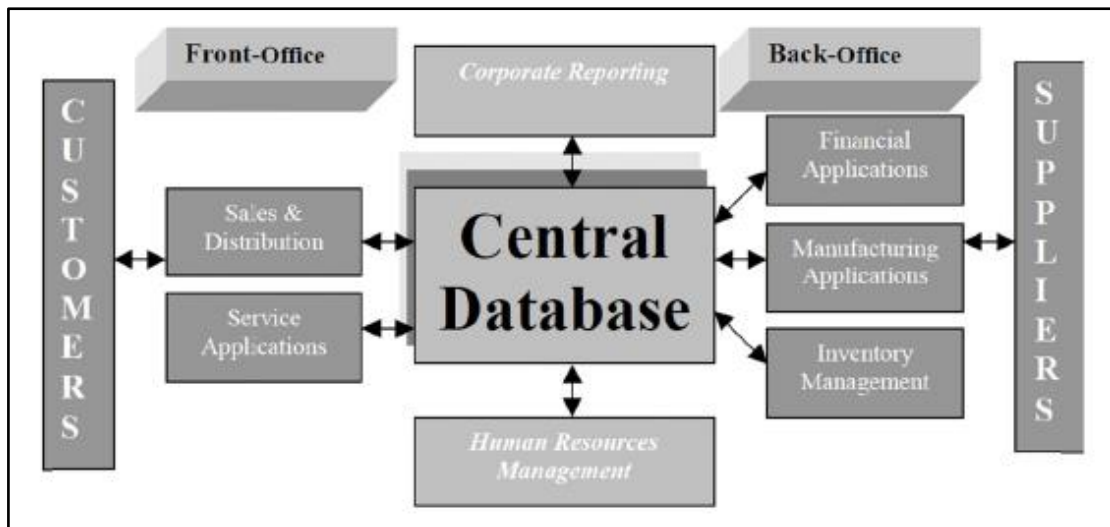


Figure 1 - ERP pictorial representation of the concept (Menon, Muchnick, Butler, & Pizur, 2019)

2.2.3 Benefits of ERP

Stefanou (2001) mentioned that ERP benefits and costs are not easy to identify as they span over the project's entire life cycle. It is difficult to quantify both cost and benefits even if they were identified as most of the benefits do not come from ERP use but from the organisational change resulting from implementing the system.

Easy access to reliable information, elimination of redundant data and operations, increased efficiency leading to reduced cost and ease of adaptation in changing business environments are some of the most notable benefits of the digital ERP system (Stefanou, 2001).

2.2.4 Factors and challenges affecting ERP implementation

Like any other project implementation, there are always areas of improvement, but it is essential to learn from past experiences for that to happen. Literature has

identified some of the critical challenges when the organisation implements the digital ERP system.

Ehie and Madsen (2005) identified lack of senior management support, insufficient training and project management as some of the critical challenges in implementing the ERP system.

Excessive customisation, a lack of business understanding, poor data quality, and a misalignment of IT and business were highlighted as some of the issues by Momoh et al. (2010).

Stanciu and Tinca (2013) identified a lack of senior management support and insufficient training and reskilling or limited training as critical factors affecting ERP implementation.

Table 1 below is the summary of critical challenges in the implementation of ERP from the literature. These factors are comprehensive enough to form the basis of this study as all the implementation factors identified above will impact the Oil and Gas Industry. The difference will be the location and type of industry where the ERP system is being implemented. Therefore, all factors listed above will be considered in this study. The table is a consolidation of research work from different researchers as referenced below.

Table 1 - Note: the list comes out of the research finding from the work of ((Momoh et al., 2010); (Stanciu & Tinca, 2013); (Ehie & Madsen, 2005)). Factors affecting digital ERP implementation as discovered from the literature.

Critical challenges	(Ehie & Madsen)	(Momoh et al.)	(Stanciu & Tinca)
Excessive customisation		X	
Dilemma of Internal integration		X	
Poor understanding of business implications and requirements		X	
Lack of change management		X	
Poor Data Quality		X	
Misalignment of IT with the business		X	
Hidden costs		X	
Lack of senior management support	X	X	X
Insufficient training and reskilling / Limited Training	X	X	X
ERP vendor selection		X	
Internal implementation team		X	
Project opposition		X	
user training		X	
Project management principles	X		
Feasibility/evaluation of ERP project	X		
Human resource development	X		
Process re-engineering	X		
IT infrastructure	X		
Consulting services /Client consultation	X		

2.2.5 The applicable theoretical basis for technology adoption

From the literature, there were a few leading theories that form the basis for technology adoption studies, and they are the Technology Acceptance Model (TAM), Unified Theory of Acceptance Technology (UTAUT), Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TBA).

Technology development and changes are happening quickly; integrating users with the right technology both in the private and professional space require deciding which technology to accept or reject (Marangunić & Granić, 2015).

Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB)

TRA, which was developed in 1974, argues that people will always consider all possible consequences of their actions before deciding on adopting an attitude (Asongu, 2015).

In this study, there will be a need to understand the value added to adopting digital ERP technology. Moghavvemi et al. (2016) observed that the theory does not consider external factors that can impede the intended action, including organisational limitations and any other unforeseen eventualities.

The Theory of Planned Behaviour (TPB) developed in 1991 developed as an extension to TRA to consider perceived behavioural control, which helps determine behavioural intention. According to this theory, individual behaviour is explained by behavioural intention, which is influenced by attitude and seeming behavioural control. The above information can be used to determine if the technology should be adopted in addition to TRA considerations. Empirical evidence from the theory has predicted the intentions and behaviour quite well, even though the theory has been evaluated and found to be too rational and devoid of emotions in its analysis as they are known to potentially cloud judgment and be biased (Ajzen, 2011).

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), introduced through Fred Davis work in the late 1980s, became a dominant tool for investigating factors affecting users'

acceptance of technology. TAM is an extension to TRA and considers factors that are linked to Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). This is evident in a complex relationship between system characteristics (external variables) and potential system usage (Marangunić & Granić, 2015).

According to the model, "PU and PEOU can be used to predict the user attitude toward using new technology. Which in turn can determine the behavioural intention to use the system" (Chong et al., 2010)

Technology Organisation Environment (TOE)

Alamgir Hossain and Quaddus (2011) proposed Technology Organisation Environment (TOE) as one of the models used in adoption frameworks. It attempts to recognise features toward socio economic while also recognising the relationship of technology development and organisation's conditions linking the necessary business and organisational reconfiguration shaped by industry environment.

T-O-E framework is robust, dominant and valid enough in studying organisational level adoption (Gangwar et al., 2014).

T-O-E is not linked to industry size constraints. The framework provides a holistic view of adoption factors, user adoption processes and implementation challenges. It also looks into the technology impact on the value chain after the adoption and the technology's organisational capabilities (Wang et al., 2010).

Of all the analysed theories, T-O-E is the most relevant to be used in developing the framework for this study.

2.3 What variables influence the adoption of digital ERP in the SA Oil and gas Industry?

To determine the factors affecting ERP adoption, the TOE conceptual framework will be used. This framework is the most appropriate as it evaluates technological capability, organisational capability, and the industry's environment. For the purpose of this study, a conceptual model from the TOE adoption model will be used as recommended by Awa and Ojiabo (2016). To simplify the model, the hypothesised effects of each element within elements (technology, organisation and industry) will be merged to have one proposition for each.

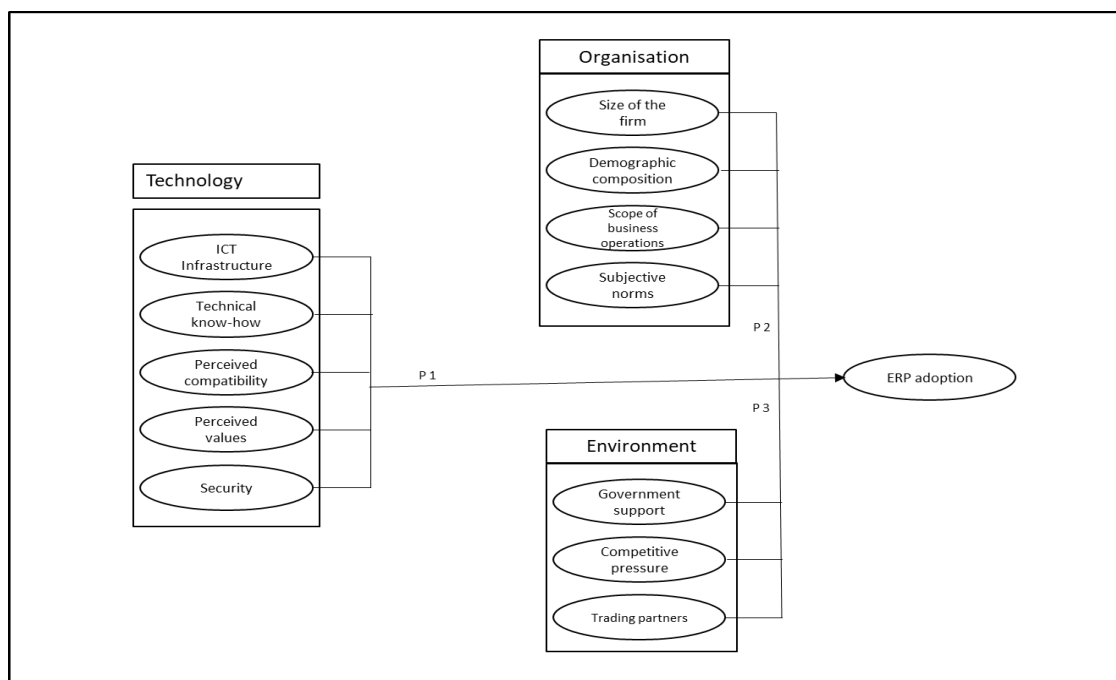


Figure 2 - T-O-E conceptual framework (Awa & Ojiabo, 2016)

Within the three adoption drivers, technology, organisation and environment in this framework, there are twelve constructs (Awa & Ojiabo, 2016). These constructs will assist in understanding and answering the research questions. Although propositions 1 to 3 have combined independent factors, the research

instrument has made sure that each factor is addressed independently and as a collective on how it links to each main factor of technology, organisation and environment. The research instrument aims to make sure that all the factors/variables are fully examined.

2.3.1 Technology

The Technology driver has five constructs that help in developing the first proposition of the study. The identified sections help identify some of the factors linked to the adoption of the ERP system using the proposition relationship. These relationships are adopted mostly from Awa and Ojiabo (2016).

Proposition 1: The oil and gas industry has the capable infrastructure, know-how, ICT security, and compatible systems leading to easy adoption of technology.

2.3.2 Organisation

Awa and Ojiabo (2016) assist in developing the second proposition linked drivers under organisation for adoption. This study is specific to the oil and gas industry; this driver is essential to distinguish ERP adoption from other types of organisations.

Proposition 2: Size, demographic composition, nature of business, and norms & standards lead to ERP adoption complications.

Organisations ability to introduce new systems becomes a considerable factor linked to digital maturity impacts on willingness for the organisation to change their existing current state and introduce different ways of doing things.

2.3.3 Environment

An environment where the organisation is operating is a critical factor during the introduction of new technology. The framework has environment as one of the critical constructs, Awa and Ojiabo (2016) have three sub-drivers that assist in formulating the proposition.

Proposition 3: Competition, partners and good government support together with legislation leads, to easy ERP adoption.

Combine all three drivers to determine factors affecting the adoption of digital ERP systems in the Oil and Gas Industry.

2.4 Which of these factors have a high impact on the successful adoption of digital ERP systems?

The first question will determine factors, then a better understanding and ranking based on their criticality will be necessary. The high impact ones will have to be the first to be solved or improved when similar implementations are made. A framework "establishes a correlation between the process-based method, a scorecard model, and ERP critical success factors to rank these factors," as proposed by Gajic et al. (2014).

Uwizeyemungu and Raymond (2009) developed the model in Figure 4 below to determine factors in adopting the ERP system that had more impact. The model will be adopted for this study. This will answer the second research question of the study.

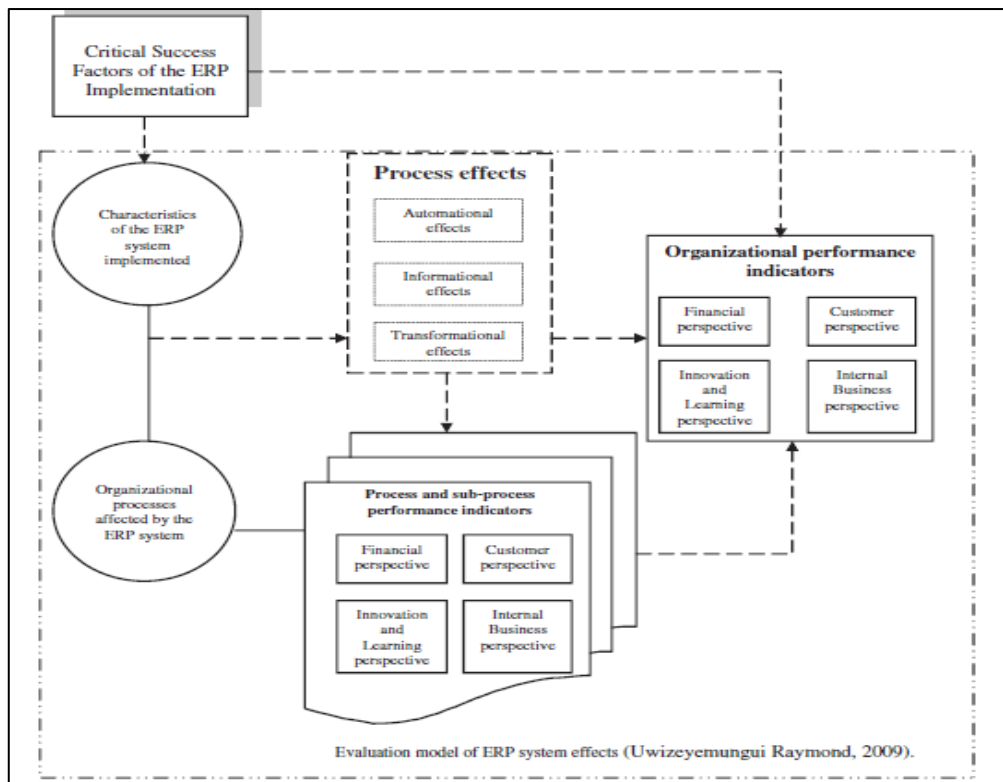


Figure 3 - ERP system effect model used to determine the impact of each factor in the overall implementation. (Uwizeyemungu & Raymond, 2009)

As shown in Figure 4 above, the effect of ERP implementation will be felt in the company indicators, process and sub-process indicators. These will be impacted by the characteristics of the ERP system, the organisational processes affected by ERP and the critical success factors.

2.4.1 High impact factors propositions

The second research question has two propositions to determine high impact factors on adoption.

Proposition 4: The company has been in existence and operating in the oil and gas sector for a minimum of two years and using the ERP system for the same period.

Proposition 5: The company uses ERP in at least two core businesses, which includes the process of delivering goods and services.

The third research question seeks to determine the impact or the level of effect each factor affect the operational and financial impact, especially the first few top-ranked factors.

This question does not necessarily need its own propositions as it seeks to understand the level of impact from the second research question. The third research question will also clarify how each factor impacts the performance of the organisation, particularly operations and finances.

2.5 Conclusion of Literature Review

The ERP system was developed in the 1960s as an inventory control management tool and was improved to the ERP as we know it today in the 2000s. Further developments into the system have continued since then as additional packages are added from time to time.

The ERP system has become the backbone of many industries in their operations, and they mainly rely on the different aspects of the system for their daily operations.

Before these organisations use the system, they first need to adopt it in their operations and the many adoption tools. This study has evaluated TRA, TPB, TAM and TOE adoption methodologies and TOE was shown to be the right conceptual system for evaluating the organisations. It has all the elements that assist in understanding the factors affecting the implementation of the system.

A further model is used to determine which of the factors impacting the implementation the most with the model was proposed by Uwizeyemungu and Raymond (2009).

Oil and Gas industry is one of the richest industries that continues to make major profits as outlined by Milman (2022), in his article that the industry made as much as \$100bn in the first quarter of 2022 alone. This will mean that the industry will not necessarily be concerned with the affordability, this has therefore convinced the researcher that cost of implementation is not a factor in this study this further justifies the application of T-O-E model to determine factors.

The identified propositions assist in evaluating and answering the research questions and objectives of the study. The interview questions will be derived based on the propositions above.

2.6 ANALYTICAL FRAMEWORK

2.6.1 *Theoretical Framework*

Two conceptual frameworks have been identified for this study. One is used to determine factors affecting the implementation of the ERP system. This conceptual framework is TOE which is a technology organisation and environment framework. This framework is discussed in detail in the sections above. It was developed in the 1990s, but it has been used over the years in different technology adoption studies. The literature discussed above shows that the TOE model can better answer the questions posed by this study.

Further to this study, the literature provided a method to determine which factors impact the ERP adoption. This study is conducted in the South African context, the literature does not seem to cover this context.

2.6.2 *Conceptual Framework*

The graphical representation of the conceptual models is provided in the sections above, and both of are clear in the requirements and how they can be applied in the construct of this study. This framework was utilised to develop the research interview guide and made sure that all the aspect required for the implementation of digital ERP are covered.

2.7 State of knowledge of the digital ERP

It is commonly acknowledged that information technology is capable of fundamentally changing the way business works; many organizations have used the advanced information technology solution of Enterprise Resource and Planning (ERP) systems to improve their competitiveness (Davenport, 1998; Rouyendegh & Erkan, 2011). This understanding in the organisations is what has led to the investment in digital technologies, the study seeks to further understand what leads to the decision to invest in the digital technology and how does these factors impact the actual adoption. With the potential benefit expected to be high many organizations are willing to undertake the difficult process of converting from whatever they currently use to an ERP system (Abdinnour-Helm et al., 2003)

CHAPTER 3. RESEARCH METHODOLOGY

This chapter describes the methodology that was followed to test the propositions that were put forward and presented in Chapter 2. These were used to answer the research questions. The section covers the approach the research took, research design, method of sampling, research instruments, data collection procedure and then the data analysis techniques. The section closes by looking at the Ethics requirements for this study.

3.1 Research approach

Antwi and Hamza (2015) have identified three distinct and significant differences between qualitative and quantitative research methods. The focus on quantitative research is understanding over-explaining a phenomenon. It focuses on proposition testing to create and construct knowledge for a simple explanation (Antwi & Hamza, 2015). Qualitative research is the type of study generally used to generate propositions or theories when little is known about the topic (Antwi & Hamza, 2015).

Choy (2014) proposes the model below to evaluate the strengths and weaknesses of both qualitative and quantitative research. This model helps in understanding the critical aspect of each methodology.

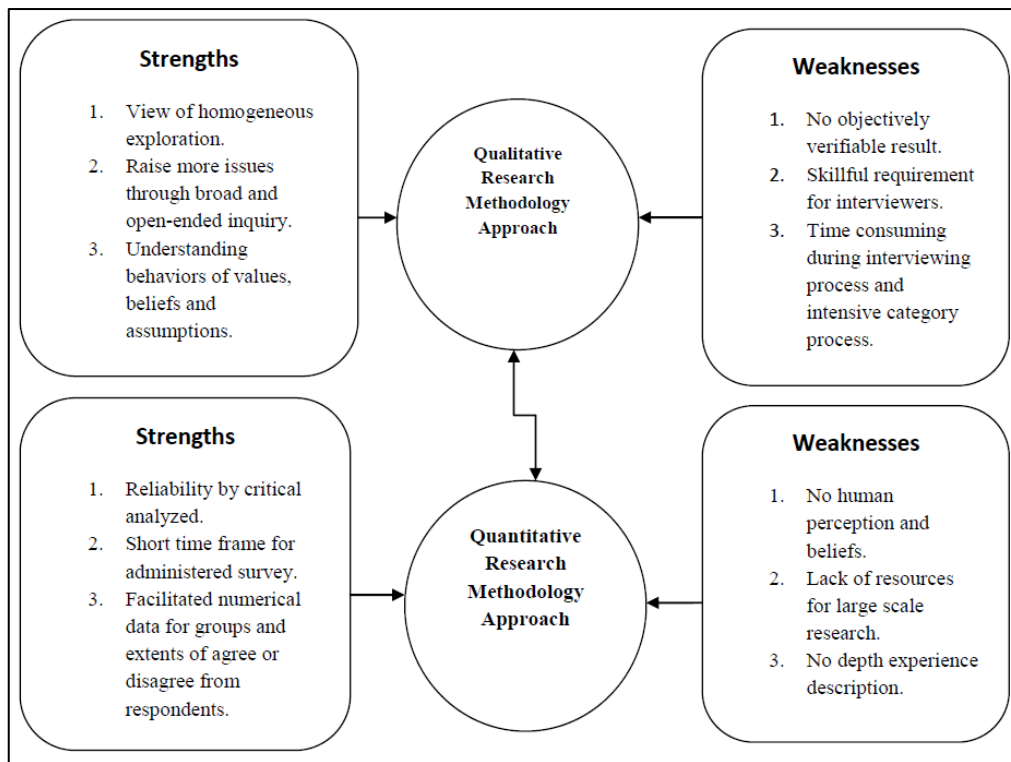


Figure 4 - The model of strengths and weaknesses of qualitative and quantitative research methodologies (Choy, 2014). Used to determine which analysis is best for this study.

This study is explorational and also requires specific answers which can only be given by specific people who were part of the decision making when the digital ERP was being adopted. This can only be done through qualitative study.

This study is about digital tool adoption in the organisation, and there are people who make decisions on whether the tool should be adopted or not at the organisational level. This decision is taken after receiving recommendations from IT specialists and the limited number of users of the tool who form part of the scoping and testing phase of implementation. The strengths of the qualitative research approach are homogeneous exploration, understanding of the behaviour of values, beliefs and assumptions, and its ability to raise more issues

through its open-ended type interview sessions. The qualitative approach weaknesses are that there is no ability to verify objectively, interview skill is critical, and during the interview process time consuming. The qualitative research is more appropriate for this study as it allows for direct interaction and an interview of who understands the reasons behind the adoption. These are the people who experienced all the factors that led to the successful implementation and shed light on these factors. Having participants that were directly involved in the implementation helped in answering the research questions. The objectives were better understood and answered by the participants as they were part of the team that decided on implementing the ERP system. Even though the system users were consulted during the implementation but, they lack the details of what led to the management and implementing team finally deciding to adopt the ERP system.

Inductive, deductive, and abductive research methodologies were identified by Blaikie and Priest (2017). Data is the characteristic associated with inductive method (Blaikie & Priest, 2017). This will be general descriptions that include patterns with associations between concepts derived from the data to primarily answer the "what" in a research question. The deductive approach is described by Blaikie and Priest (2017) as utilising and restarting conceptual and theoretical structure which have been developed previously and proven through observation. This moves the approach from the general one to the specific one (Collis & Hussey, 2013). The last approach, abductive, is described as an iterative process that begins by discovering concepts, motives and meanings that people use in the area of social life under study and is based on the understanding of

these everyday accounts. Scientific accounts are then produced (Blaikie & Priest, 2017).

In this research study, the researcher sought to understand the stakeholders understanding of the factors affecting the implementations of the digital ERP system, generally implemented in the form of a project. The inductive approach was identified as a suitable approach for this study as the conceptual framework is adopted from the existing literature.

3.2 Research design

Research design is defined by Blanche et al. (2006) as the strategic framework that connects research questions to the implementation of the research; the plan helps the researcher to understand how to collect and arrange data. Through the discussions and observations during the planned interviews, the researcher's aim was to fulfil the purpose of the research.

ERP implementation is a well-researched topic, but this changes when it comes to the South African Oil and Gas context. The topic not being well researched in South Africa justifies the study following the Nascent design. Edmondson and McManus (2007) provide a clear guideline on the design for the Nascent design; Table 2 below shows all the considerations/steps associated with this design method.

Table 2 - Archetype of methodological fit in field research (Edmondson & McManus, 2007)

State of Prior Theory and research	Nascent
Research questions	Open-ended inquiry about a phenomenon of interest
Type of data collected	Qualitative, initially open-ended data that need to be interpreted for meaning
Illustrative methods for collecting data	Interviews, Observation, obtaining documents or other material from field sites relevant to the phenomena of interest
Constructs and measures	Typically, a new construct, few formal measures
Goal of data analyses	Pattern identification
Data analysis methods	Thematic content analysis coding for evidence of construct
Theoretical contribution	A suggestive theory, often an invitation for further work on the issues or set of issues opened by the study.

Therefore, the study followed this method, ensuring that all research questions are answered by the respondents; and a clear conclusion is given by the study.

3.3 Methods of collecting Data

The approach for data collection for this research study was mainly focused on interviews that were semi-structured which allowed for follow up questions. The interviews were one on one, and they were conducted using Microsoft Teams from Microsoft version 10 as a primary data collection tool. A secondary method of sending emails to clarify specific issues, although available, was not used as most of the questions was answered during the Teams interviews.

Having interviews allowed for the respondents to share their opinions and experiences openly. It also allowed the participant to give a complete answer to

the questions (Queirós et al., 2017). Using interviews removed errors that might come as a result of respondents falling out of the targeted people who were involved in implementing the ERP system in the organisation. It also allowed for questions to be clarified to the respondents in some instances. Questionnaires are generally used when the responses are required from large number of people and require general knowledge. While in this study, the people who decide and implement the ERP system in the organisation are selected few who form part of the project implementation team. Those are the members that directly experience challenges related to implementation.

3.4 Population and sample

Having a suitable sample from the population is one of the critical aspects of any study. A proper sample consideration and selection makes sure that all the research questions or objectives are answered. The sample is generally a subset of the population selected as a representation of the general population. The assumption is made that it will truly represent the overall population.

Qualitative studies generally aim to understand different behaviours and/or attitudes of the interviewees in relation to the topic of discussion (A Meadows, 2003). It was, therefore, important that relevant samples from the people who have real experience in digital solutions and ERP were interviewed.

The South African Oil and Gas Industry Executives, managers, IT employees, different businesses, which are customers of the tool, formed the total population. The leading Oil and Gas companies/organisations in South Africa are Sasol, BP,

Shell, Caltex, Engen and PetroSA. Some of these organisations have a shareholding in different oil refineries and are also operating as independent entities. These are Sapref in Durban and Natref in Sasolburg.

The organisations above are the prominent Oil and Gas companies in South Africa. These hold more than 90% of the total share of the petrochemical sector in the country (SAPIA, 2019).

3.4.1 *Sample and sampling method*

The sample is a subset of the populations as stated above. The sample was comprised of IT managers, digital ERP IT experts, digital ERP users in three of the oil companies or refineries owned by the organisations mentioned in the population above. As it has been confirmed, the above Oil companies have implemented digital ERP systems or similar tools, and they all have a similar type of skill set to utilise a given tool. This assumption makes it allowable to use one of the oil companies as a study sample. The researcher interviewed at least 20 respondents, consisting of IT senior managers, IT specialists, digital ERP IT experts, and digital ERP users. Personnel who were directly involved in the implementation of ERP, with intimate knowledge of the processes that led to the final adoption of the tool. The respondents will be purposefully selected to make sure that the right people are interviewed. The profile of the respondents is summarised in Table 3.

Table 3 Summary of Respondents

Description of respondent type	Number to be sampled
VP IM of the organisation	1
Senior Managers IM	6
Senior managers Business	3
IT ERP specialist	7
Business specialist (ERP Users)	3
Total number of respondents	20

The respondents were directly targeted based on the level of involvement and influence in the ERP system adoption process. A balanced calibre of respondents was sourced to ensure that the responses received are not one sided and provide experiences of people who were looking at the process not in similar ways. A referral system was also adopted to get respondents that have intimate knowledge of digital ERP implementation.

3.5 The research instrument

Primary data was gathered using semi-structured interviews with straightforward, specific questions but also allowing for follow-up questions as they arose. The interviews were structured in two sections; the first section was designed to understand the factors that the respondent experienced during the implementation. The second section was structured to understand from the factors identified which ones were more challenging to find solution for and which

of them were easy to solve. This section was used to do the analysis model as presented by Uwizeyemungu and Raymond (2009). The model uses a mathematical interpolation that seek to find a correlation between a process-based method which assist in developing a scorecard determining that determine factors that have more impact in the implementation.

The research instrument had 7 sections

1. Research summary
2. Recipient details (which could be left blank if the respondent sought to ensure anonymity)
3. Basic questions
4. Technology based questions
5. Organisational based questions
6. Environmental based questions
7. Additional information and conclusion

The details in the design of questions can have a significant impact on responses received and, ultimately, the conclusions drawn in the study (Lietz, 2010). The grammar and language used were kept clear and simple to make sure that there was no confusion. In addition, each question was explained to the respondent to make sure it is was clear enough to avoid the respondents assuming different meanings at any point. The personal details of the respondents were asked but are not shared on this report so as not to disclose the personal information as per ethical guidelines and in agreement with the respondents.

3.6 Data collections Procedure

A Formal request for permission to interview was sent to the Intellectual Property Department for the conducting of interviews, and it was granted. As part of the request, the research instrument, university ethics approval, and research information sheet were sent for assessment and scrutiny. The permission email is available but omitted in this report to maintain anonymity.

After receiving company approval, the respondents were approached directly, and the interview meeting was set up with each of them at a time convenient to them. Before setting up the interview session, an email was sent requesting them to participate, and this was then followed up by the phone call to further explain the request and the project. Once the details had been clarified, an agreement was reached on the appropriate interview date and time, and a formal meeting was set up with the respondent. In some instances, the respondents had to move the interviews due to other commitments coming as an emergency. The respondent then helped in finding an agreeable alternative date and time.

3.7 Data interpretation and analysis

3.7.1 *Transcribed and recoded interviews*

The interviews were recorded using Microsoft Teams software, and for backup purposes to avoid any possible technical issues with teams recording, a cell phone recorder was also used. The cell phone recording was only used in the analysis for three occasions where teams had technical difficulties.

For transcribing, Microsoft Teams software from Microsoft 365 package transcription tool and Otter (2021) online transcription software was used. The researcher went through the transcript while listing the interviews, making sure the transcription is accurate. The word repetition was removed, and spelling errors were corrected to make sure that it is in line with the actual recording.

3.7.2 Procedures to Analyse Data

The following procedures were followed to analyse the data:

Organising the data: After transcribing, the data were arranged and organised into files for analysis in the tool.

Reading through the data: The text was read through, making notes and forming initial codes.

Categorisation: The codes were then organised into themes based on the patterns that emerged when reading through and analysing in relation to each question.

Interpretation: The data was interpreted based on the understanding of the text.

Representation of the data: The narratives were presented using tables, figures and graphs.

Pattern matching: Pattern matching was used to analyse the relationships between concepts. (Yin, 2003) argues that if the patterns match, the results can help to strengthen the validity of the study.

Cross case analysis: Cross case analysis techniques were used to analyse the emerging patterns and themes. The purpose was to distinguish between the differences and similarities across the various participants on each question, as suggested by Khan and VanWynsberghe (2008).

The above outline follows the Thematic analysis. It was used due to its advantages when it comes to qualitative analysis. Braun and Clarke (2006) listed the advantages of thematic analysis as a flexible, easy to learn method, accessible to researchers with less qualitative experience. It can generate anticipated insight. Data analysis for this study was linked to the TOE conceptual model, which allowed for the development of codes that allowed for the identification of themes and ideas. This helped in the identification of the factors affecting the adoption of the ERP system in the Oil and Gas Industry.

3.7.3 *Atlas.ti*

Atlas.ti is a software used for qualitative research and qualitative data analysis. Different media types can be coded using the software. These include text, videos, audio and images. Version 9 of Atlas.ti was used for this research to code the interview transcripts. Different functionalities within Atlas.ti was used to process the data, and they are: Document Manager, Code Manager, Quotation Manager and Network Manager which are discussed in the text below.

Document manager: This was used to upload the interview transcripts that contained the data that needed to be analysed.

Quotation Manager: This was used to manage and keep track of quotations within the text. This functionality enabled the researcher to consolidate related quotations from different documents.

Code Manager: This functionality enabled the researcher to code the key text that was relevant for the study.

Network View Manager: During the analysis codes, were translated into themes. The network view manager was then used to link relationships between themes and represent the relationships in a diagrammatical format.

3.8 Study Limitations

- All respondents were truthful during the interviews and shared details of adoption events as they transpired.
- There was limited time available for the interviews, which allowed for a limited number of follow-up questions.
- Although the sample size was broad enough, there is a possibility of a one-sided finding. This lie on the assumption that all Oil and Gas businesses in SA have similar systems.

The study is only limited to major oil and gas businesses in South Africa. Smaller organisations could have different challenges.

3.9 Transferability and dependability

3.9.1 *Transferability*

Best written research still struggle to provide direct insight into the lived experiences of their respondents (Tracy, 2010). The qualitative analysis relies on formal generalisation, which finds resonance through transferability achieved in this study when members of all oil companies feel the study overlaps with their feeling (Tracy, 2010).

The data was collected through interviews which is in the form of storytelling or testimonies. These can correctly be aligned to the reader of the research report. The transferability of this study will be above average when it comes to South Africa but below average when compared to the rest of the world as it only looks into the South African context.

3.9.2 *Credibility*

Credibility would link to how detailed the responses from the person being interviewed gives reasonable responses that lead to conclusive results. It refers to how the findings of the study are trusted, versatile and plausible (Tracy, 2010). The researcher has interviewed respondents who were directly involved in the adoption of the digital ERP system in the organisation. People who had first-hand experience in the implementation increased the credibility of the results. The research was guided by supervisors who are well experienced and were appointed by the school. They assisted in keeping the credibility of the work.

3.9.3 *Dependability*

Dependability is attainable by using overlapping methods which can be replicated or duplicated, the methods that can be audited (Morse, 2015). It involved the findings, results interpretation, and recommendations supported by the respondent's data (Morse, 2015). This means that there must be an ability to audit the results. This will be achieved by keeping all the interview records and transcripts of the research. Keeping the transcript will ensure that results can be depended on.

3.10 Ethical considerations

Wits University has detailed standards and guidelines on ethical research. This research followed all guidelines as stipulated by the university policy. The purpose of the research was explained in detail to all respondents, providing them with details of what will happen to the data collected, including their responses. Interviews were not conducted without the consent of the respondents. The consent was sought once details were explained. They fully understood these details and what would happen once their responses were received. The 20 respondents who participated were made aware that they could stop the interview at any time should they wish to do so, none of them stopped the interview at any point.

This research does not include minor children. It also does not discriminate based on gender, race or any other form of discrimination. The interview questions were the same for all respondents. All the follow-up questions were asked based on the responses from the participant in the interviews. There were no follow-up

questions that emanated after the interviews, which were critical and that needed to be posed to other participants to limit possible discrimination that could possibly affect the results.

The research did not pose a risk to the environment as all the interviews were conducted virtually, further reducing carbon footprint as there will be less driving to the respondent's location.

All respondents will be protected, as their names and details are not directly specified anywhere in the report.

The research data collection only continued after receiving University ethics board clearance and all other approvals were received, which included the company interview clearance. The researcher followed all the rules governing research ethics as stipulated by the ethics codes.

CHAPTER 4. PRESENTATION OF FINDINGS

4.1 Introduction

The presentation of the results of this study is in the form of tables and direct quotations from the interview sessions. The interviews were held one on one through the Microsoft Teams software. Each interview lasted for approximately one hour. The interviews were recorded to make sure that all the details were captured, then they were transcribed to assist with data-analysis efforts. All personal and identifiable information was removed to maintain anonymity and confidentiality. The researcher proceeded to familiarise himself with the collected data from the interviews.

Twenty interviews were held virtually in total, and below is the breakdown of these interviews:

- One Information Management (IM) Vice President who is responsible for the entire implementation of IT and digital solutions in the organisation
- Six Senior Managers in the IT departments who are directly involved in the implementation of IT and digital tools in the organisation.
- Three Senior Managers form business/implementation teams from the areas where the digital ERP has been implemented.
- Seven IT and digital specialists are the employees that were involved in setting up the IT system and making sure the ERP works as expected and all the issues are resolved speedily.

- Three business units specialist are the team members that form part of the implementing team; they are the ones who assist with the scoping and testing before the ERP is fully deployed to what is called go live.

The twenty recorded interviews were transcribed in Microsoft Word document and transferred into Atla.ti version 9 coding tool to gather an understanding of themes. The transcription process was the most laborious one, but it helped the researcher to understand the data collected. This then assisted during the data analysis, and the researcher understood it better. Although the transcribing process was a laborious one, it was a valuable skill to learn and assist the researcher in the remainder of the research, further assisting with data analysis.

4.2 Background of participants

All participants have the above matric qualifications with extensive experience in the oil and industry. Six of them have previous experience in other industries, in addition to Oil and Gas. Only four women were part of the participants. This is because of the limited number of women in the IT division.

The age of the participants varied significantly as it ranged between 35 and 55 years. Although this is a wide range, the minimum age in the implementation of these type of tools is in the mid-thirties. ERP implementation is a specialised field and requires people with relevant experience for it to be executed correctly. This is the reason why the age group is about 30 years. For the purpose of the study, it was important that participants with real-life experience in the ERP implementation are interviewed.

The VP interviewed is the one responsible for the IT team of the organisation. He is responsible for the budgeting and resource allocation for all projects implemented in that space.

All the participants have solid experience in their field, with the lowest being just above ten years. This shows that they understand the industry and have ability to give a good insight into the development, implementation and adoption of both digital tools and digital ERP systems.

As stated above, the participants come from the fields that would be part of the team that implements the digital ERP system. These have been grouped based on their skill or level of involvement in the implementation.

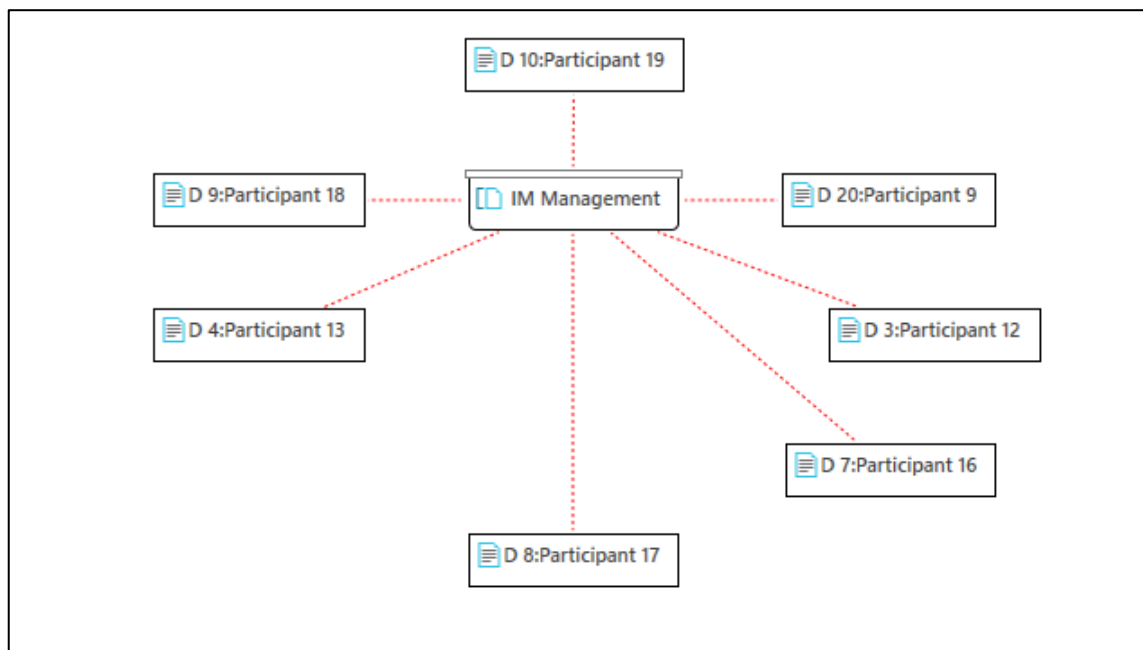


Figure 5 IM Management Team Participants

As part of the team, there is an IM Management team that comes from different areas, which include security, coding, ERP management, data management,

infrastructure and connectivity. Their role is to make sure that they provide enough resources for the implementation of the system and are responsible for the budget of the projects. These participants are shown in Figure 6, which depicts the network. The participants consisted of six managers and one vice president in the IM division.

The next group of participants are the IT specialist, which consisted of 7 participants. Their role was to make sure that the Information technology work that is required to implement the digital ERP is done correctly. These participants will be communicating with the users during the design phase and the implantation phase, making sure that the product they are creating will serve the purpose for the users. These participants are shown in the network below.

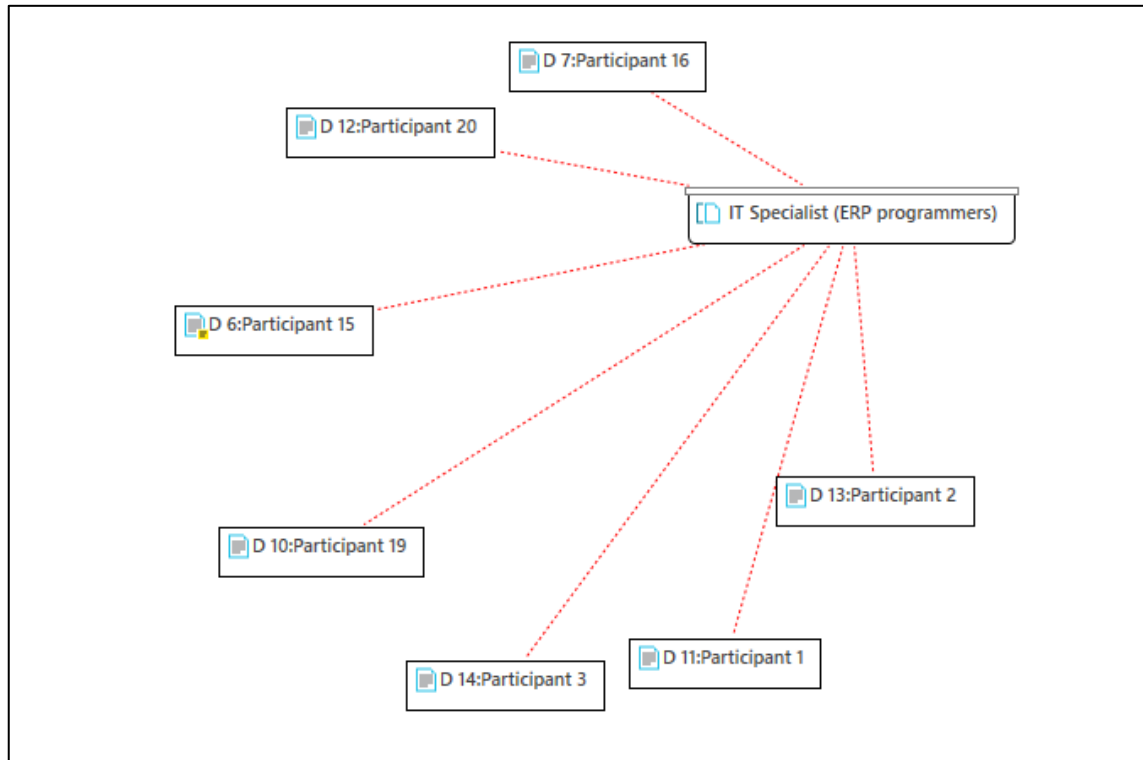


Figure 6 IT Specialists Team

The two groups above come from the technical teams of the implementation. The researcher would not have done justice to the study if only IM technical participants had been interviewed. The research included participants that come from business; these are people who were identified as super users or were people representing business which include finance, human resources and supply chain, to name a few. They would form what is called the core team that assist in developing proof of concepts. Figure 8 below shows the network of the users involved in the study.

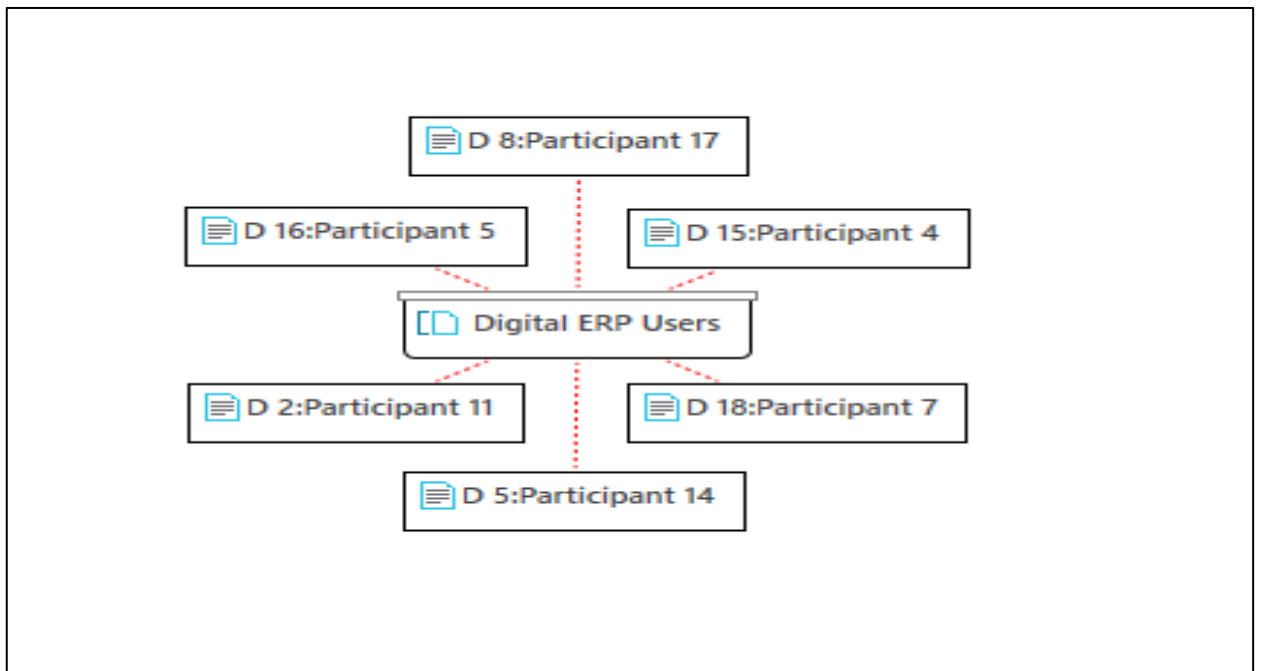


Figure 7 ERP Users Team

The participants come from different areas within the organisation; this helped to make sure that the researcher got a balanced view from both technical teams and the users of the tool.

4.3 Findings pertaining to Propositions

4.3.1 Findings pertaining to Proposition 1

Proposition 1: The oil and gas industry have the capable infrastructure, know-how, ICT security, compatible systems leading to easy adoption of technology.

This proposition is formulated to understand the technological aspects, and it is written as: The oil and gas industry has the capable infrastructure, know-how, ICT security, and compatible systems leading to easy adoption of technology. Having solid technology is the backbone of the good ERP system. This system is then enhanced by linking it to digital solutions which includes cloud data storage, Robotic Process Automation these tools enhances the ERP system and make it more efficient and operate fully as a digital system.

First, when trying to understand the orientation of the industry when it comes to technology and digitisation, the theme that emerged is that the industry is still semi-technophilic. This means that although there are some strides that have been made in embracing technology bust, there is still resistance in some areas. Below are some quotations from the participants when they described the orientation of the industry.

"I don't think they are completely resistant. I think there's a willingness. But the reluctance comes from having developed tools in the past that are useful, and now the additional effort to develop new skills, or to learn new platforms to use doesn't seem necessary."

"I think we both, in some cases, we want to move faster than what I wanted ours to move. In other cases, we need to move slower" From participant 3

"I think in the past, a bit more technophobic. I've seen a transition where people are transitioning into getting less technophobic to that effect. I think there's a lot of aspirations looking at how technology, I think now the mindset is changing."

In total there are seventeen similar sentiments showing belief that there is a move towards being technophilic. Only two show a feeling that the organisation is still Technophobic, with one showing belief that it is fully technophilic.

Several themes emerged when it comes to technological influence, and they were linked to different aspects of technology requirements during the adoption. These themes were linked to infrastructure, security, technical skills, and compatibility.

The Oil and Gas industry is not short of the required technical resources to successfully implement digital ERP or any digital tool for that matter. This came out clearly from the discussions with the respondents.

The respondents confirmed that storage capacity (cloud), good business processes, good network connectivity and reliable data sources are some of the key infrastructure requirements for the implementation of the ERP system. Below are some of the comments from the participants that support the view and the importance of the item listed above as key infrastructure required.

"The applications that sit around the ERP system are becoming more important, whether they be on-premise or cloud systems."

"Key infrastructure required is the on-premise environment, cloud solutions and hardware."

"Things like the networking infrastructure, the networking capabilities, to further mature our current networking that allows us to secure access into our business network."

"So my view is yes, you can be pro-technology, but you still have to have this people process and technology view."

The comments from different participants confirmed that the industry does have all the resources they require, and the ones that they do not have do have the capability to acquire them. This includes the acquisition of enough storage from the cloud space service providers, including Azure and Amazon web services.

The second theme that emerged linked to the first proposition was the compatibility of the currently existing systems with the new digital ERP system. It became clear from the discussion that this is one of the key considerations before the new tool is adopted. It is important that during the design phase, the compatibility is already being looked at to make sure that any possible impact is already part of the design. Some of the comments from the respondents are listed below.

"It is quite important is that you understand how the mapping is being done, the product customer mapping, so that you don't get, you know, things falling through the cracks later, or conflicts being generated because of that."

"They will always be dependent that one is to check in on your roadmap to deploy an ERP in the environment."

"ERP that we knew is that on a project, you probably will make a decision to just continue in implementation and find workarounds for the things that don't work."

"You have to make a call in terms of the next piece of your project when you go into execution, whether you're going to go ERP, full deployment but using the interface and bring it at a later stage."

The quotations above from the discussions with the respondents shows that compatibility is a consideration, and if items come up that were overlooked, a solution is developed while the project is continuing.

The next item in the technology that is looked at is the security of the system. All the participants agreed on the importance of securing the digital system from any threat. The danger could come from Cybersecurity or any other vulnerable areas. It is therefore, essential that a proper analysis on which areas of the ERP system each person has access to. This is done to make sure that team members have access to the system they need, and it does not extend to areas that are critical, and they are not supposed to be accessing. All 20 participants agreed on this security matter, to the point that it is clear that if there is a security concern, the project does not go ahead. There is a security analysis team that gives the go-ahead on the implementation of any IT systems in the organisation after they have assessed and evaluated all the aspects of the project and implementation.

Some verbatims from the interviews were as follows when it comes to security matters:

"There's obviously the security checks that need to be done there and the guarantees and the ownership of data issues that have to be just clarified."

"So there is definitely security considerations on all of those fronts, and we need to make sure that the necessary protection and firewalls and whatever else needs to be demilitarised zones etc. need to be put up in place to protect the data."

"So the one thing that we ensure is that we build in security from the start, and it's a concept that's called dev SEC ops (development, security and operations)."

"Around the systems, especially the more those hosted on the cloud-based service, the more we interested around who's the owner who holds over IP, it's our IP, who maintains the safety and security, what proof in audit traceability are there around the controls and safety security that's put in place."

"The cyber security, luckily for us we do have our security team, that whatever, like when we are exposing our platforms, to whether public cloud, there needs to be a protection of our information, they need to be approved from the security team."

The above statements come from the interviews that the researcher has with the respondents; the rest of the answers to this research question are similar, illustrating the importance of security in the organisation's systems. Removing all the vulnerabilities that might come as a result of introducing a new digital ERP system.

The participants in the interviews all agreed that there is a big benefit in having a digital ERP in the organisation and industry as a whole. Although it was difficult for the respondents to put a monetary value on the benefits, it is clear that it definitely does bring efficiency to the business, as confirmed by the comments below.

"Speed to market more customer confidence, from the organisation, our customers that we deal with because they can access our products on the app. They can track their delivery. There is no loss in financial, we can track our tracks when they move from one depot to the other. So there is real value in digital ERP."

"The business process, ERP talks to always refer to the core and non-core. Where the core is manufacturing, about production, in our case, in the non-core is finance, and so forth. So on the financial part of things, there's a lot of opportunity in terms of the processing of your invoice, if you can digitalise that, and using the technologies such as RPA robotics, which are hosted on ERP to automate and reduce manual work of processing the invoice obviously if you do that, you know, you can reduce the number of days to service these, and also the labour component that is involved if you're processing. In manufacturing on the operation side of things."

"definitely more agility, more real-time information, better access to information for effective decision making a more integrated system, a system that is not hard to configure, or a system that allows you to plug applications and unplug

applications a lot easier. So basically, you would have a lot more agility in the way you run your business."

"And ultimately, that leads to the monetary benefits. So the benefits are things like improved productivity. People can now do things quicker; they don't spend time doing cumbersome, irrelevant work or administrative work, which could just be typing numbers from one system and printing it out and typing it into another. If you can connect those things and make it electronically, it just goes quicker. So it's a productivity increase."

The statements above are some of the responses from the interviews as it can be seen from the sample above that all are confirming that having a digital ERP system brings nothing but efficiency to the organisation, meaning evaluating the benefit will form part of the core considerations when deciding on the tool.

4.3.2 Findings pertaining to Proposition 2

Proposition 2: Size, demographic composition, nature of business, and norms & standards lead to ERP adoption complications.

The second proposition seeks to understand the company, the Oil and Gas Industry and the people within the industry, then understand how do all these combined impacts or affect the implementation of the digital ERP in the Oil and Gas Industry. The proposition is written as size, demographic composition, nature of business, and norms & standards, that lead to ERP adoption complications.

The first theme from the interviews is that there are precise demographics that affect the process of acquiring the digital ERP system, but age becomes a factor

when the system is being rolled out to the entire company population. The older generations seem to be more comfortable with their current state such that it becomes difficult to change them to newer systems. The digital ERP is also having the same problem whereby the older generation opens more tickets that require them to be assisted when implementing the new tools.

Below are some of the verbatim from the interview participants related to demographics:

"So one must be very careful, but I'll at least share what I observe. But I would say age is probably the most significant thing. I would say that typically younger people are a bit more inclined to adopt some of the things, whereas as older people may be a bit more reluctant, but I would say that difference is not as big, as I think many people think it would be"

"I think before we take any solution, do we look at the usability of solution and our solution. The ease of usability because that help to fast track the rollout, especially the training. You need to really do the change management assessment requirements and then determine the skill set of people who are going to use that solution."

"I think not so much gender, but definitely, the younger folks in the organisation are obviously extremely pro digital and pro, doing things, doing low value, adding activities, or whatever."

"I think there is a culture in the organisation of sticking to what we know. And I think internally; we have a bit of change fatigue."

"You can make a general statement that younger employees are more open to kind of the newer ways of working and new solutions. I think for me, in my experience when we've had conversations, especially when we're introducing the work to a new team, we have found that the older, more experienced employees do tend to push back and are a lot more sceptical of what we're trying to achieve."

As it is clearly shown from the statements above, the participants seem to agree on the impact of the older generation and the process itself of how the system will be used.

The next theme that came out is linked to the complications that come as a result of the number of users that get affected during the implementation of the tool. The higher the number, the more complicated the implementation becomes. All the respondents agree that proper change management is vital for the good implementation of the new system.

"Then before we do any development or anything of that sort. We have a number of change management sessions. And we kick off with awareness session."

"Make sure that they are trained and then give the rest of the user guide on what to do, what they need to do and with the hope that the super users will then cushion the rest of the other people so. If the person is a superuser for finance, then there are not 30,000 finance people. There is only maybe about 300 users, you know, so if you've got 2 to 3 super users in that area, then they can actually filter down any issues that the users are picking up when they're trying to use this system."

"The more users you roll out, the more tickets or, the more incidents will be logged. So the number of users drives the number of tickets that you can get. So the challenge would be that the support becomes very difficult, the effort of support is different."

"Quite significant effort has gone into indemnifying the role players identified the impact it will have on them. And do the change program that is required to roll out the technology to them."

"Big numbers definitely has a massive impact on the rollout. And that's why it needs to be business-led and business ownership. Because if you have the right sponsorship, you have the right business involvement, and you have the right change management in place because it's a massive journey. And it's not something that gets done in a year or two. It's a five-year journey to convert the entire organisation that you cannot do in a big bang approach where you say, I'm converting all 33,000 employees today. You start because of our history of having 16 instances."

The above statements from some of the participants are the highlights of the type of responses received and the impact of the population that form part of the people to be impacted by the introduction of the new digital ERP.

The next point that needs to be addressed is the impact of other Oil and Gas industries on each other in implementing the digital ERP. This include evaluating the impact that might exist due to the industry being highly regulated. Safety to everyone who works in the operations for the Oil and Gas Industry need to feel

that their safety is a priority and safeguarded. The following was said by the participants, which formed part of the themes from the data analysis:

"It's access to 5G technology. It is this, how well do you do change management. That's very critical and key. And it's, how complex are your business processes because the more standardised your business processes, the easier it is for you to really get the value out of a modern ERP."

"It's very important, and I want to bring you back to business processes is that any ERP system is based on the business processes that a company runs. So if there are any inefficiencies in the business processes, you're going to see those inefficiencies come out in your ERP system because that's reflective of your business processes. So, if you have the right business processes that are aligned to the regulations, and make sure that all the quality checks are there in both into the ERP system."

"There is no identifiable organisation that will say, maybe they dictate how we implement this. In terms of our industry."

"The complexity comes with are you operating in one area, and with us, we operate in multiple places, so we need to consider multiple legal requirements and restrictions and all of that so, it might take you longer to implement what you need to implement purely because of the complexity of your business."

The above statements and the rest from other participants show that there might be an impact that comes as a result of the complexities of the business

processes. In addition, the complexities that come as a result of operating in multiple countries with different laws and regulations.

4.3.3 Findings pertaining to Proposition 3

Proposition 3: competition, partners and good government support together with legislation leads to easy ERP adoption.

The third proposition seeks to evaluate the environment that the Oil and Gas Industry operates in. Oil and Gas is a matured industry operating in all countries as most of their products are required generally for basic survival. Therefore, the importance of understanding how the industries interact with each other when it comes to the implementation of digital tools becomes important. There were themes that came out suggesting that each organisation do their ERP implementation without looking over the shoulder of others on what they are doing. The third proposition is written as competition, partners and good government support together with legislation leads to easy ERP adoption.

Below are some of the verbatim from the interviews in the team relating to the impact of other industry players in the digital ERP adoption:

"So the resource that you use in IT in the industry, they could be used anywhere else, because IT is IT. So when you implement the ERP solution or any major project, you don't have to look at the risk of you losing the Core delivery team, and if there was any other similar implementation of SAP or ERP outside Oil and Gas, say in the banking industry for augment, so there will be a risk in terms of the stability of your project resources."

"I don't think that impacted. I think there are different degrees of how far they've been implemented. Digitalisation, you often see claims and things that later on, you realise they maybe have been a little bit exaggerated. I think specifically in the, in the field of oil exploration and assessing reserves and things like that, I think a lot of progress has been made with digitalisation, and that directly speaks to the easiness to recover oil, which obviously will impact the oil price, which will then impact our profitability."

"I think it gets back to the kind of Competition Act we can't really see what they are doing. We would know whoever show Celtic, whoever would probably have some kind of cloud presence, what exactly they are doing on the cloud, we can't say, we would pretty much be expected to be doing similar kind of things we are doing. So they might be ahead of us or behind us. But I don't see. It would be nice if we could know exactly what they are doing. But my opinion is you should not limit yourself to do the same things as what your competitors are doing."

As it can be seen from the quotations of the interviews above, the resources as a factor comes from all over and not only in the Oil and Gas industry.

There is then the impact of other players, including the vendors and consultants. The theme that came out from this is linked to the skill and experience of the consultants being used for the implantation. The verbatim below of some responses clarifies this.

"I think there's a significant impact on the vendors, with their ability to run these kinds of programs. And we did sometimes find that the vendors would miss the dates, and then the programs were not successful. So the ability of vendors to

understand the technology and processes, which enable, as I mentioned, that is a key success factor a skill level and understanding of the problems that you try to solve with your ERP is critical for selecting a vendor to implement that solution for you."

"I think external players, there are consultants out there that are getting into the space now where they can help you make that choice. I would say, I wanted to mention this earlier, and it's a good thing you brought it up because I would say where the company is, with a low process, maturity as an organisation, with the whole influence on cloud and digital ERP, and with the whole influence on leapfrogging our competition, in terms of that digital value proposition for our customers. My suggestion is that we must get external support in decisions, like any digital technology, or the major digital implementations, and especially digital ERP."

"I think they do play a role, especially from the skills and knowledge perspective. I think, a year or two ago, a lot of the modern ERP knowledge and skills were, even though available to South Africa, were not based in South Africa. So when we are talking about service providers, they had access to the skills and competencies. That was within their organisation, but based abroad, because of the fact that more companies internationally have gone for the modern ERP versus South African companies."

"Adoptions interesting word in the sentence, but essentially, if you look at your partner ecosystem by that's a word to describe it by your key partners at Forest Park there's obviously a lot of thinking and lessons that they bring from across

the industry, whether you've been working and doing projects with many other customers."

"They come and play a very important role, especially in our industry where we don't have the internal list skills and resources to implement these sinks. So we are heavily reliant on them and their skill set."

The next theme that was evaluated was based on the impact of other partners that the organisation would work with or sell/ distribute its product through them. These have some impact on the implementation all the participants agreed of their impact. The verbatim below supports this.

"The readiness of partner is very important, for example, if the suppliers are not ready to be on board on digital platforms. Then we don't extract the value or the purpose, or we achieve core. We get only maybe half of the benefits that we want to realise because they are suppliers and customers. They are the key component of our value chain."

"Readiness by all parties is important as it affects the speed of implementation, resource requirements and the need for process changes due to changes required in order to accommodate the party that is not ready."

"I think from a customer perspective; if they're not willing, it does affect us we cannot keep on rolling and implementing new things on top of the others while there is no adoption. We do rely on them for their feedback to say what do they want to see when they use or interact with their system. So continuous adoption from them is dependent on how fast you roll out."

"So if your customers are not ready, and they have to spend a significant investment to get their systems compatible, and to a certain level of maturity, that will definitely drive new low adoption, we have seen in the past, where if you're going to be carrying the cost for customers automation, they will be willing, but if you want them to now, have additional costs, then it becomes very difficult. Because of your implementation, you're imposing an additional cost on them."

"Suppliers that can be a little bit different depending on the nature, wherein your end to end sort of supply chain process where they fit into it. That can be more problematic, especially if you've got a sort of integration on a system level between those suppliers. Then the complexity of integrating into an ERP, like SAP, is a lot more complex, and you can't just go live and leave that supplier hanging on the side."

These were some of the comments in support of the importance of partners integrated into the implementation.

4.3.4 Findings pertaining to Proposition 4

Proposition 4: the company has been in existence and operating in the oil and gas sector for a minimum of two years and using the ERP system for the same period.

On this proposition, it was important to understand that the companies interviewed have enough experience operating in the industry. The fourth proposition is written as follows: The company has been in existence and

operating in the Oil and Gas Sector for a minimum of two years and using the ERP system for the same period.

The Oil and Gas Industry in South Africa has been in existence since the year 1930 when South Africa imported all its petroleum products, and progressed to have its own first refinery in 1963, with the last one first operated since 1992 (SAPIA, 2014). The company that was interviewed was developed in between those years. Therefore, qualify to be interrogated as one of the relevant entities for this study.

Some of the participants have confirmed that the ERP has been used in the organisation for the past 20 years.

"So, if you look at the ERP evolution, so, our organisation has always been SAP ERP house, so, we believe in SAP, and that's where we started about 20 years ago, and then we then move to ECCS, which is still SAP by the different architecture, a different platform, and now, we are at the cusp of moving over to what SAP called S4HANA which is the latest ERP, which is actually right for digital transformation, this S4HANA it is much simpler configuration, it is modularised."

The statement above shows that the organisation has been using the tool for longer than two years.

4.3.5 Findings pertaining to Proposition 5

Proposition 5: the company uses ERP in at least two core businesses, which includes the process of delivering goods and services.

The Oil and Gas Industry in South Africa integrates many aspects from the procurement of crude oil to processing, all the way to selling the finished products. The process is a very complex one as there are many players involved, and it is important that there is a single auditable space where all the activities can be linked. In the industry, the ERP is used to play this role by linking the financial system with procurement and operations, to name a few. The fifth proposition is written as: The company uses ERP in at least two core businesses, which includes the process of delivering goods and services.

The Oil and Gas industry or each organisation within the industry has been using the ERP system in more than two businesses to make sure that they stay in business.

"The key thing of digitalisation is for us is to capture information at the source, example when the truck drive over the weighbridge let the meter vibrate then automatically populate that information. When the truck arrives at the customer, and the proof of delivery is captured at a customer, then the key thing with ERP technology it help will to digitise that process and automated service. So, if you just think to yourself that the no touch from the customer system demand load orders or purchase orders then send automatically into our system without any of our people touching it. The confirms the orders and delivery is scheduled thereafter it is delivered at a customer, then we are able to bill and receive that

money. The drive of digitalisation and ERP is to remove all the manual activities around that processes, that's where the value come from. So people can focus on insights of processes and not easy things like capturing data into the system."

Above is one of the statements from the participants which confirmed the use of the digital ERP by more than one business entity in the organisation. Similar sentiments were shared by other participants.

4.4 Summary of the findings

With 20 Participants willingly participating in the study, there are promising findings that can assist in determining or aligning factors that affect digital ERP adoption in the Oil and Gas industry. The participants were clear in their responses. The technology, organisation and environmental factors were identified. This is in line with the TOE framework used in developing this research and adopted as the right one to use.

The summary of the findings is listed below

Proposition 1

- Lack of technical infrastructure
- Good business process
- Well experienced implementation or project team
- Involvement of business and users of the ERP in the scoping and testing

Proposition 2

- The number of users affected determines the change management strategy
- Demographics has no bearing on the implementation team, but older members of the users might resist change
- The complexity of the industry and the importance of safety in the operations require careful implementation

Proposition 3

- The readiness of trading partners has some effect on the implementation
- A good and well experienced implementation partner is the key to the successful implementation
- Scarcity of experienced resources who are well capable of implementing the digital ERP system

CHAPTER 5. DISCUSSION OF THE FINDINGS

5.1 Introduction

The overall aim of this qualitative study was to identify factors or determinants that influence the adoption of digital innovation in the Oil and Gas Industry with more focus on the ERP system. Based on the conducted interviews, the researcher has identified themes linked that are linked to the factors that have to be considered or form part of the design during the adoption of the digital tools. The feedback from the interviews was then tied back to the research objectives for the study, which were:

- Determine factors that influence digital ERP innovation adoption in the South African Oil and Gas Industry
- Identify which factors have a significant influence or impact on the successful adoption and implementation of the digital ERP system.
- Determine the benefit of the ERP adoption in the oil and gas industry to operational and financial performance.

Nwakanma et al. (2013), identified that there are several factors that contribute towards project success. These include clear requirements and specifications from the project owner, realistic project schedule, project management skills and user involvement during project implementation. For the digital ERP, the same is true. The interviews have confirmed the importance of these aspects and other factors, which may be technological, organisational or environmental, as proposed in the TOE framework adopted for this study.

Gangwar et al. (2014), developed this conceptual model, and it is robust enough, dominant has a capability and valid, it assists in the adoption of ERP and other digital tools in the organisation. This is because it evaluates all possible areas that may have an impact on the adoption of the IT tool.

5.2 Discussion pertaining to Proposition 1

Proposition 1: The oil and gas industry have the capable infrastructure, know-how, ICT security, compatible systems leading to easy adoption of technology.

Based on the feedback received from the participants in the interviews, it was clear that without the right technology, you will not be able to successfully implement the digital ERP system. The following Themes came out strongly in relation to technology.

- Good and clear business process
- Storage capacity (cloud availability)
- Good Data management
- Good connectivity
- Compatibility
- User involvement in the implementation
- Security of system and user allocation

Of the themes that came out from the study in the technology, some align with the literature where Ehie and Madsen (2005) also identified IT infrastructure, process re-engineering, client consultation as some of the key factors that would affect the implementation of the ERP.

In the interviews, the researcher managed to identify additional factors; these include the capacity to store and manage data access. This is because having good and trusted data is wanted to make the information out of the ERP system trusted. The next item is compatibility. It is clear that during the design of the digital ERP, it is important to consider all the currently existing tools and platforms and then incorporate them during the new system design.

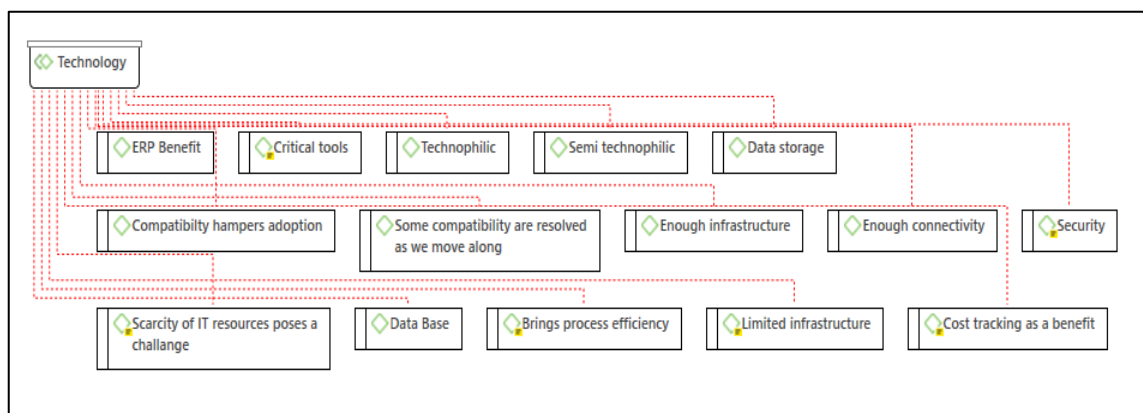


Figure 8 Technology Network Themes

The network above shows all the themes that related to technology identified from the discussions with participants. Under technology, different themes came up, and some have been discussed above. All the items under technology need to be part of the design or have a plan of action on how they will be resolved when the new digital ERP comes live.

Another aspect that came out is that the Oil and Gas Industry is semi-technophilic, meaning that the industry is still finding its way to being fully technophilic. This is due to different factors, which includes complicated operations which require certain safety standards. These standards need to be evaluated thoroughly before digitising anything.

The industry does have enough infrastructure, and the data storage is now increasing through cloud systems where the industry purchase only the required space for their services.

Security of the system comes out as the identified factor for the South African Oil and Gas Industry. All respondents emphasised the importance of avoiding the company being a victim of Cybercrime and all other potential risks that will come with an unsecured system.

The researcher established that the data from the interviews agrees with the literature. Participants identified additional technological factors above the ones from existing literature which are important considerations to be made during the implementation of the digital ERP system.

5.3 Discussion pertaining to Proposition 2

Proposition 2: Size, demographic composition, nature of business, and norms & standards lead to ERP adoption complications.

The TOE model asks that the organisational aspects be evaluated when determining the adoption factors of IT solutions. The second proposition is developed to evaluate those aspects, and from the data collected from the interviews and shown in Chapter 4 above, the following themes were identified:

- The impact of demographics is low
- Skills development is important
- Good change management
- Competing oil companies have no impact on each other

- Regulations form part of the design

Above are some of the aspects that come out of the available data. The network on an organisation below is put together to show all the themes related to it.

Age or any other demographic was found to be a non-issue when it comes to the development and only becomes an issue when the actual implementation with the total population of users, whereby the older generation tends to be reluctant compared to the younger ones.

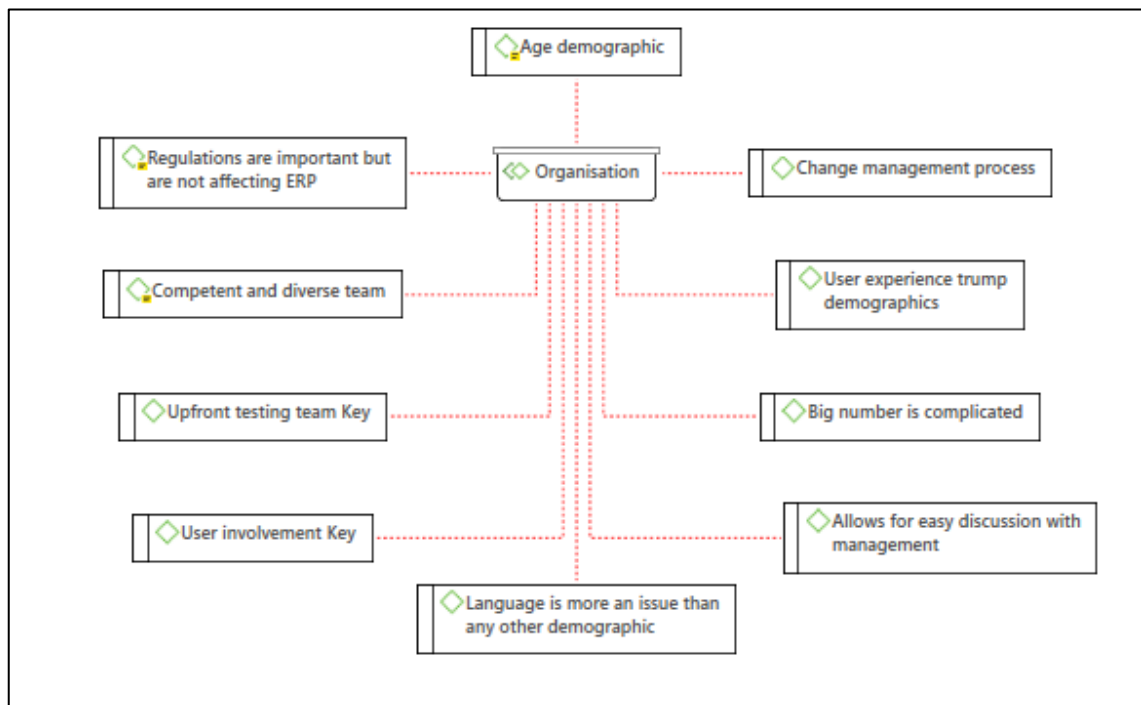


Figure 9 Organisational Network Themes

A factor that was identified in literature by Ehie and Madsen (2005), Stanciu and Tinca (2013) and Momoh et al. (2010) which is a lack of senior management support, is also supported in the South African Oil and Gas Industry. The participants stressed that the support of management is key to the extent that the

preference is to have a project and implementation sponsor who is senior enough in the organisation. This helps in making sure that the buy-in from other affected employees becomes easy. The theme of user experience also came out strongly from the participants as this is one of the factors than any other demographics.

Literature also evidenced insufficient training or reskilling as the factor that affects the implementation of ERP systems (Ehie & Madsen, 2005; Momoh et al., 2010; Stanciu & Tinca, 2013). From the research it was identified that the South African Oil and Gas Industry needs to have a competent and diverse team. Otherwise, this factor will hamper the successful implementation and adoption of the digital ERP. This aligns with the literature.

The researcher identified more factors related to the organisation as presented in Figure 10 above. Safety in the Oil and Gas Industry is critical, but this is taken care of during the design by incorporating all relevant regulations. Having a good change management system becomes key as the industry has different players that get impacted by the system change, and some of them are from outside the individual organisation.

To avoid the impact of users rejecting the digital ERP system, it is critical that the implementation is driven by business representatives, involving most, if not all, the users. The creation of super users assists in achieving this objective, so this becomes part of the factor that can make the implementation a success.

5.4 Discussion pertaining to Proposition 3

Proposition 3: competition, partners and good government support together with legislation leads to easy ERP adoption.

The third proposition is linked to the Oil and Gas industry's environment. This aspect is critical to the TOE model design. The environment could have both positive and negative impacts on the implementation of digital tools. The following themes came up from the interviews and the discussions the researcher held in relation to the environment.

- The scarcity of IT resources impacts the cost
- There is a fight for different competent resources
- The readiness of key partners is a factor
- No real impact from competition

Momoh et al. (2010) did also identify integration as one of the factors, but he only identified it on the internal of the organisation, for the Oil and Gas Industry, it is also a factor as most of the products are sold through third parties. Also, the technical suppliers need to have access or be linked to the system for smooth procurement processes. The cost was also identified by Momoh et al. (2010); this is aligned with the data from the study as it was mentioned by participants that costs become a factor when implementing the digital tool as there is always a fight for resources.

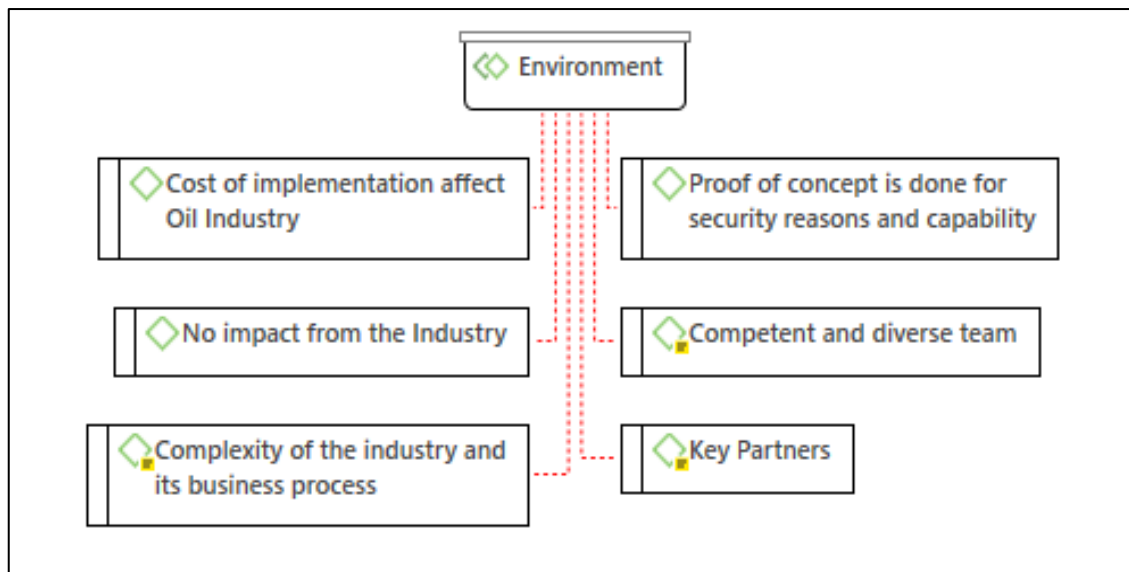


Figure 10 Environmental Network Themes

The environment in which an organisation operates is very important and cannot be underestimated. The factors that form part of that environment become key in ensuring that the organisation succeeded in its endeavours to implement new technologies. These include digital solutions.

5.5 Discussion pertaining to Proposition 4

Proposition 4: the company has been in existence and operating in the oil and gas sector for a minimum of two years and using the ERP system for the same period.

This proposition has two aims. One is to determine if the organisation has been in existence for longer than two years and uses the ERP system in at least two of the processes for its data to be used as a reference.

The interview participants confirmed that both aspects of the company being interviewed have been in existence for more than 50 years. The ERP system is

used in many functions. These include operations, finance, Human Resources and supply chain for its day to day functions.

The second part is about which of the factors have more impact in terms of ranking. Although participants could not clearly identify which factors can be ranked higher, it is clear that having a good business process translated into tangible actions is key in implementing the ERP system.

Security is the next most important aspect of digital ERP adoption. It is important that hackers are kept at bay. The best way of doing this is to make sure that any system being introduced into the organisation is thoroughly vetted before it is implemented. The participants confirmed that the technology security team needs to approve the system's introduction before the implementation.

The critically important aspect is what benefit does the tool have. There is no organisation that can agree to spend money and introduce tools while there is no benefit in doing so. The participants confirmed that having an ERP system has an efficiency benefit the example of this is installing a robotic system that will do all the repetitive work, freeing up employees to concentrate on more meaningful work.

The importance of having an ERP system cannot be downplayed in the organisation, and a further improvement to digital ERP enhances its capability. The benefit from it becomes greater as stated above, the efficiency brought by the introduction of digital ERP is significant. The employees now have time to focus more on the meaningful work and only do the checks of the repetitive work

to make sure that the robotic system is still well-calibrated and performing as expected.

5.6 Discussion pertaining to Proposition 5

Proposition 5: the company uses ERP in at least two core businesses, which includes the process of delivering goods and services.

This proposition aim was to understand the operational impact and ultimately the financial impact of introducing the digital ERP system.

Although this could not be entirely determined as the verbatim results above showed, there is a considerable benefit operationally in having a digital ERP system. The system can link to the customers in real-time, confirming orders and delivery and automatically sending invoices to the customers. This automated process brings about efficiency to the system and also eliminates any possible human errors and delays.

The ERP system is linked to automation systems and then to the cloud, which also means that there is enough data space capacity that will allow for cost-saving that will come as a result of not purchasing big servers to accommodate the required technological space. The IT effect can generally be considered part of organisational performance measures, although they do not necessarily correspond to company processes.

A further study can be put together to evaluate this proposition as a complete study to research it in detail.

5.7 Chapter Conclusion

The factors affecting the adoption and implementation of the digital ERP in the South African Oil and Gas Industry has been identified through the interviews and discussions with participants. The factors have been categorised into three sections linked to the TOE model identified as the right tool to ensure that all aspects of the organisation are evaluated, and factors are identified in all three of them.

From the Technological aspect, it is clear that although it is essential, the proper security analysis must accompany it before it is implemented, a good business process, and there must be a benefit to the company.

Organisational the company must have good change management. The implementation must be business-led and include all the regulations requirements as part of the design.

On the environmental aspect, the organisation needs to understand the importance of external players, including consultants and vendors, as they might make or break the implementation if they are not chosen correctly. The suppliers and customers need to be able to continue doing business with the organisation, so they also need to be compatible with the new systems that are being introduced.

All these aspects were evaluated and identified in this study. The factors identified in this section some aligned to the factors which were identified in literature as tabulated in Table 1 above. Lack of management support and insufficient training

was identified by all three researchers and this study also Identified them as critical. Ehie and Madsen (2005), further Identifies Infrastructure and consulting fees and these are also the aspects that align with the factors identified by the respondents in this study. Change management, business process understanding, integration with internal processes and user training are some of the aspects which were identified by Stanciu and Tinca (2013), these were also identified as a problem and a key success factor by the respondents. These examples shows the alignment of the study findings with the current existing although some of it originates from other industries.

CHAPTER 6. CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction

This chapter aims to draw conclusions and make inferences from the data collected in the study. The discussion will focus on the consolidated factors affecting the implementation and adoption of the digital ERP system. The recommendations are made based on these factors and suggestions for future research to assist in identifying potential further research to add to the body of knowledge related to the Oil and Gas Industry in South Africa.

6.2 Answers to the research questions

The study has three research questions, which the researcher, through the existing literature and engaging in interviews with participants went on to answer. The study sought to understand the factors affecting the implementation of digital tools. Once identified find a way to understand the impact these factors have and rank them accordingly. Then finally, understand the operational and financial impact of these factors. Below is the summary of the answers to these questions.

What are the factors that determine the adoption of digital ERP systems in the South African oil and Gas industry?

The factors were identified from each category of the TOE conceptual model used for the study and they included the following:

From the Technological aspect, lack of technical infrastructure may lead to the inability to implement digital tools. This should be partnered with a good business

process and is clearly understood by all involved. The experience of the team plays a key role in making sure that the main issues with the current issues are addressed.

Organisationally, change management becomes the key factor depending on the number of users affected. There are many stringent rules and regulations for the industry making it difficult to implement without full consideration of the safety impact.

On the Environmental aspect, the industry does not operate independently it is important that key partners become part of the overall implementation and make sure of their readiness. Good experience implementation partner with enough resources to support your implementation is one of the most critical aspects as the ERP implementation is a specialised process.

Which of these factors have a high impact on the successful adoption of digital ERP systems?

There are some factors that were identified as having a greater impact than others: Having a good business process, good change management and experienced team and implementation partner.

How do the factors that have a high impact affect operational and financial performance?

Having a bad business process will always impact how you operate your plant or systems. The overall operations will not be efficient and the delivery to customers might not be met.

Having a good and experienced implementation partner will reduce implantation time this will reduce the cost of the project and have the tool implemented quicker. This will mean that the organisation will start getting the benefit of the digital ERP quicker.

6.3 Conclusion of the study

The purpose of this study was to apply a conceptual framework based on literature to identify and explain factors or determinants that influence digital innovation adoption in the South African Oil and Gas Industry. This was to be done with a focus particularly on the ERP System. Respondents through the interviews have provided factors they have identified as affecting the adoption of digital tools and digital ERP in the Oil and Gas Organisation.

The TOE model proposed three key aspects. The organisation's technology, the organisational structure itself, and the environment the Oil and Gas Industry operate within. The study concludes that all three aspects are essential for the successful implementation of digital innovations. The organisation can have all the required technology, but the implementation will not succeed if no proper structures and processes link to the organisational part. It will also not succeed if the business partners are not ready to embrace the new innovation as they will be the ones to whom the final products are sold.

The factors identified for the industry align with the literature with some additional ones that came from the participants. Implementing any new system comes with

challenges, but a good change management coupled with the business process helps make sure that the impact is minimised.

6.4 Recommendations

The main significance of this study was to understand the problems that an Oil company operating in South Africa researcher may encounter when implementing and adopting digital tools. The study focused on South Africa as an area that is not as well researched.

It has been established that oil companies in South Africa wish to implement the digital tool needs. First, its technological capability, then its organisational capability, and then the environment. It is recommended that the organisation perform a full assessment before the decision to adopt, making sure that the implementation is supported entirely by the business that will use the tool. They are part of the scoping and design of the solution.

6.5 Suggestions for further research

Aside from identifying the factors impacting the implementation of digital innovations and then ranking them based on their impact, this study has provided some opportunities for further research. The following suggestions are made:

1. Understanding from the user perspective the factors that make it easy for them to accept new technology within the Oil and Gas Industry. This mainly focuses on the users who are never part of the decision to implement new solutions.

2. Understand the exact economic impact of introducing the new innovations. This includes the required resources, this includes time employees will have to spend developing the scope and not performing their normal functions.

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Appendix A: Consistency Matrix

The purpose of this study is to develop a conceptual framework to identify and explain factors or determinants that influence digital innovation adoption, particularly the Enterprise Resource Planning (ERP) system in the oil and gas industry.					
RQ #	Research Question	Proposition #	Proposition statement	Data collection method	Data analysis method
1	What are the factors that determine the adoption of digital ERP in the SA oil and Gas industry?	1	The oil and gas industry have the capable infrastructure, know-how, ICT security, compatible systems leading to easy adoption of technology.	Interview guide questions 1, 2, 3, 4, 5	Thematic analysis
1	What are the factors that determine the adoption of digital ERP in the SA oil and Gas industry?	2	Size, demographic composition, nature of business, and norms & standards lead to ERP adoption complications.	Interview guide questions 6, 7, 8, 9	Thematic analysis
1	What are the factors that determine the adoption of digital ERP in the SA oil and gas industry?	3	competition, partners and good government support together with legislation leads to easy ERP adoption.	Interview guide questions 10, 11, 12	Thematic analysis

2	Which of these factors have a high impact on the Successful adoption of digital ERP systems?	4	the company has been in existence and operating in the oil and gas sector for a minimum of two years and using the ERP system for the same period.	Use data from first research question	Data analysis model as per Uwizeyemungu and Raymond (2009)
2	Which of these factors have a high impact on the Successful adoption of digital ERP systems?	5	the company uses ERP in at least two core businesses, which includes the process of delivering goods and services.	Use data from first research question	Data analysis model as per Uwizeyemungu and Raymond (2009)

Appendix B: Interview Guide

This is the interview guide, for the research topic “Exploring factors that influence digital adoption in the South African Oil and Gas industry”. This is part of requirements for the completion of the Master of Management in the field of Digital business.

The research seeks to understand and explain the main considerations that leads to the implementation of the digital ERP in the Oil and Gas industry. This information will also be used to try and determine the level of impact each factor has in the operation of the organisation.

Although there is a list of questions below, the respondents are encouraged to raise any other issue relating to the implementation and adoption of the digital ERP system, that he/she might deem important for the implementation of the system.

“Exploring factors that influence digital adoption in the South African oil and gas industry” with the focus on the ERP		
Semi Structured Interview with	Name	Tittle
e:mail address	Date & Time	
Interviewer	The interview is conducted to fulfil the requirements in completing the Masters Management in the field of Digital Business	
Basic Questions		
Brief Summary of the Interviewee background		

What is the Major Focus/Service of your area	To your department To the organisation To the industry
What is the general technological orientation of your organisation	Technophobic or Technophilic?
Technology	
1. What are the key infrastructure requirements for the implementation of digital ERP system?	• Which of these does your organisation have to support the implementation? (generally, describe them and the role they play in the adoption) • How has the availability or lack of infrastructure impacted the implementation and running of the ERP system? (give actual examples of when the availability did not allow to implement as required)
2. Describe the team that to implement/adopt a new technology with more focus on the ERP?	• What role does the experience of the team play in the decision to adopt (testing, time, decision time) • What role did the users play in the scoping, testing and deciding to adopt the ERP?
3. To what extent did the degree of compatibility with the current existing systems impact on the decision to adopt and actual adoption?	• Was the decision to sort out compatibility issues delayed at any point, and if so, how did this play out?
4. What value/benefit do you perceive digital ERP brings to the organisation?	• How does this perceived value/benefit impact the facilitation of discussions with the decision makers in the organisation?
5. What are the security (i.e. cybersecurity) considerations that have been made during the decision to adopt the digital ERP?	• How has the identified risks impacted the adoption of the ERP system? • What are the additional risks that the ERP system introduce in the organisation, how did they impact the adoption?

Organisation	
6. How did age and gender or any other demographic characteristics influence the decision making on the adoption of the ERP system?	• What is the range of the age groups for the team involved in the ERP adoption decision? • What other demographic characteristics had an impact on the adoption?
7. What was the number of the users that were affected by implementation of the ERP, and how did this impact the rollout of the ERP system?	
8. What would you say are the key aspects that impact the implementation of the ERP system in the Oil and gas industry?	• How did these factors influence the adoption, please give examples?
9. Oil and gas industry is highly regulated with key focus on operational safety and quality of product, this means that there are some norms and standards that the organisation would not be able to deviate from.	• How did this impact the implementation of the ERP system? • Who are the key players (organisations) and how did they influence the implementation of the ERP system?
Environment	
10. Who are the key competitors in the Oil and gas industry in South Africa and how did they impact the implementation?	• How did the actions, decisions, behaviour, etc of the competitors influence the implementation of the ERP system?
11. How does the external players, including the consultants, vendors and any other players involved in the acquiring of the ERP system impact the implementation and adoption of the ERP system?	
12. How does the readiness or lack thereof of the trading partners affect the implementation of the digital ERP system?	• What needed to be done to make sure that external partners that would be affected by the adoption of the digital ERP are also ready and can continue to interact with the system without issues?

Additional Questions
Any additional information that you believe might be beneficial to the study that you would like to share

Appendix C: Participant information sheet



Good day

My name is Dumisani Zuma and I am enrolled as a student at the University of the Witwatersrand, Johannesburg, in pursuit Master of management in the field of Digital Business degree. As part of my studies, I have to undertake a research project, and I am investigating factors that influence digital ERP adoption in the South African Oil Industry, under the supervision of Prof Mjumo Mzyece. The aim of this research project is to find the factors explain them then study them to understand their impact in the adoption of the digital tools.

As part of this project, I would like to invite you to take part in an interview which will take approximately 1 hour. The interview will be done virtually and with your permission, I would also like to audio record the conversation. The recording will be stored in the password protected computer and only myself as the researcher will have access to this recording. It will be deleted after the study has been completed and exam results are obtained.

There will be no personal costs to you if you participate in this project, you will not receive any direct benefits from participation but there are no disadvantages or penalties if you do not choose to participate or if you withdraw from the study. You may withdraw at any time or not answer any question if you do not want to. The interview will be completely confidential and anonymous as I will not be asking for your name or any identifying information, and the information you give to me will be held securely and not disclosed to anyone else. I will be using a pseudonym (false name) to represent your participation in my final research report. If you experience any distress or discomfort at any point in this process, we will stop the interview or resume another time.

If you have any questions during or afterwards about this research, feel free to contact me on the details listed below. This study will be written up as a research report which will be available online through the university library website. The data collected from this research project will be stored in password protected system and will be kept for 2 years. With your permission the data collected from this research project may be used by other researchers in an anonymized format. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za

Yours sincerely,
Dumisani Zuma

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Supervisor 's: Prof. Mjumo Mzyece, mjumo.mzyece@wits.ac.za , +27 11 717 3649

: Dr Maradona Gataru, maradona.gataru@wits.ac.za ,

Appendix D: Interview consent

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG



WBS Wits
Business
School
Sculpting global leaders

Title of research: Exploring factors that influence digital ERP adoption in the South African Oil Industry

Name of researcher: Dumisani Zuma

I, agree to participate in this research project. The research has been explained to me and I understand what my participation will involve. I agree to the following:

(Please circle the relevant options below).

I agree that my participation will remain anonymous	YES	NO
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I agree that the researcher may use anonymous quotes in his / her research report	YES	NO
---	-----	----

I agree that the interview may be audio recorded	YES	NO
--	-----	----

I agree that the information I provide may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained.	YES	NO
--	-----	----

|
..... (signature)
..... (name of participant)
..... (date)

..... (signature)
..... (name of Researcher)
..... (date)