A Framework for Enhancing University Enterprise Resource Planning System Requirements Elicitation Involving the Stakeholders

K Matyokurehwa

orcid.org/0000-0002-1979-0255

Thesis accepted in fulfilment of the requirements for the degree Doctor of Information Systems

at the North-West University

Promoter: Professor Koga Gorejena

Co-promoter: Professor Osden Jokonya

Graduation ceremony: May 2021

Student number: 28055705

ACKNOWLEDGEMENTS

I thank the giver of Life, the Lord Almighty, for giving me life and good health to do this study.
Technology is developing at rapid speeds and human beings are exposed to different software with different capabilities. However, the software does not meet the expectations of the stakeholders because these are not being involved during the requirements elicitation stage. The stakeholders are just given a piece of software and told to *like and use it*. The study is informed by the need to humanise the ERP systems by involving stakeholders in ERP requirements elicitation.

I am profoundly grateful to my promoters who gave me direction and constructive feedback, Professor Gorejena, Professor Jokonya and my late Professor Mavetera.
I thank my sisters for their support during my studies: Ester, Erina, Eunity, Emelly and Vongai. I also thank North-West University for the NWU bursary they offered me to continue with my studies. I thank Dr Gombiro for providing assistance in quantitative analysis, especially with the regression tests. I thank my friends especially Themba Chinogwenya for the support during my studies. I thank the participants who took their time in interviews and all those who completed the questionnaire: may God richly bless you all. I also thank the external examiners who gave me constructive feedback.

DEDICATION

I dedicate this thesis to the giver of life, the Lord almighty, my father Janis Matyokurehwa, my late mum Maria Matyokurehwa, my wife Maria Matyokurehwa and the entire family for their support during my study.

DECLARATION

This thesis titled "*A Framework for Enhancing University Enterprise Resource Planning System Requirements Elicitation Involving the Stakeholders"* is submitted for the degree of Doctor of Philosophy in Information Systems at North-West University, Mafikeng Campus and has not been submitted previously to any other institution for the award of the above mentioned degree. All work related to this study has been duly acknowledged in the thesis.

Signature: K Matyokurehwa Date: 10/04/2021

ABSTRACT

Enterprise Resource Planning requirements elicitation at universities is a torrid task to the ERP developers. The stakeholders are given an ERP system which they are supposed to adopt and use. Evidence from literature attests that ERP requirements elicitation at universities is a challenge. Universities are complex organisations with different stakeholders with diverse requirements which the ERP system should accommodate.

Universities currently use ERP systems to coordinate their various operations. Requirements elicitation in ERP systems at Universities has been given little attention and that has led to many ERP projects failing or being delivered late. In a survey sent to three universities in Zimbabwe by the researcher most participants acknowledged the importance of stakeholder's involvement during ERP requirements elicitation but most participants pointed out that they were not involved during this elicitation stage. The purpose of the study was to identify the weaknesses of the existing ERP requirements elicitation frameworks, examining the needs of the university during the ERP requirements elicitation process. The study developed an improved ERP requirements elicitation framework to assist universities during requirements elicitation.

The study was guided by the Soft Systems theory, Activity theory, Domain theory and the Stakeholder theory. These theories helped in developing the proposed conceptual framework to assist universities during the ERP requirements elicitation process. The study utilized the pragmatism philosophy and exploratory sequential mixed methods to validate the proposed ERP requirements elicitation framework. In the first phase, the qualitative approach used interviews to gather data from 12 participants who came from four study units. The qualitative analysis generated themes which were used to formulate hypothesis which were tested in the second phase using the quantitative approach. A total of 275 responses were received from the quantitative approach which came from the four study units. Exploratory factor analysis was used to test the validity of the measuring instrument, summated scales were used to perform T-tests, ANOVA and regression tests. The results of the qualitative and quantitative were integrated to ascertain whether they corroborate the literature.

The findings suggest that the needs for a university during ERP requirements elicitation are as follows: The organisational sociological perspectives need to be examined as social structures do have a bearing on the knowledge used within the organization. Stakeholder's perceptions need to be taken on board during ERP requirements elicitation process. Stakeholders need to be classified according to their roles during ERP requirements elicitation so that crucial roles are not left out in the process. The elicitation technique(s) employed by the requirements engineer may

augment in making the unknown known during the ERP requirements elicitation process. The domain knowledge for an institution need to be examined so as to preclude missing ERP requirements. The study recommends the involvement of stakeholders during the ERP requirements elicitation process. The study recommends that requirements elicitation is a social activity and there is a need to examine the sociological perspectives of the stakeholders so that holistic ERP requirements may be extracted. The study also recommends that there is a need to use different elicitation techniques during ERP requirements elicitation so that overlooked ERP requirements may be extracted from the stakeholders.

Keywords

ERP requirements elicitation, domain knowledge, stakeholder characteristics, stakeholder role, elicitation techniques, sociological perspectives, mixed methods, pragmatism.

LIST OF ABBREVIATIONS

AST1 -01	University A, Stratum 1, Participant 01
BST2 -01	University B, Stratum 2, Participant 01
CST3 -01	University C, Stratum 3, Participant 01
df	Degrees of Freedom
ERP	Enterprise Resource Planning
EST4 -01	External Stakeholder, Stratum 4, Participant 01
HAS	Human Activity System
KMO	Kaiser-MeyerOlkin Measure of Sampling Adequacy
M	Mean
P-S-G-V	Persona -Scenario -Goals –Viewpoints
QUAL	Qualitative
QUAN	Quantitative
r	Correlation Coefficient
SD	Standard Deviation
VORD	Viewpoints-Oriented Requirements Definition

ACADEMIC WORK RELATED TO THIS STUDY

8 March 2018, PhD Research Methodology, Colloquium, Approved, NWU Mafikeng Campus.

16 November 2016, PhD Research Proposal, Colloquium, Approved, NWU Mafikeng Campus.

Matyokurehwa K, Mavetera N, Jokonya O., 2017 “Requirements Engineering Techniques: A Systematic Literature Review.” *International Journal of Soft Computing and Engineering* Volume-7 Issue-1, March 2017, pp. 14-20.

Matyokurehwa K, Mavetera N, Jokonya O., 2018 “ERP Systems in Higher Education: A Deeper Look at their Failures and the Way Forward”. *International Research in Education* ., Vol. 6, No. 2.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 BACKGROUND TO THE RESEARCH PROBLEM

1.1 Introduction

The practice of software development commenced in 1958 and in just 10 years' time problems started to emerge. The software development took more time than anticipated, projects ranover budget and the software did not deliver the expected outcomes, leading to the coinage of the term software crisis (Randell, 1979; Fitzgerald, 2012). The problems that started 50 years ago are still focal areas for research on how best to resolve software failures. A lot of models, approaches, and frameworks have been developed to contain software failures because user requirements keep changing, data processed keeps increasing, thereby making technological advancement of some software's obsolete (Dyba, 2005; Lotfi and Dastjerdi, 2016). Enterprise Resource Planning (ERP) has received major attention and research in recent years.

This study commences by defining critical terms to guide the readers on what the study entails:

Requirements elicitation is the art of discovering requirements from the users of the system and these users are called stakeholders (Lim and Finkelstein, 2011). Requirements elicitation is a process, not an event, hence there is a need to follow certain steps to reach the stakeholder's needs.

The stakeholder is defined as any entity or individuals with a direct or indirect interest in the system being developed. The stakeholders are crucial in requirements elicitation because they are the sources of the requirements that have to be implemented in the ERP system. There are three categories of stakeholders: the primary stakeholders who use the ERP system each day, secondary stakeholders who do not use the ERP system very often and lastly, the tertiary stakeholders who do not use the ERP system but are also affected by the use of the information system (Abras et al, 2004). It is not feasible to bring on board every stakeholder during requirements elicitation to elicit the requirements but their views ought to be considered whenever this is feasible (Abras et al, 2004).

ERP started as the software used by manufacturing companies in the 1970s but countries like USA, China, UK and Spain have embraced the ERP software for other strategic intentions (Kumar and Van Hillegersberg, 2000; Mihai et al, 2015). ERP has shifted from being a manufacturing-oriented software to one that supports other industries. Many organizations have realized the importance of using ERP systems in their businesses as the system coordinates various departmental operations together (Kilic et al, 2015; Orougi, 2015). The

ERP system, however, comes at a cost to the implementing organization, hence the need for proper planning so that the ERP project can be a success. There are two types of ERP systems: in house and off the shelf ERP systems (Anderson et al, 2011). In house systems are custom built to address the challenges that an organization experiences and they may take time to develop while off the shelf ERP systems are customized to meet the needs of an organization. This thesis is premised on in house ERP systems developed in Zimbabwe.

Many Universities have consolidated their operations using the ERP systems for easy management of processes. According to Seo (2013), an ERP is an application software that brings together the various functions of an organization into one system that can be used across the organisation. Departments within a University can communicate and share information easily and reduce costs. ERP systems failure rates are very high because these systems are currently incapable of addressing the needs of stakeholders. The research community has not investigated much on techniques that could be used to gather, analyse and document the requirements for ERP systems (Asgar and King, 2016). ERP systems are quite complex to implement because they take on board all the operations of other departments into one system as compared to the legacy systems that cover only one department (Grabski et al, 2001; Nwankpa and Datta, 2012).

ERP systems used in different domains share some similarities; however, the education sector exhibit certain unique features which need special treatment during requirements elicitation such as student records, time tables and other aspects (Rabaa'i, 2009). ERP implementation follows the following five stages:

a. the planning phase which entails coming up with the project team and analysis of business processes to identify the business processes that should be improved. This involves data gathering from stakeholders to get their requirements,

b. the to be phase focusses on high-level designs like prototyping,

c. the construction phase focusses on populating real data into the system,

d. the testing phase entails system testing and

e. the implementation phase is when the system goes live and covers user training (Parr and Shanks, 2000).

The planning phase is the most critical activity because if the organization’s requirements are not adequately defined, then the whole project is bound to fail. The planning phase sets

deadlines for the ERP project and the budget required to complete such a project, so this phase is critical and should be expertly handled.

In house developed ERP systems for universities have continued to gain dominance because of their ability to address the unique needs of the university (Chaushi et al, 2017). Also, Almigheerbi et al (2020) observed that these ERP systems boost the higher education system through integration of administrative functions, which in the past was supported by separate legacy systems.

1.2 Background and Context

Many tertiary institutions have moved from using legacy systems to ERP (Nwankpa and Datta, 2012). ERP is a complex system and there is always a misfit between what the ERP system provides and what the organization needs (Wu et al, 2007; Panayiotou et al, 2015). There is need to identify what the organization specifically needs at the onset of an ERP project in order to avert an ERP failure (Alsulami et al, 2014; Panayiotou et al, 2015). ERP systems development should commence by identifying the stakeholders to elicit the requirements from and specifying what the system should do, a process normally called the requirements development (Vieira et al, 2012). The requirements development and management deals with change requests and the assessment of their impact on the system (Wiegers, 2003).

Many ERP systems implemented at universities suggest that stakeholders are not satisfied in using them because they were not involved in the initial design, specification and development of the systems, thereby making their work frustrating because at times it takes more time to do a simple task that they would have accomplished in a shorter time before when they used the legacy systems (Abdinnour and Saee, 2015). Stakeholder's satisfaction is of paramount importance in assessing the success of an information system as that immediately translates into increased productivity at the workplace (Lowry et al, 2007; Mardiana et al, 2015). Many authors have highlighted the importance of stakeholders' involvement in ERP projects (Bano, 2014; Bano and Zowghi, 2015; Johann and Maalej, 2015). The articles in question have not, however articulated how these stakeholders could be identified, selected and incorporated during requirements elicitation.

Studies show that stakeholders would want information systems that are easy to use, satisfy their work needs, specifically in achieving their day to day activities (Lu et al., 2010; Ceccucci et al., 2010; Mardiana et al, 2015). Organizations expect a good return on their investment in information systems at the same time (Stefanou, 2001; Hendricks et al, 2007; Egdair et al, 2015; Fadlalla and Amani, 2015; Haislip and Richardson, 2015).

ERP is a monolithic artefact that does not entirely replace the role played by stakeholders in an organization but could ameliorate the efficiency, accuracy and speed in the execution of daily tasks (Mavetera, 2017). The ERP systems are developed through the collective efforts of stakeholders and the system is designed for use by the same stakeholders. Stakeholders struggle to explain in detail what their requirements are when designing a new system but their expectations from the system are invariably more than what the system was developed to do. We are bound to ask these questions:

- Is the problem with the ERP system or the stakeholders?
- Where is the origin of the problem?
- What causes that specific problem to occur?

A closer look at the above questions clarifies that an artifact is created by the stakeholders and is programmed with instructions on how to perform repetitive tasks efficiently. Sutcliffe (2012: 2) observes also that in every stakeholder's design, the artifact should meet the specific requirements of the stakeholders; if the requirements are poorly constructed, the artifact will not meet the requirements of the stakeholders. Sutcliffe (2012: 2) offers a stunning example of the Titanic disaster of April 14, 1912; the ship was built according to the requirements of the stakeholders, the ship was built with three watertight compartments operated using electric doors. The requirement was that if the ship got flooded with water in the three compartments, the ship would not sink. However, they overlooked the fourth compartment that it should also be watertight and on the sad day after the ship hit the iceberg, the water went into the fourth compartment and this uncanny omission caused the ship to sink.

The Titanic disaster also highlights the requirements overlooked by stakeholders to save costs: the stakeholders believed that it was not necessary to put lifeboats for all the passengers and the crew members in the ship as this was perceived as a cost-cutting measure that only culminated in the disastrous consequences. This brings us to the conclusion that the problem is with the stakeholders not with the artefact. The essential point is that the problem occurs during requirements elicitation, and that the problem was caused by various assumptions made by the stakeholders when developing the artefact. By extension, the specific problem can only be solved by involving carefully selected stakeholders so that all possible assumptions about the artefact are fully articulated and considered before development starts and this precludes major disasters once the artefact is operational.

There have been reported failures of ERP systems at Universities, the most notable ones being the University of New South Wales, Adelaide University, Royal Melbourne Institute of Technology (RMIT) (Rabaa'i, 2009). In the USA, Cleveland State University had to sue the ERP vendor when the ERP system managed to handle only half of the transactions while at Ohio State University the budget set for the ERP system implementation shot up to 85 million USD from the 53 million budgeted initially (Rabaa'i, 2009). In Australia, Griffith University had problems with its ERP because the system failed to address specific customer requirements (Beekhuyzen et al, 2001).

In the USA, the University of Massachusetts-Amherst campus students failed to register because the ERP system crashed due to system unreliability; Stanford University students failed to access the ERP system making it a total failure in the sense that it could not process what it had been designed to accomplish (Wailgum 2005). At Stanford University the ERP system resulted in lower productivity as compared to the previous ones that the customers were using. Apparently, the customers cited that the ERP took too much time to access information on the system (Wailgum 2005). The University of Indiana denied financial aid to 3000 students because of a faulty ERP system (Wailgum 2005; Lewis 2016).

Montclair State University sued Oracle Company over a failed ERP implementation because of the long time that the project took (Kanaracus 2016). This is a clear sign of over-requirements being factored into the development of the system (Belvedere et al, 2013; Shmueli et al, 2015). A lot of ERP projects fail, and some of the major problems are attributed to a failure in understanding the change requirements, departmental conflicts due to software requirements and stakeholders not giving the support required during data gathering (Seo, 2013; Wamicha & Seymour, 2015; Lewis 2016). Sixty to eighty percent of ERP systems have failed to meet the expected goals and other ERP systems did not ameliorate the performance of stakeholders (Hawari & Heeks, 2010; Sanzogni, 2010).

Many ERP systems have failed due to lack of stakeholder involvement during the elicitation stage (Hawari & Heeks, 2010; Kwahk & Ahn, 2010; Pouransafar et al, 2013; Wamicha & Seymour, 2015). This may fail to meet the guidelines for a successful information systems model as postulated by DeLone and McLean (2003). The stakeholder should be satisfied to use the information system and that should translate into increased employee morale which could be evident in the increase in productivity at work (Mardiana et al, 2015). The problem is how to identify stakeholders at a university from whom to extract the ERP requirements (Erfurth & Erfurth, 2014).

In research done on ERP systems in Zimbabwe, the stakeholders were not involved in the ERP system development and there was no document on the expected costs and benefits

derived from the ERP implementation (Mukwasi & Seymour, 2014). In a survey that consisted of 20 questionnaires sent to three universities in Zimbabwe, most participants acknowledged the importance of stakeholder involvement in the ERP system development but most participants pointed out that they were not involved during the ERP requirements elicitation stage. The participants also noted that the ERP systems are not intuitive since the stakeholders were not involved to proffer their requirements

1.3 Problem Statement

Chakraborty et al (2010) observes that requirements development have changed significantly over the past decade because many projects now have short life cycles because of DevOpps and developers require constant communication with stakeholders for a successful system to be developed. The academic debate had proposed the ERP requirements elicitation cycle to be linear and deterministic when in reality it is highly chaotic, non-deterministic and non-linear (Chakraborty et al, 2010). The chaotic nature of the ERP requirements elicitation has given rise to numerous failed ERP systems.

Izhar et al (2018) observes that the requirements management process is composed of four stages which are:

a. Requirements Elicitation,
b. Requirements Analysis,
c. Requirements Specification, and
d. Requirements Validation.

Requirements Elicitation is the most critical stage in ERP system development but many requirements engineers and developers do not seem to appreciate the value this stage. According to Bormane et al (2016), most of the project failures that amount to 50-60 % are attributed to inadequate elicitation of stakeholder requirements. If requirements are insufficiently defined during the requirements elicitation stage, they would be very costly to fix during the later stages of requirements management. ERP Requirements elicitation that has been done correctly is likely to meet the stakeholder's needs.

The education sector has not been spared from problems associated with inadequate requirements elicitation. Universities currently use ERP systems to coordinate their various operations. ERP projects cost a substantial amount of money that runs into millions of USD (Haddara and Elragal, 2013; Rosa et al, 2013; Parthasarathy and Daneva, 2016). There is an urgent for a holistic approach in handling the ERP requirements elicitation process so that the ERP system never fails but delivers the expected outcomes to the organization and the

stakeholders. However, ERP projects in most cases fail due to their complexity. The failure of an ERP project can be disastrous and lead to the bankruptcy of an institution (Huang et al, 2004; Amid et al, 2012). Failure of an ERP could also mean that the institution would have failed to get the return on its investment (Wong et al, 2005).

Asuncion (2009) observes that many ERP systems have failed even though they were delivered on time. In essence, ERP systems fail to meet the real requirements of the stakeholders. Research shows that stakeholder involvement in ERP is of paramount importance as these users provide crucial feedback that ought to be used in ERP requirements elicitation stage (Garg & Garg, 2013; Ogunyemi & Olofinsao, 2014). Stakeholder involvement leads to better requirements elicitation which ultimately reduces ERP failures (Ogunyemi and Olofinsao, 2014; Berner, 2015). However, most ERP projects do not involve the participation of stakeholders during the requirements elicitation stage. This has made it extremely difficult to correctly elide the ERP requirements for the new system which has translated into major ERP project failures (Johansson & Carlsson, 2013).

Requirements elicitation in ERP systems at Universities has been given little attention and that has led to many ERP projects failing or being delivered late (Sumner, 2000; Hustad & Olsen, 2014; Wamicha & Seymour, 2015). The university setup is different from other domains; in the university environment, the ERP system is designed to fulfil the academic needs of students and teachers (Nizamani et al, 2014). The ERP system also has to coordinate the various departmental functions. In most cases when the ERP system is introduced in an institution, there is always a mismatch between what the system can do versus the existing business processing (Wong et al, 2005; Sumner, 2015). There is a need to re-engineer the existing business processes to match what could be achieved by the ERP system (Sumner, 2015).

.

Many researchers have raised the issue that many ERP projects fail due to organizational requirements that have not been taken on board (Soffer et al, 2005; Amid et al, 2012; Ahmad & Cuenca, 2013; Abu-Shanab et al, 2015). There is a need for a requirements elicitation framework that could be used to avert ERP project failures (Daneva & Wieringa, 2006; Niu et al, 2014; Johansson & Carlsson, 2013). Many researchers have initiated and developed frameworks that could be used to address some of the challenges leading to the failure of ERP but very few have come up with frameworks targeting universities as they are in a unique industry (Johansson & Carlsson, 2013; Nizamani et al, 2014).

Technology has not failed us but the requirements engineers of the ERP systems have not appreciated adequately the existence of the stakeholders who specifically use the ERP systems. These stakeholders at the other end have not been afforded the chance to express their requirements explicitly on what should be included in the ERP system. ERP requirements elicitation has not improved in the past years because the stakeholders that should give input during the requirements elicitation process in most cases are never consulted (Abd Elmonem et al, 2017; Matyokurehwa et al, 2017). Abd Elmonem et al (2016) argued that one of the challenges of ERP requirements elicitation is finding the requirements engineer who is knowledgeable about the problem domain to elicit the required ERP requirements.

1.4 Research Framework

A process-based research framework postulated by Roode (1993), in which the social nature of the Information Systems is examined was utilized in this study in framing the research questions. Information Systems is an inter-disciplinary field where an information system is composed of the technology, stakeholders, processes and the organisation. There is need to resolve current challenges by designing and developing an ERP system that meets the needs of the organization while at the same time being socially accepted by the stakeholders.

Research into information systems often commences with a definitive problem at hand that needs to be solved. The problem at hand is usually expressed as a question that needs to be answered from the research findings. Roode (1993) postulates that the researcher utilises different questions to explore diverse aspects of the problem under investigation. According to Roode (1993), each research problem consists of four generic research questions which are “why?”, “what?”, “how does?” and “how should?” The research questions for this study are generated from the four generic research questions. Figure 1.1 shows the four generic research questions.

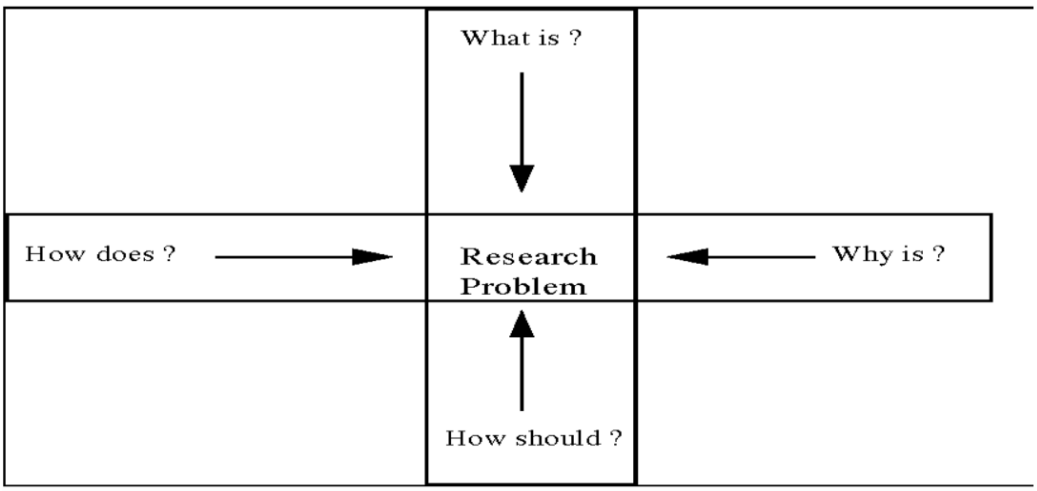


Figure 1-1: The Research Questions (Roode, 1993)

What questions

These type of questions explore the fundamental nature of the research problem. The main aim is to expose the underlying problem statement investigated. The type of research questions that follow the "*what"* question are shown in section 1.5.

How should questions

The research developed an ERP requirements elicitation framework that may assist universities during ERP requirements elicitation. The framework was informed from the literature review findings. The framework was validated using the qualitative and quantitative results (see Chapter 5 and 6). The research developed new insights that ERP requirements elicitation process is a social activity that requires the active participation of all the stakeholders so stakeholders' requirements are integrated and realised by the new system. This was attested by interviews with ERP experts who evaluated the ERP requirements elicitation framework and concurred that the components in the ERP requirements elicitation framework are adequate in addressing the specific ERP requirements.

1.5 Research aim and objectives

This section outlines the research aim and objectives of the study. The research strove to develop an enhanced ERP requirements elicitation framework to assist universities during ERP requirements elicitation. The objectives of the research are outlined and designed to:

1. Identify the weaknesses of the existing frameworks used in universities in requirements elicitation.

2. Determine the needs for framework during ERP requirements elicitation.
3. Develop an improved ERP requirements elicitation framework to assist universities during requirements elicitation.
4. Evaluate the ERP requirements elicitation framework developed in this study.

1.6 Research questions

The framing of the research questions integrates the research framework postulated by Roode (1993), as discussed in section 1.4. The research is pedestalled on four research questions and these are informed from the knowledge gaps identified in Chapter 2 of this research.

Main research question

How could ERP requirements elicitation at universities be done optimally?

Sub research questions

1. What are some of the weaknesses of the existing frameworks used in ERP requirements elicitation at universities?
2. What are the needs for a framework developed to assist universities during ERP requirements elicitation at universities?
3. How could ERP requirements elicitation at universities be enhanced?
4. To what extent do the ERP requirements elicitation framework assist universities during ERP requirements elicitation?

1.7 Significance of the study

Various research studies have been done in ERP systems dealing with manufacturing and other sectors but little research has been done in the higher education sector on ERP systems hence the need for this research (Okunoye et al, 2012; Hustad & Olsen, 2014; Soliman and Karai, 2015). ERP development is complex and expensive but the institutions expect good returns on their investment. Ironically, a number of ERP systems have failed due to enterprise requirements not properly elicited in the design and development of the ERP systems (Beekhuyzen et al, 2001; Soffer et al, 2005; Wamicha & Seymour, 2015; Lewis, 2016). It is

crucial to understand the role played by ERP requirements elicitation so that some of the ERP failures identified at some universities may be averted.

DeLone and McLean (2003) submit that successful information systems should satisfy the stakeholders to use the system more frequently in order to achieve the goals of the institution. However, if the stakeholder's requirements are not properly identified during development, the system may not achieve the expected outcome and stakeholders' needs. A failed ERP system makes more news than a successful ERP system, so this has to be rectified to save the institution's image. The research contributes incrementally to the body of knowledge on ERP systems in higher education by developing a framework that assists universities during ERP requirements elicitation.

To the best knowledge of the researcher, there is no study that focuses on ERP requirements elicitation, especially the stakeholder involvement in higher education converging on ERP systems developed by the university themselves. This is further attested by Matyokurehwa et al (2017) and Abd Elmonem et al (2016) that there has not been any significant improvements in ERP requirements elicitation in the past five years. This current study endeavours to fill this gap by examining ERP requirements elicitation in Zimbabwean universities. Most of the studies focussed on the success factors in ERP implementation in developed countries (Chatzoglou et al, 2016; Schniederjans & Yadav, 2013; Almajali & Tarhini, 2016; Garg & Agarwal, 2014). There is a noticeable gap in the literature on ERP requirements elicitation in higher education focussing on in-house developed ERP systems in developing countries. So the study strives to address this gap by developing a framework to be used by universities during ERP requirements elicitation. Furthermore, the study may stimulate further debate in the academic community on ERP requirements elicitation involving the stakeholders in universities.

1.8 Research Methodology

The research methodology provides direction on how the research was conducted to solve the research problem. The research methodology was informed by the literature review that identified gaps in the existing knowledge and proffered possible solutions to address these gaps. The methodology was guided by the research design onion postulated by Saunders et al (2011). The importance of research was to create an artefact that would solve the research problem, the artefact was relevant to the research problem and was also disseminated to an appropriate research-oriented audience (Peffers et al, 2007).

1.8.1 Research philosophy

The pragmatist research philosophy guided the researcher in gathering and analysing data on ERP. In a nutshell, the philosophy gave the researcher the direction on what aspects to focus upon. Different philosophies can be utilized to address the research problem such as pragmatism, interpretivism, realism and positivism (Saunders et al, 2011). In this research, the pragmatism philosophy was adopted because no single approach could yield reliable and relevant data (Teddlie & Tashakkori, 2003; Saunders et al, 2011). To get a better understanding of the research phenomenon, a mixed-methods study was employed. Pragmatism supports inductive reasoning where a conclusion is based on the information collected. This pragmatic philosophy also supports deductive reasoning where theory is used to derive new hypotheses (Morgan, 2007).

1.8.2 Research method

The sequential exploratory mixed method was used in this research. The sequential exploratory mixed method sought to work on the strengths of qualitative and quantitative methods in addressing the research problem (Johnson and Onwuegbuzie, 2004; Auer-Srnka and Koeszegi, 2007). Combing both methods meant that the resultant outcome was stronger than what could have emerged through the utilisation of one method. The qualitative study focussed on descriptions, experiences of the participants in a natural setting such as an office but restricted to small sample size (Savin-Baden & Major, 2013). The quantitative study, on the other hand, focused on numeric values but large sample size. According to Creswell et al (2003), the sequential exploratory mixed method commences with the qualitative study in the first phase and progressively gets to quantitative study in the second phase. The researcher used the qualitative study in the first phase to gain more insight into the phenomenon under study and this was followed by the quantitative study which elaborated the qualitative findings from the first phase. The quantitative phase answered the descriptive research questions.

1.8.3 The research strategy

The research strategy can take the following forms: a case study, experiment, action research, survey and grounded theory (Saunders et al, 2011). The case study was selected because it is a well-tested inquiry used extensively in information systems (Yin, 2009). The case study cementedcomplemented the exploratory sequential mixed methods as participants in both methods gave rich insight into the research problem investigated.

1.9 Ethical considerations

The research obtained ethical clearance from North-West University before the data collection started. The research was guided by the guidelines of the data protection and human rights legislation on the issue of privacy and confidentiality and the data collected was sorely for academic purposes only (Ashworth, 2004). Participants participated freely in the study without being coerced. Confidentiality of data collected during the study was treated with the utmost care and participants were assured of their responses will not be linked to their identities as pseudonyms were used to identify participants.

1.10 Thesis structure

Chapter 1: Introduction. The chapter outlines the research problem together with the objectives of the research study. The significance of the research was also indicated with a précis of the research methodology.

Chapter 2: Literature Review. The chapter interrogates the theories, models, and frameworks used in ERP requirements elicitation. The strengths and weaknesses of these theories, models, and frameworks are examined and knowledge gaps identified calling for further research in ERP requirements elicitation.

Chapter 3: Conceptual Framework Development. This chapter proposes a Conceptual framework development based on the literature review conducted in Chapter 2. The proposed framework is based on the weaknesses and strengths of existing theories and frameworks from the literature review.

Chapter 4: Research Methodology. The chapter discusses the research methodology adopted in addressing the ERP requirements elicitation. The data collection and analysis are discussed in this chapter.

Chapter 5: Qualitative Results. The chapter presents the qualitative results from the interviews done with the 12 participants. The chapter operationalises the design of the questions for the quantitative phase, which is discussed in the next chapter.

Chapter 6: Quantitative Results. The chapter presents the quantitative results from the questionnaires sent to participants. The quantitative results were a follow up from the qualitative study.

Chapter 7: Integrated Results and Development of framework. The chapter presents the integration of the qualitative and quantitative results. The chapter also presents the final ERP

requirements elicitation framework which assists universities during ERP requirements elicitation.

Chapter 8: Conclusion, Reflections, and Recommendations. The chapter discusses how the objectives and the research questions were addressed in the study. The study also presents the contribution made to the body of knowledge. The limitations of the study and the future research directions are also presented in this chapter.

1.10 Chapter summary

The chapter presented the research problem of the study together with the objectives and the research questions to be answered by the study. The chapter also explained the justification of the study. The research methodologies and how the data was collected and analysed were explained in this chapter. The next Chapter 2 presents the current and recent literature on ERP requirements elicitation.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The preceding chapter presented the research problem, research objectives, research questions and the contribution of the research to the epistemic horizons in the discipline. This chapter reviews the existing literature on ERP requirements elicitation in universities. Requirements elicitation is an arduous task that invites the requirements engineer to involve all stakeholders so that their requirements are elicited. If the process is not managed well, this culminates in poor requirements being formulated which ultimately fail to address the needs of the stakeholders (Bevan, 2009; Mulla & Girase, 2012). A number of studies have been carried out in the field of ERP requirements elicitation but very few studies have so far focused on in house ERP requirements elicitation at universities (Hustad and Olsen, 2014; Soliman & Karai, 2015).

Some scholars argue that the existing frameworks in ERP requirements elicitation do not address the root causes in averting the failure rate of in house ERP systems at universities (Gargeya & Brady, 2005; Wamicha and Seymour, 2015; Lewis, 2016). This may suggest that the existing frameworks fall short in addressinng in house ERP requirements elicitation at universities. There is a need to identify the gaps in aligning institutional requirements to the ERP functionality (Panayiotou, 2015). The process of extracting ERP requirements can be a difficult task as elicitation commences with understanding the application domain to identify the ERP data sources and then select the stakeholders to participate in the elicitation process.

ERP projects are complicated because the system is not built for a single stakeholder but for various departments. It is in this light that stakeholder involvement is critical for the ERP system to meet their expected needs. There has been considerable resistance to ERP implementation at Universities because the academic staff fears that the transparency in ERP systems could possibly expose their transactions and ultimately they would not have control on those transactions while the administrative staff fears that the ERP implementation could lead to job losses when processes are automated (Seo, 2013; Matyokurehwa et al, 2018). This has caused significant misunderstanding in developing ERP systems at universities because of the fear of the unknown but the benefits of a successful ERP development save the organization a lot of money and improves the business processes.

ERP system failures at universities have raised questions as to the suitability of the current frameworks in averting failure in ERP projects (Bhat et al, 2013; Olugbara et al, 2014; Aljohani et al, 2015). Valverde (2012) notes also that there is a need for an ERP requirements elicitation framework to avert ERP project failures. There is a need for further research to identify the

gaps causing the ERP systems to fail in higher education institutions. In order to understand the problem at hand, it is critical to look at what makes a successful ERP system. Mavetera (2017) recognises that level one information system should include the stakeholders who have a vested interest in the system being developed; the processes that should be followed to meet the organizational vision and lastly the technology that should be utilised to meet the requirements of the stakeholders.

2.2 Overview of ERP systems in Higher education in Africa

Matyokurehwa et al (2018) carried out a survey on ERP systems failures in higher education from the year 2010 to 2016. The study picked a research done by Mahanga and Seymour (2015) which examined institutions of higher learning in Tanzania and Namibia. The study found out that the ERP technology failed to be integrated into the education sector because the vendors supplied an ERP system that was not designed for instructional purposes making the system not relevant to the needs of students and lecturers. Adade-Boafo (2018) went on to elaborate that the off the shelf ERP systems increase the risk of ERP failures. ERP systems in higher education need to address unique requirements of the stakeholders which cannot be met by the off the shelf ERP systems. In house developed ERP systems may help in bridging this gap by coming up with ERP systems that address the real requirements of the stakeholders.

Karia (2016) observed that the failure rate of ERP systems in Egypt is high due to the complex nature of the Egyptians. The Egyptian culture believes in safeguarding personal information to the extent that it will not be shared with anyone. This makes it difficult during ERP requirements elicitation to extract the requirements of the ERP system. Cultural perceptions may affect ERP requirements elicitation in higher education. Eyitayo (2014) concurs that culture affect ERP requirements elicitation with his Botswana context study, where the author noted that the Batswana culture accept hierarchical orders and subordinates expect to be told what to do. This means that during ERP requirements elicitation, the needs of the employees with lower ranks are marginalized and they would not proffer rich ERP requirements.

Bogonko & Ogalo (2019) posit that user involvement during ERP implementation is critical for an ERP system to meet its expected requirements. The user involvement commence during the ERP requirements elicitation stage to capture the requirements to be implemented by the ERP system. Skoumpopoulou & Robson (2020) also suggested that when stakeholders are engaged during the ERP requirements elicitation stage, this will translate in a successful ERP system being developed which will in turn bring numerous benefits to the institution.

Kalema et al (2014) and Ullah et al (2018) observed that there has been a remarkable investment in ERP systems in higher education which translated in improved teaching and learning to a greater extend. Most of these ERP systems in higher education are being developed in house (Fakeeh, 2015). Universities are replacing the existing administrative systems to ERP systems inorder to improve their operations. However, the hgher education sector is a unique domain which is different from other domains where ERP systems were implemented in the past. The domain knowledge is crucial during ERP requirements elicitation. Kenzi et al (2010), postulate that domain knowledge may have negative effects during requirements elicitation; there may be a tendency to approach specific challenges by relying on what worked in the past and that often leads to a bias in problem-solving. It is advisable not to rely on past experiences when confronted with a new challenge. There is need to bring on board a person with no assumptions about the domain so that they may pick inconsistencies easily and ask relevant questions (Buxto & Randell, 1969; Kenzi et al, 2010).

Domain elicitation seeks to capture the stakeholder's requirements by taking into cognisance their application domain. This will enable the requirements engineer to capture the explicit knowledge that exists in a specific domain. Explicit knowledge expresses the concepts and relationships that can be expressed in a formal language. Latef et al (2018) acknowledged that domain knowledge is crucial during requirements elicitation so that accurate requirements may be extracted. The authors also recognise that the requirements engineer's understanding of the domain knowledge will translate into accurate requirements being extracted as compared to a requirements engineer with limited domain knowledge. A lack of domain knowledge understanding will result in ambiguous requirements being extracted from the stakeholders. However, Aranda et al (2015) argues that the interviewee had a positive and significant effect during the requirements elicitation process and the requirements engineer's problem domain knowledge has small but significant effect during requirements elicitation process. The authors propose that there is need for training in tasks related to requirements elicitation and problem domain so that the requirements engineer may be effective during requirements elicitation process.

2.2.1 Involvement of Stakeholders during ERP Requirements Elicitation

In this section, we examine the benefits of stakeholder involvement when developing in house ERP systems during the requirements elicitation stage.

2.2.1.1 Capturing the Domain Knowledge

Alebrahim and Heisel (2014) define domain knowledge as the environmental properties together with the assumptions about that environment which should be captured to crystallise the knowledge about a specific domain. The environment in this context entails the stakeholders, existing systems, government policies and other related aspects. Bjørner (2007) defines the domain as the events, processes that exist in the domain, the entities that exist in that domain and the behaviour associated with the various entities in that domain. The appreciation of the domain is the pre-condition for a successful ERP system development. A requirements engineer working on ERP system for a university would need to appreciate the culture of the university, the various faculties available in that university, the key stakeholders for that university, the existing systems in place, the business processes undertaken by the university and the international laws that affect requirements elicitation processes (Offen, R., 2002; Calero et al, 2006). The sources of domain knowledge used by the requirements engineers could range from the stakeholders in that organization, the existing system currently used in the domain, national and international policies that could constrain how the system develops and the experts in that domain (Loucopoulos & Karakostas (1996:37). These sources of information help in requirements elicitation in addressing the problem domain.

A requirements engineer who lacks application domain knowledge would have difficulties during requirements elicitation, but with a good understanding of the application domain, the requirements engineer should be capable of choosing the appropriate elicitation technique to apply (Hadar et al, 2014). However, over-reliance on domain knowledge may have a negative impact as the requirements engineer may use their assumptions without factoring what the stakeholders critically seek to address (Hadar et al, 2014).

ERP systems are very complex and this calls for the domain knowledge to be explicitly captured so that the system meets the needs of the stakeholders. To elicit high-quality requirements, the domain experts who are the stakeholders should be consulted (Kaiya & Saeki, 2006). The quality requirements here encompass the non-functional ones such as performance, security, and others since these bring about specific constraints (Alebrahim & Heisel, 2014). One of the requirements elicitation challenges is to understand the problem domain so that the business-related problems are articulated by exchanging knowledge from various stakeholders and the requirements engineers. This can be achieved by coming up with a common vocabulary of terms, allotting meanings to concepts, reconciling differences from various stakeholder's viewpoints and periodically revisiting the captured domain knowledge to update it (Ghaisas & Ajmeri, 2013).

Domain knowledge acquisition is concerned with obtaining the required knowledge from the stakeholders, together with the domain experts so that new knowledge can be generated (Alebrahim, 2017: 193). Stakeholders play a critical role in generating new knowledge used in domain knowledge. That is why we need to involve the stakeholders during ERP requirements elicitation so that the domain knowledge is immediately captured to create a complete ERP requirements elicitation. Understanding the problem domain means that the stakeholder's problems are taken on board and the ERP system developed meet their expectations.

2.2.1.2 Capturing the Process Knowledge

Process knowledge defines all the business concepts that make up a business process, including entities such as business activities, events, rules, control flow, and others. The Process Knowledge helps in making the knowledge explicit and facilitates knowledge sharing among stakeholders and requirements engineers (Jenz, 2003). Stakeholders are familiar with the organizational processes and the context; involving them helps in minimising missing crucial processes during the requirements elicitation process. The organizational context captures the roles played by various stakeholders in the organization and the resources used in the process (Mavetera, 2011:166).

The process knowledge creates a sense of commitment and ownership by various stakeholders involved in requirements elicitation. The stakeholders are bound to explain fully the processes involved in meeting an organisational goal; this means that rich ERP requirements are captured from the stakeholders. Assumptions about alternative processes in arriving at the same goal can be explored and this helps the requirements engineer in clarifying requirements that could have otherwise been missed if the process knowledge was not used. For example, the process of enrolling a student at a university gives the requirements engineer a clear view of the course of action and the requirements that the new ERP system should meet, the process raises some assumptions like if the student is doing a Master's degree from the same University, should the student use the same student number from the Bachelor's degree?

2.2.1.3 Capturing the Method Knowledge

The stakeholders outline the necessary steps that should be followed in doing a particular task and this can be captured using the method knowledge. A collection of subtasks together with the appropriate rules on how the subtask should be performed will make up a method

(Chandrasekaran et al, 1998). When the method associated with the subtasks is done, then the task associated with a specific method would have been achieved also. Fensel et al (1997) write that the method knowledge is the PSM "*Problem Solving Methods."* PSM outlines the reasoning steps together with the required knowledge to perform a specific task. The PSMs outlines how stakeholder's knowledge can be used to solve the problem at hand. The question that arises is: *what is the problem at hand?* The problem at hand is the task that should be met by the ERP system. To capture the method knowledge from the stakeholders, the stakeholders need to explain the ultimate goal that should be reached and the stakeholder explain fully the steps that should be followed to reach that goal. The stakeholders need to understand the underlying domain knowledge so that the task description is complete and within the scope of the domain. This also ensures that the captured requirements are of high quality from the stakeholders. Method knowledge allows the stakeholders to ensure that certain business rules are adhered to when the ERP system performs a specific task.

2.2.1.4 Capturing the Status Knowledge

There is a need to capture the various stages of an object during the execution of a transaction. The object will change during the method of knowledge where a subtask completion will mean that the task associated with a method is also completed. The task completion will translate the task's status into another status. For example, let us take the student status who should be registered into the system, the status will translate from being unregistered and after the successful completion of the registering task, the student status will change to register. That status knowledge will be articulated by the stakeholder so that the requirements engineer will discover rich requirements that the system should address. Mavetera (2011:165) also writes about the existence of objects within the system with the static and dynamic states. Static objects do not change their status during their life span in the system while dynamic objects change their status after an event occurs.

The status knowledge will assist the requirements engineer in establishing the requirements that should follow after a certain goal has been achieved. For example, if a student is registered in the system, the system should not allow that same student to be registered again in the system. Instead, another goal should be met thereafter.

2.2.1.5 Capturing the Intentional Knowledge

The Intentional Knowledge was enucleated by Jurisica et al (2004) as composed of beliefs, desires, and intentions of stakeholders that the system should meet. The belief represents the stakeholder's knowledge, the desires represent what the stakeholder wants to meet and the intentions represent the desires that the stakeholder is bound to achieve. The stakeholder's intention plays a critical role as they dictate whether they want to pursue a specific goal or they just want to do another goal (Jurisica et al, 2004). The stakeholder's intentions should be captured in the ERP system and the only way to capture that is to involve them during ERP requirements elicitation. The stakeholders will outline the goals that the system should meet and the requirements engineer will also derive the non-functional requirements that should be met so that the stakeholder can achieve the intended goal by using the system. The ERP system should meet the organizational vision statement which can be achieved by meeting the various departmental objectives which feed into the vision statement of the organization. This can only be achieved by involving the various stakeholders during the requirements elicitation.

2.2.1.6 Capturing the Social Knowledge

Social Knowledge covers the interdependencies and the social settings that exist among various stakeholders in the organization. The social knowledge is made up of concepts such as the stakeholder's role in the organization, the authority they command and the position they hold (Jurisica et al, 2004; Mavetera, 2011: 167). These concepts assist in coming up with organizational models that can succour in fathoming the organizational settings, which plays a focal role in redesigning business processes if necessary. The organizational social context should be understood during ERP requirements so that the stakeholders' social knowledge can be captured. Using the ERP requirements elicitation at a university, the requirements engineer will find out that the university is made up of different departments with diverse interests which at times may be conflicting or complementing each other. The various stakeholder's interests which can be defined as goals will have to be captured. The capturing of those goals should be done so that no stakeholder is disadvantaged due to the stakeholder's role in the organization, the authority they command and the position they hold so that rich requirements can be captured.

In this section, various reasons stakeholders need to be involved during requirements elicitation were examined. The next section discusses existing requirements elicitation frameworks.

2.3 Domain knowledge and requirements elicitation

Hadar et al (2014) argue that an expert requirements engineer in a certain domain might be biased and tend to rely on their assumptions instead of being attentive to the requirements of the stakeholders during requirements elicitation. However, domain knowledge of the requirements engineer enables the requirements engineer to ask questions that are meaningful to the stakeholder and also expect answers that the requirements engineer understands. Domain knowledge assures the completeness in requirements elicitation since the requirements engineer knows the issues that should be addressed instead of relying on the information supplied by the stakeholder. So cases of missed ERP requirements may be precluded if the requirements engineer is knowledgeable about the application domain because they can identify all data sources during ERP requirements elicitation.

Niknafs and Berry (2012) observed that one of the key factors that influence the effectiveness of the requirements elicitation process depends on the individuals involved. The authors went on to elaborate that the key factor in ameliorating the effectiveness of those individuals involved in the requirements elicitation process is the knowledge about the domain knowledge. The same authors observed that even if the requirements engineer is knowledgeable about the problem domain, they may fall on tacit assumptions or overlook certain issues and thereby failing to extract accurate requirements. Subsequently, these researchers propose a computer based system that may assist the requirements engineer in a given problem domain during requirements elicitation process (Osada et al, 2007).

2.3.1 Knowledge gap 1

There is a huge mismatch from what the literature postulates and the existing ERP frameworks. Most of the ERP frameworks do not address the domain knowledge in ERP requirements elicitation process (Gervasi et al, 2013; Rizali and Anwar, 2016 &Tran and Anvari, 2016). So this study incorporates the domain knowledge construct during requirements elicitation process. Domain knowledge construct will translate into accurate ERP requirements being captured (Latef et al, 2018; Zhou et al, 2019). Domain knowledge will also assist in extracting overlooked ERP requirements (Siegemund, 2014 & Ferrari et al, 2016). The domain knowledge will also assist the requirements engineer in asking relevant questions (Hadar et al, 2014; Xu et al, 2018). The domain knowledge plays a pivotal role in aligning ERP requirements to statutory laws (Brechko et al, 2020). The following table 2.1 summarises the domain knowledge attributes with the various supporting sources that help the requirements engineer during ERP requirements elicitation process.

Table 2-1: Domain knowledge attribute

Domain Knowledge attribute	Source
Asking relevant questions	Hadar et al, 2014; Xu et al, 2018
Alignment with statutory laws	Ghaisas and Ajmeri, 2013; Lau et al, 2006, Brechko et al, 2020.
Capture the business processes	Dobson and Sawyer, 2006; Pinggera et al, 2010; Abecker et al, 2001; Siegemund et al, 2011 Cherfi et al, 2013; Suri & Mos, 2016;
Capture accurate requirements	Niknafs & Berry, 2012; Hadar et al, 2014; Hindle et al, 2016; Latef et al, 2018; Zhou et al, 2019;

2.4 Theoretical background

Andoh-Baidoo (2017) argued that there is need for context-specific theorizing in the Information Systems (IS) field. The field of IS calls for the consistent approach incorporate contextual variables into general models. Context in IS, broadly refers to characteristics and usage contexts of the technology artifact (Andoh-Baidoo, 2017). There are a number of contextual variables that need to be included in the research model, such as culture context, socio-political context, technological context and usage context (Hong et al, 2014). The following sections will examine diverse theories and will be guided by the context specific theorizing in information systems postulated by Hong et al (2014).

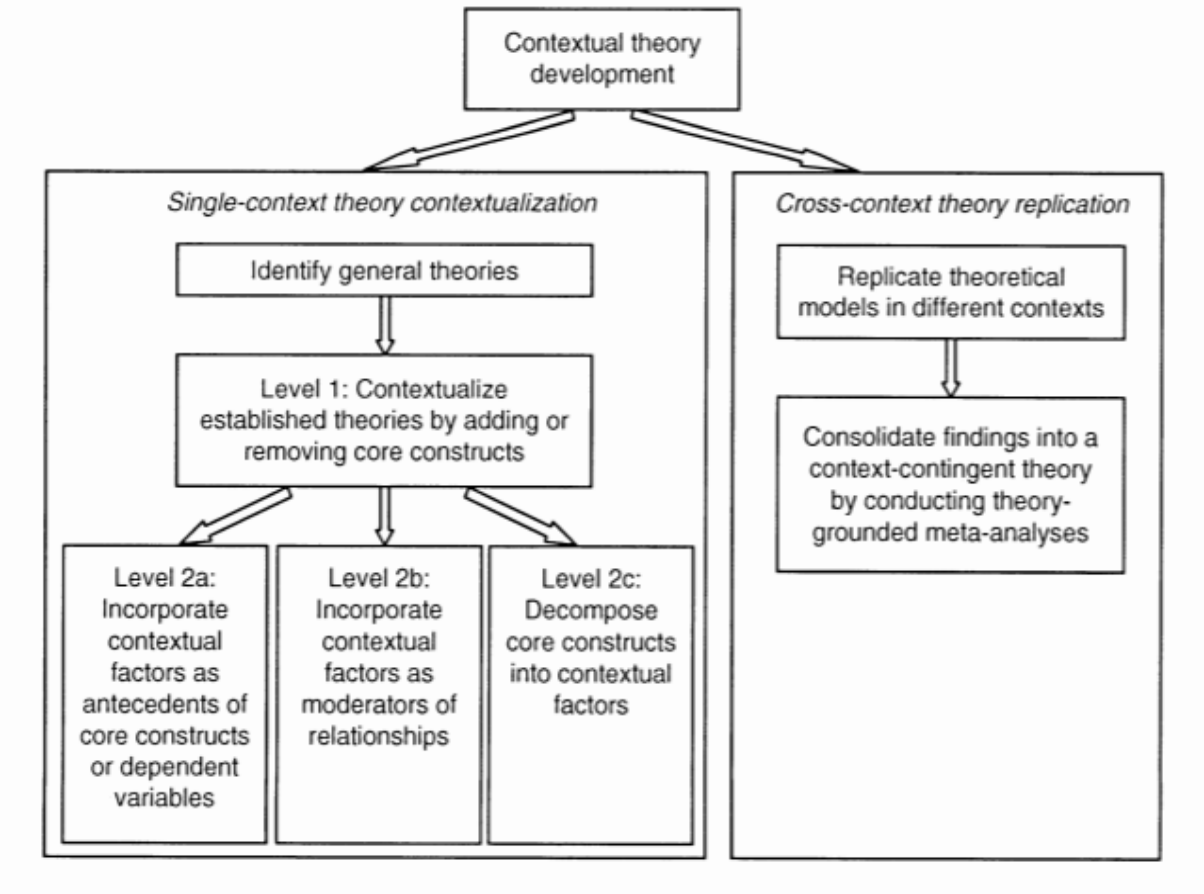


Figure 2-1: Context-specific theorizing in information systems (Hong et al, 2014)

2.4.1 The Human Activity Systems (HAS)

Human Activity Systems shows that human beings are rarely predictable; what they need today will be different from what they need in the next year. This notion should be taken into consideration during ERP requirements elicitation. Ditsa (2003) observed that the HAS is classified into three categories: in the first category, the primary tools deal with the physical tools or artefacts such as an ERP system, the secondary tools are psychological tools such as the language and ideas and lastly the tertiary tools deal with the psychological tools such as the culture. The stakeholders' problems during ERP requirements elicitation can be the physical one that is the artefact is not meeting the expected outcome of the stakeholder or it can be a psychological one. HAS has been used in researches that deal with social and technical facets in addressing the stakeholder's problems. The HAS acknowledges that the stakeholder's action is socially bound and in that regard, the stakeholder's requirements should not be viewed in isolation from the social context. Simonette et al (2010) argues that stakeholders are the main actors in any new system but several engineering methods do not include the human element aspects during requirements elicitation.

Stakeholders need to be involved during systems development because they are part of the system and the environment will not be avoided from the system components as it dictates the rules to be observed during the system development. HAS addresses the problem space that necessitate the development of the ERP system from different dimensions; meaning engraved within the problem such as the norms, beliefs, and assumptions; social relations such as organizational conflicts, leadership styles, and power; human design factors such as the rules, policies, processes; environmental factors (Alman, 2013). The theory discourages requirements engineers from an over-reliance on procedural roles of individuals in the organization since organisations are complex and require a pluralistic view to addressing the problem at hand. Harris (2012) argues that the stakeholder's knowledge is obtained from the external environment through reflection. In other words, the culture, norms, assumptions, rules and behaviour are produced through the social interactions with other stakeholders. Unfortunately, most stakeholders are not apt to describe the organisational and social problems they face so the requirements engineer's task is to use the Burrel and Morgan (1979) sociological paradigms which are discussed in the next section.

2.4.2 Sociological Perspectives

Burrel and Morgan (1979) came up with four sociological paradigms that have been extensively used in research: the radical humanist, radical structuralist, interpretive and functionalist. In each paradigm, there is internal consistency in terms of assumptions on the people and the society under study together with the goals being investigated (Burrell & Morgan, 2017). The four perspectives are mutually exclusive, meaning that we cannot utilise two perspectives at the same time because by accepting the perspective's assumptions we refuse the other perspective's assumptions (Pozzebon et al, 2014). The perspectives are the assumptions that can be adopted by a community and enabling the members to share perceptions and by so doing the members will engage in shared practices (Hirschheim & Klein, 1989).

In requirements elicitation, it is critical for the requirements engineer to take into consideration the social world to distinguish between epistemological and the ontological assumptions (Pozzebon et al, 2014). The epistemological assumptions are concerned with how the requirements engineer will obtain the knowledge needed to develop the ERP system while the ontological assumptions are concerned with the technical views together with the social world (Pozzebon et al, 2014). The epistemological and the ontological assumptions will create two dimensions: the radical change vs regulation and the subjectivist vs objectivist. The objectivist uses models together with methods derived from sciences so that human affairs can be studied while the subjectivist proposes that natural sciences methods are not appropriate for

the study of social world but the dimension seeks to understand the stakeholder's ability to create, modify and interpret the world they are found in (Burrel & Morgan, 1979). The other dimension, the radical change focusses on conflict, change, and coercion while the regulation looks at a social world with order, consensus, and stability. These two dimensions are grouped to come up with the four sociological perspectives discussed in the next section.

Overview

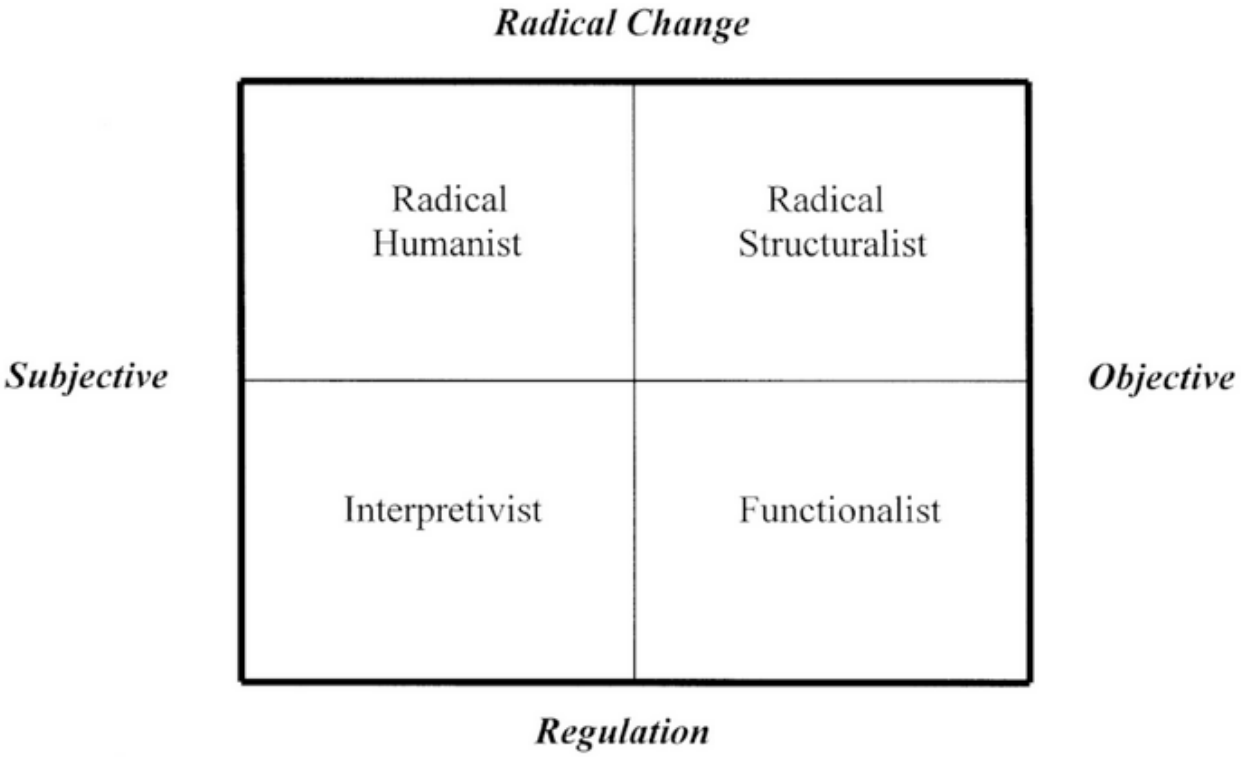


Figure 2-2: The Four Sociological Paradigms (Burrel and Morgan, 1979)

2.4.2.1 ERP systems and research paradigms

A research paradigm is a set of beliefs and agreements shared by the research community on how problems should be understood and articulated (Kuhn, 1970). A research paradigm is associated with several assumptions, for example, social structures which do have a bearing on the knowledge used. In essence, a research paradigm has a profound effect upon the body of knowledge developed from the research executed. So it is crucial for researchers to understand the implications of the selected paradigm. Burgess et al (2013) observes that there is growing body of knowledge that insists on attention to social factors when doing research

in ERP systems. Many scholars have argued that there is need to consider social factors when doing a research in ERP systems (Nandhakumar et al 2005; Chang et al, 2008; Sternad & Bobek, 2013). Examining social issues entails the use of social science research paradigm which is the case in the Burrel and Morgan (1979) four sociological paradigms chosen. Grabski et al (2011) argues that ERP systems are the most complex, largest and demanding information systems with many problematic issues yet to be resolved by researchers.

2.4.2.2 Knowledge gap 2

Many scholars observed the need to consider social factors when doing a study in ERP systems (Nandhakumar et al 2005; Chang et al, 2008; Sternad & Bobek, 2013, Karia & Soliman 2017, Salloum et al, 2018, Bhattacharya et al, 2019). ERP systems are complex hence the need to address them from a social science research paradigm (Grabski et al, 2011). Hence, a study in ERP systems need to infuse the Burrel and Morgan (1979) four sociological paradigms. The following Table 2.2 shows the research paradigms and the ERP systems.

Table 2-2: Research paradigms and ERP systems

Research paradigms and ERP systems	Source
Need to consider social factors in ERP systems	Karia & Soliman 2017, Salloum et al, 2018, Bhattacharya et al, 2019).
Need for the requirements engineer to consider the social world	Burgess et al, 2013;

2.4.2.3 The Functionalist perspective (Objective – Regulation)

The functionalist perspectives are based on regulation and use the objectivist paradigm to solve the research problem. The proponents of this perspective contend that formal assessments can be applied to understand a problem using a predefined method. Institutions can be controlled by using procedures and standards when performing day to day activities. The perspective is practical as it seeks to comprehend the society so that usable knowledge can be generated. This is a problem-oriented paradigm that is geared at providing solutions to problems. Organ and Stapleton (2013) write that proponents of the functionalist perspective are convinced that there is a need to give explanations about the social order, consensus, solidarity and ultimately the satisfaction of the stakeholder. The functionalist approach considers the social world as composed of artefacts that can be identified and measured using natural sciences methods (Mavetera, 2012). This approach has been used extensively for

ERP systems problems because the assumption in this perspective is that institutions are stable and they do not experience changes very often.

The perspective assists information systems researchers to view society as a complex system but with components that can work together to achieve stability. The approach is crucial as it looks at the societal functions like the norms in the society, the customs and traditions. This assists information systems researchers to comprehend society so that valuable knowledge can be generated. The approach also appreciates the fact that society can only be understood by examining how the parts are interrelated to each other. Every stakeholder in society is instrumental in keeping the whole system functioning and the problems in the society are usually caused by stakeholders not doing what they are supposed to do. Institutional environments are made up of tangible entities that need to be identified and studied using methods postulated by the natural sciences. Using this approach enables the requirements engineer during requirements elicitation as the functionalist perspective gives the foundation for methods applied in requirements elicitation and if the existing method is found to be ineffective in addressing the problem at hand, an alternative method becomes a viable option.

2.4.2.4 The Interpretive Perspective (Subjective – Regulation)

This perspective seeks to understand the social world from the position of subjective experience (Burrel & Morgan, 1979). The approach sees the world as a social process that is continuously being created by stakeholders. The assumption in the perspective is that there is no conflict, contradictions, and change and that human affairs are ordered. The social world is seen as being extremely problematic and philosophers seek to understand the source of this social reality. The interpretive perspective recognizes the subjective world in which the observer derives truth using their own judgment. Organ and Stapleton (2013) and Ardalan (2010) observe that the interpretive perspective differs from the functionalist in that the interpretive perspective recognizes that stakeholders are complex and cannot be studied using equations as postulated by the functionalist approach. The interpretive perspective recognizes that there is no singular solution for different organizations, hence the problems at hand need to be looked at and find the best solution.

The interpretive perspective could assist in requirements elicitation as it supports subjectivity since stakeholders hold different opinions about the ERP system to be developed. Jokonya (2014) writes that the interpretive perspective supports stakeholder participation and therefore their commitment in system development. The perspective advocates for consensus agreements in the organisation and this could greatly assist in requirements elicitation as the communication with various stakeholders could assist in reaching consensus on requirements for the ERP system to be developed. Pellegrinelli and Murray-Webster (2011) write that it is

important to view a software requirements project by considering the cultural and organisational context by focusing on the experiences of project participants. The requirements engineer will need to work with the stakeholders giving them directions and paying special attention to the social and political context to reach the expected goals.

2.4.2.5 The Radical Structuralist Perspective (Objective – Radical Change)

This perspective advocates for radical changes using an objective approach. The approach uses consciousness as the foundation for critiquing society. The approach argues that conflicts in society bring about radical changes which are triggered by political and economic issues. The perspective assumes that the conflicts in society always exert pressure on organizations to meet the society's needs. Power has a big influence on some of the conflicts in the organizations and that could trigger changes in the organization. The perspective could assist organizations in ensuring the stakeholders' requirements are always considered even though conflicts may arise but the conflicts may help in ensuring that the elicitated ERP requirements are relevant to the needs of the stakeholders.

The perspective recognises conflict and chaos as pivotal for the continuous improvement of processes in an organisation. The perspective can assist in the ERP requirements elicitation process as new ERP systems will always be resisted by stakeholders for unknown reasons and the perspective advocates for radical changes so that some stakeholders may be emancipated from the social structures. The approach considers class in the organisation, so for ERP requirements elicitation process to be effective, the stakeholder's participation should be based on the stakeholder's position in the organization since the approach treats knowledge as a reflection of the stakeholder's material world.

2.4.2.6 The Radical Humanist Perspective (Subjective – Radical Change)

The radical humanist perspective advocates for radical changes but using a subjective approach. The perspective recognizes that for any process improvement to occur in an organization, the stakeholders are the starting point. The approach strives to understand the stakeholder's strengths, weaknesses, knowledge and limitations as the fundamental aspects that can improve their potential. The perspective's underlying notion is that a person's consciousness is controlled by the superstructure that the person interacts with. The anti-human nature of the society is highlighted by the perspective and it seeks to find ways to set free human beings from the spiritual bondage so that they can realise their full potential in life. Radical change is advocated for by the perspective so that human beings can realise their

dreams in life. The radical human perspective can assist stakeholders with their opinions about information systems so that their requirements can be taken on board.

Pellegrinelli and Murray-Webster (2011) observed that the perspective can be applied in the requirements elicitation process by considering who are the stakeholders who can be included in the project and who can be excluded by looking at their positions in the organization, their gender and the powerful influence of the stakeholders. For the ERP requirements elicitation process to be a success, the requirements engineer needs to engage the stakeholders so that they open up on how they create and interpret the world around them. This can assist the requirements engineer in identifying the barriers that prevent them during ERP requirements elicitation.

2.4.2.7 Sociological Perspectives Summary

The sociological perspectives are crucial during ERP requirements elicitation because the organizational context is highly complex and there is a need to have different world views and choose the best approach that addresses the problem at hand. The different world views discussed above assist in addressing the ERP requirements elicitation by choosing the most appropriate approach to apply based on the organizational context.

The institution's complex problems can also be viewed using the Systems Methodology. The next section discusses the Systems methodologies with ERP requirements elicitation.

2.4.3 The Systems Methodology

Jokonya et al (2012:50) observed that the systems approach is a multidisciplinary way of viewing the institution's complex problems. Organizations are dynamic, and with that in mind, stakeholders do not have specific goals and agreed objectives, stakeholders do not share the same views with other stakeholders in an organization (Jokonya et al, 2012:50). The systems approach works on the weaknesses of traditional approaches that fail to recognize that organizations are complex and highly unpredictable.

2.4.3.1 Systems Thinking Approach

Overview

Systems thinking provides a way of looking at complex situations from different angles. Frank (2012) defines systems thinking as a way of understanding the system as a whole, comprehending the interconnections together with their interactions with the other subsystems

and also the ability to view the system from multiple perspectives. Systems thinking recognizes the importance of the environment in requirements elicitation as this could affect the requirements captured. Environmental factors that should also be considered during requirements elicitation include the political, organizational context, viewpoints of stakeholders, economic and social issues (Frank, 2012). The systems thinking approach addresses the weaknesses of traditional reductionist methods which failed to address organizational complexities (Jokonya, 2014). Organisations are not stable hence the need to view the specific complexities through multiple perspectives to reach an informed conclusion.

Baxter and Sommerville (2011) write that the social and technological factors that affect the functionality of a system should be taken into consideration during requirements elicitation. They elaborate that systems at times meet the technical requirements but then they fail to deliver the expectations of the organisation's real work needs. The problem is attributed to the fact that the approach did not consider the organizational complexities which are embedded in the social environment of the organization. The multifaceted view of organizational complexity advocated by the systems approach gives it an edge in capturing ERP requirements where stakeholders hold different viewpoints on a problem.

Systems approach has been fuelled by the escalating organisational complexities, heterogeneous stakeholders and the ever-changing environment. Mitre (2017) writes that a problem can be solved by first identifying a component and then understanding that component's relationship with other components that form an entity. A component cannot be examined and appreciated in isolation with the other components that form the entity as this will give rise to the problem re-occurring in the future. The act of looking at a system as a whole is sometimes referred to as practical holism. The practical holism can help in framing the problem in ERP requirements elicitation.

Godfrey (2010), Checkland and Poulter (2010) concur that the real world is complex and is made up of interconnected components that are hierarchically organized. They elaborate that the main aim of the systems approach is to meet a purpose for a system and that purpose responds to the question of why a certain process has to be done. Once the purpose of the system has been articulated, then the requirements for the system can be elicitated from the stakeholders. Stakeholders will determine the purpose of the system through their beliefs and viewpoints evolved from the culture; performance management should be utilised to check if the purpose is being met and lastly uncertainty should be managed well by including feedback to minimize the overall impact (Godfrey, 2010).

The focus of requirements elicitation has drastically shifted from being centred sorely upon the technical specifications of the system commonly referred to as the hard systems to a focus

on the social aspects commonly referred to as the soft systems (Jokonya, 2014). There is a need to strike a balance between the hard systems approach and the soft systems approach to effectively meet the needs of the stakeholders. The next section discusses the soft systems approach.

2.4.3.2 Soft Systems Methodology

Overview

The soft systems methodology was conceived at Lancaster University by Checkland (1999) who wanted to solve business problems using the concepts of software requirements elicitation. The discovery was that stakeholders had diverse views on what makes a system, the need for coming up with a system and what constitutes the problem (Burge, 2015). The soft systems methodology is at times referred to as the requirements elicitation technique that takes into the loop stakeholders in requirements elicitation (Niu et al, 2011). The complexity of the human world has brought about the soft systems methodology because stakeholders have different views of the same situation at hand. For example, two people playing a computer game will have different conclusions about the overall game usability because they have different views based on their own experiences of what constitutes usability. So in a nutshell, the soft systems methodology takes the real world views of stakeholders and then generates models that can assist in explaining what transpires in the real world to deduce recommendations.

The soft systems methodology looks at a world from different viewpoints to identify the requirements. Robertson and Robertson (2012) identified three important viewpoints that can be utilised to derive requirements: the first viewpoint is "*how it is"* looks at the world view we are trying to comprehend, "*what is it"* looks at how things are executed and lastly "*what it will be"* the future view of how the system could look like. To break down the viewpoints, the "*how it is"* looks at the application domain so that the requirements engineer appreciates the key terms used in that domain so that requirements can be captured correctly. The "*what is it"* seeks to understand the stakeholders' needs by identifying their goals, the inclusion criteria for stakeholders to participate in requirements elicitation and lastly comprehend the organizational business processes. The "*what it will be"* clarifies the requirements from the stakeholders that the system should meet. Katina et al (2014) write that requirements elicitation in complex situations can take some time but ultimately these will be captured.

Most systems development do not take into consideration the stakeholders' needs but systems are developed by humans and they are meant to be used by human beings, so the

human being is the main actor in the systems development. In retrospect, it is important to take the needs of the human beings for the system to succeed. Simonette et al (2010) observes that 80% of the system re-do problems are attributed to inaccurate elicitation requirements. This explains why it is important to take into consideration the needs of diverse stakeholders during requirements elicitation. The soft systems approach's goal addresses the complexity associated with diverse stakeholders holding different viewpoints about a problem. The Human Activity System in the soft systems approach is the elicitation stage where three key requirements can be elicitated; *normal requirements* – these are the required requirements that the system should meet; *expected requirements* – these are the basic requirements that should be met by the system and failure to meet these the stakeholders will be dissatisfied in using the system and lastly the *exciting requirements* – these are the extra features that the stakeholders may wish the system should have but if they are not met, the stakeholders will not be dissatisfied in using the system (Kumlander, 2006; Simonette et al, 2010).

Soft systems approach advocates for a participatory design using the stakeholder centred concept. All system development should involve the stakeholders so that requirements captured truly reflect the worldviews of the stakeholders who will use the system. This will translate into a better system being developed because of the rich domain knowledge of the stakeholders from whom the requirements were elicitated. The soft systems approach is best suited for addressing ill-structured problems while another concept called the hard systems approach addresses well-defined problems (Alexander and Beus-Dukic, 2009:77). The soft systems approach will enable us to change the way we see things in the world.

Although the soft systems methodology has received considerable recognition in the academic arena, there are some weaknesses that need to be addressed. The methodology is silent on the stakeholder selection criteria used during requirements elicitation because some important characteristics should be taken into consideration such as the age, gender, willingness to participate and the domain knowledge experience. The other weakness of the methodology is that consensus is difficult to achieve as advocated for by the approach because of the diverse viewpoints of stakeholders. The soft systems methodology advocates for a participatory design in requirements elicitation but the participatory design favours the most powerful stakeholders who can influence the views of other stakeholders.

2.4.3.3 Hard Systems Methodology

Overview

The Hard Systems Methodology (HSM) commences with a problem that exists in the real world and that problem requires some processing to achieve the desired solution. The HSM assumes that the problems that exist in the real world are structured and well-defined goals and they have an optimum solution. Checkland and Poulter (2010) observe that HSM can solve real-world problems by first looking at the desired state and comparing that with the present state to reach the desired goal. The HSM looks at how we move from the current state to the desired state to close the gap between the two states. The HSM can be applied in ERP requirements elicitation by looking at what is required from the new system and how best to fulfil those requirements with the new system.

The complexity of problems in the real world cannot be solved by using mathematical models to derive optimum solutions (Jackson, 2003: 43). The HSM assumes that stakeholders do not have multiple perceptions in terms of reality, but in real-world, this cannot be true as universities are made up of different departments with different function lines and in that regard, they will have different perceptions of a specific a problem. So the challenge with the HSM is how to deal with problems that are very complicated where stakeholders have diverse viewpoints and where mathematical models cannot be applied willy-nilly.

ERP requirements elicitation in a complex environment such as a university context cannot be done using mathematical models and turning a blind eye to the socio-cultural issues that could impede effective ERP requirements elicitation. The human situation is not structured, so the HSM which advocates for structured and well-defined goals to deliver the best solutions fails to hold water. The complexity of universities cannot be overlooked when dealing with requirements elicitation as the ERP system will beultimately gets to be used by all the stakeholders at the university in order to fulfil their day to day activities.

2.4.3.4 Critical Systems Thinking and Practice

Overview

The Critical Systems Thinking and Practice proposed by Jackson underwent a series of refinements from 1997 to 2006 and now brings together the various contemporary systems methodologies (“hard systems, soft systems, system dynamics, emancipatory and the post-modern system thinking”) to address the complexities associated with heterogeneous problems faced in organizations (Jackson, 2010; Jones, 2014). The approach draws upon the principles of Critical Systems Thinking: the critical awareness of various systems approaches on their strengths and weaknesses; appreciation for pluralism in various systems thinking and improvement (Jackson, 2010; Ho, 2014). The approach captures the weaknesses of the

previous systems approaches such as the hard systems methodology which failed to deal with the complexity found in the real world and pluralism. The soft systems methodology advocates for consensus in reaching a goal but in real life, it is difficult to reach a common understanding from heterogeneous stakeholders who hold diverse viewpoints on a problem. The approach was also inspired by the weaknesses of the Organizational Cybernetics and Complexity Theory which failed to address extremely complex situations. Although different systems methodologies have their strengths and weaknesses, each methodology is best suited to address different situations wherein some of the methodologies' weaknesses outweigh their strengths.

Critical Systems Thinking and Practice advocates for pluralism in systems thinking as it is attuned to addressing the organisational complexities. The pluralism prescribed by the approach proffers a different orientation as compared to other methodologies. Pluralism is important since different stakeholders hold diverse and at times conflicting requirements. The approach seeks to protect the diversities found in different paradigms and the way implementation is conducted will be closely critiqued using the lenses provided by other perspectives. The approach has got four phases which are "creativity, choice, implementation and reflection" (Jackson, 2010). The requirements engineer should take into consideration these phases in addressing the organizational complexity to yield different views on the problem using alternative perspectives. The approach also advocates that other perspectives should be considered such as the "functionalist, the interpretive, emancipatory and the postmodern" (Jackson, 2010; Jones, 2014).

After identifying the problems in the organization, the approach advocates for the selection of the best systems methodology to derive an optimum solution. The selection of the systems methodology is based on the strengths and weaknesses of the methodology. The approach offers a meta-methodology which outlines how to tackle organisational limitations in a holistic manner using different systems approaches. The approach could greatly assist requirements engineers during ERP requirements elicitation to choose the best approach by looking at the problem at hand.

2.4.3.5 Emancipatory Systems Thinking Approach

Overview

The emancipatory systems thinking approach was developed to address the weaknesses of the hard systems thinking and the soft systems thinking approaches (Jokonya, 2014). The approach seeks to address the marginalised stakeholders whose views are not taken into

consideration because of the influence of some stakeholders with power in the organisation and conflicts (Petrović, 2016). The requirements of the marginalised stakeholders will not be taken into consideration and ultimately the developed ERP system will not meet their needs. The approach seeks to identify some of the inequalities that may exist in organisations thereby promoting changes that will be needed to develop successful systems. The emancipatory approach assumes that the organizational situations can be too coercive and the paradigm is best suited to deal with organisations with coercive management styles (Kogetsidis, 2011). The approach seeks to empower the stakeholders with no voice in the organization so that their requirements can be captured during requirements elicitation.

The emancipatory approach is based on the concept of stakeholder emancipation that seeks to empower the stakeholders to their full potential in terms of individual development. Stakeholders in organizations have diverse views on a problem, but however, some stakeholders use their powerful influence to make their views heard and then implemented at the expense of other stakeholders. The emancipatory approach seeks to achieve fairness by accommodating diverse views of stakeholders in requirements elicitation. The approach best handles requirements elicitation where coercive management styles exist in an organization so that fairness is ultimately achieved. Watson and Watson (2011) observed the importance of emancipatory systems thinking as the approach seeks to give every stakeholder an equal opportunity to participate during requirements elicitation so that no one is disadvantaged.

2.4.3.6 The Systems methodology summary

The systems thinking approach in requirements elicitation in ERP systems use the holistic approach when addressing a problem. All sub-components that make up an entity should be interrogated when addressing a problem because of the coupling that exists as leaving one component recreates the problem in a different format. The soft systems approach is best suited to situations where the problem situation needs to be understood so that appropriate improvements are made. Caution must be taken so that the problem situation is best understood before the actual system development can start, otherwise, the developed system may fail to meet the needs of the stakeholders and that would subsequently result in dissatisfied stakeholders. Although the approach has received considerable attention in the past decades, some weaknesses such as the selection criteria for stakeholders from whom requirements will be elicitated should be acted upon. The hard systems methodology is best suited in situations where the problems are well structured and the best solution is obtained. However, not all problems are structured and well defined, real-world complex problems are

highly uncertain so they require multiple viewpoints to reach an optimum solution. The critical systems thinking and practice combines all the other systems approaches to generate an amalgamated approach applied to solve organizational challenges through an optimum solution. Lastly, the emancipatory systems thinking was developed to cater for the organizational environment which experiences coercive management styles so that fairness can be achieved during requirements elicitation.

2.4.4 Stakeholder Theory

The stakeholders in an institution are those individuals who are affected by the information system developed to achieve the institution's objectives (Freeman, 1984; Sharp et al, 1999). Miles (2017) argued that stakeholder theory is subject to multiple interpretaions and applications but however, the theory has widespread appeal and is being applied in multi-contextual domains. Miles presented constructs which various authors postulated with regards to the stakeholder theory. There are four stakeholder constructs from the stakeholder theory which may be included during ERP requirements elicitation. The first is the influencer stakeholders, these are the stakeholders with the highest power and interest within the institution as postulated by Miles (2017) & Hasnas (2013). The second class of stakeholders are the claimant stakeholders, these are the stakeholders who lack coersive power within the institution but however, they actively pursue their claim or interest until the issue is attended to by management (Greenwood and Freeman, 2011; Miles, 2017). The other class of stakeholders are the collaborators, these stakeholders co-operates within an institution but however, they lack active interest to influence the institution (Miles, 2017; Desai, 2018). Lastly, the recipient stakeholders are passive recipients of the institution activities (Greenwood and Freeman, 2011; Miles, 2017).

The stakeholder theory is critical in establishing the relationships between the stakeholder's needs and the organisation's objectives. If the stakeholder's needs are properly met that translates into meeting the institution's mission statement and vision. It is crucial to cater for the requirements of these stakeholders during requirements elicitation for the successful implementation of an information system.

The stakeholder theory has been used to elicit requirements from stakeholders (Sharp et al, 1999; Nuseibeh & Easterbrook, 2000; Cheng & Atlee, 2007; Filieri et al, 2015). For the stakeholder theory to make an impact during ERP requirements elicitation, it is important to identify the various stakeholders in the institution (Sharp et al, 1999). Sharp et al (1999) identified four types of stakeholders in an organization whose needs should be considered in

the development of an ERP system: users who use the system to do their business tasks each day; the system developers whose mandate is to develop the system; the legislators whose mandate is to make sure the system development is within the confines of the law and, lastly, the decision-makers within the institution which form top management. The requirements of these diverse stakeholders should be catered for to make the ERP system a success.

2.4.4.1 Knowledge gap 3

The stakeholder theory has been used to elicit requirements from stakeholders as shown in the preceding section. However, there is need to identify the various stakeholders in the institution (Sharp et al, 1999; Nuseibeh and Easterbrook, 2000; Cheng & Atlee, 2007; Filieri et al, 2015). The challenge that confronts the requirements engineers is to select the appropriate stakeholders during requirements elicitation who will represent the views of other stakeholders since it is not feasible to involve every stakeholder. This study seeks to address this specific issue in stakeholder identification and selection using the suggested constructs from the stakeholder theory. The following Table 2.3 shows the postulated stakeholder theory constructs.

Table 2-3: Stakeholder theory

Stakeholder theory constructs	**Source**
Influencer stakeholders	(Hasnas, 2013; Miles, 2017; Greenwood and Freeman, 2011)
Claimant stakeholders	(Greenwood and Freeman, 2011; Miles, 2017)
Collaborators stakeholder	(Miles, 2017; Desai, 2018)
Recipient stakeholders	(Greenwood and Freeman, 2011; Miles, 2017)

2.4.5 Activity Theory

Georg et al (2015) postulated that the Activity Theory may be utilized to identify the societal constraints that should be addressed by an ERP system in order for the system to be a success. The Activity Theory defines the human activity as composed of an object or aim and the aim should bring about the expected outcome (Georg et al (2015). The aim is shared by the community which is this case are the stakeholders. The authors went on to observe that the Activity Theory will be utilized by the requirements engineer to identify unknown stakeholders and their social constraints that the requirements engineer will utilize during

requirements elicitation. Stakeholders' social constraints need to be taken into account during ERP requirements elicitation since a university ERP system is made up of diverse stakeholders with different worldviews with regard to ERP requirements elicitation. There is need for social science theories that address the social constraints of the stakeholders during ERP requirements elicitation process.

Martins & Daltrini (1999) argued that the problems of requirements elicitation will not be solved purely by technology alone, once the stakeholders' social aspects have strong importance in the activity. This means that ERP requirements will not be extracted from the stakeholders without taking into consideration the sociological context in which the requirements exist. However, the social context do have its own share of problems such as the power relations, conflicts and marginalized stakeholders within an organization which also need to be addressed by the requirements engineer. ERP requirements elicitation to be a success, there is need to comprehend the activities performed by the stakeholders in their social context for rich ERP requirements to be extracted.

Neto et al (2005) observed that understanding the social and organizational context is the nucleus for successful system development. The authors went on to say that the usability of a system depends on the context of use which is largely affected by the context the system will operate in. The authors also observed that stakeholders do not understand how to describe their social nor organizational problems. There is need for the requirements engineer to have a better understanding of the stakeholders' social context so that they select the best elicitation technique to elicit the requirements in a particular context.

2.4.6 Domain Theory

The Domain Theory was developed at the City of University of London by Sutcliffe and Maiden (1998). The theory was motivated by the cognitive science theory which fall in the knowledge representation category. The theory postulates a way of modelling the domain knowledge, which should be based on the abstraction of the problem space. The problem space has to be understood by the requirements engineer before the design of the system. The Domain Theory postulated by Sutcliffe and Maiden (1998) is being used in Information Systems as a theory of expertise that help researchers in predicting and explaining concepts of abstraction which assist in requirements elicitation.

The Domain Theory asserts that the domain knowledge is a naturally occurring expertise that is help by the requirements engineer and to a less precise, by the stakeholders. So, for ERP requirements elicitation to be carried out successfully, there is need for the requirements engineer to be knowledgeable about the domain so that rich ERP requirements may be

extracted. The cognitive theories of memory asserts that the human memory is organized hierarchically and studies reveal that requirements engineers tend to re-use abstractions or mental knowledge structures when dealing with new systems (Sutcliffe & Maiden, 1998).

Broy (2013) observed that the domain is crucial in ERP requirements as the key domain terms, rules, laws, terminology and notions are elaborated so that ERP requirements are captured without distotions by the requirements engineer. In a nutshell, the domain model is a collection of domain information at an adequate level of abstraction (Broy, 2013; Portugal et al, 2016). The theory asserts that there is need for a requirements engineer during requirements elicitation who would act as the facilitator or mediator between the ERP developers and the stakeholders during the requirements elicitation.

2.4.7 Summary of the theoretical background

The theoretical background examined a number of theories that underpin this research. The theoretical contribution for each theory examined in the preceeding sections is summarized under theoretical constructs table.

Table 2-4: Theoretical constructs

Author	Theory	Construct	Contribution
Ditsa (2003)	Human Activity theory	Social context or the (Sociological perspectives)	Sociological perspectives influences ERP requirements elicitation
Burrel and Morgan (1979)	Sociological paradigms	Sociological perspectives	Sociological perspectives influences ERP requirements elicitation
Frank (2012) Checkland (1999)	Systems Thinking Approach Soft Systems Methodology	Stakeholder role, Stakeholder characteristics	Stakeholder role and characteristics affects ERP requirements elicitation.
Miles (2017)	Stakeholder Theory	Stakeholder role, Stakeholder characteristics	Stakeholder role and characteristics affects ERP requirements elicitation
Sutcliffe and Maiden (1998); Broy, 2013; Portugal et al, 2016).	Domain theory	Domain knowledge	Domain knowledge affects ERP requirements elicitation

		Perception	Perception affects ERP requirements elicitation
Jackson, 2010	Critical Systems Thinking and Practice	Elicitation techniques	The Elicitation technique chosen affect ERP requirements elicitation process

2.5 Existing ERP Requirements Elicitation Frameworks

Many researchers have proposed diverse frameworks of selecting stakeholders for involvement in requirements elicitation but, some of the suggested frameworks lacked crucial elements that may succumb in extracting rich requirements for the new system. The following section will discuss some of the proposed requirements elicitation frameworks and their shortcomings in addressing ERP requirements elicitation.

2.5.1 Tacit Knowledge Framework

Gervasi et al (2013) proposed the Tacit Knowledge Framework which used the following terms: *expressible* which denotes known knowledge; *articulated* denotes documented known knowledge *accessible* which denotes that the knowledge is known but not on the stakeholder's mind currently and *relevant* to the current project and the domain. From this, the known knowledge by the stakeholder is not the real problem at hand; the knowledge that the stakeholder cannot express, articulate and which is very relevant to the system under development is a problem. The Tacit Knowledge Framework also proposed that the unknown knowledge kept by the stakeholders but not articulated due to political or societal reasons, pose a great challenge to the requirements engineer to elicit this knowledge. However, domain knowledge on both the requirements engineer and the stakeholder is very crucial to discover some of the unknown knowledge.

Observations

The applicability of the Tacit Knowledge Framework in ERP requirements elicitation would have been aided by suggesting elicitation techniques used to discover the unknown requirements from stakeholders. Also, the framework should have proposed a selection criterion to be adopted in selecting stakeholders during requirements elicitation.

2.5.2 Stakeholders Selection Model for Software Requirements Elicitation

Rizali and Anwar (2016) proposed a framework to be used in requirements elicitation which is based on four selection factors. The first factor is the stakeholder knowledge since stakeholders are the source of the main requirements, hence their knowledge about the problem at hand is very crucial. The second factor is the stakeholder's role, the role seeks to identify the various roles played by stakeholders in the organization and select stakeholders from there to get rich requirements. The third factor is the stakeholder's interest which determines the willingness of the stakeholder to give correct and useful requirements. Lastly, the stakeholder's communication skills.

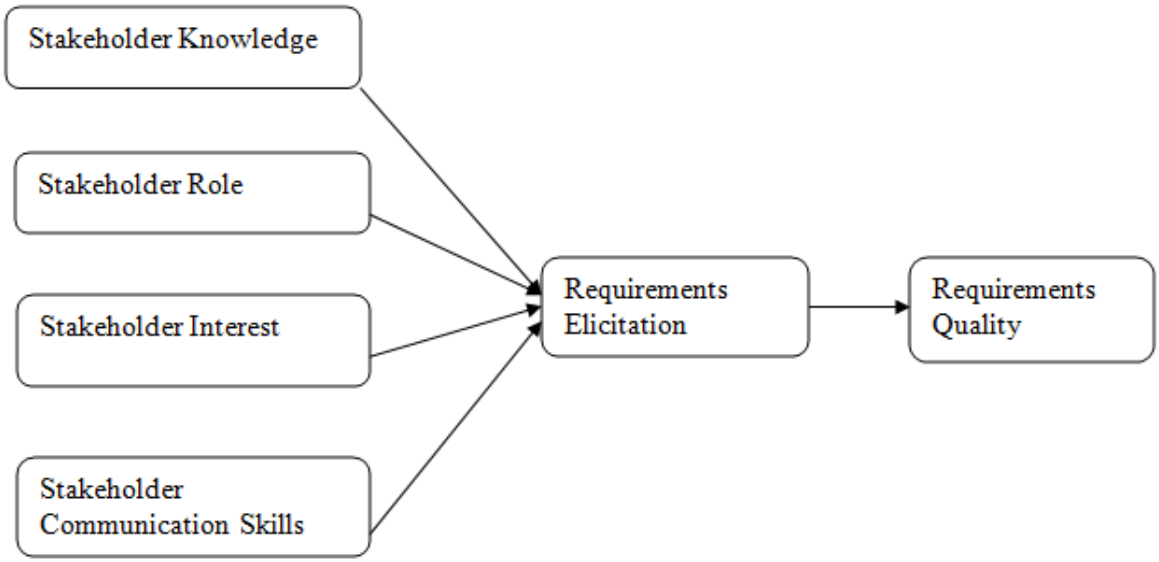


Figure 2-3: Stakeholders Selection Model for Software Requirements Elicitation (Anwar & Razali, 2016)

Observations

The authors propose a good selection framework that would help in eliciting requirements but however, the proposed framework did not cater for other stakeholder's characteristics which may have a bearing during ERP requirements elicitation which is: age, gender and the marginalized stakeholders. Gender should be taken into consideration when selecting the stakeholders because women are more sensitive when it comes to opinions raised by others as compared to men and there should be a balance so that rich requirements can be captured (Venkatesh et al., 2000; Mason, 2016). The way elderly stakeholders see an ERP system is markedly different from the young stakeholders so there is a need to consider the age so that

rich requirements can be extracted from stakeholders. Marginalised stakeholders in most cases are not selected because they do not have influence in decision making and their requirements are simply not considered.

2.5.3 A Five-Dimensional Requirements Elicitation Framework for e-Learning Systems

Tran and Anvari (2016) propose a Five-Dimensional Requirements Elicitation Framework for e-Learning Systems as follows. The first dimension is the Change management which answers the "*why"* to change. This dimension elucidates the need for change from the current system to the new system to the stakeholders. The second dimension is the user characteristics answers "*who"* are the stakeholders who should be involved. The third dimension is the knowledge that answers "*what"* to change; this dimension utilizes the domain knowledge experts to derive requirements for the new system. The other dimension is the cognitive process which answers the "*how"* to change which utilizes the cognitive processes in capturing requirements from the stakeholders. The last dimension is the evaluation which gauges the success of the implantation process.

Observations

The framework addressed some of the critical factors that should be considered in ERP requirements elicitation; however the framework did not proffer suggestions on elicitation techniques to extract the requirements from the stakeholders. The framework also did not address the stakeholder's social environment since requirements elicitation is a social activity and there is a need to consider the stakeholder's sociological perspectives.

2.5.4 Stakeholders Typology Framework

Salhotra (2014) proposed a framework that could be used in ERP requirements elicitation and the framework grouped stakeholders according to the stakeholder's power, legitimacy and urgency.

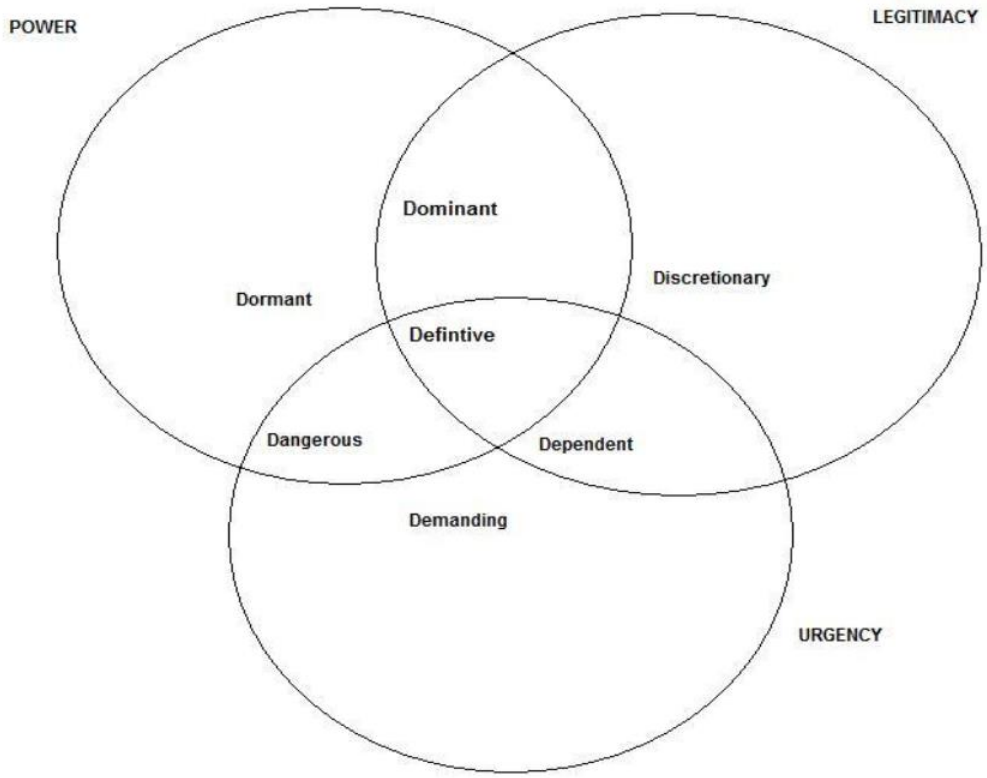


Figure 2-4: Stakeholders Typology (Salhotra, 2014)

The technique grouped the stakeholders according to their respective typologies namely, Dominant, Discretionary, Dependent, Demanding, Dangerous, Definitive and Dormant.

Dominant stakeholders have the power to influence their requirements. Discretionary stakeholders do not have power but proffer suggestions during requirements elicitation. Dependent stakeholders have no power but they have crucial requirements that may be extracted during requirements elicitation provided other stakeholders give them a chance. Demanding stakeholders have urgent requirements but at times their requirements are not taken on board if they are not in line with the ERP project scope and organizational goals. Dangerous stakeholders have power and urgent requirements, and they exert pressure on the requirements engineer for their requirements to be implemented.

Definitive stakeholders do have the three attributes: power, urgency and legitimacy. They influence requirements during requirements elicitation. Dormant stakeholders do have the power to impose their requirements but their requirements are not very urgent and in most cases, they remain passive.

Observations

The framework only identified the various categories of stakeholdes but there is no elaboration as to how the actual stakeholders to be involved in the ERP project would be selected from each group. Salhotra (2014) observed that the stakeholders' characteristics are socially constructed yet they did not include the element of societal paradigm in their framework. Requirements elicitation calls upon the requirements engineer to make some assumptions about the nature of stakeholders in the organization and the nature of the problem to be solved by the new ERP system. The assumptions that the requirements engineer decides to integrate determine the outcome obtained. Requirements elicitation deals with knowledge extraction from the stakeholders and the fundamental assumption is how the knowledge is going to be obtained from the stakeholders. To better articulate this problem at hand, the knowledge can only be extracted after understanding the social and the technical nature of the organization.

2.5.5 Summary of existing ERP frameworks

The following section provides a summary of strengths and weaknesses of existing frameworks discussed in the preceeding sections. The section also identifies a knowledge gap which needs to be explored further in this study.

2.5.5.1 Knowledge gap 4

The existing ERP requirements elicitation frameworks discussed from section 2.5.1 to 2.5.4 exhibit both strengths and weaknesses. Each framework discussed compelled the researcher to interrogate these aspects. There is need to develop a more improved ERP requirements elicitation framework that is robust and informed by the strengths and weaknesses of the existing ERP frameworks discussed above. Table 2.5 shows a summary of strengths and weaknesses of existing models and frameworks.

Table 2-5: Theories, Models and Frameworks summary

Theory, Model Framework name	**Author(s)**	**Strengths**	**Weaknesses**
Stakeholder Selection Model for Software Requirements Elicitation	Anwar and Razali (2016)	-Engages the stakeholders -Captures diverse stakeholders interests	-Stakeholder selection criteria is too brief --No stakeholder selection criteria
Scenario-Based Requirements Approach	Carroll (1995)	-Facilitate in capturing rich requirements from stakeholders	- Difficult working with the natural language

	Sutcliffe et al (1998)	-Improves communication during the elicitation stage -Easy to use scenarios	- Requires experienced stakeholders -Hard to define goals
Soft Systems Methodology	Checkland (1999)	-Engages the stakeholders - looks at the world from different viewpoints	- Stakeholder selection criteria not specified
Tacit Knowledge Framework	Gervasi et al (2013)	-Stakeholder participation	--Stakeholder selection criteria not specified
A Five-Dimensional Requirements Elicitation Framework for e-Learning Systems	Tran and Anvari (2016)	-Stakeholder participation -- Considers the domain knowledge	-No stakeholder selection criteria selection -Elicitation techniques not involved
Viewpoints-oriented requirements definition model	Kotonya and Sommerville (1996)	-Requirements looked at various viewpoints -Engages the stakeholders -Focus on stakeholders needs	- Restricted to service-oriented systems only -Does not handle conflicts across viewpoints -Does not handle concurrency -- Need other elicitation techniques to extract rich requirements

2.6 Software requirements elicitation

A software requirement is a characteristic that one observes externally in the proposed system (Davis, 2013). The requirement explains the “what”, i.e. what the system should do to meet the stakeholder’s needs without specifying the solution to meet that need. The observable characteristic can be in the form of a functional or non-functional requirement. The functional requirement dictates the system’s functionality in meeting the stakeholder’s needs while the non-functional requirement adds a constraint on how the functionality will be performed like the issue of security, availability, reliability and others (Davis, 2013).

To better articulate the functional requirements, the frame requirements elicitation approach is normally utilised where the problem is decomposed into sub problems to reflect the needs of the stakeholder (Ahmad et al, 2015). According to Pohl (2016), 60% of errors in software projects emanate from requirements elicitation and these errors are usually discovered later in the project development phases. The costs associated with fixing those errors are much higher, and most are errors are caused by communication barriers during the requirements elicitation stage where the stakeholders' needs are not captured in precise and succinct terms.

Domain terminology should be considered by the requirements engineers so that they capture the needs of the stakeholders without errors because one term can have a different meaning to the requirements engineers when defined and expressed by the stakeholders (Laplante, 2013). For effective communication to take place, a proper communication medium should be chosen to capture the stakeholder's needs. The success of verbal communication rests on the language spoken, gestures used during the communication process and the feedback (Pohl, 2016).

Westfall (2014) argued that there is need to select key stakeholders to elicit requirements and thereby reduce incomplete requirements. It is understood that it is not feasible to take on board all the stakeholder's needs since at times their needs may conflict with each other. In such a situation, then prioritised requirements negotiation become the only viable alternative to the requirements engineer in capturing the needs of the stakeholders.

2.6.1 Requirements Elicitation Techniques

There are several traditional techniques used in requirements elicitation. These range from interviews, observation, questionnaires, prototyping, brainstorming, focus groups, ethnography, joint application development, requirements workshops, protocol analysis, task analysis and workshops (Zowghi and Coulin, 2005; Sutcliffe and Sawyer, 2013). In this study, a few techniques that could be used to elicit stakeholder's requirements are examined.

2.6.1.1 Personas

Overview

A persona is a term used in user-centred design with a detailed description of a fictitious or imaginary stakeholder created to represent a group of stakeholders and focusses on the stakeholder's goals and behaviour (Turner et al, 2013). Norman (2013) identified three types of goals which are experience goals, end goals, and life goals. Experience goals are personal goals that are difficult to extract such as the way someone feels when using an ERP system.

The feelings are associated with the system's quality, responsiveness and other characteristics. This tends to vary from one stakeholder to another. The end goals are the tasks performed by the user when they already have an end outcome in mind. For example, opening an ERP system to view student's results, the user already has in their mind the end outcome of seeing the results from the system. The end goal is crucial in determining the system experience and these should be met in order for the user to value the relevance of the ERP system to their needs. Lastly, life goals dictate the long term desires of a stakeholder in using the system to meet their end goals. Even though life goals are not explicitly elaborated during the requirements elicitation, they are crucial to take note of so that the stakeholder will not be satisfied only with the system but will end up being a loyal user to the system (Norman, 2013).

The personas are generated using the data obtained during interviews with stakeholders and also includes some fictitious personal details associated with the persona to make the user more real. The persona may include the following details to make it more real: user's name, the user's photograph, what they like and what they do not like, their background, their goals and expectations as provided by the ERP system (LeRouge et al, 2013). Cooper (1983) developed the concept of persona from the interviews he captured from eight stakeholders and he generalized the user to create a persona that could interact with the software developed based on the user's goals and behaviour. The concept of using a fictitious user in requirements elicitation generally assists the requirements engineer in comprehending the needs of a real user and their characteristics (Schneidewind et al, 2012).

Giboin (2011) observed that personas enhance stakeholder communication because a persona acts as a proxy for a specific group. The roles that interact in the system need to be identified and each role can be assigned to create a persona. Personas help in capturing the needs of key stakeholders without compromising the needs of other secondary stakeholders. For example, in ERP system development we cannot take into consideration the needs of every stakeholder at the university otherwise we end up having a system with so many features with very few stakeholders being satisfied with the ERP system specifications. The concept of personas addresses this challenge by defining goals for the key stakeholders that the system should meet. The goals should also capture the real user's motivations that are exhibited in their behaviour. The issues of why some users want to do certain tasks can help the requirements engineer to enhance or remove some tasks but at the end meet the same goals (Cooper et al, 2003).

While most elicitation techniques focus on functional requirements, very few techniques focus on non-functional requirements and personas elicit both functional and non-functional requirements (Miller and Williams, 2006; Baguma et al, 2009; Hosono et al, 2012). It is critical

to use personas during ERP requirements elicitation so that the non-functional requirements are also captured.

Observations

Although personas have received considerable attention in requirements elicitation, there is a considerable amount of time needed to do the research and document the personas which if not carefully addressed, will not bring the real benefits provided by the personas (Long, 2009). If resources are not ample to implement research into personas, then it is best to shun the use of personas as this will not proffer the expected results. There is a great deal of training needed to properly administer personas in requirements elicitation even though this has been exacerbated by limited material on how to conduct research into personas (Long, 2009; Matthews et al, 2012). Bagnall et al (2005) also observed that for personas to work effectively, the requirements engineer should have an understanding of the domain where the persona was taken from. This is necessary so that the requirements engineer can articulate the personas representing the elderly stakeholders or those with disabilities. There is therefore a need for some special training so that the requirements engineer can capture the goals defined in the persona. Some elderly stakeholders just fear to use technology and this will be difficult to capture in the persona if the factors of fear to use technology are not discovered, then the persona will not address the real needs of the user.

Since personas are generated from interviews, at times the important information is not included in the persona but the less important information is overemphasized rendering the persona ineffective in addressing the needs of the users. For personas to be highly effective, they should be aided by scenarios on how the goal will be reached by the stakeholder interacting with the ERP system as compared to just mentioning the goals without explaining in detail the steps needed to meet that specific goal.

2.6.1.2 Scenario-Based Requirements Approach

Overview

Scenario-based requirements approach has been a focal research area for many authors (Carroll, 1995; Sutcliffe et al, 1998; Rosson & Carroll, 2012). Scenario-based requirements elicitation are descriptions depicting the real world in the form of stories that can be explained using pictures, natural language or other methods (Sutcliffe, 2003). The scenario describes

how the stakeholder will interact with the ERP system to do a specific business task. The approach seeks to address the communication gap between diverse stakeholders who prefer using the natural language while the requirements engineers use technical terms that the stakeholders may not comprehend (Mannio and Nikula, 2001; Krouwel and Op't Land, 2012). To improve the communication between the stakeholders and the requirements engineers, scenarios are integral components of the redesign where the stakeholders express their system requirements using natural language.

Scenarios are easier to comprehend as they depict how the stakeholder will interact with the ERP system to be developed and the environment the system will operate in to meet the stakeholder's needs. Scenarios have been used to elicit requirements in cases the stakeholders find it difficult to define the goals they want the ERP system to meet. Instead, they can represent what they want using pictures, natural language or annotations of what the envisage ERP system should do. Scenarios help in understanding the requirements of the system fully, taking into full cognisance the actors involved in meeting a specific business task (Sutcliffe, 1998; Sutcliffe, 2012). The use of scenario-based requirements elicitation will require stakeholders with experience in doing a certain business task as the approach requires the stakeholder to reflect on the way they used to do a business task and how they want the system to be developed to execute that task. The other critical benefit of using scenarios is that they focus on the real user stories and that enables the stakeholder to give a full-fledged description of what the proposed ERP system should do to meet their needs but many scenarios will need to be done to capture the requirements of the stakeholders but that can increase the costs associated with requirements elicitation (Sutcliffe, 2012).

ERP requirements are made up of functional and non-functional requirements. The scenarios capture both of these requirements (Mussbacher et al, 2009; Ameller, 2010). The non-functional requirements during requirements elicitation should be considered because most requirements engineers have devoted attention to functional requirements elicitation without adequately addressing the non-functional requirements. The ERP system functionality cannot be considered by merely focusing on the functional requirements to the expense of non-functional characteristics that constrain how the ERP system should operate (Chung and Leite, 2009). Although the software elicitation community recognises the software requirements are made up of functional and non-functional requirements, very few practitioners fully consider the importance of non-functional requirements.

2.6.1.3 Requirements Elicitation using Goals

In this section, goal-oriented requirements elicitation technique will be discussed.

Goal-Oriented Requirements Elicitation (GORE)

Vassev et al (2014) observed that the major goal of GORE is to capture and analyse the stakeholder's requirements. The GORE approach utilizes the actor and the goal concepts to come up with the goal-oriented analysis (Vassev et al, 2014). The GORE approach focusses on the "why" but not on "what" should be done by the system and that is the reason the approach is used in the early stages of requirements elicitation. The GORE approach assists in discovering early requirements of the stakeholders and these early requirements can be in the form of hard goals which are the functional goals and soft goals which are the non-functional goals. Horkoff and Yu (2013) defined goals as the objectives that the system under development should meet and these objectives are derived from the stakeholders. GORE assist in linking the technical requirements and the social needs of the stakeholders to come up with rich requirements (Horkoff & Yu, 2013). The involvement of stakeholders in deriving the goals will enhance in addressing the correct problems in the domain which the ERP system should address.

Goals can take different forms; the functional goals describe what the system should do while the non-functional goals specify how the system will achieve a specific task but the non-functional requirements are hard to test, for example, the performance and security of a system (Siegemund, 2014). Soft goals are goals that are slightly hard to verify if they have been satisfied for example; "*the student's academic record should be accessed by authorized personnel".* As articulated by Liao and Wang (2013) soft goals can only be satisfied is there is significantly positive evidence and little negative evidence to that soft goal. If the soft goal is not satisfied, then there is more negative evidence against the goal and less positive evidence (Liao and Wang, 2013). Goal modelling assist in achieving the completeness of a requirement, requirements that are not relevant will be avoided and also help in explaining the requirements to the stakeholders (Lamsweerde, 2001). Hard goals are the goals that can be verified to check if they were satisfied by using some techniques (Asuncion, 2009).

Goals have been used in requirements elicitation in a bid to meet the stakeholder's requirements. Goals facilitate the elicitation of requirements as can be attested by the KAOS (Knowledge Acquisition in automated Specification) methodology that considered the goal as the key concept in requirements elicitation (Yu & Mylopoulos, 1998; Ali et al, 2010). Stakeholders often become more aware of their requirements when they identify a goal and

in the process, they can also identify sub-goals. Goals can help in clarifying requirements in cases where the stakeholders cannot elaborate precisely on the first requirements, especially when dealing with non-functional requirements like security, performance, usability and others (Asuncion, 2009). Non-functional requirements are difficult to effectively measure and hence stakeholders also have problems in precisely starting how their requirements should be met.

Goals help in handling conflicting requirements from different stakeholders who may have diverged views, this is usually caused by non-functional requirements because one goal which is met can also affect the satisfaction of another goal (Horkoff & Yu, 2013). Conflicts will always emerge because one stakeholder's goal will impact negatively on the other stakeholder's and there is a need for conflict resolution so that both goals can be captured to reflect the stakeholder's needs. Goals assist in checking the risks associated with not meeting a specific goal (Horkoff & Yu, 2013). Goals also help in coming up with goal negation that seeks to prevent the satisfaction of a goal by pursuing an alternative new goal to reduce the risk factor (Eden & Ackermann, 2013). This is crucial if the risk can only be avoided through goal negation and this justifies the importance of goals in risk analysis.

A business rule is a statement that constraints how a business is run which are based on the business policy and the business rule may also be influenced by outside sources like the government laws that should be followed by the organization together with the stakeholders (Burgstaller et al, 2016). Asuncion (2009) observed that there is a need for an alignment between a business rule and the goal to form the goal operationalization. The business rule will add a constraint on how the goal will be met. Kardasis and Loucopoulos (2005) argued that goals and rules have a relationship that can show goals that have been done because of the rules enforced on them and goals may also show rules that may prevent them from being fulfilled. So in a nutshell, the business rules of an organization need to be considered when using goals in requirements elicitation.

2.6.1.4 Viewpoints-oriented requirements definition (VORD)

Kotonya and Sommerville (1996) proposed a requirements elicitation model using viewpoints, which looked at three things; identification of the viewpoint, the documentation of the viewpoint and the requirements analysis of the viewpoint. Biabani et al (2017) also argued that coding and testing of systems is not very crucial as compared to requirements elicitation which seeks to unearth the right requirements for the system being developed. A viewpoint can be direct or indirect, the direct viewpoint refers to the customers that get services from the intended

system to be developed, these could be the users of the system and the indirect viewpoints have some interest in the system being developed, these could be the organization or the environment or government policies and others (Kotonya & Sommerville, 1996). The viewpoint requirements elicitation approach acknowledges that requirements cannot be looked at from one single point but rather from different viewpoints (Hull et al, 2010:63). Salem (2010) also argued saying that the VORD process model elicits requirements from all the entities that will interact or use the system. This effectively means that the ERP requirements elicitation should be obtained from different sources and each source will be termed a viewpoint. Hull et al (2010:63) also suggested some viewpoints that could be used in requirements elicitation and these are the stakeholders, organization and the domain. However, the other viewpoints that could be included could be also the environment and the existing system.

Although the VORD model received considerable attention in requirements elicitation in the past decade, by allowing system design using the stakeholder's contribution using views, however the model has got some challenges. The model ought to be augmented by another requirements elicitation technique so that rich requirements may be obtained.

2.6.1.5 Requirements Elicitation Techniques Discussion

The number of requirements elicitation techniques that are being used to elicit stakeholder's requirements attests that no technique can capture all the requirements of the stakeholders at once. Many authors have recognized the existence of the Persona-Scenario methodology used in requirements elicitation (Hosono et al, 2009; Valaitis et al, 2014) but however, the methodology failed to address stakeholder's requirements succinctly. Aoyama (2007) proposed the Persona–Scenario-Goal (PSG) methodology so that diverse requirements from stakeholders can be captured but however, the PSG failed to address the issue of pluralism in requirements elicitation. So this can be seen that various methodologies are being proposed to address the requirements elicitation but are not adequately capturing the requirements of the diverse stakeholders.

2.7 Chapter discussion findings

Chapter 2 looked at the existing literature on ERP requirements elicitation, the stakeholder theories, the processes followed when conducting ERP requirements elicitation and the existing ERP frameworks. There was critical focus on the strengths and weaknesses of these theories, processes, and frameworks. The review generated theoretical lens on some of the weaknesses of the existing frameworks in addressing the ERP requirements elicitation, hence

the need for an ERP requirements elicitation framework that could address the weaknesses in the frameworks reviewed in the literature.

The literature review identified some of the strengths of the existing theories, models and frameworks and their applicability in ERP requirements elicitation. Some of the weaknesses identified could assist in formulating a more robust ERP requirements elicitation framework that could be utilized at universities. Even though the literature review was not exhaustive because of time constraints, the identified literature clarified what needs to be done to address the shortcomings of these identified theories, models and frameworks.

2.8 Chapter summary

The study identified different approaches currently in vogue in addressing the requirements elicitation which can attest to the complexity of the area, but of all reviewed approaches, they all had weaknesses in addressing the requirements elicitation and that is why we have more approaches being proposed every time in a bid to address this high complexity whose genesis lies in the software crisis (Randell, 1979). While a lot of studies have focussed on requirements elicitation, very few have concentrated on ERP requirements elicitation in universities involving the stakeholders in the requirements elicitation process.

The review identified some gaps in ERP requirements elicitation which needs an ERP requirements elicitation framework focusing on universities to address the stakeholder's needs. The chapter respnded to the research question in identifying the weaknesses of the current or existing frameworks used in ERP requirements elicitation at universities. The chapter clarified and mapped 4 knowledge gaps that the study strives to address. The next section summarises the reviewed theories, models and frameworks by highlighting their strengths and weaknesses.

CHAPTER 3 CONCEPTUAL FRAMEWORK DEVELOPMENT

3.1 Introduction

The preceeding chapter reviewed current and recent literature and discussed various theories and frameworks used in requirements elicitation. The chapter culminated in identifying some gaps that should be addressed by developing an ERP requirements elicitation framework that would meet the stakeholder's needs. ERP requirements elicitation is a complex process and the heterogeneous problems at universities call for an approach that views the problems holistically. This chapter presents the theoretical lenses that underpin the study and also presents the proposed preliminary ERP requirements elicitation framework that was informed by the literature review.

3.2 Theoretical review

The following sections discuss the theoretical tenets used in Information Systems research. Research in Information Systems is guided by different theoretical tenets. Information Systems research is a form of inquiry designed to uncover knowledge and facts about the problem under investigation (Mavetera, 2012:51). Researchers in information Systems convince other researchers by establishing actionable knowledge as the research output is inspired by theories and methods which control the actions performed by the people in social sciences (Mavetera, 2012:51). There is also need for a research framework (see Chapter 1 section 1.4) which guides the researcher in providing answers to the nature of the problem under investigation. The research framework guides the researcher in selecting the most appropriate research approach in a study and the methodology applied.

Gregor (2006) defines theory in three ways: firstly. As statements that explain how something is done, secondly, as statements providing lenses for viewing and explaining the real world and lastly, as statements that show relationships among constructs that may be tested. The following sections present lenses for viewing and explaining the world of ERP requirements elicitation and constructs that could be used in ERP requirements elicitation. Lim et al (2013) argue that any research article that makes use of theory in making arguments in describing a phenomenon of interest, providing explanations for how things happen, or how relevant that phenomenon of interest is to their current study, that paper would have used theory in the study.

3.2.1 Critical Systems Thinking

Critical Systems Thinking and Practice advocates for pluralism in systems thinking as it is attuned to addressing the organisational complexities. The pluralism prescribed by the approach proffers a different orientation as compared to other methodologies. Pluralism is important since different stakeholders hold diverse and at times conflicting requirements. The approach seeks to protect the diversities found in different paradigms and the way implementation is conducted will be closely critiqued using the lenses provided by other perspectives. The approach has got four phases which are “creativity, choice, implementation and reflection” (Jackson, 2010). The requirements engineer should take into consideration these phases in addressing the organizational complexity to yield different views on the problem using alternative perspectives. The approach also advocates that other perspectives should be considered such as the “functionalist, the interpretive, emancipatory and the postmodern” (Jackson, 2010; Jones, 2014). (See Chapter 2 section 2.4.3)

3.2.2 Activity Theory

Georg et al (2015) postulated that the Activity Theory may be utilized to identify the societal constraints that should be addressed by an ERP system in order for the system to be a success. The Activity Theory defines the human activity as composed of an object or aim and the aim should bring about the expected outcome (Georg et al (2015). The aim is shared by the community which is this case are the stakeholders. The authors went on to observe that the Activity Theory will be utilized by the requirements engineer to identify unknown stakeholders and their social constraints that the requirements engineer will utilize during requirements elicitation. Stakeholders’ social constraints need to be taken into account during ERP requirements elicitation since a university ERP system is made up of diverse stakeholders with different worldviews with regard to ERP requirements elicitation. There is need for social science theories that address the social constraints of the stakeholders during ERP requirements elicitation process. There is need for the requirements engineer to have a better understanding of the stakeholders’ social context so that they select the best elicitation technique to elicit the requirements in a particular context. (See Chapter 2 section 2.4.5) for further information about this theory.

3.2.3 Domain Theory

The Domain Theory was developed at the City of University of London by Sutcliffe and Maiden (1998). The theory was motivated by the cognitive science theory which fall in the knowledge representation category. The theory postulates a way of modelling the domain knowledge,

which should be based on the abstraction of the problem space. The problem space has to be understood by the requirements engineer before the design of the system. The Domain Theory postulated by Sutcliffe and Maiden (1998) is being used in Information Systems as a theory of expertise that help researchers in predicting and explaining concepts of abstraction which assist in requirements elicitation.

The Domain Theory asserts that the domain knowledge is a naturally occurring expertise that is help by the requirements engineer and to a less precise, by the stakeholders. So, for ERP requirements elicitation to be carried out successfully, there is need for the requirements engineer to be knowledgeable about the domain so that rich ERP requirements may be extracted. The cognitive theories of memory asserts that the human memory is organized hierarchically and studies reveal that requirements engineers tend to re-use abstractions or mental knowledge structures when dealing with new systems (Sutcliffe & Maiden, 1998). The theory asserts that there is need for a requirements engineer during requirements elicitation who would act as the facilitator or mediator between the ERP developers and the stakeholders during the requirements elicitation. (See Chapter 2 section 2.4.6)

3.2.4 Sociological perspectives applied in Information systems

Mavetera (2012:58) observed that any theoretical framework should encompass the assumptions, concepts and values of the stakeholders when examining the nature of reality. The sociological perspectives in Information systems seek to address the pattern or model that should be followed when developing ERP systems. The theory has been discussed in the preceeding chapter (see Chapter 2 section 2.4.2).

i) Functionalist Perspective

Information systems researchers who subscribe to this perspective believe that organizations are made of functional units which are ordered. Information systems professionals who operate in this perspective utilize reductionist principles in solving system problems. The perspective advocates one to use the right instruments and methods to find the truth (Mavetera, 2012:61). There are also other Information systems professionals working in other perspectives which need to be examined.

ii) Interpretive Perspective

The perspective advocates for the understanding of the social world from the subjective experience. The perspective assumes that stakeholders in an organization are diverse and in that regard they have different conflicting viewpoints to a problem (Robertson & Robertson,

2012). The perspective is based on the notion that the business environment is constantly changing due to changing government laws, cultural issues and others.

iii) Radical Structuralist Perspective

The perspective believes that the social conflicts within an organization are caused by political and economic crises within society. The approach seeks to address those stakeholders who are marginalized within an organization. The marginalized stakeholders may be discriminated in terms of their gender, culture, age or their social status in the society. This perspective see the assistance of the emancipator will help to liberate the suppressed interests of the marginalized stakeholders in the organization.

iv) The Radical Humanist Perspective

The approach is centred on radical changes but using a subjective approach. The radical humanist perspective believes that the organizations are too complex and the institutional problems cannot be addressed by using one method (Jones, 2014). The approach seek to accommodate diverse stakeholder perceptions during ERP requirements elicitation.

3.2.5 Stakeholder Theory

Freeman (1984) came up with the stakeholder theory and the theory has had a profound impact on researchers' on their perception in relation to the organization and its social environment. Organizations have a responsibility to their stakeholders and any decision that the organization should make, should involve the stakeholders also. However, stakeholders are diverse and they have different interests and perceptions regarding a specific issue. The stakeholder theory has been used to elicit requirements from stakeholders (Cheng and Atlee, 2007; Filieri et al, 2015).

The Stakeholder theory submits that stakeholders are complex and issues get complicated when the stakeholders are involved (Okesola et al, 2019). The complex arises from the fact that how do you identify the stakeholders and the selection criteria to be adopted when selecting the stakeholders (Okesola et al, 2019). When the requirements of the stakeholders are not taken on board during requirements elicitation, the developed system will fail to meet the stakeholders needs (Jokonya et al, 2015). The theory has been discussed before in the preceding chapter (see Chapter 2 section 2.4.4).

3.2.6 Summary of the Theoretical review

The theoretical review provided the lenses for the development of a conceptual framework. Research in Information Systems methodology approach need to be guided by theoretical

tenets, hence the need for a theoretical review and how it underpins the current study. The approach advocates for the role of the requirements engineer during requirements elicitation to examine the nature of knowledge. The framework is also informed by the tenets of the Domain theory which asserts that domain space has to be understood by the requirements engineer before the design of the system commences.

The conceptual framework is also informed by the Sociological perspectives which assert that organizations are social entities which can only be understood by considering the organizational social context. ERP requirements elicitation is a social activity calling for the consideration of stakeholders' social aspects when dealing with requirements. The conceptual framework is also informed by the Stakeholder theory when it comes to stakeholder identification and selection, both critical in minimizing overlooked and missing ERP requirements. (See Chapter 2 section 2.4.7) for the postulated constructs from the theoretical analysis.

3.2.7 Existing ERP Requirements Frameworks

The preliminary ERP requirements framework is also informed by the weaknesses and strengths of existing ERP requirements frameworks. The frameworks were examined in the preceeding chapter (see Chapter 2 section 2.5).

3.3 Preliminary ERP Requirements Elicitation Framework

The preliminary framework is informed by the findings from the preceeding chapter.

3.3.1 Study constructs

Andoh-Baidoo (2017) argued that the independent variables need to be defined and measured. The study identified the following independent variables which affect the ERP requirements elicitation process. The variables were extracted from the theoretical review done in the preceeding chapter. (See Chapter 2 section 2.4.7**)**.

Table 3-1: Study constructs

Author	independent variable	Constructs	Contribution
Sutcliffe and Maiden (1998); Jia and Capretz, 2018	Stakeholder Perceptions	Requirements engineer, Stakeholder	Perceptions of stakeholders affect ERP requirements elicitation
Sutcliffe and Maiden (1998); Broy, 2013; Portugal et al, 2016).	Domain knowledge	Data source, Regulations, Domain terminologies	Domain knowledge affect ERP requirements elicitation
Burrel and Morgan (1979); Pozzebon et al, 2014); (Burrell & Morgan, 2017).	Sociological perspectives	Functionalist, Interpretive, Radical Structuralist, Radical Humanist	Sociological perspectives affect ERP Requirements elicitation

Greenwood and Freeman, 2011; Desai, 2018; Razali , 2016	Stakeholder role	Dominant stakeholders,Demanding stakeholders, Dependent stakeholders, Dangerous stakeholders, Definitive stakeholders,Discretionary stakeholders, Demean stakeholders	Stakeholder's role affect ERP Requirements elicitation
Greenwood and Freeman, 2011; Desai, 2018; Filieri et al, 2015, Razali , 2016	Stakeholder characteristics	Age, Gender, Experience, Level of Education, Position	Stakeholder's characteristics affect ERP Requirements elicitation
Jackson, 2010	Elicitation Techniques	Personas, Scenario, Goals, Viewpoints	The Elicitation technique chosen affect ERP requirements elicitation process

3.3.2 Stakeholder Perceptions

The requirements engineer and the stakeholder's perceptions during ERP requirements elicitation are critical to the success of an ERP system. Jia and Capretz (2018) argue requirements can be extracted using the requirements engineer and the stakeholder's perceptions and failure to address their perceptions may lead to software project failures. Stakeholders usually need their views to be considered during ERP requirements elicitation so that the system developed meets their expected outcomes.

3.3.3 Domain Knowledge

In every domain there exist different notions, insights, and rules that should be adhered to during ERP requirements elicitation. Domain modelling is part of the problem-solving in ERP requirements elicitation. The operational system context of the domain which includes the ERP operational environment has to be understood by the requirements engineer so that all the available data sources are included during the requirements elicitation. The operational environment may include the existing systems that could be a good source for the ERP requirements and the government regulations that should not be violated during ERP requirements elicitation.

To capture ERP requirements efficiently, the domain concepts should be identified and if new concepts emerge, they should be updated timeously. The data sources for the domain knowledge should be identified before requirements elicitation starts. This will prevent missing important data sources crucial for capturing rich requirements for the new system being

developed. Parreira and Penteado (2015) observed that one of the key reasons why software projects fail is that even though software engineers are well versed with the requirements elicitation activities, in most cases they fail to understand the problem domain of the new system to be developed.

The requirements engineer also needs to be aware of the wider system context such as the business processes, technology used and the market forces. ERP requirements elicitation requires domain knowledge to capture high-quality requirements from stakeholders. Without adequate knowledge of the domain, poor requirements will be captured that will ultimately not meet the needs of the stakeholders. Domain knowledge can significantly reduce the confusion associated with terminology in a specific domain during information retrieval or questions and answer sessions (Feiliang, 2012).

3.3.4 The Sociological Perspectives.

The sociological perspectives clarifies the nature of the organizational problems that need to be solved and based on the problem identified, the requirements engineer will apply the suitable systems thinking approach to solve the problem.

3.3.4.1 Functionalist Perspective

The Functionalist Perspective anticipates that the problem to be solved in the organization is well structured, the problem is also technical and places less reliance on human aspects (Daellenbach, 2001; Checkland & Poulter, 2010). The perspective is also based on the assumption that organizations are made up of artefacts that can be identified and measured using natural science methods and if one method cannot provide an optimum solution another method will be chosen (Mavetera, 2011). To capture accurate ERP requirements for an institution, the requirements engineer must adhere to the assumptions of the perspective. In this regard, the requirements engineer will work with the managers who will outline the institutional objectives for the new ERP system to be developed and the requirements engineer will translate the objectives into a new system using the best means. The requirements engineer will apply the Hard Systems Thinking approach (see Chapter 2 section 2.4.3), to solve organizational problems.

3.3.4.2 Interpretive Perspective

The perspective assumes that the stakeholders in the institution have conflicting viewpoints to a problem (Niu et al, 2011; Robertson & Robertson, 2012). The perspective is best applied in institutions where obtaining requirements from stakeholders and coming up with the best

solution to a problem is very complex. The perspective is based on the notion that the business environment is constantly changing due to mutable government laws, cultural issues and others. The requirements engineer will work with the diverse stakeholders to come up with the requirements that meet the organizational objectives. The perspective advocates for the participatory approach of all the affected stakeholders in ERP requirements elicitation. The Soft Systems Thinking approach (see Chapter 2.4.3), will be applied by the requirements engineer which advocates for the participatory approach of all the affected stakeholders.

3.3.4.3 Radical Structuralist Perspective

This approach seeks to address the marginalised stakeholders whose views are not taken into consideration because of the influence of some stakeholders with power in the organization (Petrović, 2016). The requirements engineer should consider the needs of the marginalised stakeholders so that their day to day work is made more enjoyable and rewarding. The requirements engineer is viewed as an emancipator bringing together the requirements of the various stakeholders in the new system. The emancipator will help to liberate the suppressed interests of the marginalised stakeholders and the stakeholders will be able to give their requirements during the requirements elicitation process. The Emancipatory Systems Thinking approach (see Chapter 2 section 2.4.3), will be applied by the requirements engineer to solve the organizational problems.

3.3.4.4 The Radical Humanist Perspective

The approach advocates for radical changes but using a subjective approach. It recognizes the importance of stakeholders' participation during requirements elicitation. The radical humanist perspective believes that the institution is too complex and the institutional problems cannot be addressed by using one method (Jackson, 2010; Jones, 2014). The approach is based on the notion that during requirements elicitation, the requirements engineer may use different techniques to elicit requirements from stakeholders due to the complexity of the requirements. One method will not capture all the requirements from the stakeholders, hence the need for diversity in methodologies so that rich requirements may be captured. Critical Systems Thinking and Practice (see Chapter 2 section 2.4.3), will be applied by the requirements engineer to solve the organizational problems.

3.3.5 Stakeholder Role

The stakeholder theory advocates for the selection of stakeholders to be involved in requirements elicitation (see Chapter 2 section 2.4.4). The stakeholders need to be classified according to their roles so that crucial roles are not left out in the process. Ryan (2014) argues that in any requirements elicitation activity, there is a need to identify the stakeholders from whom the requirements will be elicitated. Katonya and Sommerville (2000) also argues that there is a need to identify the right stakeholders to extract requirements from. The right stakeholders can be identified by using the stakeholder groups and from those groupings, the required stakeholders will be selected. Sadiq and Jain (2014) postulate that stakeholders can be identified by grouping the stakeholders into two categories which are the primary and secondary stakeholders.

Nisar et al (2015) argued to come up with good quality software, stakeholders need to be involved at each during the ERP requirements elicitation process. Anwar and Razali (2015) also suggest that stakeholder identification during requirements elicitation has a significant impact on the quality of the elicitated requirements. When inappropriate stakeholders are selected during the ERP requirements elicitation, the requirements extracted fail to address the real needs of the stakeholders. The requirements engineering community sought to end the software crisis problem but in the process created another problem, on how to elicit requirements from diverse stakeholders from different backgrounds (Nisar et al, 2015). Anwar and Razali (2016) also observed that the influence of a stakeholder during requirements elicitation is very critical so the stakeholder selection should also cater to the stakeholder role and their influence on the project. So there is a need to identify the right stakeholders for quality ERP requirements to be elicitated.

3.3.6 Stakeholder Characteristics

Anwar and Razali (2015) argued that it is crucial to select stakeholders based on the following characteristics: stakeholder role, stakeholder knowledge, and stakeholder interest and communication skills. Darwish (2016) also argued that the stakeholder's skill in explaining their requirement during the ERP requirements elicitation is critical. In most cases, the stakeholder knows but may not be able to articulate their requirements during the elicitation process.

Al-Zawahreh and Almakadmeh (2015) observed that a lack of stakeholder experience and lack of communication between stakeholders may lead to extracting poor requirements. The experience of the stakeholder goes a long way in extracting quality ERP requirements. Celar et al (2010) observed that stakeholder's power within the organization, the stakeholder's

impact on the project, stakeholder's knowledge and stakeholder's willingness to participate in the project are critical stakeholder's characteristics that should be included when selecting stakeholders.

3.3.7 ERP Requirements Elicitation

The theory postulates that conversations during requirements elicitation take place in specific location and time. The conversations are on the ERP knowledge extraction from the stakeholder by the requirements engineer. The knowledge from the conversations is usually interpreted against the norms, culture, and assumptions about the organizational context. In order to obtain the tacit knowledge, there is a lot of unknowns that need to be known from the conversations. The unknown knowledge held by the stakeholder can be extracted by using an appropriate requirements elicitation technique allowing them to recall, articulate, and express the relevant tacit knowledge. Based on the stakeholder's characteristics, the requirements engineer can select the best elicitation technique to extract the tacit knowledge from the stakeholder. The elicitation technique can augment in making the unknown known and this takes us to the proposed elicitation techniques to identify the unknowns. (See Chapter 2 section 2.6).

3.3.7.1 Personas

A persona is a way of representing the stakeholder's goals and behaviour. The persona is generated from the interviews done by the stakeholders. The persona differs from other elicitation techniques as they concentrate on accuracy and correctness of requirements, on the other hand, the personas employ an analogical approach that enables a requirements engineer to get a deep understanding of the stakeholder's requirements (Cheng and Atlee, 2007; Bavani and Ahmad, 2008). To make the persona more real, the persona includes the user's name, the photograph together with their social status. Personas facilitate requirements to be grouped from various stakeholders in an organization in a structured and organized manner. The personas will greatly assist the requirements engineer to group large amounts of stakeholder data and come up with unique stakeholder groups that will be used to elicit the requirements. To fully grasp the stakeholder's needs, several personas will be written to take into consideration different scenarios that may arise while the stakeholder is trying to reach a specific goal. Personas help in discovering the unknowns from the persona created. (See Chapter 2 section 2.6.1.1)

3.3.7.2 Scenarios

Any mistakes made during requirements elicitation will lead to major systems failure or a complete abandonment of the system development which will be coupled with huge financial losses to the organization (Parker, 2012). Stakeholders have problems in explaining their needs during requirements elicitation, but they find it easy to explain what they do every day and the problems associated with doing their tasks using scenarios. Parker (2012) observed three types of scenarios that can be used during requirements elicitation: problem scenarios which describe the problems faced by stakeholders in performing their tasks; activity scenario which articulates how stakeholders perform their tasks each day and lastly interaction scenarios which describe how the stakeholders communicate with the system. Benner et al (2014) write that scenarios help discover non- functional and functional requirements that the traditional requirements elicitation techniques will not be able to pick. In a nutshell, the scenario documents the activities and problems identified by the personas (Parker, 2012). The scenarios are grouped into three categories namely; the problem scenario which describes the problems stakeholders have in performing their work; the activity scenario which describes how the stakeholders perform their work daily and lastly the interaction scenario which describes how the stakeholders will interact with the ERP system (Parker, 2012). (See Chapter 2 section 2.6.1.2)

3.3.7.3 Goals

The goal sub-component facilitates in clarifying requirements in cases where the stakeholders cannot elaborate precisely on the first requirements, especially when dealing with non-functional requirements (Asuncion, 2009). Goals help in handling conflicting requirements from diverse stakeholders who may have different views (Horkoff & Yu, 2013). The organizational business processes need to be identified for the goals to be formulated. The goal formulation should also take into consideration the psychological and social needs of the stakeholders and not to focus on the technical aspects only. The goals are helpful as they can pick missing or overlooked requirements from the stakeholders. Aljahdali et al (2011) argued that stakeholders define goals for the new ERP system and the requirements engineer will need to probe the stakeholders why these goals are needed, how to achieve them and who is responsible for meeting that goal. In this way the “why” questions help in extracting more requirements from the stakeholders and by so doing reducing cases of missing ERP requirements and overlooked requirements.

Goals have been used in requirements elicitation in a bid to meet the stakeholder’s requirements (See Chapter 2 section 2.6.1.3). Stakeholders often become more aware of their

requirements when they identify a goal and in the process, they can also identify sub-goals. Goals can help in clarifying requirements in cases where the stakeholders cannot elaborate precisely on the first requirements, especially when dealing with non-functional requirements like security, performance, usability, and others (Asuncion, 2009). The goal approach assists the requirements engineer in checking the risks associated with not meeting a specific goal (Horkoff & Yu, 2013).

3.3.7.4 Viewpoints

The viewpoint approach in requirements elicitation recognizes that the system requirements cannot be elicited from a single perspective but the requirements are collected from different viewpoints (Kessi et al, 2014). The requirement source is referred to as the viewpoint. Information obtained from different viewpoints will be combined to make the requirements for the ERP system. The sources of requirements will come from stakeholders, other systems that communicate with the ERP system being developed, environment entities that will be affected by the new system being developed (Salem, 2010). The viewpoints approach enables the requirements engineer to elicit requirements for the ERP system from different sources and this will lead to rich requirements being obtained. (See Chapter 2 section 2.6.1.4)

The next section proposes an improved ERP requirements elicitation framework to be used by universities.

3.4 Proposed Preliminary ERP Requirements Elicitation Framework

The previous sections discussed the various components that make up the preliminary ERP requirements elicitation framework. Each component addresses a specific problem in the ERP requirements elicitation framework. The proposed preliminary ERP requirements elicitation framework was informed by the existing ERP requirements elicitation frameworks and theoretical review discussed in the preceeding chapter (see Chapter 2 section 2.5) and (see Chapter 2 section 2.4.7).

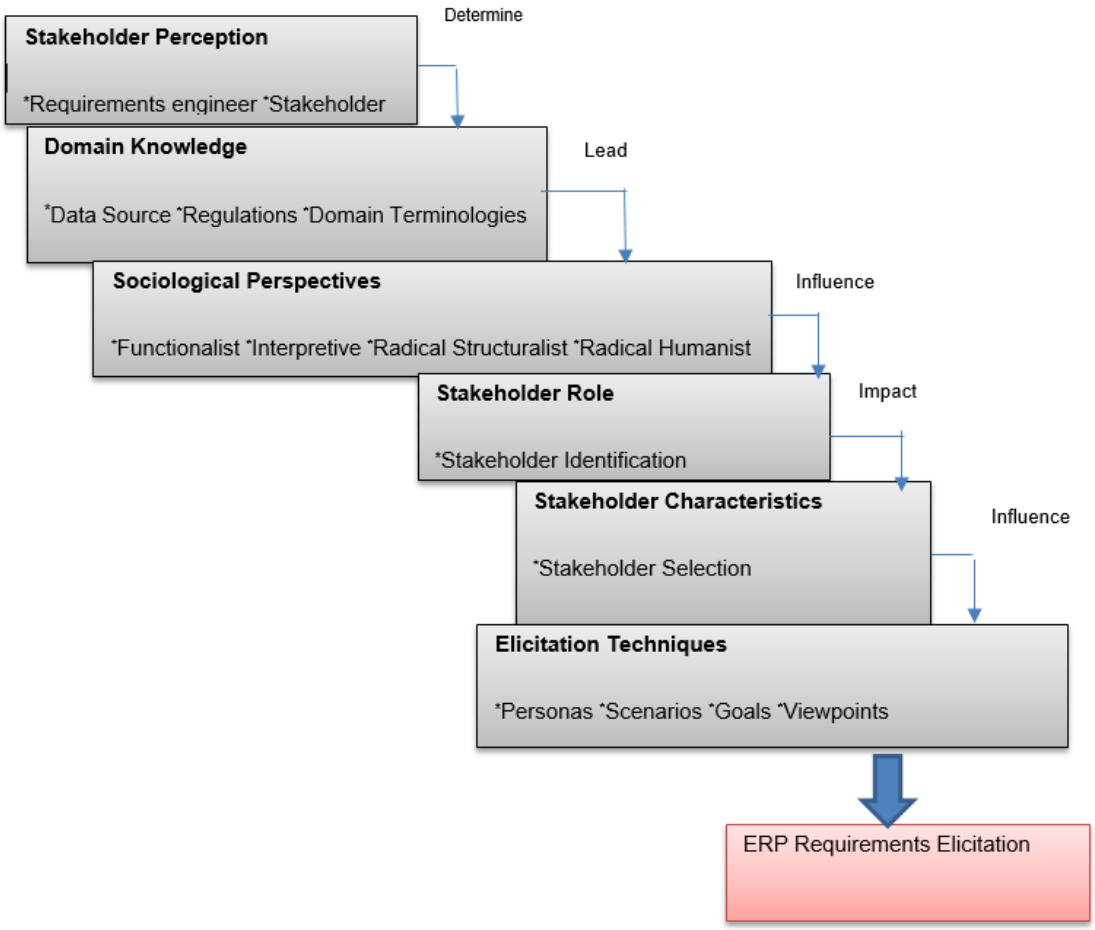


Figure 3- 1: Preliminary ERP Requirements Elicitation Framework

Figure 3.1 illustrates the preliminary ERP requirements elicitation framework composed of six components. The components are as follows: *Stakeholder Perception, Domain Knowledge, Sociological Perspectives, Stakeholder Role, Stakeholder Characteristics and Elicitation Techniques.* The preliminary ERP requirements elicitation framework appreciates there is no singular approach when dealing with ERP requirements but there is need to look at each problem from different perspectives to reach an optimum solution. Universities are complex entities with diverse stakeholders and viewpoints, calling upon all stakeholders to look at the problem holistically for rich ERP requirements to be elicited. The proposed ERP requirements elicitation framework could assist universities during the requirements elicitation process so that rich requirements that address the needs of the stakeholders are ultimately extracted.

3.5 Discussion of the Framework

This section discusses briefly the contribution of each component in the ERP requirements elicitation framework.

3.5.1 Stakeholder Perception

The stakeholder perception component ensures that the stakeholders and the requirements engineers' perceptions have to be understood before the ERP requirements elicitation process commences. Jia and Capretz (2018) underscored the need to take on board the perceptions of the stakeholders and the requirements engineers to prevent missing ERP requirements. The requirements engineer needs to explain the purpose of the ERP requirements elicitation process to the stakeholders and why the stakeholder's input is crucial to the success of the ERP project.

3.5.2 Domain knowledge

The domain knowledge component ensures that ERP project scope is set as this guides the ERP requirements engineer during elicitation to consider those that fall within the ERP project scope. The component also anticipates that the requirements engineer identifies the various data sources that may assist the requirements engineer during the ERP requirements elicitation process (see Chapter 2 section 4.6). The component is expected to empower the requirements engineer with the domain technical terms so that they understand the domain vocabulary for them to understand the ERP requirements during elicitation (see Chapter 2 section 4.6). The component also advocates for ERP requirements that do not violate the government regulations (see Chapter 2 section 4.6).

3.5.3 Sociological Perspectives

The sociological perspectives component assists the requirements engineer to understand the nature of the problem at hand before requirements elicitation could start. The framework expects that if the nature of the problem is fully understood, then the appropriate approach would be taken to address the problem at hand. The institutional problems need to be looked at from different perspectives by the requirements engineer so that rich requirements may be extracted from the stakeholders (see Chapter 2 section 4.2). The sociological perspectives component is made up of four sub-components which are functionalist, interpretive, radical structuralist and radical humanist. The following section addresses the contribution of each sub-component to the proposed framework.

3.5.3.1 Functionalist Perspective

The functionalist perspective sub-component anticipates that the problem to be solved in the organization is well structured, the problem is also technical and places less reliance on human aspects (Checkland & Poulter, 2010). The sub-component also anticipates that institutions are made up of artefacts that can be identified and measured using natural science methods and if one method cannot provide an optimum solution another method will be chosen (Mavetera, 2011). The sub-component also anticipates that stakeholders have unitary worldviews and in that regard, stakeholders agree on the ERP requirements (see Chapter 2 section 3.1).

The component is useful in that the requirements engineer will select managers who will outline the requirements for the institution since stakeholders do not have diverging views on ERP requirements. The proposed preliminary framework expects the requirements engineer to apply the Hard Systems Thinking approach to solve the organizational problems (See Chapter 2 section 4.3). However, most institutions do not have consensus when it comes to the nature of ERP requirements, hence the need to look at other sociological perspectives.

3.5.3.2 Interpretive Perspective

The interpretive perspective sub component assumes that the stakeholders in the institution have different conflicting perceptions and viewpoints to a problem (Robertson & Robertson, 2012). The preliminary framework anticipates that institutions are made up of diverse stakeholders with totally different perceptions hence there is a need to consider their different worldviews during requirements elicitation (see Chapter 2 section 3.2). The framework expects the requirements engineer to work with the diverse stakeholders to come up with the ERP requirements to meet the institutional objectives. The preliminary framework expects the requirements engineer to apply the Soft Systems Thinking approach which advocates for the participatory approach of all the affected stakeholders (see Chapter 2 section 4.2). However, some institutions do have a coercive problem situation so there is a need to consider other sociological perspectives to understand the nature of the problem.

3.5.3.3 Radical Structuralist Perspective

The radical structuralist sub-component seeks to address the marginalized stakeholders whose views are not taken into consideration because of the influence of some stakeholders with power in the institution (Petrović, 2016). The preliminary framework expects the requirements engineer to take into consideration the requirements of the marginalized stakeholders so that their day to day work is made more enjoyable and rewarding. The

marginalized stakeholders are based on their demographic characteristics such as their race, status, and gender (Hassan, 2013). The preliminary framework expects the requirements engineer to be the emancipator who may bring together the requirements of the marginalized stakeholders into the new system. The framework expects the requirements engineer to apply the Emancipatory Systems Thinking approach in solving the institutional problems (see Chapter 2 section 4.5). However, some institutions do have very complicated problem situations that may need more than one sociological perspective to be understood, so there is a need to consider the last perspective to understand the nature of the problem.

3.5.3.4 Radical Humanist Perspective

The radical humanist sub-component advocates for radical changes but using a subjective approach. The perspective believes that the institution is too complex and the institutional problems cannot be addressed by using one method (Jackson, 2010; Jones, 2014). The preliminary framework expects the requirements engineer to use different techniques to elicit ERP requirements from stakeholders due to the complexity of the problem situation. One method will not capture all the requirements from the stakeholders, hence the need for pluralism of methods in eliciting ERP requirements. The preliminary framework expects the requirements engineer to apply the Critical Systems Thinking and Practice in solving the institutional problems (see Chapter 2 section 4.4).

3.5.4 Stakeholder Role

The stakeholder role component advocates for identifying the stakeholders who would be involved in the ERP requirements elicitation process. Katonya and Sommerville (2000) also argued that there is a need to identify the right stakeholders to extract requirements from. So the right stakeholders can be identified by first classifying the stakeholders into different categories so that crucial stakeholders are not left out. Various stakeholder categories will be used to identify the right stakeholders to be involved during ERP requirements elicitation (see Chapter 2 section 6.4). The stakeholder's role will be used by the requirements engineer to identify various stakeholders in the organization.

In the functionalist perspective component, the requirements engineer will consider the Dominant and Dangerous stakeholders since all other stakeholders are believed to share the same requirements. However, for the interpretive perspective component, since stakeholders have diverse conflicting perceptions of a problem the preliminary framework expects the requirements engineer to consider all the stakeholder's categories. The radical structuralist

component, the preliminary framework expects the requirements engineer to consider the Dormant, Definitive, Dependent and Demean stakeholders. Lastly, in the radical humanist perspective component, the proposed framework expects the requirements engineer to consider all the stakeholder categories since institutions are too complex and the institutional problems cannot be addressed by using one method.

3.5.5 Stakeholder Characteristics

The stakeholder characteristics component anticipates that after the right stakeholders have been identified then there is a need to select the stakeholders who will be involved with the actual ERP requirements elicitation process. The proposed framework advocates for stakeholder characteristics to be used as the selection criteria for the stakeholders during the ERP requirements elicitation process. The proposed framework advocates for the following stakeholder characteristics to be used by the requirements engineer in selecting stakeholders. The stakeholder's Gender, Experience, Communication Skills, Age, Interest, Domain Knowledge, Culture, Cognitive Style, Social Embeddedness, Position and Level of Education (see Chapter 2 sections 6.2 to 6.3). The proposed stakeholders' characteristics will help in extracting tacit knowledge during ERP requirements elicitation since the attributes cater for the stakeholder's diversities and thereby getting different perceptions with regards to ERP requirements.

3.5.6 Elicitation Technique

The elicitation technique component is made up of four sub-components which assist the requirements engineer in extracting rich ERP requirements. The sub-components are persons, scenarios, goals and viewpoints (P-S-G-V). The unknown knowledge held by the stakeholder can be extracted by using an appropriate requirements elicitation technique that enable them to recall, articulate and express the relevant tacit knowledge. The elicitation technique can greatly augment in making the unknown known so this takes us to the proposed elicitation techniques that can help to discover the unknowns. The proposed framework will help the requirements engineer in selecting the appropriate technique to extract the ERP requirements.

3.5.6.1 Personas

The personas sub-component ensures that the requirements engineer discovers ERP requirements by engaging with the stakeholders. By creating a fictitious or imaginary to

represent a group of stakeholders and focusses on the stakeholder's goals and behaviour, this ensures that ERP requirements are not missed or overlooked (Turner et al, 2013). Feelings associated with the system's quality, responsiveness and other characteristics can be extracted from the stakeholders. Since personas are generated from the data obtained during interviews with stakeholders this makes the fictitious personal details associated with the persona to be more real in addressing the needs of the stakeholders (see Chapter 2 section 8.1.1). The notion of personas in requirements elicitation will assist the requirements engineer in comprehending the requirements of a real user and their characteristics (Schneidewind et al, 2012).

3.5.6.2 Scenarios

The scenario sub-component acknowledges that the stakeholders have problems in explaining their requirements during requirements elicitation, but they find it easy to explain what they do every day and the problems associated with doing their tasks using scenarios. The scenario description by the stakeholders will enable the requirements engineer to identify possible exceptions or errors that may be associated with a single scenario, thereby discovering tacit knowledge that may be difficult to elicit from the stakeholders. Benner et al (2014) write that scenarios help discover non- functional and functional requirements that the traditional requirements elicitation techniques will not be able to pick. The scenario seeks to address the communication gap that exists between diverse stakeholders as the stakeholders prefer using the natural language while the requirements engineers use technical terms that the stakeholders cannot comprehend (see Chapter 2 section 8.1.2). The communication gap that exists between the requirements engineer and the stakeholders is closed by the use of user stories as the stakeholders express their requirements using the natural language which in most cases is vague. Scenarios help in understanding the requirements of the system fully together with the actors involved in meeting a specific business task (see Chapter 2 section 8.1.2). The use of scenario-based requirements elicitation will require stakeholders with experience in doing a certain business task as the approach requires the stakeholder to reflect on the way they used to do a business task and how they want the system to be developed to execute that task (see Chapter 2 section 8.1.2).

3.5.6.3 Goals

The preliminary framework acknowledges that the goals help the requirements engineer in handling conflicting requirements from diverse stakeholders who may have different views on a requirement (Horkoff & Yu, 2013). The goal formulation should also take into consideration the psychological and social needs of the stakeholders and not to focus on the technical

aspects only. The proposed framework will help the stakeholders to refine their goals by identifying a goal the ERP system should meet then further broke it down into sub goals and each sub goal's contribution will be identified by the requirements engineer (see Chapter 2 section 8.1.3).

3.5.6.4 Viewpoints

The viewpoints sub-component acknowledges that ERP requirements cannot be elicited from a single perspective but the requirements are collected from diverse viewpoints (Kessi et al, 2014). The requirement source is referred to as the viewpoint (see Chapter 2 section 8.1.4). The diverse sources of ERP requirements will come from stakeholders, other systems that communicate with the ERP system being developed and the environment entities that will be affected by the new system being developed (Salem 2010). Information obtained from these different viewpoints will be combined to come up with the ERP requirements for the new system. Getting the perspectives of the diverse viewpoints during requirements elicitation will enable the requirements engineer to extract the tacit knowledge required for the ERP requirements.

The proposed framework proposes that the ERP requirements elicitation should not be done using one technique because some unknowns in requirements will not be extracted. The viewpoints ought to be augmented by another requirements elicitation technique so that rich requirements may be obtained. The proposed framework will use a combination of these four techniques and the requirements engineer will apply the elicitation technique basing on the problem at hand. The four elicitation techniques are collectively termed the Persona-Scenario-Goal-Viewpoint Methodology (P-S-G-V).

3.6 Chapter summary

The chapter discussed the proposed framework for ERP requirements elicitation which has got the potential to solve ERP requirements elicitation at universities. The framework was constructed on the understanding that the ERP requirements elicitation process is complex and highly subjective and requires a framework that takes into consideration the social and the technical aspects in addressing the ERP requirements. The framework was informed by the strengths and weaknesses of existing frameworks identified during the literature review, also the theoretical review informed the proposed framework. The main assumption is that for effective ERP requirements elicitation to take place, stakeholder perceptions of the requirements engineer and the stakeholders need to be understood first for rich ERP requirements to be extracted. Also, the Domain Knowledge has to be understood by the

requirements engineer so that relevant data sources may be identified which aid in extracting requirements for the new ERP system.

The stakeholder's problems can be understood from a sociological perspective, hence the need to consider the stakeholder's social context for ERP requirements to be extracted. The stakeholder's social context can be better articulated using sociological perspectives. Each sociological perspective addresses a unique problem space. After the problem has been identified, then the requirements engineer needs to find the appropriate technique to solve that problem. The stakeholders also need to be identified using the stakeholder's roles, the roles are categorised into diverse categories to prevent missing crucial categories. The stakeholder characteristics will then be used to select the stakeholders to be involved during the ERP requirements process. The framework also proposes to use the P-S-G-V approach in eliciting the requirements of the stakeholders. Since universities are a complex organisations, the proposed framework advocates for an approach that uses different methods to elicit ERP requirements.

In summary, the chapter proposed an ERP requirements elicitation framework that assists universities during requirements elicitation. However, the proposed framework needs to be validated by action research to check its usefulness in addressing the ERP requirements elicitation process. The next chapter will discuss the research methodology to be adopted in validating the proposed ERP requirements elicitation framework.

CHAPTER 4 RESEARCH METHODOLOGY

4.1 Introduction

The preceding chapter proposed a framework informed by the findings from the literature review. This chapter discusses the research methodology used to develop and validate the proposed new ERP requirements elicitation framework. The chapter is organized into the following sections: the research philosophy to understand the nature of the problem at hand. The research strategy informs the type of research method adopted to validate the proposed new framework. The data collection process followed in validating the preliminary framework is outlined, culminating in the development of the new framework that is expected to assist universities with ERP requirements elicitation.

The researcher followed the research onion proposed by Saunders et al (2011) so that crucial stages were not left out.

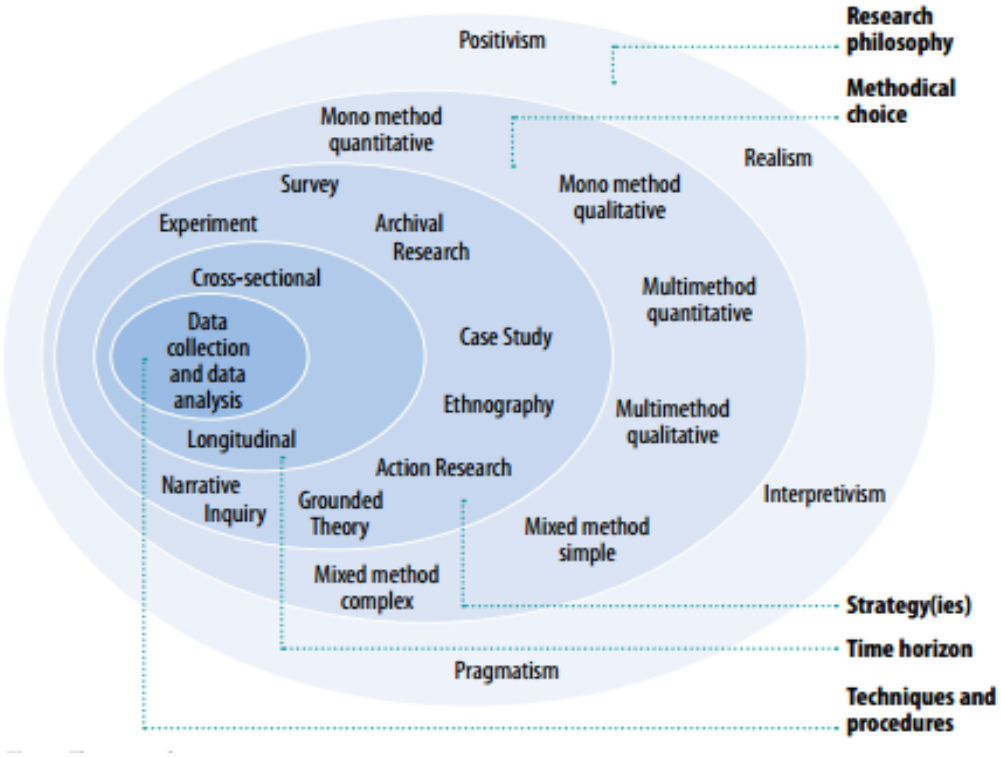


Figure 4- 1: The research design (Saunders et al, 2009)

4.2 The Research Philosophy

The research philosophy seeks to define the underlying nature of knowledge being investigated. Flick (2015) argues that philosophical assumptions guide the researcher on how

the research is carried out to answer the research problem. The nature of knowledge investigated could help in selecting the appropriate research philosophy (May, 2011). Academic scholars have diverse views on the philosophical foundations of the research approach (Mkansi & Acheampong, 2012). The epistemological foundations of the differences in philosophy should not dictate the data collection method adopted neither should that dictate the data analysis approach employed. Mkansi and Acheampong (2012) raise a question on how philosophy is best suited for social sciences or natural sciences. The field of Information Systems does overlap into other fields like Computer Science, Business and Social Sciences (Steinmetz, 2005; Mkansi & Acheampong, 2012). The academic debate is centred on whether the quantitative approach should be used in natural sciences and qualitative approach used in social sciences (Babbie, 2007; Steen and Roberts, 2011). This raises a question: which philosophy is best to apply in a given field?

Creswell and Poth (2016) defined a paradigm as a set of beliefs in which action is guided. Ontology is the study of being (Scotland, 2012) and the ontological assumptions are based on what constitutes reality. Epistemology is based on the nature and forms of knowledge (Cohen et al, 2007). Epistemological assumptions are based on how knowledge is created and communicated (Scotland, 2012). Each research paradigm is based on its own ontological and epistemological assumptions. Different paradigms contain different ontological and epistemological views, meaning that they have different assumptions on what constitutes reality and knowledge. This is usually evident in the methodology and methods used in the research.

4.2.1 Research paradigms

The most common paradigms are the pragmatism, interpretivism, realism and positivism (Saunders et al, 2009).

4.2.1.1 Interpretivism paradigm

The interpretivist paradigm is premised on the notion that human beings interpret their own world to derive meanings and act on their interpretation (Pham, 2018). In that regard, a phenomenon may have multiple interpretations. The diversity in interpretations of the phenomenon under investigation assist the researchers in getting a deeper understanding of the phenomenon. However, Cohen et al (2011) observed that Interpretivists seek to obtain a deeper understanding of the phenomenon under investigation with its complexity but without generalizing the findings to other contexts. Scotland (2012) also observed that if reality is subjective for Interpretivists as it varies from one researcher to another, then Interpretivists may have challenges arriving at the same conclusion. A number of researchers in ERP

requirements used the interpretivist paradigm to get a deeper understanding of the phenomenon under investigation (Bitsini, 2016; Alhajaj, 2018; Nguema, 2018).

4.2.1.2 Positivism paradigm

Aliyu et al (2014) argues that positivism is premised on the idea that truth and reality is independent of the viewer and observer. Positivist views are associated with the quantitative research approach as reality can be discovered, measured and is independent from the observer. The positivist paradigm advocates for real and factual happenings that could be studied scientifically and explained in a lucid manner. The predicament with the positivism is that it can only be applied in quantitative researches which can be measured scientifically (Chowdhury et al, 2020). A number of researchers in ERP requirements utilized the positivism paradigm to discover reality of the phenomenon under study (Uddin et al, 2020; Jayawickrama et al, 2017).

4.2.1.3 Pragmatism paradigm

Morgan (2014) argues that the fundamental principle in pragmatism is rooted in its practicality: how can the research problem be solved? Kivunja and Kuyini (2017) argue that it was impossible to access the "truth" by virtue of using one method as advocated by the positivist paradigm nor was it possible to obtain social reality as postulated by the interpretivist paradigm. Pragmatism seeks to provide practical and pluralistic approaches to research that may allow the use of diverse methods on the behaviour of participants and their beliefs. Creswell et al (2011) noted that the paradigm is supported by the mixed methods which utilize the multiple viewpoints to address the research problem.

4.2.1.4 Justification for using the pragmatism paradigm

To better articulate the phenomenon under investigation, it is crucial to have multiple views of the problem by using both the quantitative and qualitative approaches. The research adopted the pragmatism because the paradigm focuses on addressing the ERP research problem and adopts a pluralistic approach. This paradigm was chosen because it combines positivism in using the quantitative approach and interpretivism in the qualitative approach.

4.3 The Research Approaches

The research approach is a systematic plan of action carried out to answer the research questions. The research methodologies fall into two categories: quantitative and qualitative approaches. According to Landrum and Garza (2015), quantitative is numeric in nature while qualitative is non-numeric. The qualitative approach is based on the researcher's

interpretation of the phenomenon under investigation to get a deeper understanding. The quantitative approach is based on real and factual happenings that can be measured and explained in a lucid manner. The qualitative is supported by the interpretivist paradigm while the quantitative is supported by the positivist paradigm (Scotland, 2012). The following Figure 4.2 shows the pragmatic alternative to the issues applied in social science researches.

A Pragmatic Alternative to the Key Issues in Social Science Research Methodology

	Qualitative Approach	Quantitative Approach	Pragmatic Approach
Connection of theory and data	Induction	Deduction	Abduction
Relationship to research process	Subjectivity	Objectivity	Intersubjectivity
Inference from data	Context	Generality	Transferability

Figure 4- 2: A pragmatic alternative (Morgan, 2007).

Figure 4.2 shows various approaches that could be followed when doing research. Liu (2016) observes that the inductive approach employed in qualitative studies seeks to generate new theory or themes from the emerging data. The relationship to the research process in the qualitative approach is highly subjective because it is premised on the researcher's interpretation which may vary from one researcher to the other (Scotland, 2012). The qualitative approach works very well with a small sample size. However, the findings from the qualitative approach may not be transferable to other contexts (Cohen et al, 2011). The quantitative approach uses the deductive strategy where a hypothesis is developed and tested (Woo et al, 2017). The relationship to the research process is very objective because reality can be measured scientifically (Aliyu et al, 2014). The qualitative approach works very well with a bigger sample size. According to Morgan (2007), the pragmatic approach combines the qualitative and the quantitative approaches to come up with abduction reasoning, intersubjectivity and transferability. According to Chan (2017), the abduction approach goes back and forth between the inductive and the deductive approaches by converting observations into theories and assessing the theories through action. The intersubjectivity used in the pragmatic approach implies that diverse people or groups are consulted and new knowledge created is essentially transferable to other contexts.

The phenomenon under investigation dictates the type of approach to utilise to generate new knowledge, on whether to use qualitative or quantitative or to combine both (Morgan, 2007).

The quantitative approach is best used to pre-test hypothesis and develop generalized results. The approach is best used in answering "*what*" research questions. On the other hand, the qualitative approach is best used to get a deeper understanding of the phenomenon under investigation. The approach is best used in answering "*why*" and "*how*" research questions. Based on the nature of this research, the researcher adopted the pragmatic approach, the mixed method approach to dealing with the current research problem.

4.3.1 Mixed methods

To address the research problem, there was a need for a practical approach using multiple viewpoints to enhance the accuracy of the findings. If the multiple viewpoints arrive at the same conclusion, then the accuracy of the research is not contestable. Venkatesh et al (2013) observed that the mixed method approach proffers the researcher with complementary and contradictory conclusions from the two strands: the qualitative and the quantitative studies. These divergent views helped the researcher to re-examine the conceptual framework and the assumptions associated with each mixed-methods strands. Venkatesh et al (2013) observes that from 2001 to 2007, research done in Information Systems in 6 major IS journals using the mixed methods approach were less than 5%. There is a need for Information Systems researchers to use the mixed methods approach. The mixed research method uses two approaches; the researcher may commence with the qualitative research approach in the first phase of the study and then use the quantitative research approach in the second phase of the study or vice versa (Mafuwane, 2012:91). Alternatively, the approaches may be done concurrently (Doyle et al, 2009; Guetterman et al, 2015).

When positivist and interpretivist paradigms are evident in the study, it is advisable to use pragmatism which does not follow the strict positivism and interpretivist paradigms (Venkatesh et al, 2013). A mixed method research seeks to work on the strengths of quantitative and qualitative methods in addressing the research problem (Johnson & Onwuegbuzie, 2004; Auer-Srnka & Koeszegi, 2007). Creswell and Clark (2007) and Guetterman et al (2015) categorised mixed methods according to the following distinctions:

- **Embedded:** This approach embeds the qualitative approach in a quantitative approach or vice versa but with one approach playing a bigger part than the other. For example having a bigger quantitative approach with a small qualitative approach.
- **Convergent designs:** This approach involves quantitative and qualitative data collection and analysis being done at similar times and the stages are followed by the integrated analysis.

- **Sequential mixed methods approach:** This approach uses two methods. The researcher may choose to use the first method and do data analysis and proceed to use the other method. The two methods are given the following names depending with which method starts first. The sequential exploratory approach commences with a qualitative data collection and analysis while the sequential explanatory approach commences with the quantitative data collection and analysis.

The researcher adopted the mixed methods because this helped in explaining the complex phenomenon of requirements elicitation in ERP systems.

4.3.1.1 Purpose of mixed methods

Venkatesh et al (2013) postulated that the mixed methods is not the panacea that will lead to discovery, development, or extension of substantive theories. The use of mixed methods in a study need to serve a purpose. The table 4-1 below summarises the seven purposes of mixed research methods.

Table 4-1 Purposes of mixed methods research (Adapted from Venkatesh et al, 2013)

Purposes	Description	Examples	Illustration
Complementarity	Mixed methods used to gain complementary view about the same phenomena.	Venkatesh et al (2016); Hendren et al (2018); Hughes et at (2021)	A qualitative study was used to gain insights on the findings from the quantitative study.
Completeness	Mixed methods used to make sure a complete picture of the phenomena under study is obtained.	Hong et al (2018); Venkatesh et al (2014); Sparkes (2015) Corrigan & Onwuegbuzie (2020)	The qualitative data and results provided rich explanations from the quantitative data.
Developmental	Questions of one strand emerge from the inferences of the previous one.	Venkatesh et al (2016); Schoonenboom & Jonnson (2017); Teddlie & Tashakkori, (2009) Corrigan & Onwuegbuzie (2020)	A qualitative study was used to develop constructs and hypothesis and the quantitative study tested the hypotheses.
Expansion	Mixed methods are used to expand the understanding obtained in the previous study.	Riazi & Candlin (2014); Teddlie & Tashakkori, (2009) Corrigan & Onwuegbuzie (2020)	The findings from one study for example qualitative study were expanded by examining the findings from the other quantitative study.
Corroboration/ Confirmation	Mixed methods are used to assess the credibility of inferences obtained from one strand.	Venkatesh et al (2016); Teddlie & Tashakkori, (2009) Schoonenboom & Jonnson (2017);	A quantitative study was conducted to confirm the findings from the qualitative study.
Compensation	Mixed methods are used to compensate the	Venkatesh et al (2016);	The quantitative analysis compensated for small

	weaknessess of one strand by using the other.	Teddlie & Tashakkori, (2009) Corrigan & Onwuegbuzie (2020)	sample size in the qualitative study.
Diversity	Mixed methods are used in order to obtain divergent views of the phenomena under study	Teddlie & Tashakkori, (2009); Mertens (2014); Corrigan & Onwuegbuzie (2020)	Qualitative and quantitative studies were used to compare perceptions of a phenomenon of interest by two different participants.

Mixed methods study need to serve one or more of the seven purposes of mixed methods postulated by Venkatesh et al (2016). Many researchers fail to articulate the purposes for choosing the mixed methods (Tashakkori and Teddlie, 2009; Venkatesh et al, 2016, Corrigan & Onwuegbuzie, 2020). The purpose of the mixed methods chosen help in answering the research questions of the study. In this study, the developmental purpose was the reason for choosing the mixed methods. The developmental purpose was adopted for the following reasons; to validate the proposed ERP requirements elicitation process which is the main aim of the study. The study proposed a preliminary ERP requirements elicitation framework using constructs from the literature review (see Chapter 3 section 3.4). The next chapter, the qualitative study, partially validated some of the constructs (see Chapter 5 section 5.4). Findings from the qualitative study assisted in developing hypotheses (see Chapter 5 section 5.7) which were tested in the quantitative study (see Chapter 6 section 6.10). When the purpose for conducting mixed methods is developmental, a sequential mixed methods will be approapriate than the concurrent approach (Venkatesh et al, 2016; Corrigan & Onwuegbuzie, 2020).

4.3.2 Sequential exploratory mixed methods

The Sequential Exploratory mixed methods was adopted in this study. The researcher commenced with the qualitative data collection and analysis and the outcomes of the findings from the qualitative analysis helped in preparing the quantitative data collection instrument. Mafuwane (2012:91) wrote that the data from the two approaches need to be integrated to produce a complete analysis of the research problem. Combining the two approaches in research facilitates agreement irrespective of which method is used first. Figure 4.3 details the phases that were followed during the data collection and analysis for both phases.

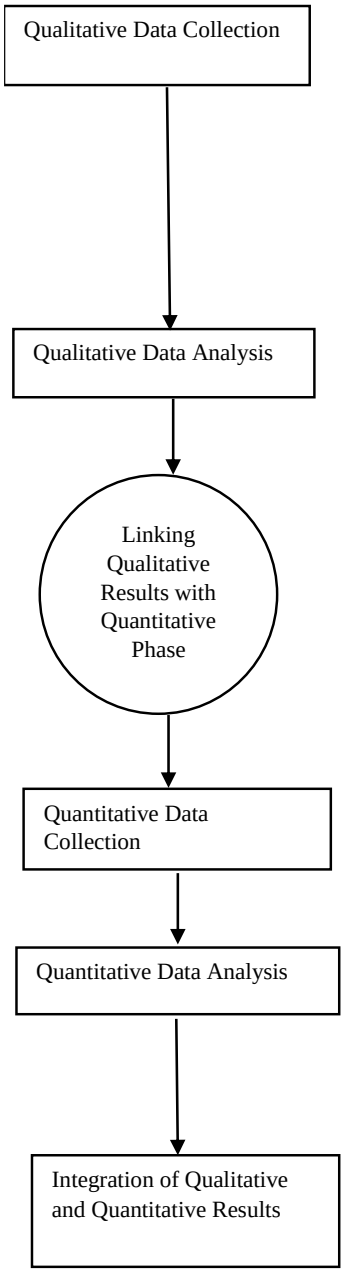
Phase	Procedure	Result
	--Develop interview questions --Select participants from 3 units of study --Purposively select 1 participant from each stratum --Perform face to face semi – stuctured interviews with 12 participants	-Audio data to be transcribed into interview interview transcripts
	--Coding the data --Generating themes from the data --Cross case theme development --Cross thematic analysis	--Themes emerging from the data --Cross case visual themes --Cross case thematic matrix
	--Develop a questionnaire based on the qualitative data results	--Closed ended Questionnaire
	--Questionnaire survey (*n=396*)	--Numeric data
	--Code the data into SPSS v.21 --Data screening --Perform descriptive statistics analysis --Perform inferential statistics analysis	--Normality of data --Mann Whitney U-test --t-Test --ANOVA --Correlations and Regressions
	--Explanation of Qualitative and Quantitative results and the significance of the results	--Results discussion & implications --Future research direction

Figure 4- 3: Sequential Exploratory mixed-methods Design Procedures (Jokonya, 2014:122).

4.3.3 Justification for using Sequential exploratory mixed methods

Since the research aim was to develop and validate a framework used in ERP requirements elicitation, there was a need to conduct a sequential exploratory approach where a qualitative approach using in-depth semi-structured interviews was done first and then followed by the quantitative approach using questionnaires. The semi- structured interviews done assisted the researcher in identifying problem areas that required close ended questions to be prepared to get responses from the participants. This enabled the researcher to get a deeper understanding of the stakeholders' views towards ERP requirements elicitation.

The sequential exploratory mixed methods was chosen because the results from the quantitative study were used to validate the findings from the qualitative study (Pyett, 2003; Onwuegbuzie et al, 2010). The use of sequential exploratory mixed methods helped the researcher in developing the instrument for the quantitative phase because the instrument was informed by the findings from the qualitative phase (Guetterman et al, 2015). The researcher also integrated the findings from the qualitative study with the findings from the quantitative study so that the qualitative and the quantitative become independent in addressing the research problem (Guetterman et al, 2015).

4.4 The Research Design

According to Saunders et al (2011), the research design may use any of the following methods: case study, experiment, action research, survey, and grounded theory. Runeson and Höst (2009) note that the case study approach has been used extensively in software elicitation research because it provides a deep understanding of the phenomenon under investigation. The case study approach was adopted in this research because it is a well-tested inquiry in information systems (Yin, 2009). The case study cements the sequential exploratory mixed methods to provide deep insight into the issues investigated.

Yin (2013) elaborates that the case study approach helps in answering the "*how"* "*what"* and "*why"* ERP requirements elicitation questions of the study and that the case study is appropriate in studying the complex organisational nature. The case study approach uses multiple sources of evidence to get a deep understanding of the phenomenon investigated (Yin, 2013). ERP requirements elicitation required multiple sources of evidence so that rich requirements may be captured to ultimately reflect the real needs of the stakeholders. Crowe et al (2011) submit that the case study approach is a "*naturalistic*" design where the researcher

does not have control to manipulate the variables as compared to "*experimental"* design. The phenomenon can only be understood in its natural settings without distorting the research findings. The case study approach is appropriate in explaining, describing and exploring the phenomenon investigated (Crowe et al, 2011). The case study helped in validating the proposed ERP requirements elicitation framework.

4.4.1 Case Studies in Information Systems

The case studies are mostly used in the fields of Sociology, Social work, Business, and Political science (Yin, 2003; Easterbrook and Aranda, 2006; Runeson and Höst, 2009). The main aim of the case study approach in the above-mentioned fields is to proliferate the knowledge about organizations and individuals. However, in the field of Information Systems, the notion of knowledge advancement about organizations and individuals is the main reason for undertaking research, hence the need to incorporate the case study in the Information Systems field. Runeson et al (2012) perceive that using experiments to solve a research problem in Information Systems has got many predicaments in replicating the same experiment, but with the case study approach, the outcome can be replicated since there is no strict boundary between the environment and the objects being studied.

In this study, the focal point is on ERP requirements elicitation and for effective ERP requirements elicitation to be done, the stakeholders' requirements must be identified so that the developers can generate an ERP system meeting those requirements. In a nutshell, the field of Information Systems is a multidisciplinary area that calls for case studies to provide answers to the research problem and advance the existing body of knowledge. The case study approach adopted in the Information systems field uses the pragmatic approach advocating for a results-oriented approach different from the case studies done in Social Sciences that focus on philosophical aspects (Runeson et al, 2012).

4.4.2 Defining the case

Crowe et al (2011) submit that the research questions and the information from the literature review may assist in defining the case study. Each case identified should have the same time frame, the relevant participants and the type of evidence collected. The research questions were based on ERP requirements elicitation at universities in Zimbabwe involving the stakeholder's participation. Universities in Zimbabwe were chosen because the ERP systems are developed in-house and the ERP requirements have to be elicitated from the stakeholders. The time frame for the case was two months to collect the data and do analysis for the

qualitative phase and three months to develop the quantitative instrument, collect data and do the analysis.

4.4.3 Case Selection

A stratified sampling technique was employed because the population is not homogeneous. The population was composed of four strata: computing students, computing lecturers, ERP developers and management and lastly the external stakeholders. The inclusion criteria for stakeholders in the ERP data collection was that they should have used the ERP system for at least a year making them well-versed with the ERP requirements. The inclusion criteria for the universities were as follows: the university had implemented ERP systems for more than 10 years because they have a deep understanding of the ERP system and the perspectives of stakeholders on ERP requirements elicitation. The study also included a university that had implemented ERP systems for less than 5 years to get the perspectives of stakeholders on ERP requirements elicitation. The university should have a faculty of Computing Studies from whence the participants were selected. The study also considered external stakeholders (consultants) with knowledge of ERP systems.

Zimbabwe has a total of 16 universities and the majority are government-funded (Gunjal, 2016). A total of 6 universities are privately funded while 10 are government-funded (SARUA university questionnaires, 2011). Universities that meet inclusion criteria were approached and three universities were selected. The study used four units of analysis (including the external stakeholders) in the case study approach. Runeson et al (2012) define this concept as an embedded case study since all the four units had used the ERP systems before. The sample included two government-funded universities, one privately funded university and external stakeholders. The sample provided the researcher with diverse views on ERP requirements elicitation; two of the universities selected had implemented the ERP systems for more than 10 years, the other University had less than 5 years and the external stakeholders had vast consultancy experience in ERP systems. Runeson et al (2012) also concur with the diversity notion in the case selection as they elaborated that the units of analysis should have some notable variation in their properties so that meaningful comparisons can be articulated. Jokonya (2014: 110) contends that the diversity in the stakeholder's composition in an organization makes the selected cases appropriate in answering the research questions.

4.4.4 Case Study Data Collection

To get a good understanding of the case investigated, the data was obtained from multiple sources of evidence (Crowe et al, 2011). The multiple sources of evidence included the

qualitative study interviews and the quantitative study questionnaires. The multiple sources included the four different units of study; three universities and external stakeholders (ERP consultant companies). Mavetera (2011:89) avers that every research should have research goals manifested through technical, social or philosophical choices. The research goals guided the researcher in framing the data collected to answer the research problem. The technical aspects deal with the hardware and the environmental factors that should be met to elicit the stakeholder's ERP requirements. The social aspects deal with creating humanistic ERP systems by finding the perspectives of the stakeholders in ERP requirements elicitation so that robust ERP systems can be developed. The philosophical aspects deal with the pragmatism principle; how does the researcher obtain the knowledge from the stakeholders so that that knowledge can be used in ERP requirements elicitation? The knowledge can be extracted through functional pragmatism which stipulates that the stakeholder should have knowledge about a specific task and the expected outcome; referential pragmatism which stipulates that the stakeholder should have the knowledge to perform a task using the ERP system; lastly the methodological pragmatism which says that stakeholders can get knowledge from reflections of performing a task using the ERP system which can give rise to negative or positive effects associated with the task which may be improved if necessary.

The multiple sources of data adopted in this study improved the internal validity of the study in answering the research questions (Crowe et al, 2011). The data collected from these multiple data sources should bring similar conclusions. The instruments used to obtain the data were designed in such a way that the social aspects and the philosophical aspects were catered for, so that the ERP requirements elicitation process at universities may be enhanced.

4.4.5 Case Study and Theory Building

Reeves et al (2008) perceived that theories provide the researcher with special "lenses" that enable them to view complicated societal problems such as *why do stakeholders behave in a certain manner.* The complicated societal problems need different lenses to understand the problem at hand but each lens focuse on a different subset of the problem. Eisenhardt and Graebner (2007) observe that theory building from case studies involves utilising one or more cases to derive theoretical propositions. The theory enables understanding and prediction. Case studies help the researcher in developing the theory inductively. Many researchers have viewed case study data as highly subjective but a well-articulated theory derived from the case study is objective because the researcher is close to the data (Eisenhardt & Graebner, 2007; Jokonya, 2014: 110). Case studies have been used for many purposes, some use case

studies to provide descriptions about the phenomenon under investigation, some to test theories and some to generate theories (Eisenhardt, 1989; Steenhuis & Bruijn, 2006; Yin, 2013).

Theory building generally requires rich descriptions from the qualitative data obtained so that new theories can be generated. Eisenhardt & Graebner (2007) observe that for an accurate theory to be produced from the case study that is interesting and testable, there is a need for rich empirical data. Interviews provide rich and empirical data that could be used to generate interesting and testable theories (Eisenhardt & Graebner, 2007).

4.5 The Data Collection

The research used the sequential exploratory approach. According to Runeson et al (2012:16), combining qualitative and quantitative data collection methods normally termed triangulation improves the precision and validity of the study being done. The first phase commences with the qualitative data collection and the data is analysed, in the second phase, the quantitative data is collected and analysed. The last stage combines the results from the qualitative and the quantitative so that new insights may be gleaned. The first phase of the qualitative data collection helped the researcher to answer the *"how"* questions and the second quantitative data collection addressed questions on the causality together with the magnitude of the effect (Berman, 2017).

4.5.1 The Qualitative Data Collection

The researcher commenced with the qualitative study because of its in-depth investigations into the research problem. The qualitative study allowed the researcher to obtain new insights into the research problem thereby generating hypotheses for the research that were tested with the quantitative study (Runeson *et al*, 2012:13). Jokonya (2014:128) also recognises that the objective of the qualitative study is to crystallise concepts that may explain the societal processes when they are interpreted by the researcher. Data triangulation was used from four different locations. To enhance the reliability and validity of the research, a representative selection of participants was obtained (Runeson *et al*, 2012:35). The qualitative study brought in multiple interpretations of the research problem and that enabled the researcher to look at the conundrum from different viewpoints.

Cunliffe (2011) observed that Burrell and Morgan's assumptions on the nature of social reality are critical in research as they form the basis for knowledge and theory building. Cunliffe (2011) writes about two assumptions that depict social reality. Subjectivist assumptions view reality as in the stakeholder's mind, hence the need to explore the stakeholder's individual experiences and understanding using the qualitative approach. Objectivist assumptions view reality as external but imposing itself on the subjects and it determines the stakeholder's behaviour. These assumptions helped the researcher in choosing the most appropriate study group, the data to be collected and the analysis of that data.

4.5.2 The Qualitative Sample Size

The sample size in qualitative researches has remained a challenge with many academic researchers submitting different viewpoints on it. Mason (2010) observes that several factors affect the sample size in qualitative research but the principle is the concept of saturation which states that when new data does not add new insights into the current research problem. Richie et al (2003) outlines some factors that may affect the sample size of the study: population heterogeneity, the selection criteria number, special interest groups that may require intensive study, a study that may require multiple samples, the types of methods used in data collection and lastly the budget available. Marshall et al (2013) write that the concept of data saturation was designed for grounded theory studies but may be applied in qualitative researches that use the primary data source as interviews. Mason (2010) also further elaborates that the research objectives are the pointer to the research design chosen and ultimately the sample size adopted during data collection.

Despite the many challenges facing qualitative researchers in terms of the acceptable qualitative sample size, Marshall et al (2013) proposed three methods to determine the qualitative sample size. The first method is citing the recommendations suggested by the qualitative researchers; the second method is acting on precedent by citing the sample sizes from studies that addressed a similar research problem in the past and lastly, using statistical justification to show that saturation has been reached within the dataset. The knowledge required from the research problem can also help us in determining the sample size. Jokonya (2014:113) also clarifies that an increase in the sample size does not translate into reducing the sample bias but purposive sampling could help. For qualitative research to work effectively, the participants selected for the interviews should be highly knowledgeable about the research problem so that an in-depth analysis of the problem is ultimately obtained.

Trotter (2012) writes that very small sample size for qualitative research is ideal provided that the sample is representative and this ranges in terms of the culture and sub-cultures extracted from the society, the special populations that do have unique beliefs and behaviour that needs further exploration. Francis et al (2010) also observes that to deter early data saturation in qualitative researches, the sampling of the participants should use pre-defined attributes such as the participant's gender, age, and ethnicity. Francis et al (2010) also proposes an approach to reach data saturation in qualitative researches by first interviewing 10 participants with the appropriate sampling diversity and they came up with a stopping criteria which stipulate that after the 10 interviews, 3 additional interviews could be done and if no new themes emerge, this is defined as the data saturation point otherwise the stopping criteria is then tested after each successive interview.

4.5.3 Qualitative Sample Selection

The demographic characteristics of the participants were used to select the participants interviewed. The study sample for this study consisted of computing students in the first stratum, computing lecturers, management together with the ERP developers and the external consultants in the last stratum. The sample selected was based on the participant's knowledge in ERP requirements elicitation. A purposive sampling procedure (Ritchie et al, 2013) was used focusing on participants with knowledge and experience in using ERP systems. The researcher selected 1 participant from each stratum in each study unit of analysis for the interviews, which means a total of 12 participants were selected from the four units of analysis.

The demographic characteristics included the following attributes: gender, age, education qualifications, culture, social embeddedness, and experience in using the ERP system. The inclusion criteria for this study were as follows: the participants included in the study were those with knowledge about ERP systems. The participants with little or no knowledge about ERP systems were not included in the study. The participants who had used the ERP system for at least one year were also included in the study as they had some experience and had identified weaknesses that should be addressed in the future. The researcher noted that there were no new themes that emerged after the 12th interview was done, so there was no need to do further interviews.

4.5.3.1 Justification for using purposive sampling

The expert sampling was utilized which fall under purposive sampling. Serra et al (2018) noted that purposive sampling is premised on small yet rich information sample sizes. Etikan et al (2016) also observed that expert sampling choose a participant based on the qualities they

possess which contribute to the quality of data obtained. Setia (2017) also concurred that expert sampling help in understanding the phenomenon being studied in detail by focussing on participants with knowledge about what is being researched. The researcher utilized this method by selecting participants who were willing and with the knowledge in house ERP requirements elicitation. Sharma (2017) also argued that the expert sampling proffer relevant research as the researcher concentrated on participants with particular characteristics that helped in examining the phenomenon under study. The sampling technique adopted assisted the researcher in getting an in-depth appreciation of the research problem. The sampling technique also helped the researcher to answer the research questions. Smith (2018) observed that findings from purposive sampling can also be generalized to other contexts when the study was presented in depth and with interpretive richness. The study made use of in depth focus on research questions by involving participants with knowledge about ERP requirements elicitation and interpretive richness was examined in Chapter 5 using the thematic analysis of the data and in Chapter 6 using the statistical-probabilistic generalizability.

4.5.4 The Interviews

Interviews have been used extensively as a method of data collection in qualitative researches (Turner, 2010; Jamshed, 2014). Semi-structured interviews comprising key questions on ERP requirements elicitation helped the researcher to gain a deeper understanding of the research problem (Gill et al, 2008). The semi-structured interviews were adopted because they provided the researcher with a controlled conversation focusing on the critical problem areas. To have a controlled conversation with the interviewee, interview guides were prepared to avert diversion from the key issues on ERP requirements elicitation (see ANNEXURE G). The participants felt at ease when the interview questions started with easy questions that participants could easily answer and later, more precise and difficult questions followed.

The interviews from the selected participants provided the researcher with detailed insights into the ERP requirements elicitation. The interviews were done at places convenient to the participants for them to open up on issues concerning ERP requirements. Gill et al (2008) observed that interviews are most appropriate for exploring topics where the participants are not free to discuss in a group environment. The participants were informed that the interview was going to be recorded so that the interviewee's responses would be analysed later (see ANNEXURE C). Recording interviews assisted substantially in capturing what the interviewee said and that improved the validity of the research (Bailey, 2008; Garcez et al, 2011).

To check if the interview guides were clear to participants and also that the guide addressed the research questions, a pilot interview was conducted before the actual data collection.

Before the interview commenced, the purpose of the interview was explained and the interviewee was assured that the study adhered to ethical principles. This made the interviewee psychologically prepared for the interview and allowed them to give honest answers. The interviewee was asked to sign a consent form to show that the interviewee was willing to participate in the process without being coerced (see ANNEXURE E). The interview per each interviewee lasted on average of 40 minutes. To get a deep understanding of the ERP requirements elicitation, the researcher listened attentively to the interviewee and took shorthand notes. The researcher also used neutral body language such as nodding, smiling and showing that they are interested in the conversation (Gill et al, 2008).

4.5.5 Qualitative Data Analysis

Data collected from the interviews was transcribed using verbatim transcription so that the researcher captured the experiences of the participants without any distortions. ATLAS.ti version 8 was used to analyse the data. Inductive data analysis approach which is data-driven was used to establish patterns and come up with explanations to those patterns (Klauer & Phye, 2008). The patterns helped the researcher in generating meanings from the data and later on generated hypotheses for the quantitative study. The inductive approach reduced the data collected into brief textual data from which the researcher established meanings. Thematic analysis was used to establish different categories for emerging themes.

Thomas (2006) identified critical steps followed in inductive data analysis which guided the researcher in qualitative data analysis. The first step was to clean the data which entailed that the interview raw data was formatted into a common format. The next step was to ensure that the researcher was familiar with the raw text so that open codes could be obtained from the data. The next step was to identify the constructs from the text data into themes, the raw data was read multiple times so that specific categories were identified. Text segments that did not fall within the research questions were discarded and some categories were combined when their meanings were similar to reduce duplication on categories. These steps were used by the researcher in qualitative data analysis.

The data analysis was done iteratively so that missed insights from the data were picked in the next iteration. This helped the researcher in exploring the different viewpoints of participants on ERP requirements. These diverse viewpoints of participants were used to generate hypotheses that were tested using the quantitative approach.

4.5.6 Validity and Reliability in Qualitative study

Heale and Twycross (2015) defined validity in qualitative studies as the extent to which a concept under investigation is accurately being measured. This means that for the study to be valid, there is a need to focus on ERP requirements elicitation during the data collection. Another measure of quality in a qualitative study is the reliability, which looks at the accuracy of the measuring instrument used during data collection. They are two commonly used methods for assessing the validity in qualitative researches which are construct validity and content validity. Construct validity was used to check if the instrument was able to measure what it should measure. This was done using pilot testing of the interview guide to check if the instrument was measuring what it should measure if not, some adjustments were done to the instrument so that the instrument met the expected outcomes.

Content validity looked at whether the instrument adequately addressed the entire domain related to the research study. To check that, the interview guides were prepared which addressed the research questions. The researcher sought the help of an expert in ERP systems to check the interview guides if they were addressing the research questions of the study, the researcher did some adjustments to the interview guides in line with the expert's advice. Reliability in the qualitative study can best be addressed by trustworthiness (Golafshani, 2003**)**. Guba (1981) proposed four criteria to be used to measure trustworthiness in the qualitative study; credible, dependable, transferable and confirmable. To ensure the credibility of the study, the researcher got another person to check the quality of the instrument for errors or vague wording and also the instrument was pilot tested to selected participants to get their views on the instrument and the researcher did some adjustments in line with the participants' views. The study made use of verbatim quotations to aid in coming up with thick descriptions from the interviews. This assisted the researcher in not distorting the message conveyed by the participant during the interview.

Dependability was ensured by coding the data from the study to look for patterns and themes and then re-code the data to check for patterns and emerging themes that may be established from the data which were not picked from the first iteration. To ensure the confirmability of the study, the quality of the study was benchmarked against other authors in ERP requirements elicitation. Transferability looked at the applicability of the research findings to other contexts or populations. The researcher ensured that thick descriptions were provided from the interviews so that the readers are familiar with the phenomenon being investigated and they can relate the findings to their situations.

Lastly, to ensure that the validity of the study was strengthened, the triangulation strategy was employed. The triangulation greatly reduced the bias by using data triangulation (using

different informants to enhance data quality) and methodological triangulation (by using different research methods) (Anney, 2014). This means that the researcher was able to research multiple perspectives. The next section will discuss the quantitative approach.

4.5.7 The Quantitative Data Collection

The measuring instrument was a questionnaire prepared on the basis of the findings from the qualitative study and the literature review (see ANNEXURE H). The researcher distributed the questionnaires to four study units. The researcher used a four-point Likert scale to obtain the opinions of the participants. The midpoint neutral was omitted from the questionnaire so that the researcher captured the most accurate responses from the participants (Johns, 2010; Croasmun & Ostrom, 2011). The researcher pre-tested the questionnaire on a few participants to check the quality of the questionnaire and the researcher adjusted the instrument based on the expert's views. The data obtained were analyzed using the Statistical Package for the Social Sciences (SPSS) v21.

4.5.8 The Quantitative Sample Size

The study population was from four study units and a purposive sampling technique was used. Sample size has been a topical issue among researchers and many propositions have been given on sample sizes for quantitative researches (Creswell & Clark, 2007). To reach a statistically significant size, if it does exist, then an appropriate sample size of participants must be calculated (Burmeister & Aitken, 2012). Before a sample size for a quantitative study is calculated, there is a need for the researcher to decide, what is the most significant difference in the research study? Then the sample size is calculated to show that statistically significant difference. The sample size in a quantitative study is very critical so that the researcher can obtain strong conclusions about the phenomenon being investigated. Delice (2010) observed that the sample size for quantitative study should be informed by the research questions, similar sample sizes done in the past researches and the research design.

Fox et al (2007) write that the research study's statistical power is greatly enhanced when the sample size increases. The statistical significance in a study reflects that there is a likelihood that positive results may be obtained and those findings can be used to make robust conclusions about the research problem. The sample size was determined after taking into consideration the following factors: the non-response from participants, the attrition and the respondent mortality (Makambe, 2017:33). It is difficult to get 100 percent return rate from

questionnaires distributed to participants, in some cases some participants may just return in-complete questionnaires and in some cases spoiled questionnaires. Gorard (2010) postulates that it is advisable to overestimate the sample size rather than underestimating it. The sample size was overestimated from 370 to 396 see the explanation after table 4.2. The following Table 4.2 shows the population from the four data units.

Table 4-2 Study population

Stratum	Computing Students	Computing Lecturers	Management and ERP developers	External Stakeholder(s)	Population Size Total (N_i)	Sample Size
University A (N_1)	240	13	10		$N_1 = 263$	$p_1 = 36.8\%$ **y= 145**
University B (N_2)	160	11	9		$N_2 = 180$	$p_2 = 25.2\%$ **y = 100**
University C (N_3)	230	15	11		$N_3 = 256$	$p_3 = 35.9\%$ **y = 143**
External Stakeholders (N_4)				15	$N_4 = 15$	$P_4 = 2.1\%$ **y = 8**
Total (N)	630	39	30	15	N = 714	**y = 396**

Key

pi = stratum composition

Ni = population size per stratum

N = total of population size

y = total of sample size and questionnaires distributed

yi = the sample size per stratum, where pi * y

According to Research Advisors (2006), a sample size of a population can be calculated by using Morgan's sample size table (see ANNEXURE A). The Morgan's sample size table stipulates that a population of 714, using a 95% confidence level and a 3.5% confidence interval, the sample size lies between 370 and 396. Hence, a sample size of 396 was used in the study which represents about 55% of the population as it concurs with Gorard (2010) recommendations on overestimating a sample size. A sample size that represents 50% of the population is deemed adequate (Leedy & Ormrod, 2005). The number of questionnaires that were administered per each unit of study is shown in the table 4.1 above with the "*y"* key.

Vosloo (2014) noted that no matter which sampling technique is employed in a quantitative study, non-responses from the participants remain a major problem that the researcher has to

confront. Remedial actions need to be taken so that low response rates can be reduced as this affects the sample size, which in turn has a major bearing on the statistical power to test the hypothesis from the qualitative study (Vosloo, 2014). To reduce the low response rate, the researcher made sure that the questionnaire is kept short and to the point, the researcher provided some incentives to the participants for them to complete the questionnaires and regular follow-ups after every two weeks was done by the researcher to remind the participants who had been given the questionnaire to complete. The participants included in the quantitative study were those with knowledge about ERP systems.

4.5.9 The Quantitative Reliability Test

Heale and Twycross (2015) observed that in quantitative research, consideration should be given to the notion of how the researcher enhanced the quality of their research study. This can only be measured using the validity and reliability of the study. Validity looks at how a concept is accurately measured by the researcher. Validity was explained under the section of validity and reliability in a qualitative study (see Chapter 4, section 4.6.6). In this section, the focus is on the reliability test which was measured differently in a quantitative study. Although it is difficult to measure the exact value of reliability in a quantitative study, however an estimated value of reliability may be calculated.

One approach of measuring reliability in quantitative studies is the use of internal consistency. Cronbach's reliability testing method of Alpha was used to measure the internal consistency of the various constructs of the measuring instrument, which in this case was the questionnaire. If the internal consistency is high, it means that the items in the measuring instrument are closely related to each other and if items are poorly formulated, the internal consistency will be very low (Tavakol and Dennick, 2011). Internal consistency is expressed on a scale commencing from 0 to 1. A coefficient of greater than 0.7 will be considered as reliable (Deniz and Alsaffar, 2013).

A pilot run was done on the instrument and a total of 35 questionnaires were administered but 27 were returned and the feedback from the participants was noted down and corrective measures in line with the participants' feedback were implemented. The instrument was administered to computing lecturers, ERP developers and management, ERP consultants and computing students. The results of the pilot study showed the overall Cronbach's Alpha coefficient ($\alpha = 0.748$) with a total number of items being 61 from 27 cases, (see Chapter 5 section 6.2.1).

4.5.10 Quantitative Data Analysis

Descriptive and inferential statistics were used to analyse the data. The descriptive statistics helped in showing patterns that emerged from the data, allowing the researcher to make simple interpretations of the data. Descriptive statistics also made use of graphs, means, standard deviations and variances to summarize the data understandably (Bickel & Lehmann, 2012). The descriptive statistics helped the researcher in simplifying the vast amounts of sample data in a sensible manner, in other words, the descriptive statistics made the hard to understand sample data from the quantitative study to be understood. However, the descriptive statistics need to be augmented with inferential statistics to make robust conclusions about the phenomenon being investigated.

Inferential statistics were done after the descriptive statistics since descriptive statistics did not enable the researcher to reach conclusions from the sample data regarding the hypothesis formulated. The inferential statistics also assisted the researcher in understanding the views of the participants with regards to ERP requirements elicitation. The inferential statistics enabled the researcher to check if the observed patterns emanating from the sample data were real or is just a coincidence. Basing on the sample data obtained from the quantitative study, the researcher used the Shapiro-Wilk analysis test to check whether to use parametric tests or non- parametric tests. The Shapiro-Wilk analysis test tested the normality of the data if the data is normally distributed the parametric tests will be used else the non-parametric tests will be applied (Ali and Bhaskar, 2016). The data were normally distributed hence the parametric tests were used in the study.

Analysis of Variance (ANOVA) was used to test the differences in means between two or more groups while Independent T-tests were used to calculate two related variables' differences. Pearson correlation test was used to test the association strength between two continuous variables (University of Minnesota, 2017).

4.6 Integration of Qualitative and Quantitative Results

Guetterman et al (2015) observed that most researchers who use mixed methods in their studies collect their data using qualitative and quantitative approaches but they do not integrate the two approaches. The triangulation of qualitative and quantitative results offered the researcher with a more detailed analysis of the ERP requirements elicitation at universities. The meta-inferences provided diverse viewpoints to the same phenomenon being investigated thereby improving the accuracy of the study (Jack, 1979; Tashakkori & Creswell, 2007) see (Chapter 7 section 7.2). The components of the

qualitative and the quantitative were equally important and the process followed the equivalent status design (Venkatesh et al, 2016). The integration of qualitative and quantitative results provided a holistic view of the ERP requirements elicitation study. The integration unearthed unique variances that could not have been picked by just one method (Jack, 1979). The weaknesses of the qualitative approach were compensated by the quantitative approach, thereby providing a balanced view of the phenomenon being investigated.

Bryman (2006) observed that the integration of qualitative and quantitative results enhances the credibility of the study and also to confirm the hypothesis set from the qualitative study which was tested using the quantitative study. New insights emerged from the integration of qualitative and quantitative results which may not have been picked by the separate qualitative and quantitative approaches. Santos et al (2017) noted that convergence and divergence in data can be identified using the mixed methods approach and the researcher was better informed about the ERP requirements elicitation. In this regard, the researcher integrated the results from the qualitative study with the findings from the quantitative study so that a holistic view of ERP requirements elicitation may be revealed.

4.7 Unit of analysis

Kumar (2018) argued that the unit of analysis is the first step in data analysis. Kumar went on to say that the unit of analysis is the person or object the researcher collects data from. The unit of observation is defined as the entity at which the actual measurements are done (Kumar, 2018). The unit of analysis includes the following; individuals, organizations, countries, technologies, and objects (Kumar, 2018). The following table presents the unit of analysis for the research questions. The main research question - how can ERP requirements elicitation at universities be done? - is answered by the following sub research questions.

Table 4-3 Unit of analysis (Kumar, 2018)

Research Questions	Unit of Analysis	Data Collection	Unit of Observation
What are some of the weaknesses of the existing frameworks used in ERP requirements elicitation at universities?	Social Artefacts	Content Analysis	Documents
What are the needs for a framework developed to assist universities during ERP requirements elicitation at universities?	Individuals (Stakeholders)	Interview and Survey of stakeholders	Individuals (Stakeholders)

How could ERP requirements elicitation in universities be enhanced?	Individuals (Stakeholders)	Interview and Survey of stakeholders	Individuals (Stakeholders)
To what extent do the ERP requirements elicitation framework assist universities during ERP requirements elicitation?	Individuals (Stakeholders)	Validation interview of ERP experts	Individuals (ERP Experts)

The unit of analysis shown in Table 4.3 above was used during the data collection in this study. The individuals' referred to in the unit of analysis are the stakeholders who participated during the qualitative and quantitative data collection while the other individuals' are the ERP experts who were interviewed when the ERP requirements elicitation framework was being validated. The social artefacts refer to knowledge and conceptual frameworks that exist in the body of knowledge. The Table 4.3 provided the unit of analysis for each research question.

4.8 Research Study Limitations

The study was focused on four study units in Zimbabwe. Although the study focused on only four study units, however, the findings may be applicable or transferable to other universities in ERP requirements elicitation. The four study units were chosen because of the limited time and budget constraints to cover other study units. The units of study chosen however provided richness in their diversity which made the findings transferable to other universities operating in similar settings. The sampling approach adopted in the research only focussed on participants with knowledge about ERP requirements elicitation but however, future studies may include other participants so that diverse views may be captured.

4.9 Ethical Considerations

The ethical issues in research should be respected by any researcher (Brown & Mitchell, 2010; Weijer et al, 2014). It is the responsibility of the researcher to protect the data of the participants. The researcher took many measures so that ethical standards were not violated by the researcher. The following measures were undertaken by the researcher in ensuring that the study did not violate the ethical standards. The researcher obtained the ethical clearance letter from North West University before the data collection started (see ANNEXURE K). The purpose and procedures of the research were explained to the participants at the onset of the study so that the participants made an informed decision of whether or not to participate in the study. The research was guided by the guidelines of the data protection and human rights legislation on the issue of privacy and confidentiality and the data collected was sorely used for academic purposes only (Ashworth, 2004).

Participants participated freely in the study without being coerced. Confidentiality of data collected during the study was treated with the utmost care and the participants were assured of their responses were not going to be linked to their identities. Instead, pseudo names were used to hide the identities of the participants. The researcher made sure that the questions asked during the data collection would not offend the participants and only data relevant to the study were asked. The data obtained during the data collection phase was kept for a reasonable time before being discarded for verification purposes if the need arose**.**

4.10 Chapter Summary

The chapter outlined the research methodology used by the researcher in validating the ERP requirements elicitation at universities in Zimbabwe. This chapter provided the rationale for choosing the research methodology to answer the research questions of the study. The study adopted a pragmatist philosophy and this helped in providing the foundation of the research. The research strategy justified choosing the case study as suitable for this study. The case study also justified why the cases were from Zimbabwe universities. The chapter also explained the case selection adopted in the study and the case study data collection.

The chapter explained why the sequential exploratory mixed methods approach was suitable for the study instead of just using one approach. The chapter also justified the data sample sizes for qualitative and quantitative phases. The quantitative phase was informed by the findings obtained from the qualitative study. The chapter also explained the need for the integration of findings from both the qualitative and quantitative findings. Ethical considerations of the study were also discussed insofar as these guided ethical standards. The next chapter discusses the results obtained from the qualitative study.

CHAPTER 5 QUALITATIVE RESULTS

5.1 Introduction

The previous chapter presented the research methodology adopted in validating the ERP requirements engineering framework. This chapter presents the qualitative results from the four study units in Zimbabwe. The chapter discusses also the procedures followed during the data collection and analysis.

5.2 Qualitative data collection procedure

Vosloo (2014) postulated that the qualitative data procedure will bring to light the participants' observations and judgments in line with the phenomenon under investigation. The qualitative data procedure in this study followed the data collection and analysis approach outlined in Chapter 4 (see Section 4.4 Figure 4.1). An expert sampling procedure was done and twelve participants were selected from the four study units that met the researcher's inclusion criteria (see Chapter 4 section 4.6.3). The interviews were done following the interview guide prepared by the researcher and the participants were briefed about the aim of the interview and they signed the interview agreement letter (see Chapter 4 section 4.6.4), (see ANNEXURE G) for the interview guide that was used. All the interviews were semi-structured and lasted on average 40 minutes per participant. The participants were sent the interview guide prior to the interview to familiarize themselves with the interview questions. The participants were asked for permission to record the interview and two participants declined so the researcher took notes of the interview proceedings. After the interviews, the interview data was transcribed within 24 hours of the interview.

5.3 Thematic analysis

The thematic analysis followed the procedures outlined under the research approach (see Chapter 4 section 4.4).

5.3.1 Participants demographics

The participants were each assigned a unique code for example [AST1-01, BST2-02, CST3-01 and EST4-01]. Letters A, B and C signify the university and E signify an external consultant. The letter ST1 refers to the stratum the participant falls in (see Chapter 4 section 4.6.3), and the integer 01 or 02 signifies the participant's unique number. The interviews were done between March and April 2019.

Table 5-1 Participants' demographics

Interviewee No.	Number of years using ERP system	Position
AST1-01	4	Student
AST1-02	4	Student
AST2-01	5	Computing Lecturer
AST3-01	4	ERP Developer
BST1-01	4	Student
BST2-01	2	Computing Lecturer
BST3-01	3	ERP Developer
CST1-01	4	Student
CST2-01	3	Computing Lecturer
CST3-01	5	ERP Developer
EST4-01	3	Consultant
EST4-02	4	Consultant

5.3.2 Qualitative data coding

The researcher utilised codes that were very close to the language of the participant in the interview transcript. The researcher made a lot of iteratives to ensure that no codes were missed in the process. The code names given were close to the language of the participant so that the participant's voice is not obliterated. A total of 344 codes were generated and some of the codes were similar to each other such that the researcher merged some codes to ultimately collate 115 such codes. The similar codes were grouped into 15 different categories and were given names. The process of the qualitative data analysis followed the steps outlined in Chapter 4 (see section 4.6.5).

5.3.3 The coding Framework

Table 5.2 highlights how the codes and the categories were merged to generate the themes for the study. The table depicts the codes generated from the open coding, the categories the codes were grouped into and the themes that were elaborated as a consequence.

Table 5-2 Coding Framework

Open Code	Category or Group	Theme
Need for knowledge of the domain terminology Need to create a common vocabulary between stakeholders and the requirements engineer Need to understand the domain terminology	Lack of Domain Knowledge Understanding	**DOMAIN KNOWLEDGE UNDERSTANDING**
Business processes and rules needs to be examined before requirements elicitation starts Change management process ERP requirements are better elicitated when the nature of the problem is understood before requirements gathering start ERP system boundary and context Existing ERP problems needs to be understood Meanings can be derived from the stakeholder conversations and actions Need for requirements engineer to extract meanings from the conversations during requirements elicitation Need for the requirements engineer to be analytical during requirements elicitation Need for the requirements engineer to pick requirements stakeholders fail to express Need to check for scope creep during requirements elicitation Need to examine stakeholders actions during requirements elicitation Need to examine the existing problems for the current ERP system Need to take note of the stakeholder actions when gathering requirements Need to understand the way stakeholders do their things using the existing system Stakeholder's actions during requirements elicitation unearth hidden requirements Understand stakeholder body language Understanding business processes	Requirements Engineer Knowledge	
Different data sources help in extracting rich requirements Need to consider all available data sources	Different Data Sources	

Need to examine all data sources during requirements elicitation Need to minimise missing requirements by examining all data sources		
ERP system should be in line with the statutory regulations of a country Need to consider culture and race Need to consider environmental issues Need to consider the environmental issues during requirements elicitation Need to consider international laws during requirements	Environmental Perspective	
ERP system development without stakeholders involvement will not meet the stakeholders needs Involving only managers during requirements elicitation will lead to missing requirements Lack of stakeholder involvement make the system fail to meet the needs of stakeholders lack of user involvement will lead to missing requirements Managers can give ERP requirements without involving other stakeholders Need for a system that meets the stakeholders requirements Need for requirements elicitation by involving the stakeholders Need for stakeholders to express their requirements Need for the ERP system to align with the stakeholders needs Need to consider all stakeholders requirements at the same level Need to get the diverse stakeholder's perceptions during requirements elicitation Need to include all stakeholders in requirements elicitation Need to understand the requirements of the stakeholders Off the shelf ERP system are one size fits all Overlooking some stakeholders will result in missing ERP requirements Requirements elicitation is very crucial and most overlooked by requirements engineers Requirements elicitation is very crucial to get the stakeholders needs	Lack of Stakeholder Involvement	

Requirements not addressing user needs Stakeholder actions during requirements elicitation is a good way to extract hidden requirements Stakeholder involvement addresses the needs of the stakeholders Stakeholders different perceptions unearth hidden requirements Stakeholders explanations help to identify Business processes and rules Stakeholders have diverse needs and hence need to involve all the stakeholders to get rich requirements Stakeholders involvement in requirements elicitation translate to a system meeting their needs System not meeting user needs Understand current system challenges Understanding stakeholder requirements		**SOCIOLOGICAL PERSPECTIVES**
Map social and technological issues together Nature of problem will help in selecting stakeholders in requirements elicitation Need for stakeholder's psychological assessment before requirements elicitation starts Need for the social environment to be understood before requirements elicitation starts Need to assess the nature of problem as it depict the stakeholders to select Need to consider the social context during requirements gathering Need to do a stakeholder psychological analysis before requirements start Social and technological factors should not be viewed in isolation Social issues influence the requirements elicitation process Stakeholder psychological assessment influence the quality of requirements Stakeholders are selected based on the nature of the problem at hand Stakeholder's requirements should be viewed together with the social context Stakeholder's social issues and technological issues should not be viewed in isolation ERP requirements are never structured and clear	Stakeholder Psychological Analysis	

Marginalized requirements neglected to cater for those in top management Marginalized stakeholders give rich ERP requirements Need to involve the marginalized stakeholders during requirements elicitation Need to take on board all stakeholders requirements equally Voice of the marginalized needs to be heard	Marginalized Stakeholders	
Diversity in stakeholder composition improves ERP requirements Stakeholder role, age, gender, domain knowledge Stakeholder experience help in extracting requirements Stakeholder knowledge, age, communication skills, interest Level of education, experience, race, gender, domain knowledge Need to consider experience, level of education Need to consider the stakeholder experience, gender, level of education and willingness to participate	Stakeholder Attributes	**STAKEHOLDER CHARACTERISTICS**
Management, marginalized stakeholders, managers, students and lecturers Need for staff members, students, top management and external stakeholders Need to classify stakeholders into different categories Need to consider the most dominant stakeholders Need to consider the external stakeholders Need to consider the demanding stakeholders Need to consider the marginalized stakeholders	Stakeholder Categorization	**STAKEHOLDER ROLE**
Discover hidden requirements	Different Elicitation Techniques	

Explaining the steps needed to reach an outcome help in gathering requirements Stakeholder frustrations help in discovering requirements Goals help in discovering requirements Need for different elicitation techniques during requirements elicitation Need to check the actions of the stakeholder as a way to find a suitable elicitation technique Need to use different elicitation techniques for different stakeholders Personas assist in capturing the diverse stakeholder's requirements Persona's help in discovering requirements Scenarios assist in getting business rules and processes Scenarios help in elicitation requirements		**ELICITATION TECHNIQUES**
Need to get the perceptions of the stakeholders for rich requirements Requirements are not clear and straight forward Stakeholder's diversity create conflicting requirements Requirements engineer perceptions about requirements elicitations crucial Stakeholders have challenges expressing their requirements Stakeholders do not understand how to express their requirements Stakeholders need workshop on requirements elicitation Stakeholder overlook critical requirements	Unclear Stakeholder Requirements	**STAKEHOLDER PERCEPTION**

Six key themes that were derived from the coding process are shown below, together with the core theme for the study.

Table 5-3 Key themes for the study

Key Themes	Core Theme
Domain Knowledge Understanding	ERP Requirements Elicitation
Sociological Perspectives	
Stakeholder Role	

Elicitation Techniques	
Stakeholder Characteristics	
Stakeholder Perception	

The emergent themes from the study are shown in the following Network diagram.

5.3.4 The Network Diagram

The Network diagram made use of the summary data obtained from the open coding. What is visible from the Network diagram is that the ERP Requirements Elicitation process is influenced by the six major themes and their sub-themes shown in the Network diagram.

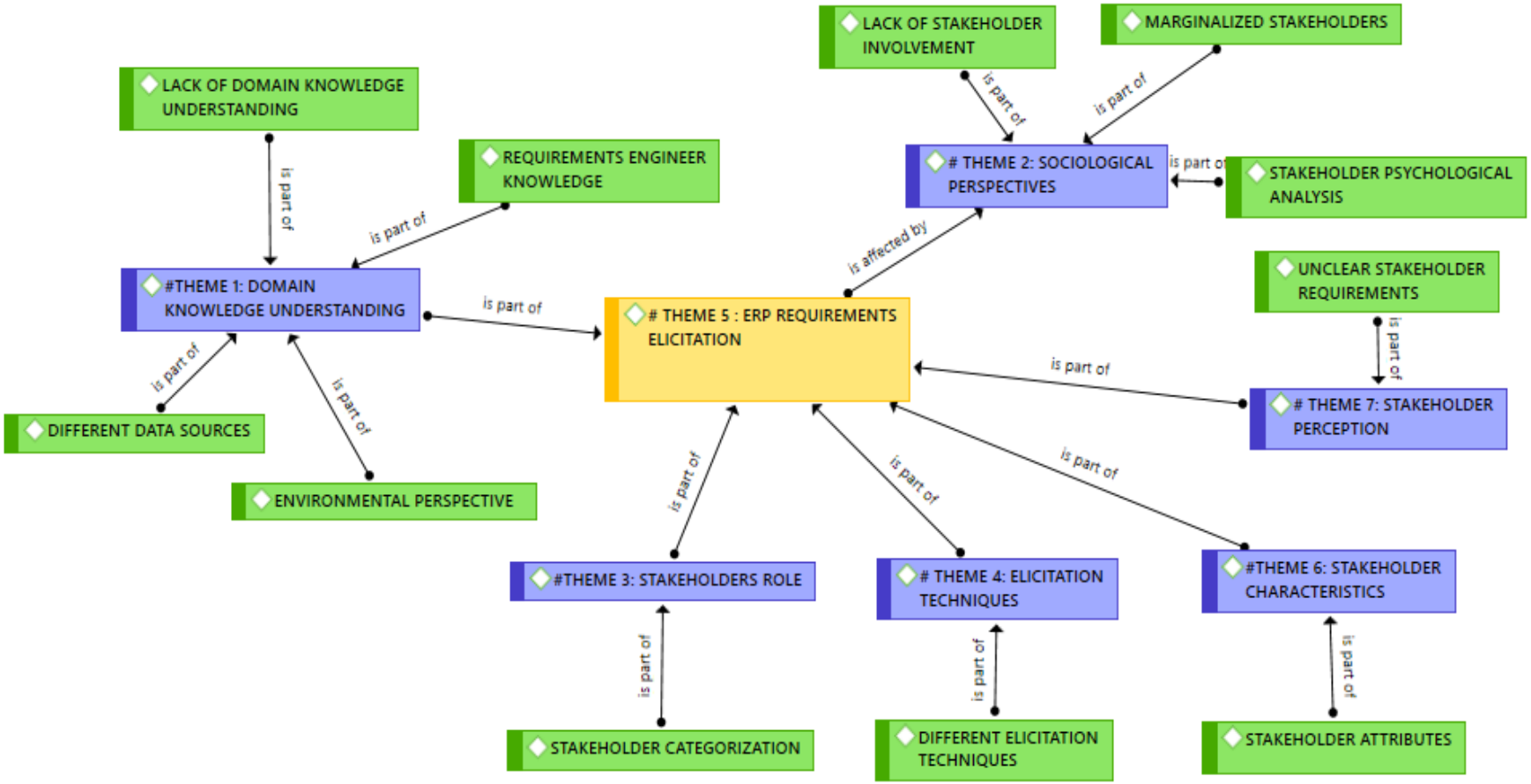

LACK OF STAKEHOLDER INVOLVEMENT
MARGINALIZED STAKEHOLDERS
LACK OF DOMAIN KNOWLEDGE UNDERSTANDING
REQUIREMENTS ENGINEER KNOWLEDGE
THEME 2: SOCIOLOGICAL PERSPECTIVES
STAKEHOLDER PSYCHOLOGICAL ANALYSIS
UNCLEAR STAKEHOLDER REQUIREMENTS
#THEME 1: DOMAIN KNOWLEDGE UNDERSTANDING
THEME 5 : ERP REQUIREMENTS ELICITATION
THEME 7: STAKEHOLDER PERCEPTION
DIFFERENT DATA SOURCES
ENVIRONMENTAL PERSPECTIVE
#THEME 3: STAKEHOLDERS ROLE
THEME 4: ELICITATION TECHNIQUES
#THEME 6: STAKEHOLDER CHARACTERISTICS
STAKEHOLDER CATEGORIZATION
DIFFERENT ELICITATION TECHNIQUES
STAKEHOLDER ATTRIBUTES
is part of
is affected by

Figure 5- 1: Qualitative network diagram

5.4 The Discussion of Findings

The following section discusses the findings from the open coding. The discussion focusses on each theme and sub-theme(s) and provides a brief explanation of the findings. ANNEXURE G shows the questions that were asked the participants to derive the themes shown under this section.

5.4.1 Theme 1: Domain Knowledge Understanding

This theme was generated from the coding process which is very crucial when doing ERP requirements elicitation. The requirements engineer and the stakeholders need to understand the domain before the requirements can be elicitated. This theme was generated from the sub-themes which are discussed below: 1a: Lack of Domain Knowledge Understanding 1b: Requirements Engineer knowledge. 1c: Understanding ERP System Context 1d: Different Data Sources. 1e: Environmental Perspective

5.4.1.1 Sub Theme 1a: Lack of Domain Knowledge Understanding

The first sub-theme showed that there is a need for the domain knowledge understanding for ERP requirements elicitation to be carried out successfully. However, in most cases, the stakeholders and the requirements engineers lack a solid understanding of the underlying domain as can be attested by the data obtained from the open coding.

5.4.1.2 Sub Theme 1b: Requirements Engineer knowledge

The second sub-theme depicts that the requirements engineer must be very knowledgeable with the domain so that they may ask relevant questions that help in ERP requirements elicitation.

5.4.1.3 Sub Theme 1c: Environmental Perspective

The third sub-theme argues that there is a need to assess the environment that the ERP system will operate in. There is a need to assess the environmental issues such as the statutory regulations of a country and international laws when doing requirements elicitation so that the requirements do not violet these statutes.

5.4.1.4 Sub Theme 1d: Different Data Sources

The third theme argues that there is a need to identify all available data sources to avert missing requirements during ERP requirements elicitation.

5.4.2 Theme 2: Sociological Perspectives

The second theme was generated after examining the following sub-themes which are: 2a: Lack of Stakeholder Involvement, 2b: Stakeholder Psychological Analysis and 2c: Marginalized Stakeholders.

5.4.2.1 Sub Theme 2a: Lack of Stakeholder Involvement

The first sub-theme argued that ERP requirements elicitation without involving the stakeholders would bring forth an ERP system that does not address the stakeholders' requirements. The sub-theme also pointed out that only involving managers during requirements elicitation would lead to missing ERP requirements.

5.4.2.2 Sub Theme 2b: Stakeholder Psychological Analysis

The second sub-theme attests that stakeholder's social and technological issues should not be viewed in isolation. The sub-theme also further asserts that the nature of the problem ascertains the type of stakeholders included in the requirements elicitation process.

5.4.2.3 Sub Theme 2c: Marginalized Stakeholders

The third sub-theme argued that marginalized stakeholder's requirements should be considered during ERP requirements elicitation because they proffer very rich requirements since they are the ones who will be using the system daily.

5.4.3 Theme 3: Stakeholder Role

The third theme was generated after examining the sub-themes which influence the ERP requirements elicitation process. The sub-theme Stakeholder Categorization.

5.4.3.1 Sub Theme 3a:

The results from the open coding point out that there is a need to categorize stakeholders into different categories to represent all the stakeholder's roles during the ERP requirements elicitation.

5.4.4 Theme 4: Elicitation Techniques

The fourth theme was generated after examining the sub-theme which is: 4a: Different Elicitation Techniques.

5.4.4.1 Sub Theme 4a: Different Elicitation Techniques

The results from the open coding suggested that there is a need to utilize different elicitation techniques for different stakeholders so that hidden requirements may be extracted. One size fits all approach does not help much during ERP requirements elicitation because diverse stakeholders cannot be subjected to one technique during requirements elicitation.

5.4.5 Theme 5: ERP Requirements Elicitation

This is a major theme from the findings which is associated with all the other themes from the qualitative study.

5.4.6 Theme 6: Stakeholder Characteristics

The theme was generated after examining the sub-theme which is the Stakeholder Attributes.

5.4.6.1 Sub Theme 6a: Stakeholder Attributes

The sub-theme pointed out that that there is a need to include various stakeholder attributes when selecting stakeholders during ERP requirements elicitation so that there is diversity in stakeholder composition.

5.4.7 Theme 7: Stakeholder Perception

The theme was generated after examining the sub-theme which Unclear Stakeholder Requirements.

5.4.7.1 Sub Theme 7a: Unclear Stakeholder Requirements

The sub-theme pointed out that stakeholders have difficulties expressing their requirements and in most cases, they overlook crucial requirements during ERP requirements elicitation.

5.4.8 Respondents responses per each theme

The following section discusses the findings from the study and how they addressed the research questions and also verbatim responses from random respondents on the themes that emerged from the study.

5.4.9 Theme 1: Domain Knowledge Understanding

The following sections will discuss the verbatim quotations from the respondents, however the researcher picked those verbatim quotations which expressed the same notion but in a different way in each theme.

Respondents suggested that lack of domain knowledge understanding affects the ERP requirements elicitation process as can be attested by the respondents' verbatim from the sub-themes discussed below. However, some of the quotations do have grammatical mistakes that the researcher did not correct to enhance the credibility of the study. The themes generated were derined purely from the respondents' views. The respondents were given code names to preserve their anonymity (see Section 5.4.1).

5.4.9.1 Lack of Domain Knowledge Understanding

The following verbatim quotations were picked by the researcher under this sub theme. The verbatim quotations addressed the lack of domain knowledge understanding during ERP requirements elicitation. The lack of domain knowledge understanding compromises the quality of the elicitated requirements by the requirements engineer. This is elaborated by the following verbatim quotations from the respondents.

"If domain knowledge is not understood properly, we end up gathering requirements that do not address the specific needs of the stakeholders." ***BST2-01.***

The respondent argued that domain knowledge needs to be understood by the stakeholder for rich requirements elicitation otherwise the stakeholder may end up giving requirements that do not address the domain requirements.

"..I think it's important to [so] that the requirements engineer and the stakeholder are on the same platform. This will help in ensuring that the extracted requirements from the stakeholder represent the true reflection of what the stakeholder meant." ***CST3-01.***

There is need for the requirements engineer and the stakeholder to know the domain terminologies.

"I think it is very crucial so that you are on the same page with your stakeholders, for example a stakeholder may be talking about something and if the requirements engineer is not well versed with the domain terminology, they may end up capturing requirements that are the opposite of what the stakeholder wants." ***EST4-01.***

There is need for the requirements engineer and the stakeholder to know the domain terminologies.

"The domain terminology will help in ensuring that the stakeholder and the requirements gatherer are speaking the same language. One word may mean something totally different in another domain, so the domain terminology will help in capturing the requirements of the stakeholders without any distortions." ***EST4-02.***

The respondents stressed the need for domain knowledge on the part of stakeholders so that rich requirements may be captured. Sasidharan (2019) and Simović et al (2018) concurred with these findings that lack of domain knowledge affect the quality of ERP requirements.

5.4.9.2 Requirements Engineer knowledge

The following were the verbatim quotations selected by the researcher from the respondents under the requirements engineer knowledge. The respondents also argued that the requirements engineer should be very fluent in the domain so that they understand the requirements of the stakeholders without distortions.

The respondents argued that the requirements engineer should identify all the available data sources where requirements may be extracted from adding to the richness of the extracted ERP requirements and also ensuring that there are no cases of missing requirements as can be attested by this respondent:

"It's important to exploit all the data sources because if we do not get information from all the data sources we might not get all the requirements during the requirements gathering." ***AST1-02.***

"It is important so that the system is complete, that is the ERP system will manage to address all the relevant avenues so that the requirements engineer will be having all the information to address the problem at hand." ***AST2-01.***

For the requirements engineer to address all the stakeholders' problems at hand, they need to be knowledgeable with the domain.

I feel that is very important so that all sources of the ERP requirements are identified and also to avoid cases of missing requirements later during system development." ***EST4-01.***

The requirements engineer's knowledge will succour in reducing cases of missing requirements. Simović et al (2018) concurs with these findings and postulated that there is need for a

requirements engineer during ERP requirements elicitation so as to preclude issues of missing requirements.

5.4.9.3 Environmental Perspective

The following were the verbatim quotations selected by the researcher from the respondents under the environmental perpsective sub theme. The respondents argued that the environmental perspective needs to be understood so that the ERP requirements do not violate government regulations.

"..When you are doing requirements elicitation the environment issue come[s] handy in that you need to look at the boundaries of the ERP and also the context in which you are going to design it." ***CST2-01.***

"The ERP system should also conform to the government regulations and other external laws of the country so in that regard, it is very critical to pay an ear to the environmental issues when gathering ERP requirements." ***BST2-01.***

"The environment also help[s] the requirements engineer to make sure they adhere to certain government regulations and industry standards and norms for the ERP system to be a success." ***AST2-01.***

".. Every system that is developed there is an environment in which it will be used, so the environment in which the ERP system will be used will need to be examined so that the system conforms to the statutes in that environment." ***EST4-01.***

The respondents shared the same sentiments that there is a need to consider the environmental issues when doing requirements elicitation so that the system will conform to the regulations in place. Lee et al (2020) also postulated that the environment needs to be understood so that the ERP system confirms to the regulations of the country.

5.4.9.4 Different Data Sources

These were the verbatim quotations selected by the researrcher under the different data sources sub theme. The respondents argued that different data sources enhance the extracted ERP requirements and help in reducing cases of missing requirements.

"The data sources will help in ensuring that no requirements will be missed during requirements gathering." ***CST3-01.***

"Data sources are also a form of obtaining requirements for the ERP system, so it is very crucial to establish all the data sources so that some overlooked requirements will not be missed in the process." ***BST2-01.***

"It's important to exploit all the data sources because if we do not get information from all the data sources we might not get all the requirements during the requirements gathering." ***AST1-02***

The findings on the need for different sources to be examined during ERP requirements elicitation are also supported by Vieira et al (2018) and Wang et al (2019). Diverse data sources incrementally enhance the quality of the ERP requirements captured.

5.4.10 Theme 2: Sociological Perspectives

Many viewpoints need to be assessed during ERP requirements elicitation because every university is plagued by social differences that may affect the ERP requirements elicitation process.

5.4.10.1 Lack of Stakeholder Involvement

The following were the verbatim quotations picked by the researcher under the lack of stakeholder involvement sub theme. The ERP requirements elicitation process should involve the stakeholders and the respondents voiced their concerns on the lack of stakeholder involvement during ERP requirements elicitation.

"Normally what I can say ERP gathering requirements should involve the users of the system and with reference if you look at our institution most of the times we are told that there is a new ERP that has been implemented by without involving the users." ***CST2-01.***

"We cannot have a situation where the system is just brought to the stakeholders and the stakeholders are just told to use the system without giving their input." ***BST2-01.***

*"At times you might come up with a good ERP system but if you do not consult the stakeholders they may reject it saying the system is not addressing what they want****." AST1-01.***

The respondents stressed the need for the active involvement of the stakeholders in requirements elicitation so that the ultimate ERP system that will be developed will meet the expectations of the stakeholders. The findings also concurs with Osman (2018), who postulated that there is need to involve stakeholders when developing ERP systems.

5.4.10.2 Stakeholder Psychological Analysis

The researcher picked the following verbatim quotations under this sub theme. The respondents observed that the stakeholder's social and technological issues should not be viewed in isolation. This is attested by the following quotes from the respondents.

"Psychological issues of the stakeholders will affect the quality of the ERP requirements that will be extracted by the requirements engineer." ***AST3-01.***

"You will find out that certain psychological issues may cause the stakeholders to withhold very crucial requirements and by so doing, rich requirements will not be elicited, hence the need to assess if there are some psychological issues the stakeholders are facing." ***EST4-01.***

"..That's right in the sense that stakeholders are social beings, their performance, their interaction it is to a large extent controlled by their social status." ***BST3-01.***

The respondents alluded that there is a need for a stakeholder psychological analysis so that rich ERP requirements may be extracted from the stakeholders. The findings on stakeholder's social context to be taken into consideration when developing ERP systems are supported by Haddara & Moen (2017) and Voegler et al (2019).

5.4.10.3 Marginalised Stakeholders

The following verbatim quotations were selected by the researcher under this sub theme. The respondents also suggested that marginalised stakeholders should also be involved in ERP requirements elicitation process as their requirements are critical even though they may have a low social status in the university.

"Marginalised stakeholders in most cases they do have very rich requirements because they are the type of people who do not easily change jobs and they know the ERP system very well and they also can identify requirements for the ERP system without a lot of problems." ***BST2-01.***

"No matter how small they may look and no matter how irrelevant they might look you will realize that those small things will make a big impact later when the ERP system is developed. Every brick matters no matter how small, for the structure to stand it requires that little detail that you thought was not important." ***AST1-01.***

"Yes, of course, other people in the organizations may not value the role that they do in the organization but those marginalized stakeholder's requirements are very critical to the success of the ERP system." ***EST4-01.***

"…If you look [at an] ERP system it's made up of different components so it is not only the managers' requirements that should be taken on board but however the marginalized stakeholders' needs are very important also.." ***CST2-01.***

All four respondents argued that the requirements of the marginalized stakeholders are very critical for the success of an ERP system. The findings corroborate with Petrović (2016) who postulated that marginalized stakeholders need to be given a voice in the organization.

5.4.11Theme 3: Stakeholder Role

The third theme clarifies that the stakeholder's roles do affect the ERP requirements elicitation process and the sub themes are discussed below.

5.4.11.1 Stakeholder Categorization

The researcher picked the following verbatim quotations under this sub theme. The respondents suggested that for effect ERP requirements elicitation process to take place, the stakeholders need to be categorized as can be attested by the following quotes from the respondents.

I think it narrows down our specifications to certain groups because these groups may be interacting differently with the system so if you say the users who are lecturers and the users who are students, by that we are narrowing down our requirements to a certain group, so that we can specifically cater for one group and also cater for another group." ***AST1-02.***

"…so that we make sure we satisfy the requirements of each and every group, for example if you are doing an ERP system for a university and you forget that we have regulatory bodies if you forget that we have parents and guardians as stakeholders and if you forget that we have students and alumni and if you don't classify them, you may end up forgetting certain stakeholders whose requirements are very important." ***BST3-01.***

"Well categories will help in making sure that all stakeholders are represented, at times you might leave out some important stakeholders so if you group the stakeholders into categories it means all the stakeholders will be represented." ***CST3-01****.*

"Categories help in segmenting your stakeholders so that you will see which categories to pick during requirements gathering." ***EST4-02.***

All the four respondents above agreed that by putting stakeholders into groups, will help in minimizing cases of missing ERP requirements. The findings also corroborate with Anwar & Razali (2015) and Ryan (2014), who argued that there is need to identify key stakeholders before

ERP requirements elicitation commences. This will help in ensuring that all ERP requirements are captured during the ERP requirements elicitation process.

5.4.12 Theme 4: Stakeholder Characteristics

The respondents also argued that stakeholder's characteristics influence the extracted ERP requirements. This can be attested by the following quotes from the respondents.

5.4.12.1 Stakeholder attributes

The researcher selected the following verbatim quotations under this sub theme. The respondents argued that stakeholders need to be selected based on their attributes.

"..So that we have a uniqueness in the requirements gathering, I think it's best to consider the stakeholder's level of education, experience, stakeholder role, and gender." ***AST2-01.***

"..I feel stakeholders should be selected based on their domain knowledge understanding, level of education is also important, gender is also crucial and the stakeholder's experience I think." ***BST2-01.***

"..Well, the stakeholder's level of education is important, their willingness to participate is very important, their communication skills is very important so that…" ***AST1-02.***

"Yes there is need to create a balance rather than using one stakeholder's characteristics during requirements gathering, so I think stakeholder interest is very important, also age can be considered, the stakeholder role in the organization, stakeholder knowledge also is crucial." ***EST4-01.***

"..I think it's true taking gender for example women they think in a certain manner which is totally different from their male counterparts… I think gender, age and experience should be considered. ***CST2-02****.*

Here, the respondents had diverging views on stakeholder characteristics, but the respondents stressed the need that the stakeholder's characteristics should be varied, the stakeholder's role may be influential but other attributes such as the stakeholder's experience, level of education, gender and others should also be considered when selecting the stakeholders during requirements elicitation. The findings were also supported by Darwish (2016) who argued that there is need to consider the stakeholder's characteristics when selecting stakeholders during ERP requirements elicitation.

5.4.13 Theme 5: Requirements Elicitation Techniques

The respondents also alluded that ERP requirements elicitation is affected to a greater extent by the elicitation technique(s) that would have been used by the requirements engineer.

5.4.13.1 Different Elicitation Techniques

The following verbatim quotations were selected by the researcher under this sub theme. The respondents argued that there is a need to utilize different elicitation techniques for different stakeholders so that rich ERP requirements may be extracted from the stakeholders.

"..Different techniques help us to gather the requirements more effectively, stakeholders are different and hence one size fit all approach will not work when doing requirements elicitation so different techniques will help." ***AST2-01****.*

"You will find out that some techniques work better under certain situations and certain scenarios, so it is important to determine which technique is best to be applied under a particular situation." ***BST3-01.***

"Basically requirements vary so by using different techniques will help in extracting all the requirements needed for the ERP system than using a single technique." ***EST4-01.***

"Well there is [a] need to use different elicitation techniques for different stakeholders…" ***EST4-02.***

The findings suggest that different elicitation techniques need to be utilized to accommodate diverse stakeholders during ERP requirements elicitation. The findings are also supported by Kessi et al (2014) who argued that ERP requirements cannot be elicited from a single perspective but the requirements need to be collected from diverse worldviews. .

5.4.14 Theme 6: Stakeholder Perceptions

The respondents argued that ERP requirements elicitation is also affected by the stakeholder perceptions and the sub-theme is discussed below.

5.4.14.1 Unclear Stakeholder Requirements

The following verbatim quotations were picked by the researcher under this sub theme. The ERP requirements from the stakeholders are usually not clear and there is a need for the requirements engineer to be innovative during requirements elicitation so that clear requirements are captured.

"..There is [a] need to explore how best the stakeholder can express what the system should do for them." ***AST1-03.***

"..At times users may have challenges in expressing their needs not because they cannot express what the system should do but at times they overlook some important issues which will make they not like the new ERP system when developed." ***CST2-02****.*

"..Expressing a requirement is one of the most difficult tasks during ERP requirements gathering. Stakeholders usually have a list of issues that the ERP system should do but the challenge is how to translate those issues into requirements. In most cases you will find out that some stakeholders overlook some important requirements assuming that the requirements engineer should just know those requirements. ***EST4-02.***

Respondents observed that the stakeholders do have challenges in coming up with the requirements for the new ERP system and in most cases, they overlook critical requirements and expect the requirements engineer to extract the requirements on their behalf. The findings were also supported by Jia & Capretz (2018) who underscored the need to take on board the perceptions of diverse stakeholders to preclude missing ERP requirements.

5.5 Research questions revisited

The output of the qualitative findings helped in answering some of the research questions of the study. This section will briefly re-visit the research questions and how the questions were addressed with the findings from the qualitative study. The research questions helped in addressing the aim and objectives of the study. The following Table 5.3 helps in linking the themes generated from the qualitative findings to the sub- research questions of the study.

Table 5-4 Mapping of themes to research questions

Theme	**Research question (s)**
Theme 1: Domain Knowledge Understanding	**2 and 3**
Theme 2: Sociological Perspectives	**2 and 3**
Theme 3: Stakeholder Role	**2 and 3**
Theme 4: Stakeholder Characteristics	**2 and 3**
Theme 5: Requirements Elicitation Techniques	**2 and 3**
Theme 6: Stakeholder Perceptions	**2 and 3**

The qualitative findings managed to answer the sub - research questions 2 and 3, however research question 1 was answered in chapter 2 in the literature review section. Research question 4 was addressed in Chapter 7, (see section 7.4)

5.6 Summary of findings

The results from the qualitative findings generated six themes linked to the research questions of the study. Thematic analysis was used to generate the major themes obtained: Domain Knowledge Understanding, Sociological Perspectives, Stakeholder Role, Stakeholder Characteristics, Requirements Elicitation Techniques, and Stakeholder Perceptions.

Although some related studies were done by Anwar and Razali (2016) proposing the stakeholder selection criteria in ERP requirements elicitation, their study was too brief and leaves out crucial factors that were discussed in this chapter. Salhotra (2014) proposes the stakeholder's typology but does not consider other factors which do affect the selection of those stakeholders such as the knowledge of the requirements engineer in extracting overlooked ERP requirements from the stakeholders.

ERP requirements elicitation at universities needs domain knowledge understanding both from the stakeholders and the requirements engineer so that deep requirements can be extracted. In addition, there is a need to explore the social differences which may exist in an institution that could affect ERP requirements elicitation. The findings also suggest that there is a need to consider the stakeholder's role in ERP requirements elicitation. The qualitative findings helped in developing the instrument ultimately refined and used in the quantitative phase.

5.7 Hypothesis development

The research followed the qualitative and quantitative approach (qual – quan; see Chapter 4 section 4.4). The outcome from the qualitative study led to the development of the hypothesis that is ultimately tested in the quantitative study using a questionnaire. From the qualitative study, the researcher observed that ERP requirements elicitation is affected by six key themes.

The variables that need to be tested in the quantitative study are the following: domain knowledge, sociological perspectives, stakeholder role, elicitation techniques, stakeholder characteristics, stakeholder perception, stakeholder level of education and stakeholder position. The following table 5.4 shows the hypotheses developed for testing in this study.

Table 5-5 Hypotheses generated from the qualitative study

H1	There is a significant relationship between the elicitation techniques and the ERP requirements elicitation
H2	There is a significant relationship between the domain knowledge and the ERP requirements elicitation
H3	There is a significant relationship between the stakeholder role and the ERP requirements elicitation
H4	There is a significant relationship between the sociological perspectives and the ERP requirements elicitation
H5	There is a significant relationship between the stakeholder characteristics and the ERP requirements elicitation
H6	There is a significant relationship between the stakeholder perception and the ERP requirements elicitation
H7	There is a significant relationship between the level of education and the ERP requirements elicitation
H8	There is a significant relationship between the stakeholder position and the ERP requirements elicitation

5.8 Chapter summary

This chapter presented the qualitative results of the study. The data were obtained from 12 participants from four study units. The qualitative study generated 6 themes that were used to inform the judicious development of the hypotheses. The qualitative phase helped the researcher in getting a deeper understanding of the ERP requirements elicitation at universities in Zimbabwe. The findings helped in validating the ERP requirements elicitation framework. The next chapter discusses the quantitative data collection and analysis.

CHAPTER 6 QUANTITATIVE RESULTS

6.1 Introduction

The previous chapter presented the qualitative results obtained from the study. These qualitative findings informed the research instrument for the quantitative study. This chapter presents the quantitative results from the four study units in Zimbabwe. The procedures followed during the data collection and analysis are discussed in this chapter. Descriptive data analysis and correlations were used in data analysis. SPSS version 21 was used for this exress purpose.

6.2 Questionnaire Design

The findings from the qualitative study informed the design of the questionnaire, specifically the themes obtained from the qualitative study. The hypothesis formulated (see Chapter 5 section 5.7) was mapped onto the research questions.

The questionnaire was divided into seven sections (see ANNEXURE 8). The first section strove to establish the demographics of the participants; the second section elicited the stakeholder's perceptions on ERP requirements elicitation; the third section involved the domain knowledge and its effect on ERP requirements elicitation; the fourth section involved the Sociological Perspectives; the fifth section involved the stakeholder's role; the sixth section involved the Stakeholder's Characteristics; the seventh section involved the Requirements Elicitation Techniques.

6.2.1 Pilot Study

Pilot testing was done to refine the instrument before the actual administration. Expert sampling technique was employed when selecting participants (A total of 35 questionnaires were administered but 27 were returned and the feedback from the participants was established and corrective measures in line with the participants' feedback were implemented. The instrument was administered to computing lecturers, ERP developers, ERP consultants, and computing students using expert sampling (see Chapter 4 section 5.3.1) on purposive sampling justification. The results of the pilot study are shown in Table 6.1 reflecting the overall Cronbach's Alpha coefficient ($\alpha = 0.748$) with a total number of items being 61 from 27 cases.

Table 6-1 Pilot Cronbach's Alpha

Stakeholder's Perceptions scale

Reliability Statistics

Cronbach's Alpha	N of Items	N
.805	8	27

Domain Knowledge Understanding scale

Reliability Statistics

Cronbach's Alpha	N of Items	N
.859	11	27

Sociological Perspectives scale

Reliability Statistics

Cronbach's Alpha	N of Items	N
.716	13	27

Stakeholder's Role scale

Reliability Statistics

Cronbach's Alpha	N of Items	N
.604	10	27

Stakeholder's Characteristics scale

Reliability Statistics

Cronbach's Alpha	N of Items	N
.772	11	27

Requirements Elicitation Techniques

Reliability Statistics

Cronbach's Alpha	N of Items	N
.716	8	27

Overall Cronbach's Alpha

Reliability Statistics

Cronbach's Alpha	N of Items	N
.748	61	27

Table 6.1 above shows high Cronbach values suggesting that there was good internal consistency from the instrument and this justified then the administration of this instrument to a large sample.

6.3 Data Collection

The data collection was done from August to September 2019 and three research assistants were employed to administer the questionnaires (see ANNEXURE H) for the questionnaire sample that was distributed. An expert sampling technique was selected in distributing the questionnaires to participants meeting the researcher's criteria (see Chapter 4 section 4.5.3). A sample size of 396 was extracted from a population of 714 from the four study units that met the researcher's selection criteria (see Chapter 4 section 4.6.8). A total of 396 questionnaires were administered and 278 questionnaires were returned but 3 questionnaires had missing data and were discarded. The response rate after discarding the non-usable questionnaires with missing data stood at 70%. The discarded questionnaires had more than 25% in missing data hence the reason to discard them.

6.3.1 Quantitative Data Analysis

The quantitative data analysis made use of descriptive and inferential statistics to analyse the data. In descriptive analysis, the researcher resorted to frequencies, mean and standard deviation, while for the inferential statistics the researcher utilised T-Test, ANOVA and Person's correlation.

6.3.2 Respondents' Demographics

The table 6-2 shows the respondents's demographics.

Table 6-2 Respondents' demographics

Variable Name	Category	Frequency	Percentage (%)
Age	16 to 25	202	73.5
	26 to 35	26	9.5
	36 to 45	33	12.0
	Above 46	14	5.1
Gender	Male	158	57.5
	Female	117	42.5
Position	Computing Student	209	76.0
	Computing Lecturer	36	13.1
	ERP Developer/Management	15	5.5
	External Consultant	15	5.5
Highest Level of Education	O Level	8	2.9
	A Level	192	69.8
	Diploma	9	3.3
	Undergraduate	10	3.6
	Postgraduate	56	20.4
Number of years using an ERP system	Less than 2	121	44.0
	3 to 5	109	39.6
	6 to 10	32	11.6
	Above 10	13	4.7
Ever been involved with ERP requirements elicitation	Yes	32	11.6
	No	243	88.4
Institution working for or studying at	University A	93	33.8
	University B	79	28.7

	University C External Consultant	88 15	32.0 5.5

The next section discusses the respondents' demographics.

6.3.2.1 Age

The results showed that the majority of the 202 respondents ranged from 16 to 25 years, accounting for 73.5%. The respondents were from computing students undertaking their studies at the three universities. The 26 to 35 age group had 26 respondents which accounted for 9.5% of the total respondents. The other category was 33 respondents from 36 to 45 age group which represented 12% of the respondents. The last 14 respondents were above 46 years, representing 5.1% of the respondents.

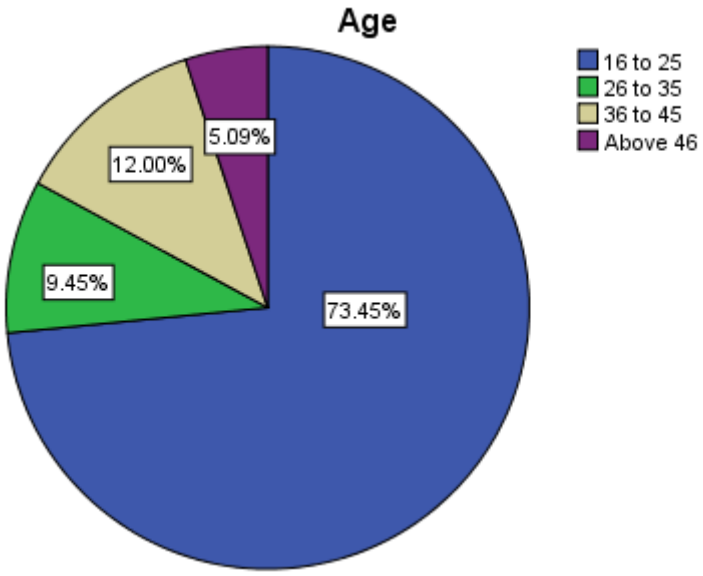


Figure 6-1: Respondents' age

6.3.2.2 Gender

The results show that 158 males took part in the survey, accounting for 57.5% of the respondents. The females were 117, translating into42.5% of the respondents. The results also may suggest that female students are significantly under-represented in a degree in computing.

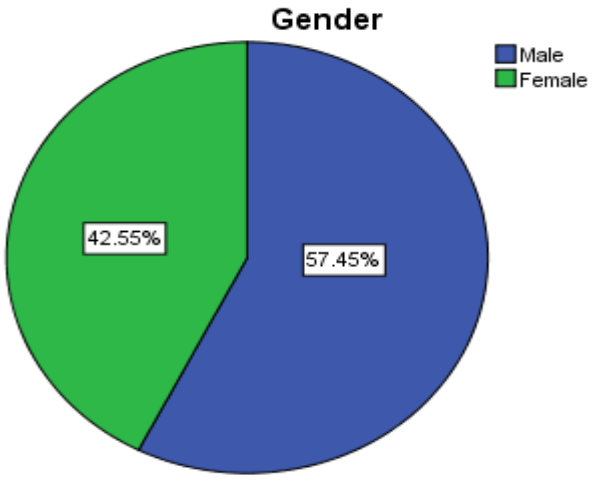


Figure 6-2: Respondents' gender

6.3.2.3 Position

The results show that 209 of the respondents were computing students, accounting for 76% of the respondents. There were 36 computing lecturers who took part in the survey and that accounted for 13.1% of the respondents. There were 15 ERP developers and management personnel in the survey and they represented 5.5% of the respondents. For external consultants, 15 participated in the survey, contributing to 5.5% of the respondents.

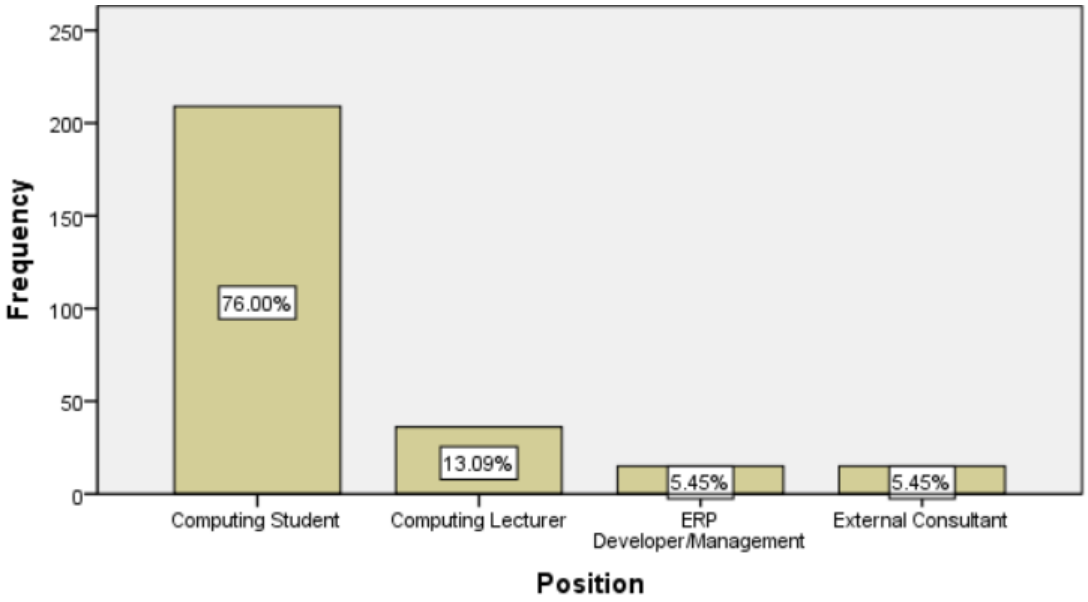


Figure 6-3: Respondents' position

6.3.2.4 Highest level of education

The results indicate that the majority of the respondents had completed their Advanced Level studies, which represented 69.8% of the respondents with a total number of 192. The higher respondents' rate for the Advanced Level is attributed to the fact that the Ordinary Level qualification is the minimum normal entry requirement to pursue a computing degree in all Zimbabwean universities. Respondents who completed their postgraduate studies amounted to 56, representing 20.4% of the respondents. The higher respondents' rate is also attributed to the fact that a postgraduate qualification is the minimum requirement for one to be appointed a computing lecturer in Zimbabwean universities. This was followed by respondents who had completed their undergraduate studies who amounted to 10 and represented 3.6% of the respondents. Respondents who completed their Diploma studies amounted to 9 which represented 3.3% of the respondents. The last category was respondents who had completed their Ordinary Level studies that amounted to 8 which represented 2.9% of the respondents.

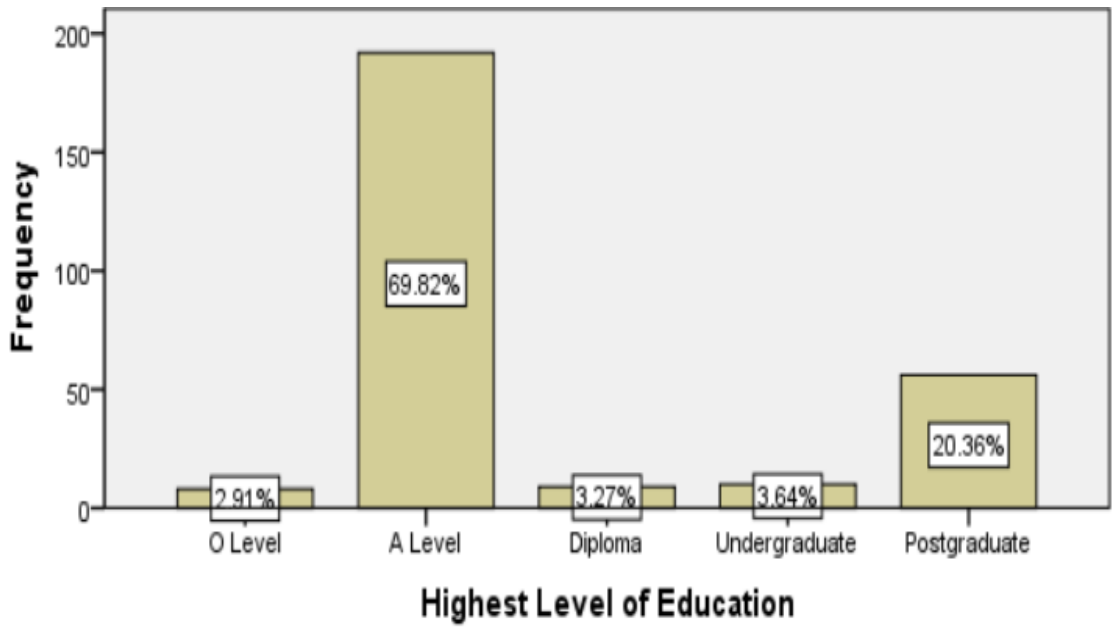


Figure 6-4: Respondents' highest level of education

6.3.2.5 Number of years using an ERP system

The results indicate that most of the respondents had used an ERP system for at least a year with a total of 121 respondents (44%). The majority of these respondents were students in Computing Studies in their second year of study. The respondents who had used the ERP system from 3 to 5 years amounted to 109 which accounted for 39.6%. This was followed by respondents who had used the ERP system from 6 to 10 years which amounted to 32 which represented 11.6%. Respondents who had used the ERP system above 10 years were 13 and they represented 4.7% of the respondents.

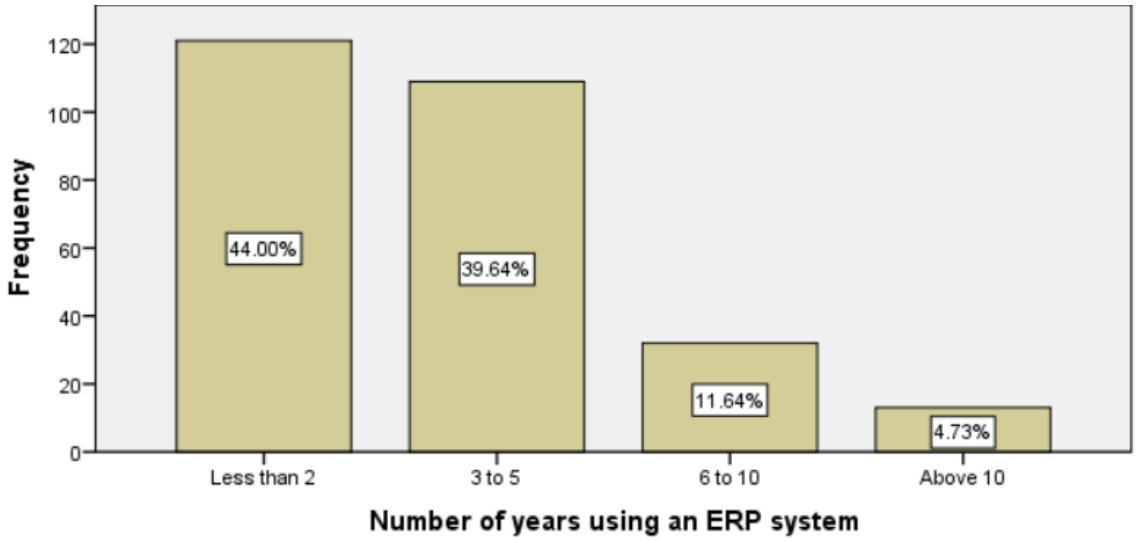


Figure 6-5: Respondents' number of years using an ERP system

6.3.2.6 Ever been involved with ERP requirements elicitation

The results suggest that 243 of the respondents were never involved in ERP requirements elicitation which accounted for 88.4%, while 32 respondents (11.6%) had been involved in ERP requirements elicitation. This suggests that the majority of stakeholders have not been involved in ERP requirements elicitation.

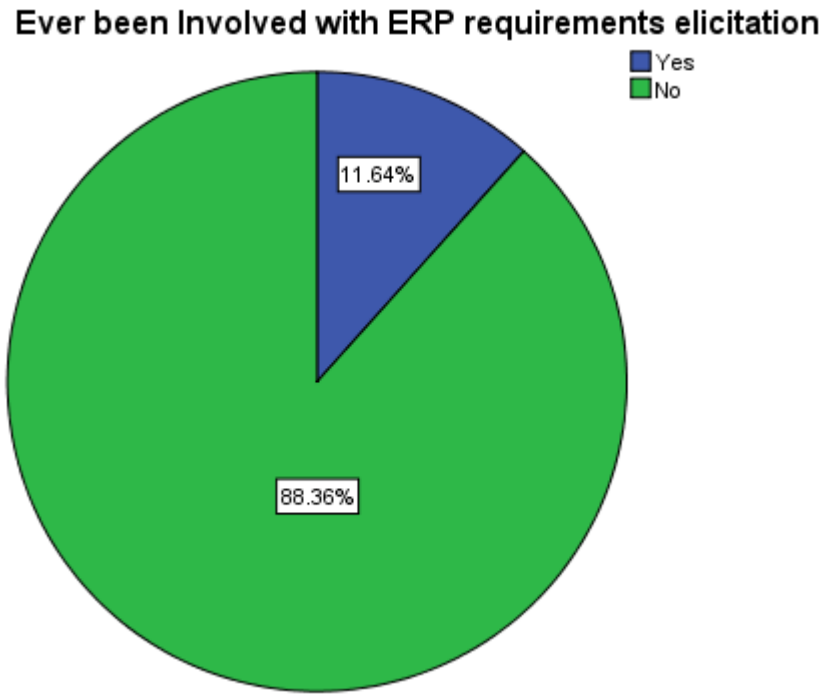


Figure 6-6: Respondents' ever involved with ERP requirements elicitation

6.3.2.7 Current institution for work or study

The real university names were not disclosed to preserve their anonymity, instead university names A, B and C were used. University A had the highest number of respondents with 93 which represented 33.8% of the respondents. University C followed with 88 respondents which represented 32% of the respondents. This was followed by University B with 79 respondents which represented 28.7% of the respondents. The last category was the external consultants with a total of 15 respondents which represented 5.5% of the respondents.

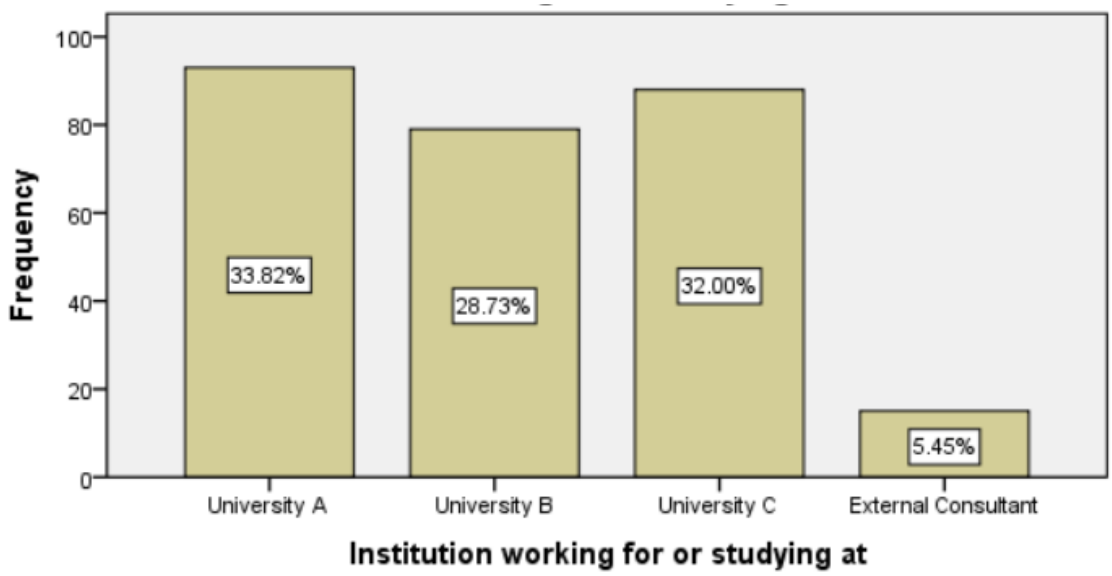


Figure 6-7: Respondents' institution

6.4 Instrument reliability testing

The instrument was tested for reliability using Cronbach's alpha to measure the internal consistency of the items. Han (2018) observes that a Cronbach's alpha coefficient reliability greater than 0.7 is acceptable. However, Antony and Fergusson (2004) argue that coefficients above 0.6 are also recommended to measure the reliability of an instrument. The Cronbach's alpha coefficient reliability of each construct was calculated and the overall coefficient is depicted in the following table. There were six constructs calculated separately as shown below.

Table 6-3 Cronbach's Alpha scales

Stakeholder's Perceptions scale

Reliability Statistics

Cronbach's Alpha	N of Items	N
.726	8	275

Domain Knowledge Understanding scale

Reliability Statistics

Cronbach's Alpha	N of Items	N
.768	11	275

Sociological Perspectives scale

Reliability Statistics

Cronbach's Alpha	N of Items	N
.674	13	275

Stakeholder's Role scale

Reliability Statistics

Cronbach's Alpha	N of Items	N
.758	10	275

Stakeholder's Characteristics scale

Reliability Statistics

Cronbach's Alpha	N of Items	N
.727	11	275

Requirements Elicitation Techniques

Reliability Statistics

Cronbach's Alpha	N of Items	N
.614	9	275

Overall Cronbach's Alpha

Reliability Statistics

Cronbach's Alpha	N of Items	N
.846	61	275

The results from Table 6.3 showed the overall Cronbach's Alpha coefficient (α = 0.846) which suggests a high internal consistency in the study. The coefficient was obtained from 61 items and 275 cases.

6.5 Factor analysis

Factor analysis is a method used to test the validity of the instrument within a particular context. There are two methods used to perform Factor analysis, namely the Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), (Orcan, 2018; Wu, 2018). EFA is utilized by researchers to explore relationships between survey items while the CFA is used to confirm the relationships between survey items (Orcan, 2018; Knekta et al, 2019). Orcan (2018) went on to say that if the relationships between the survey items is not known, it is advisable to use EFA. CFA is best suited when there is strong model assumption, in which case, an already existing proven structure is investigated using the new data set (Brown & Moore, 2012; Pan, 2017; Orcan, 2018).

A number of researchers utilized EFA in exploring the theoretical structure of the phenomena in ERP requirements studies (Law & Ngai, 2007; Ganesh & Mehta, 2010; Amid et al, 2012; Gupta et al, 2017). However, according to Maskey el al (2018) and Watkins (2018), there is need for researchers to explain the Kaiser-Meyer Olkin Measure of Sampling Adequacy, the rotation used (Varimax or Promax), Factor extraction/Retention criteria, the acceptable factor loadings and the percentage variance explained. The explanation above will aid in achieving satisfactory factor analysis solution. The EFA is used by researchers to validate theories and measurements (Reio & Shuck, 2015; Watkins, 2018; Georgiou & Kyza, 2017). Watkins (2018) argued that the relationship between the constructs and the indicator variable allows the mapping of theoretical constructs onto the empirical phenomena when using EFA. EFA has been used by various researchers in ERP requirements to analyse the contribution made by each construct when validating theories or measurements (Abugabah et al, 2015; Georgiou & Kyza, 2017; Mekadmi & Louati, 2018; Ghazaleh et al, 2019). EFA was utilized in this to test the validity of the constructs, their contribution and the mapping of theoretical constructs onto the empirical phenomena under study. The EFA was adopted in this study to meet the developmental purpose of the mixed methods chosen for this study (see Chapter 4 section 4.3.1).

EFA was carried out on each construct in the instrument and Likert items with low correlations were dropped. Gren and Goldman (2016) argue that the first step in EFA is to make sure that the items are correlated to one another and they measure the same construct. The Kaiser-Meyer Olkin Measure of Sampling Adequacy asserts that the measure of sampling adequacy should be greater than 0.5 for it to be acceptable and items with less than 0.5 correlations removed (Gren

& Goldman, 2016). The varimax method was used for the rotation. The researcher utilised the principal component analysis extraction method with Eigen-values greater than one. The coefficient display was sorted by size and suppressed small coefficients less than 0.4. The mean scores were utilised to get the average scores of the items and the standard deviation was used to establish the extent of the spread of the data items from the mean. The findings are shown in the following tables.

6.5.1 Factor 1 loadings - Stakeholder's perceptions on ERP requirements elicitation

Table 6.4 displays the factor 1 loadings for stakeholder perceptions on ERP requirements elicitation.

Table 6-4 Factor 1 loading -Stakeholder's perceptions on ERP requirements elicitation

Item	Factor loading	Eigen value	Variance %	KMO	Bartlett's test	Mean	SD
Cronbach Alpha (α = .726), items = 8, dropped = 1, N=275		4.174	65.79	.835	1249.892		
ERP requirements elicitation should involve the stakeholders so that their requirements are met	.906					3.85	.360
Stakeholder overlook crucial ERP requirements during ERP requirements elicitation	.903					3.85	.353
Stakeholders need ERP requirements knowledge to participate in ERP requirements elicitation process	.838					3.87	.352
Diverse stakeholder's perceptions need to be accommodated during ERP requirements elicitation	.814					3.88	.332
The ERP system is meeting my expected outcomes	.702					3.86	.376
Stakeholders have challenges in expressing their requirements during ERP requirements elicitation	.639					3.82	.484
Stakeholders need awareness on ERP requirements elicitation	.581					3.66	.474

process to prevent unclear ERP requirements.							

The Cronbach alpha coefficient for the stakeholder perceptions on ERP requirements elicitation was (α = 0.726) and the standard loadings for the items were above 0.5 except one item which was dropped. The Eigenvalue of the items greater than 1 the Likert values explained 65.79% variance. The KMO value for the measure of sampling adequacy was 0.835, which is greater than the acceptable value of 0.5. Bartlett's test of sphericity was also significant with ($p < 0.01$) which means the instrument was reliable. The researcher utilized a four Likert scale so the average mean score comes to 2.5. The mean values greater than 2.5 were treated as acceptable while mean values below 2.5 were treated as unacceptable.

The mean (M) and the standard deviation (SD) of the construct suggest that stakeholder's perceptions of ERP requirements elicitation measurements were adequate. The highest mean score was (M= 3.88), for the item; diverse stakeholder's perceptions need to be accommodated during ERP requirements elicitation. This suggests that the respondents felt that it is essential to engage stakeholders during ERP requirements elicitation so that their requirements are extracted. The SD was very close to the mean, suggesting that the respondents did not differ much in their responses.

6.5.2 Factor 2 loading –Domain knowledge understanding on ERP requirements elicitation

Table 6.5 shows the factor 2 loadings for domain knowledge understanding on ERP requirements elicitation.

Table 6-5 Factor 2 loading - Domain knowledge understanding on ERP requirements elicitation

Item	Factor loading	Eigen value	Variance %	KMO	Bartlett's test	Mean	SD
Cronbach Alpha (α = .733), items = 11, dropped items = 3, N=275		4.157	63.63	.820	1627.961		
Domin knowledge help in reducing confusion associated with terminology in a specific domain when asking questions during ERP requirements elicitation	.958					3.23	.637
Domain knowledge will significantly reduce missing	.953					3.24	.645

ERP requirements during requirements elicitation							
Domain knowledge will help in understanding the ERP system scope during requirements elicitation	.910					3.20	.632
Domain understanding is part of the problem-solving in the application domain during requirements elicitation	.851					3.09	.597
ERP requirements are derived from the application domain during requirements elicitation	.681					2.92	.797
Using different data sources help in minimizing cases of missed ERP requirements during requirements elicitation	.649					2.85	.702
ERP software projects may fail because the requirements engineer fail to understand the domain during requirements elicitation	.608					3.79	.480
Domain knowledge of requirements engineer help in asking relevant questions during ERP requirements elicitation	.574					3.22	.630

The Cronbach alpha coefficient for domain knowledge understanding of ERP requirements elicitation was ($\alpha = 0.733$) which is an acceptable range. The table also shows that there were 11 items and 3 items were dropped with sampling adequacy less than 0.5. The Eigenvalue of the items was greater than 1 and the Likert values explained 63.63% variance. The KMO value for sampling adequacy was 0.820 which was acceptable. Bartlett's test of sphericity was also significant with ($p < 0.01$) which means the instrument was reliable.

The mean and the standard deviation of the construct also suggest that the stakeholder's domain knowledge understanding of ERP requirements elicitation was measured adequately. The highest mean score (M= 3.79) which respondents observed that most ERP software projects may fail because the requirements engineer fails to understand the domain during requirements elicitation. However, the highest standard deviation (SD = 0.797), respondents had diverse views on whether ERP requirements are derived from the application domain during requirements elicitation or not.

6.5.3 Factor 3 loading – Sociological Perspectives on ERP requirements elicitation

Table 6.6 displays the factor loadings for sociological perspectives on ERP requirements elicitation.

Table 6-6 Factor 3 loading - sociological perspectives on ERP requirements elicitation

Item	Factor loading	Eigen value	Variance %	KMO	Bartlett's test	Mean	SD
Cronbach Alpha (α = .674), items = 13, dropped items = 2, N= 275		2.970	66.70	.506	1060.033		
Stakeholders who are close to the problem situation are assumed to be knowledgeable about the problem situation hence there is need to consider them when extracting ERP requirements	.908					3.47	.652
Stakeholders' social issues need to be addressed for rich ERP requirements to be extracted	.894					3.51	.647
Power relations within a university may affect the ERP requirements elicitation	.808					3.53	.568
Stakeholder's psychological issues may cause them to withhold very crucial requirements	.795					3.52	.588
Stakeholder's involvement during ERP requirements elicitation will help in reducing missing requirements.	.789					3.52	.612
ERP requirements are well structured and there is less reliance on stakeholders to give their requirements	.568					3.47	.746
Stakeholder's psychological issues may affect the quality of the ERP requirements that will be extracted during ERP requirements elicitation	.887					3.65	.528
Stakeholders with a low social status in the university should be included during ERP requirements elicitation	.832					3.68	.506

Stakeholder's action is socially bound and in that regard, the stakeholder's requirements should not be viewed in isolation with the social context.	.820					3.64	.552
ERP requirements can be extracted from the social relations such as organizational conflicts, leadership styles and power during ERP requirements elicitation	.813					3.51	.618

The Cronbach Alpha coefficient was (α = 0.674) which is recommended according to Hair et al (2006) who recommended coefficients above 0.6. Factor 3 had 13 items and 2 were dropped with sampling adequacy less than 0.5. The Eigenvalue of the items was greater than 1 and the Likert values explained 66.70% variance. The KMO value for sampling adequacy was 0.506 which was in the acceptable range. Bartlett's test of sphericity was also significant with ($p < 0.01$) which means the instrument was reliable.

The mean and the standard deviation of the construct also suggest that the sociological perspectives on ERP requirements elicitation were measured adequately. The highest mean score (M= 3.68) which respondents observed stakeholders with a low social status in the university should be included during ERP requirements elicitation. However, the highest standard deviation (SD = 0.746), respondents had diverse views on this item; ERP requirements are well structured and there is less reliance on stakeholders giving their requirements.

6.5.4 Factor 4 loading – Stakeholder's role in ERP requirements elicitation

Table 6.7 displays the factor 4 loadings for stakeholder's role in ERP requirements elicitation.

Table 6-7 Factor 4 loading - stakeholder's role in ERP requirements elicitation

Item	Factor loading	Eigen value	Variance %	KMO	Bartlett's test	Mean	SD
Cronbach Alpha (α = .758), items = 10, dropped items =2, N=275		3.414	60.76%	.594	1031.169		
Dangerous stakeholders [those with power and with urgent requirements] should be considered for ERP requirements elicitation.	.936					3.52	.588

Definitive stakeholders [those with power, legitimacy and urgent requirements] should be considered for ERP requirements elicitation	.860					3.55	.573
Demean stakeholders [those with a low social status in the institution] should be considered for ERP requirements elicitation	.733					3.51	.606
Dominant stakeholders [those with power in an institution] should be considered for ERP requirements elicitation.	.772					3.47	.706
Stakeholder's categorization will reduce cases of missed ERP requirements.	.761					3.50	.722
Demanding stakeholders [those with urgent requirements] should be considered for ERP requirements elicitation.	.635					3.47	.746
Dependent stakeholders [those with less power but with crucial requirements] should be considered for ERP requirements elicitation	.874					3.55	.605
Discretionary stakeholders [those with low power and low urgent requirements] should be considered for ERP requirements elicitation	.850					3.50	.630

The Cronbach Alpha coefficient was ($\alpha = 0.758$) which was in the acceptable range. Factor 4 had 10 items and 2 were dropped with sampling adequacy less than 0.5. The Eigenvalue of the items was greater than 1 and the Likert values explained 60.76% variance. The KMO value for sampling adequacy was 0.594 which was in the acceptable range. Bartlett's test of sphericity was also significant with ($p < 0.01$) which means the instrument was reliable.

The mean and the standard deviation of the construct also suggest that the stakeholder's role in ERP requirements elicitation was measured adequately. The highest mean scores were two with the same value (M= 3.55) for definitive stakeholders and dependent stakeholders which respondents to be included during ERP requirements elicitation. The highest standard deviation

(SD = 0.746), respondents had diverse views on this item for demanding stakeholders and their involvement in ERP requirements elicitation.

6.5.5 Factor 5 loading – Stakeholder's characteristics on ERP requirements elicitation

Table 6.8 shows the factor 5 loadings for stakeholder's characteristics on ERP requirements elicitation.

Table 6-8 Factor 5 loading - stakeholder's characteristics on ERP requirements elicitation.

Item	Factor loading	Eigen value	Variance %	KMO	Bartlett's test	Mean	SD
Cronbach Alpha (α = .727), items = 11, dropped items = 0, N=275		3.058	59.39%	.707	537.676		
Stakeholder's domain knowledge affects the quality of elicitated ERP requirements.	.866					3.29	.803
Stakeholder's role affects the quality of the elicitated ERP requirements	.802					3.41	.674
Stakeholder's cognitive Style (how a stakeholder thinks, perceive and remember information) affects the quality of the elicitated ERP requirements	.551					3.14	.803
Stakeholder's age affects the quality of the elicitated ERP requirements	.717					3.40	.765
Stakeholder's gender affects the quality of the elicitated ERP requirements	.641					3.24	.904
Stakeholder's level of education affects the quality of the elicitated ERP requirements	.619					3.43	.708
Stakeholder's culture affects the quality of the elicitated ERP requirements	.743					3.33	.594
Stakeholder's interest affects the quality of the elicitated ERP requirements	.649					3.28	.638
Stakeholder's social embeddedness affects the quality of the elicitated ERP requirements	.589					3.39	.841

Stakeholder's experience affects the quality of the elicitated ERP requirements	.811					3.33	.775
Stakeholder's communication skill affects the quality of the elicitated ERP requirements	.800					3.45	.764

The Cronbach Alpha coefficient was (α = 0.727) which is acceptable. Factor 5 had 11 items and all the items were retained. The Eigenvalue of the items was greater than 1 and the Likert values explained 59.39% variance. The KMO value for sampling adequacy was 0.707 which was in the acceptable range. Bartlett's test of sphericity was also significant with ($p < 0.01$) which means the instrument was reliable.

The mean and the standard deviation of the construct also suggest that the stakeholder's characteristics on ERP requirements elicitation were measured adequately. The highest mean score was (M= 3.45) for the item stakeholder's communication skill affects the quality of the elicitated ERP requirements. The highest standard deviation was (SD = 0.904), for the gender item which shows that the respondents were spread over out on the effect of gender on ERP requirements elicitation.

6.5.6 Factor 6 loading – Requirements Elicitation Techniques on ERP requirements elicitation

Table 6.9 shows the factor 6 loadings for requirements elicitation techniques on ERP requirements elicitation.

Table 6-9 Factor 6 loading - requirements elicitation techniques on ERP requirements elicitation.

Item	Factor loading	Eigen value	Variance %	KMO	Bartlett's test	Mean	SD
Cronbach Alpha (α = .614), items = 9, dropped items = 2, N=275		2.491	54.30%	.687	345.489		
When stakeholders are asked to explain in detail the sequence of steps they need to follow when doing a specific task may help in extracting rich ERP requirements	.755					3.47	.706
A requirements elicitation technique influence the extracted ERP requirements	.729					3.52	.612

When stakeholders are asked to define goals for the new ERP system and also asked to explain why those goals are needed and how can those goals be achieved may help in extracting ERP requirements.	.660					3.47	.746
Using a single elicitation technique during ERP requirements elicitation will miss important ERP requirements.	.611					3.52	.589
Different elicitation techniques work better under different situations.	.553					3.50	.722
Creating fictitious characters called Personas that represent different stakeholders with different requirements may help in extracting rich ERP requirements	.674					3.42	.686
Overlooked ERP requirements may be extracted by using different elicitation techniques	.581					3.81	.494

The Cronbach Alpha coefficient ($\alpha = 0.614$) which was in the recommended range (Antony & Fergusson, 2004). Factor 6 had 9 items and 2 items were dropped with sampling adequacy less than 0.5. The Eigenvalue of the items was greater than 1 and the Likert values explained 54.30% variance. The KMO value for sampling adequacy was 0.687 which was in the acceptable range. Bartlett's test of sphericity was also significant with ($p < 0.01$) which means the instrument was reliable.

The mean and the standard deviation of the construct also suggest that the requirements elicitation techniques on ERP requirements elicitation were measured adequately. The highest mean score was (M= 3.81) for the item overlooked ERP requirements that may be extracted by using different elicitation techniques. The highest standard deviation was (SD = 0.746), for the item when stakeholders are asked to define goals for the new ERP system and explain why those goals are needed and how those goals could be achieved may help in extracting ERP requirements.

6.5.7 Retained Factors

Table 6.10 below summarises the retained factors with their factor analysis

Table 6-10 Retained factor loadings

Factor	Factor loading range	Eigen value	Variance %	KMO	Bartlett's test
Factor 1 (Stakeholder's perceptions) Cronbach Alpha (α = .857), Items = 7, N= 275	.682 to .886	4.160	59.43%	.836	1241.076
Factor 2 (Domain knowledge understanding) Cronbach Alpha (α = .763), Items = 8, N= 275	.581 to .944	3.723	66.82%	.807	1456. 874
Factor 3 (Sociological Perspectives) Cronbach Alpha (α = .693), Items = 11, N= 275	.575 to .915	2.969	72.13%	.594	1031.169
Factor 4 (Stakeholder's role) Cronbach Alpha (α = .776), Items = 8, N= 275	.653 to .944	3.296	73.70%	.587	989.110
Factor 5 (Stakeholder's characteristics) Cronbach Alpha (α = .727), Items = 11, N= 275	.551 to .866	3.058	59.39%	.707	537.676
Factor 6 (Elicitation techniques) Cronbach Alpha (α = .760), Items = 7, N= 275	.539 to .897	4.09	58.43%	.712	576.832

The KMO for the 6 retained factor analysis was in the acceptable range to be utilised in factor analysis as their sampling adequacy were all above 0.5 (Napitupulu et al, 2017). The loading factors for the 6 factors ranged from 0.539 to 0.944, all the retained factors were tested for reliability using Cronbach alpha and their coefficient values were as follows: Stakeholder's perceptions (α = .857); Domain knowledge understanding (α = .763); Sociological Perspectives (α = .693); Stakeholder's role (α = .776); Stakeholder's characteristics (α = .727); Elicitation techniques (α = .760). This suggests that the scale was reliable since all the coefficient values were above 0.6 (Antony & Fergusson, 2004).

6.5.8 Summated scales

The researcher utilised summated scales after the EFA where scores of individual items were summed together to produce a summated rating score (Willits, 2016). The researcher used the mean score per response in generating the summated ratings. Six summated scales were derived: Stakeholder Perceptions, Domain Understanding, Sociological Perspectives, Stakeholder's Role, Stakeholder's Characteristics and Elicitation Techniques. These summated scales were used in performing the t-tests and ANOVA.

6.6 Data normality testing

Kitchenham et al (2019) argue that there is a need to pre-test the data to determine if the data is normally distributed or not before selecting any statistical inference method. The researcher used the dependent variables from the summated ranking scales (see section 6.5.8) and gender was used as an independent variable. The summated ranking scales need to be normally distributed for both males and females. The researcher utilised numerical and visual outputs in testing the normality of the data. Das and Imon (2016) suggest that visual outputs proffer powerful diagnostic tools on unclear assumptions.

Shapiro-Wilk tests were run to examine the data normality. The results of the tests are shown below.

Table 6-11 Data normality test

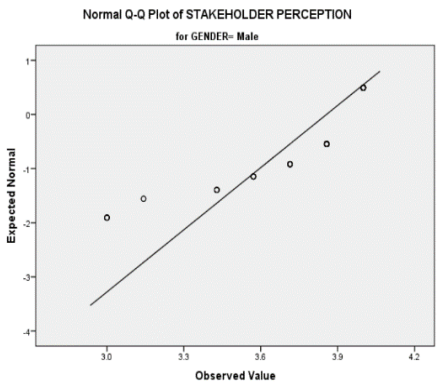
Tests of Normality

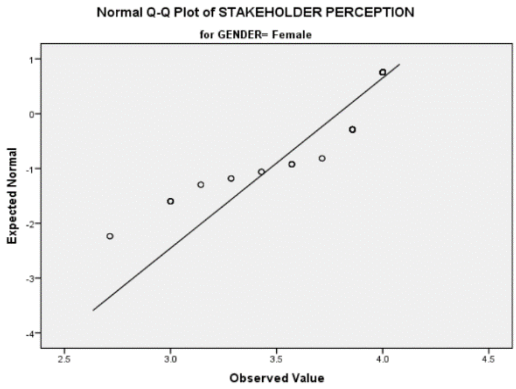
		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Gender	Statistic	df	Sig.	Statistic	df	Sig.
STAKEHOLDER PERCEPTION	Male	.329	158	.000	.606	158	.000
	Female	.369	117	.000	.665	117	.000
DOMAIN KNOWLEDGE	Male	.104	158	.000	.973	158	.003
	Female	.122	117	.000	.966	117	.004
SOCIOLOGICAL PERSPECTIVES	Male	.104	158	.000	.959	158	.000
	Female	.112	117	.001	.950	117	.000
STAKEHOLDER ROLE	Male	.161	158	.000	.900	158	.000
	Female	.136	117	.000	.939	117	.000
STAKEHOLDER CHARACTERISTICS	Male	.125	158	.000	.957	158	.000
	Female	.100	117	.006	.974	117	.024
ELICITATION TECHNIQUES	Male	.144	158	.000	.934	158	.000
	Female	.122	117	.000	.946	117	.000

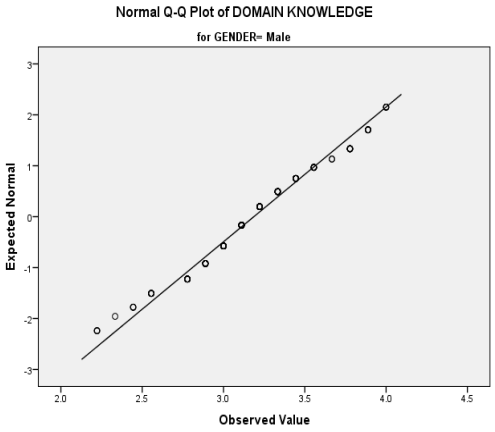
a. Lilliefors Significance Correction

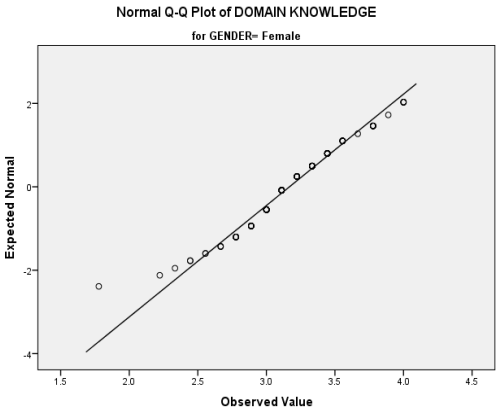
The results from Table 6.11 suggest that the data is not normally distributed as most of the values are less than 0.05 ($p < 0.05$). However, Das and Imon (2016) suggest that some visual analysis

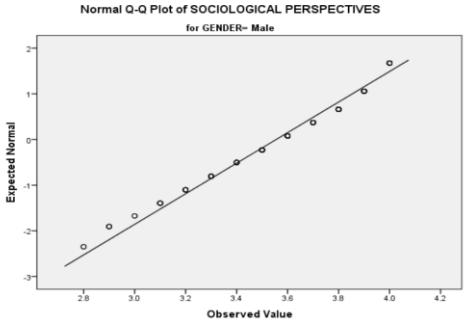
may be utilized to support the numerical output. The researcher utilised the QQ plots to cross-check the normality of the data.

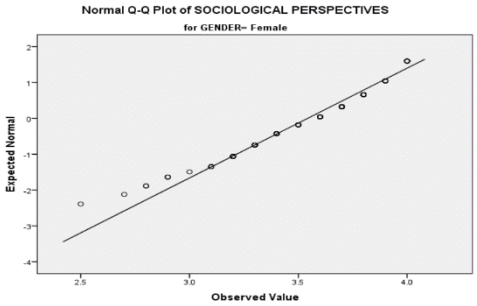












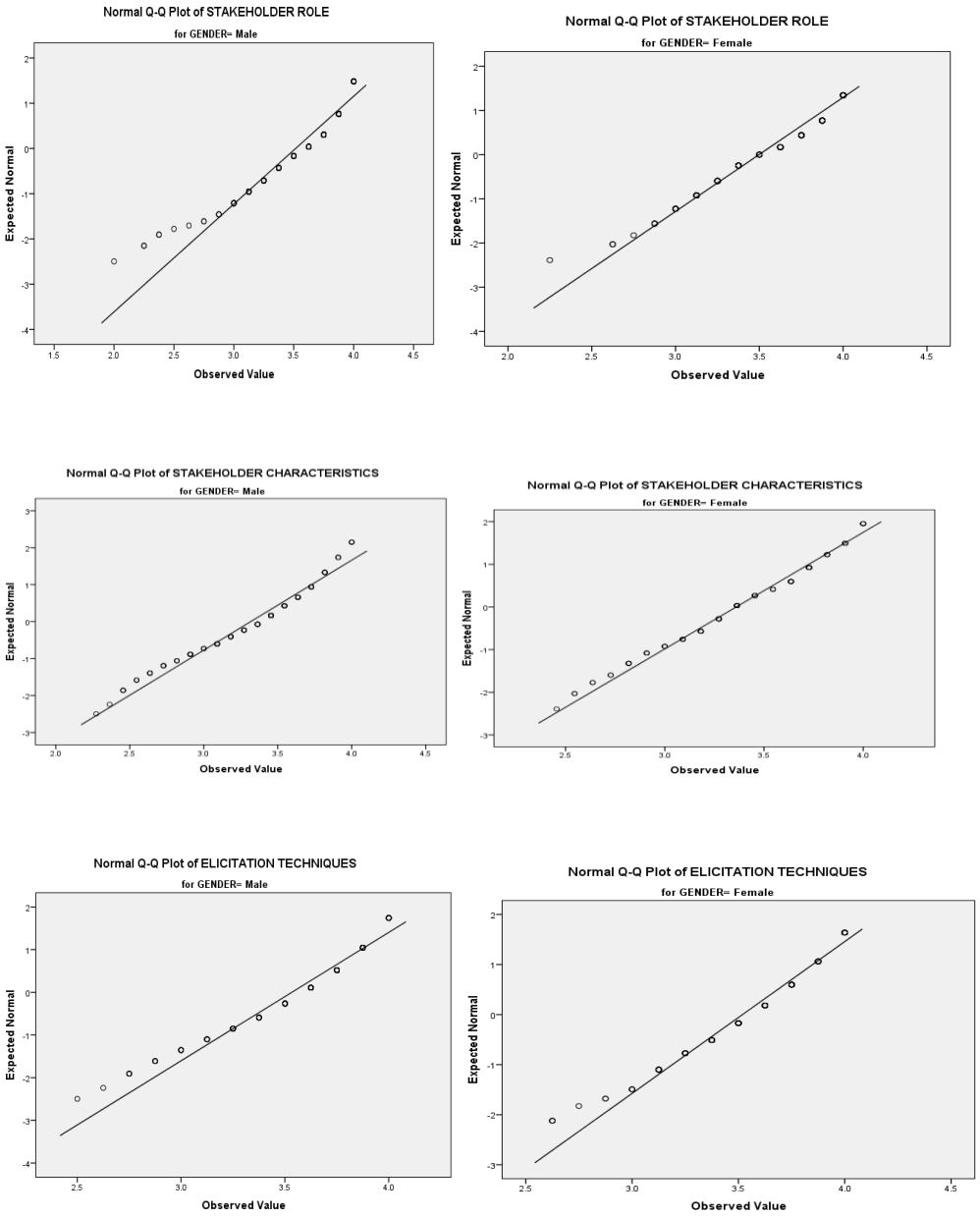


Figure 6-8: QQ plots

The Figure 6.8 shows the normality test using the QQ plots and the findings suggest that the data is approximately normally distributed, hence the researcher utilised parametric inferential statistics for further data analysis.

6.7 T-test

T-Test was done between the demographic variable and the constructs. The dependent and independent variables are the constructs and the stakeholder's position respectively. The position variable was re-coded to cater for the student and non-student respondents. The non-student respondents combined the computing lecturers, ERP developer or management and the external

consultant. The variable chosen helped the researcher to establish if this construct affected the ERP requirements elicitation. The results of the T-test are shown in the following table.

Table 6-12 T-test for demographic variable

Dependent Variable	Position (Independent Variable)	N	Mean	Std. Deviation	t Value	Df	Sig (2 tailed)
STAKEHOLDER PERCEPTION	Student	209	3.8250	.29953	-.308	273	.758
	Non Student	66	3.8377	.25907			
DOMAIN KNOWLEDGE	Student	209	3.1632	.38567	-1.208	273	.228
	Non Student	66	3.2273	.34062			
SOCIOLOGICAL PERSPECTIVES	Student	209	3.5282	.31716	-2.65	273	.040*
	Non Student	66	3.6182	.27896			
STAKEHOLDER ROLE	Student	209	3.4982	.41899	-.725	273	.469
	Non Student	66	3.5398	.36039			
STAKEHOLDER CHARACTERISTICS	Student	209	3.2706	.39045	-5.083	273	
	Non Student	66	3.5399	.32245			.000**
ELICITATION TECHNIQUES	Student	209	3.5054	.34610	-1.963	273	.051
	Non Student	66	3.5966	.26746			

Note: * p<0.05, ** p<0.01, *** p<0.001, (n=275)

The Table 6.12 showed that the stakeholder's position variable showed some significant differences on stakeholder characteristics, scores were slightly higher for non-student (M = 3.54, SD = 0.32) than student (M = 3.27, SD = 0.39), $t(273) = -5.883$, ($p < 0.01$), and sociological perspectives, scores were slightly higher for non-student (M = 3.62, SD = 0.27) than student (M = 3.53, SD = 0.32) $t(273) = -2.65$, ($p = 0.040$). This suggests that the position variable had an influence on two constructs of the ERP requirements elicitation: the stakeholder's characteristics and the sociological perspectives. However, there were no significant differences on the other three constructs which were stakeholder perceptions, domain knowledge and stakeholder role, suggesting that position does not have any significant effect on these ERP requirements elicitation constructs.

The researcher did another T-test using the gender variable and there were no significant differences in all the ERP requirements elicitation constructs, implying that gender variable did not have any effect on the ERP constructs.

6.8 Analysis of Variance (ANOVA) of demographics variables

The Analysis of Variance was done using categorical variables against the constructs. The results of the ANOVA are discussed in the following sections.

6.8.1 ANOVA categorical age variable against constructs

The results of the categorical age variable are summarized in the following table 6.13.

Table 6-13 ANOVA age test

Independent Variable (Age)	Dependent Variable	Categories	Levene test	Mean	SD	F/(Welch) value	F/(Welch) sig	df1/f2
Age	Stakeholder Characteristics	16 to 25	0.198	3.2579	0.38918	10.970	0.01	3(271)
		26 to 35		3.5629	0.9319			
		36 to 45		3.5455	0.30745			
		Above 46		3.3352	0.39202			
Age	Elicitation Techniques	16 to 25	0.010	3.4988	0.34890	(5.540)	(0.002)	3(45)
		26 to 35		3.5629	0.20824			
		36 to 45		3.5455	0.30127			
		Above 46		3.3352	0.33080			
Age	Sociological Perspectives	16 to 25	0.022	3.5248	0.31980	(6.628)	(0.022)	3(45)
		26 to 35		3.5577	0.27738			
		36 to 45		3.6121	0.29129			
		Above 46		3.5498	0.16984			
Age	Stakeholder Role	16 to 25	0.021	3.4938	0.42114	(3.536)	(0.002)	3(46)
		26 to 35		3.5433	0.32004			
		36 to 45		3.4886	0.42201			
		Above 46		3.6964	0.20636			

Post Hoc Tests	Age (I)	Age (J)	Mean Differences (I-J)	Std. Error	Sig.
Stakeholder Characteristics	16 to 25 16 to 25 16 to 25	26 to 35 36 to 45 Above 46	-.30506 -.28758 -.27459	0.07756 0.06989 0.10287	.001 .000 .040
Elicitation Techniques	16 to 25	Above 46	-.24321	0.09041	.039
Sociological Perspectives	16 to 25	Above 46	-.22525	0.08489	.042

Table 6.13 only shows those ERP requirements elicitation constructs that age influenced. Levene's Homogeneity test of variance was used and when the p-value of Levene's test was less than 0.05, the Welch value was utilised instead. Each construct had age categories ranging from 16 to 25, 26 to 35, 36 to 45 and above 45. The age was compared with the stakeholder's characteristics construct $F(3, 271) = 10.970$, $p = .01$ and significant differences in categories were noted. A post hoc test was done using Tukey HSD and showed mean differences in stakeholder characteristics between age 26 to 35 ($M = -.30506$, $SD = .07756$), age 36 to 45 ($M = -.28758$ $SD = .06989$) and age above 45 ($M = -.27459$, $SD = .10287$).

The results also showed that the age was compared with the elicitation techniques construct and significant differences in categories were noted $F(3, 45) = 5.540$, $p = .002$. A post hoc test using Tukey HSD showed mean differences in elicitation techniques in the age group between 16 to 25 ($M = 3.4988$, $SD = .34890$) and above 46 ($M = 3.3352$, $SD = 0.33080$). The age was also compared with the sociological perspectives and showed significant differences in categories $F(3, 45) = 6.628$, $p = .022$. A post hoc test using Tukey HSD showed mean differences between the age 16 to 25 ($M = 3.5248$, $SD = 0.31980$) and the age group above 46 ($M = 3.5498$, $SD = 0.29129$). The results indicate the effect of age on stakeholder characteristics, elicitation techniques, and sociological perspectives.

6.8.2 ANOVA categorical level of education variable against constructs

The results of the categorical level of education variable are summarised in the following Table 6.14.

Table 6-14 ANOVA test for the level of education

Independent Variable (Level of education)	Dependent Variable	Categories	Levene test	Mean	SD	F/(Welch) value	F/(Welch) sig	df1/f2
Level of education	Stakeholder Characteristics	O Level	.128	3.5000	.53231	9.488	.01	4(270)
		A Level		3.2467	.37966			
		Diploma		3.5758	.32141			
		Undergraduate		3.6636	.26435			
		Postgraduate		3.5179	.32888			
Level of education	Elicitation Techniques	O Level	.053	3.8281	.25823	4.378	.002	4(270)
		A Level		3.4831	.34565			
		Diploma		3.6944	.21751			
		Undergraduate		3.7125	.27035			
		Postgraduate		3.5759	.26401			
Level of education	Sociological Perspectives	O Level	.046	3.8250	.27646	(3.863)	(.015)	4(23)
		A Level		3.5089	.31536			

		Diploma		3.6778	.22791			
		Undergraduate		3.7900	.17920			
		Postgraduate		3.5875	.28352			

Post Hoc Tests	**Level of education (I)**	**Level of education (J)**	**Mean Differences (I-J)**	**Std. Error**	**Sig.**
Stakeholder Characteristics	A Level Post graduate	Undergraduate A level	-.41695 -.27117	.11994 .5616	.005 .01
Elicitation Techniques	O level	A level	-.34505	.11653	.027
Sociological Perspectives	O level Undergraduate	A level A level	-.31615 .28115	.10904 .09802	.033 .036

The results showed that the level of education influenced stakeholder characteristics $F(4, 270) = 9.488$, $p = .01$. A post hoc test was done using Tukey HSD and showed mean differences in stakeholder characteristics between A level ($M = 3.2467$, $SD = .37966$) and undergraduate ($M = 3.6636$, $SD = .26435$) however, the postgraduate ($M = 3.5179$, $SD = .32888$) differed with the A level (($M = 3.2467$, $SD = .37966$).

The level of education was also compared with the elicitation techniques and there were significant differences between categories $F(4, 270) = 4.378$, $p = 0.002$. A post hoc was done and showed mean differences between O level ($M = 3.8281$, $SD = .25823$) and A level ($M = 3.4831$, $SD = .34565$). The results indicate the effect of level of education on stakeholder characteristics, elicitation techniques, and sociological perspectives.

6.8.3 ANOVA categorical position variable against the construct

The results of the categorical position variable are summarised in the following Table 6.15.

Table 6-15 ANOVA test for the stakeholder position

Independent Variable (Level of education)	**Dependent Variable**	**Categories**	**Levene test**	**Mean**	**SD**	**F/(Welch) value**	**F/(Welch) sig**	**df1/f2**
Position	Stakeholder Characteristics	Computing student	.200	3.2706	.39045	9.245	.01	3(271)
		Computing lecturer		3.5480	.31453			
		ERP Developer/ Management		3.4364	.31154			

			External Consultant		3.6242	.34509			
Post Hoc Tests	**Level of education (I)**	**Level of education (J)**	**Mean Differences (I-J)**	**Std. Error**	**Sig.**				
Stakeholder Characteristics	Computing student	Computing lecturer	-.27743	.6775	.01				
	Computing student	External consultant	-.35369	.10036	.003				

The position was compared with the stakeholder characteristics and there were significant differences between categories $F(3, 271) = 9.245$, $p = 0.01$. A post hoc test was done and showed mean differences between computing student ($M = 3.2706$, $SD = .39045$) and computing lecturer ($M = 3.5480$, $SD = .31453$). The post hoc test also showed mean differences between the computing student ($M = 3.2706$, $SD = .39045$) and the external consultant ($M = 3.6242$, $SD = .34509$). The results indicate the effect of position on stakeholder characteristics.

6.8.4 ANOVA categorical institution variable against the construct

The results of the categorical institution variable are summarised in the following Table 6.16.

Table 6-16 ANOVA test for the institution

Independent Variable (Level of education)	**Dependent Variable**	**Categories**	**Levene test**	**Mean**	**SD**	**F/(Welch) value**	**F/(Welch) sig**	**df1/f2**
Institution	Stakeholder Characteristics	University A	.730	3.3646	.29655	8.274	.001	3(271)
		University B		3.5350	.35040			
		University C		3.0713	.37125			
		External Consultant		3.6420	.34091			
Institution	Sociological Perspectives	University A	.650	3.6204	.29101	5.239	.065	3(271)
		University B		3.4756	.33621			
		University C		3.5114	.30112			
		External Consultant		3.7125	.19279			
Institution	Stakeholder Role	University A	.001	3.6532	.30066	(8.738)	(.001)	3(67)
		University B		3.4455	.39661			
		University C		3.3920	.47312			
		External Consultant		3.6094	.31910			

Post Hoc Tests	**Institution (I)**	**Institution(J)**	**Mean Differences (I-J)**	**Std. Error**	**Sig.**
Stakeholder Characteristics	Uni A	Uni B	-.17035	.05216	.007
	Uni A	Uni C	.29333	.05052	.001

	Uni A	Ext Const	-.27443	.09195	.015
Sociological Perspectives	Uni A Ext Const	Uni B Uni B	.14479 .23686	.04658 .08326	.011 .025
Stakeholder Role	Uni A Uni A	Uni B Uni C	.20771 .26118	.06003 .05815	.003 .001

The institution was compared with the stakeholder characteristics, sociological perspectives and the stakeholder role and there were significant differences between institution and stakeholder characteristics $F(3, 271) = 8.274$, $p = 0.01$. A post hoc test was done and showed mean differences between university A ($M = 3.3646$, $SD = 0.29655$) and university B ($M = 3.4756$, $SD = 0.35040$). The post hoc test also showed mean differences between university A ($M = 3.3646$, $SD = 0.29655$) and university C ($M = 3.0713$, $SD = 0.37125$). The post hoc also showed mean differences between University A and the external consultant ($M = 3.6420$, $SD = 0.34091$). The results indicate the effect of the institution on stakeholder characteristics.

The institution was compared with the sociological perspectives and there were significant differences between the institution and sociological perspectives $F(3, 65) = 8.738$, $p = 0.001$. A post hoc test was done and showed mean differences between University A ($M = 3.6204$, $SD = 0.29101$) and University B ($M = 3.4756$, $SD = 0.29101$). A post hoc test was also done and showed mean differences between external consultant ($M = 3.7125$, $SD = 0.19279$) and University B ($M = 3.4756$, $SD = 0.29101$). The results indicate the effect of institution on sociological perspectives.

The institution was compared with the stakeholder role and there were significant differences between the institution and stakeholder role $F(3, 271) = 5.239$, $p = 0.065$. A post hoc test was also done and showed mean differences between university A ($M = 3.6532$, $SD = 0.30066$) and university B ($M = 3.4455$, $SD = 0.39661$). A post hoc test was also done and showed mean differences between University A ($M = 3.6532$, $SD = 0.30066$) and University C ($M = 3.3920$, $SD = 0.47312$). The results indicate the effect of institution on stakeholder role.

6.9 Correlation of constructs

The ERP requirements elicitation constructs were further analysed using the bivariate Pearson correlation to check the strength of relationships that exist between variables. The Pearson

correlation evaluates for statistical linear relationships among variables. The correlation of constructs helped in assessing the strength of constructs with regards the ERP requirements elicitation variable. The following table 6.17 summarises the results of the Pearson correlation among variables.

Table 6-17 Correlation matrix

Variable		1	2	3	4	5	6	7
STAKEHOLDER PERCEPTION (**1)**	Pearson Sig	1						
DOMAIN KNOWLEDGE (**2)**	Pearson Sig	.085 .159	1					
SOCIOLOGICAL PERSPECTIVES (**3)**	Pearson Sig	-.061 .310	.097 .110	1				
STAKEHOLDER ROLE **(4)**	Pearson Sig	-.107 .076	.039 .517	.680** .000	1			
STAKEHOLDER CHARACTERISTICS (**5)**	Pearson Sig	-.088 .147	.027 .661	.121* .045	.188** .002	1		
ELICITATION TECHNIQUES **(6)**	Pearson Sig	-.172** .004	.028 .640	.654** .000	.810** .000	.406** .000	1	
ERP REQUIREMENTS ELICITATION (**7)**	Pearson Sig	.140* .020	.388** .000	.722** .000	.783** .000	.520** .000	.817** .000	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

6.9.1 Summary of Pearson correlation of constructs

The following diagram that follows summarises the correlation constructs results shown in Figure 6.9.

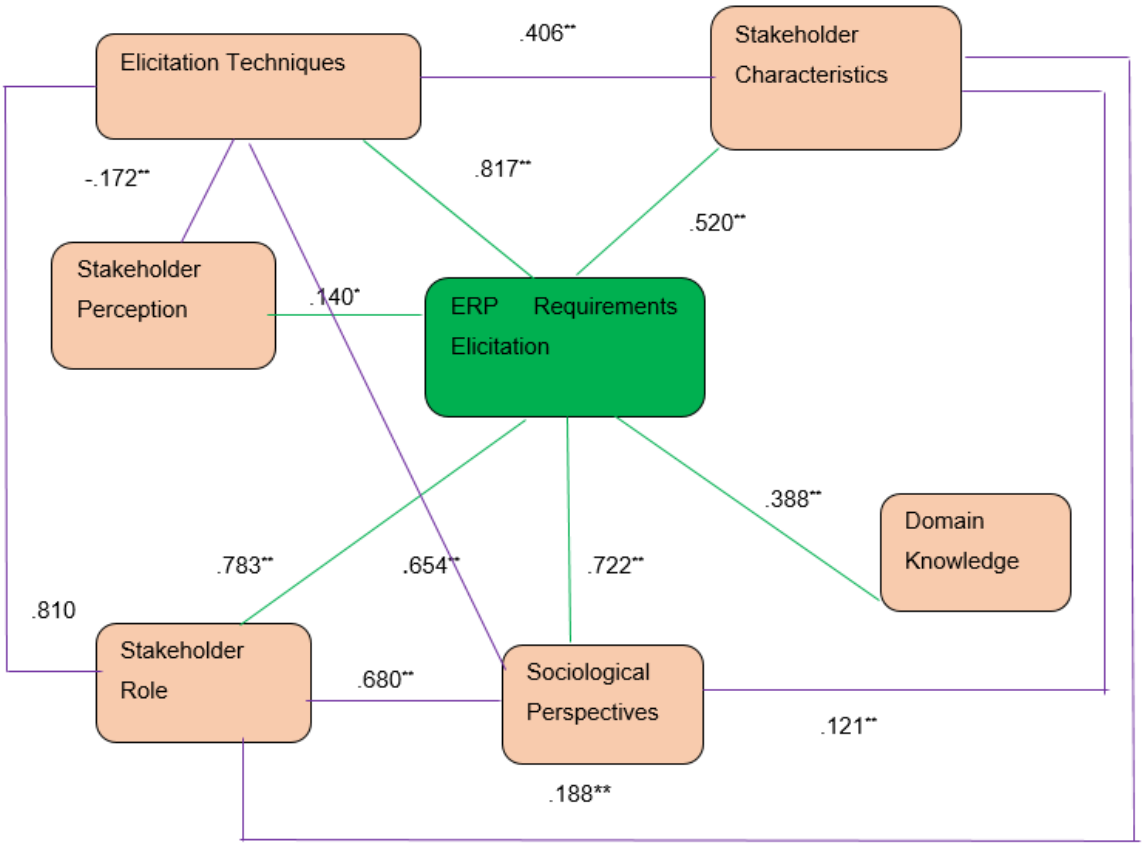


Figure 6-9: Summary of Pearson correlation of constructs

According to Taylor (1990), the correlation coefficient (*r*) takes values that range from -1 to +1. A zero correlation coefficient indicates that there is no association between the variables. Taylor also states that the closer the correlation coefficient to + or – 1, regardless of the direction, signifies a strong correlation between the variables. Taylor also suggests a scale in interpreting correlation coefficients; correlation coefficients of < = 0.35 are regarded as low or weak correlations; 0.36 to 0.67 are regarded as modest or moderate correlations and 0.68 to 1.0 (positive or negative) indicate very strong or high correlations.

Figure 6.9 above amplifies that all variables are positively correlated except the Elicitation techniques which is negatively correlated with the Stakeholder perception (*r* = -.172). The Elicitation techniques had a high positive correlation with the ERP Requirements elicitation (*r* = .817). The Stakeholder characteristics had a moderate positive correlation with the Elicitation techniques (*r* = .406). Stakeholder perception had a weak but positive correlation with the ERP Requirements elicitation (*r* = .140). Stakeholder characteristics had a moderate and positive correlation with the ERP Requirements elicitation (*r* = .520). The stakeholder role had a high positive correlation with the Elicitation techniques (*r* = .810). Also, the Stakeholder role had a high

positive correlation with the ERP Requirements elicitation (*r* = .783). The Sociological perspectives had a high positive correlation with the ERP Requirements elicitation (*r* = .722).

The Stakeholder role had a moderate positive correlation with the Sociological perspectives (*r* = .680). The Sociological perspectives had a high positive correlation with the Requirements elicitation (*r* = .722). Sociological perspectives had a weak but positive correlation with the Stakeholder characteristics (*r* = .121) and also Stakeholder role had a weak but positive correlation with the Stakeholder characteristics (*r* = .188). Lastly, the Domain knowledge had a moderate and positive correlation with the Requirements elicitation (*r* = .388).

6.10 Hypotheses

Table 6-18 Sums the conclusions based on the hypotheses for the study

H1	There is a significant relationship between the elicitation techniques and the ERP requirements elicitation
H2	There is a significant relationship between the domain knowledge and the ERP requirements elicitation
H3	There is a significant relationship between the stakeholder role and the ERP requirements elicitation
H4	There is a significant relationship between the sociological perspectives and the ERP requirements elicitation
H5	There is a significant relationship between the stakeholder characteristics and the ERP requirements elicitation
H6	There is a significant relationship between the stakeholder perception and the ERP requirements elicitation
H7	There is a significant relationship between the level of education and the ERP requirements elicitation
H8	There is a significant relationship between the stakeholder position and the ERP requirements elicitation

The hypotheses stated in Table 6.18 were derived from the previous chapter (see Chapter 5 section 5.7).

The researcher utilised stepwise regression analysis to assess variables that influenced ERP requirements elicitation variable. All the variables were tested against the dependent variable ERP requirements elicitation. The hypothesised model is shown below.

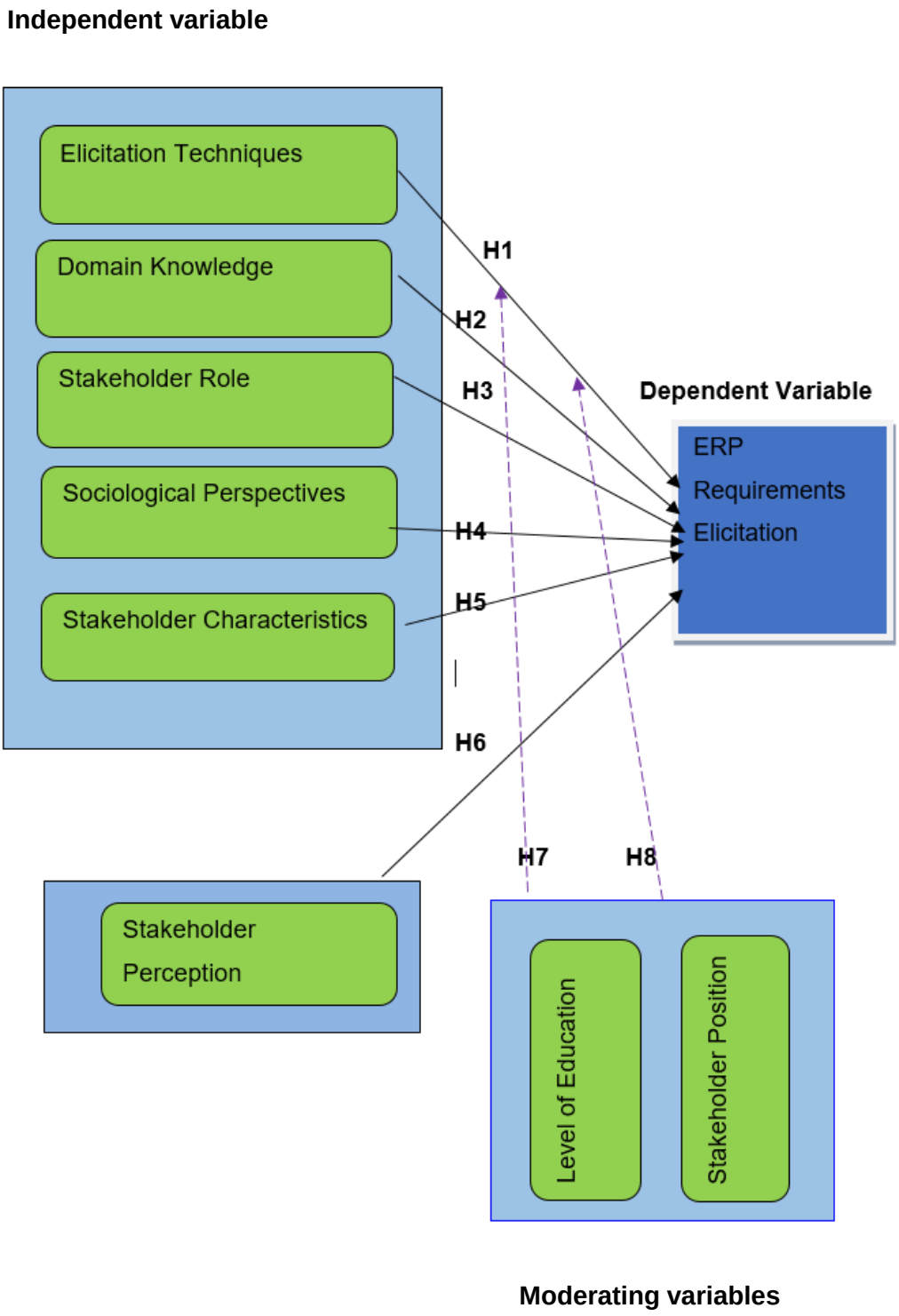


Figure 6-10: ERP requirements elicitation model

6.11 Regression

The following sections discuss the regression analysis carried out to test the hypotheses. The researcher took note of the following assumptions to make sure they are not violated during the regression process.

i) The Independence of residual values as measured by the Dublin-Watson should be close to 2 (Balakrishnan & Jaafar, 2012).
ii) Multicollinearity in the data – there should be no multicollinearity in the data, the predictors should not be highly correlated with each other (Gao & bin Chik, 2013; Daoud, 2017).
iii) Outliers – there should not exist outliers and influential data that may create bias in the model (Cousineau & Chartier, 2010).

6.11.1 Multiple regression – Domain knowledge, Sociological perspectives, Stakeholder role, Stakeholder characteristics, Elicitation techniques on ERP requirements elicitation

The testing of **H1**, **H2**, **H3**, **H4** and **H5** on ERP requirements elicitation was carried out using multiple regression and the results indicate that the Dublin-Watson value was 1.885 which was close to 2 and therefore is acceptable. There was no multicollinearity among the independent variables, as the tolerance value is above zero and the Variance Inflation Factor (VIF) value is less than 10 (Gao & bin Chik, 2013). The VIF indicates the quotient of variance in the model. The researcher checked for outliers using Cook's Distance and no outliers were found hence satisfying the regression assumptions.

Table 6-19 H1 to H5 hypotheses testing

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		Durbin-Watson
					R Square Change	Sig. F Change	
1	.972[a]	.944	.943	.04772	.944	.000	1.885

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.383	5	2.077	911.887	.000[b]
	Residual	.613	269	.002		
	Total	10.996	274			

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.681	.045		15.248	.000		
	DOMAIN KNOWLEDGE	.178	.008	.333	22.985	.000	.987	1.013
	SOCIOLOGICAL PERSPECTIVES	.176	.013	.273	13.310	.000	.493	2.030
	STAKEHOLDER ROLE	.174	.013	.352	13.232	.000	.292	3.425
	STAKEHOLDER CHARACTERISTICS	.166	.008	.326	19.778	.000	.764	1.310
	ELICITATION TECHNIQUES	.128	.017	.211	7.445	.000	.257	3.891

a. Dependent Variable: ERP Req Elicitation
b. Predictors: Domain Knowledge, Sociological perspectives, Stakeholder role, Stakeholder characteristics, Elicitation techniques

The results of the regression test suggest that the model explained 94% of the variance and the model was a significant predictor of the ERP requirements elicitation, $F(5, 269) = 911.887$, $p<0.01$. All the independent variables contributed significantly to the model with the stakeholder role contributing positively ($\beta = 0.352$, $p<0.01$). Domain knowledge contributed positively ($\beta = 0.333$, $p<0.01$). The sociological perspective variable contributed positively ($\beta = 0.273$, $p<0.01$). The stakeholder characteristics variable contributed positively ($\beta = 0.326$, $p<0.01$). Lastly, the elicitation technique variable also contributed positively ($\beta = 0.211$, $p<0.01$).

The model: $\mathbf{Y} = \boldsymbol{\beta_1 X_1} + \boldsymbol{\beta_2 X_2} + \boldsymbol{\beta_3 X_3} + \boldsymbol{\beta_4 X_4} + \boldsymbol{\beta_5 X_5} + \mathbf{e}$

Where

Y = ERP requirements elicitation

X_1 = Domain knowledge

X_2 = Sociological perspectives

X_3 = Stakeholder role

X_4 = Stakeholder characteristics

X_5 = Elicitation techniques

The predictive model developed was:

ERP requirements elicitation = (**0.333** * Domain knowledge) + (**0.273** * Sociological perspectives) + (**0.352** * Stakeholder role) + (**0.326** * Stakeholder characteristics) + (**0.211** * Elicitation techniques) + **0.045**

The model result indicates that **H1**, **H2**, **H3**, **H4** and **H5** were all supported, suggesting that these need serious consideration and factoring in the elicitation protocols.

6.11.2 Simple regression – Stakeholder perception on ERP requirements elicitation

A simple regression was carried out on stakeholder perception as the independent variable and ERP requirements elicitation as the dependent variable. The Stakeholder perception variable was used in the simple regression because it had a positive but low correlation with other variables in the Pearson correlation of constructs. The regression tests the hypotheses **H6** on dependent variable ERP requirements elicitation.

Table 6-20 H6 hypotheses testing

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		Durbin-Watson
					R Square Change	Sig. F Change	
1	.140[a]	.020	.016	.19872	.020	.020	1.804

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.215	1	.215	5.433	.020[b]
	Residual	10.781	273	.039		
	Total	10.996	274			

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.118	.159		19.617	.000		
	STAKEHOLDER PERCEPTION	.097	.041	.140	2.331	.020	1.000	1.000

a. Dependent Variable: ERP Req Elicitation b. Predictors: (Constant) Stakeholder perception

The results indicate that the model explained 1% of the variance and this attests that the model was a significant predictor of ERP requirements elicitation, $F(1, 273) = 5.433$, $p = 0.020$. The stakeholder perception did contribute to the model ($\beta = 0.140$, $p < 0.05$).

The model **Y**: = $\boldsymbol{\beta_1 X_1}$ + **e**

Where

Y = ERP requirements elicitation

$\mathbf{X_1}$ = Stakeholder perception

The predictive model developed was:

ERP requirements elicitation = (**0.140** * Stakeholder perception) + 0.159

The result from the model suggest that **H6** was supported.

6.11.3 Multiple regression – Level of education on ERP requirements elicitation

The testing of **H7** on ERP requirements elicitation was carried out using multiple regression and the results indicate that the Dublin-Watson value was 1.785 which was close to 2 and therefore acceptable. There was no multicollinearity among the independent variables, as the tolerance value is above zero and the VIF value is less than 10 (Gao & bin Chik, 2013). The researcher checked for outliers using Cook's Distance and no outliers were found hence satisfying the regression assumptions.

Table 6-21 H7 hypotheses testing

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		Durbin-Watson
					R Square Change	Sig. F Change	
1	.358[a]	.128	.116	.18840	.128	.000	1.785

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.412	4	.353	9.945	.000[b]
	Residual	9.584	270	.035		
	Total	10.996	274			

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.544	.025		140.781	.000		
	O Level	.189	.071	.159	2.649	.009	.901	1.110
	A Level	-.098	.029	-.225	-3.421	.001	.748	1.337
	Diploma	.081	.068	.072	1.195	.233	.891	1.123
	Undergraduate	.103	.065	.096	1.589	.113	.881	1.136

a. Dependent Variable: ERP Req Elicitation b. Predictors: (Constant) O level, A Level, Diploma, Undergraduate

The regression results suggest that the model explained 12% of the variance and the model was a significant predictor of the ERP requirements elicitation, $F(4, 270) = 9.945$, $p<0.01$. The independent variables contributed significantly to the model. O Level as an indicator of educational attainment contributed positively ($\beta = 0.159$, $p<0.05$).

The model: $\mathbf{Y} = \boldsymbol{\beta_1 X_1} + \boldsymbol{\beta_2 X_2} + \mathbf{e}$

Where

Y = ERP requirements elicitation

$\mathbf{X_1}$ = O Level

$\mathbf{X_2}$ = A Level

The predictive model developed was:

ERP requirements elicitation = (**0.159** * O level) - (**0.225** * A level) + **0.025**

The model result indicates that **H7** was supported..

6.11.4 Multiple regression – Position on ERP requirements elicitation

The testing of **H8** on ERP requirements elicitation was carried out using multiple regression and the results indicate that the Dublin-Watson value was 1.752 which was close to 2 and is acceptable. There was no multicollinearity among the independent variables, as the tolerance value is above zero and the VIF value is less than 10 (Gao & bin Chik, 2013). The researcher checked for outliers using Cook's Distance and no outliers were found hence satisfying the regression assumptions.

Table 6-22 H8 hypotheses testing

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		Durbin-Watson
					R Square Change	Sig. F Change	
1	.211[a]	.044	.034	.19691	.044	.006	1.752

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.488	3	.163	4.199	.006[b]
	Residual	10.507	271	.039		
	Total	10.996	274			

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.465	.014		254.407	0.000		
	Computing Lecturer	.086	.036	.145	2.421	.016	.982	1.019
	ERP Developer	.073	.053	.083	1.386	.167	.987	1.013
	External Consultatnt	.138	.053	.156	2.617	.009	.987	1.013

The regression results suggest that the model explained 1% of the variance and the model was a significant predictor of the ERP requirements elicitation, $F(3, 271) = 4.199$, $p<0.01$. The independent variables contributed significantly to the model Computing lecturer contributed positively ($\beta = 0.145$, $p<0.05$). External consultant contributed positively ($\beta = 0.156$, $p<0.05$).

The model: $\mathbf{Y} = \boldsymbol{\beta_1 X_1} + \boldsymbol{\beta_2 X_2} + \mathbf{e}$

Where

Y = ERP requirements elicitation

$\mathbf{X_1}$ = Computing lecturer

$\mathbf{X_2}$ = External consultant

The predictive model developed was:

ERP requirements elicitation = (**0.145** * Computing lecturer) + (**0.156** * A level) + **0.014**

The model result indicates that **H8** was supported.

6.11.5 Summary of hypotheses testing

The following Table 6.23 presents a summary of the hypotheses **H1** to **H8** from the regression test done. The table 6-23 indicates the significance value for each hypothesis and whether the hypothesis was supported or not.

Table 6-23 Summary of hypotheses testing

Hypothesis		**Significance**	**Supported/ Not Supported**
H1	There is a significant relationship between the elicitation techniques and the ERP requirements elicitation	0.000	Supported
H2	There is a significant relationship between the domain knowledge and the ERP requirements elicitation	0.000	Supported
H3	There is a significant relationship between the stakeholder role and the ERP requirements elicitation	0.000	Supported
H4	There is a significant relationship between the sociological perspectives and the ERP requirements elicitation	0.000	Supported
H5	There is a significant relationship between the stakeholder characteristics and the ERP requirements elicitation	0.000	Supported
H6	There is a significant relationship between the stakeholder perception	0.020	Supported

	and the ERP requirements elicitation		
H7	There is a significant relationship between the level of education and the ERP requirements elicitation	0.000	Supported
H8	There is a significant relationship between the stakeholder position and the ERP requirements elicitation	0.006	Supported

Table 6.23 indicates that all the hypotheses **H1**, **H2**, **H3**, **H4**, **H5**, **H6, H7 and H8** were supported.

6.12 Chapter summary

This chapter presented the quantitative results that helped in validating the ERP requirements elicitation framework. The chapter used descriptive and inferential statistics in analysing the quantitative data. The demographics data indicated that there were more males than females. The constructs that were tested using the regression test indicate that the constructs are useful in assisting universities with ERP requirements elicitation. The next chapter explicates and interrogates the integrated qualitative and quantitative results.

CHAPTER 7 INTEGRATED RESULTS AND DEVELOPMENT OF FRAMEWORK

7.1 Introduction

This chapter is based on the findings from Chapter 5 and 6. Qualitative data analysis was done in Chapter 5 and themes were developed that partly answered the research questions of the study. Quantitative data analysis was done in Chapter 6 and was informed by the hypotheses fomulated in Chapter 5. In this chapter, the findings and results from Chapter 5 and 6 are explicated, interrogated and discussed. The discussion of the results and findings complement the necessary logic of consolidating the ERP requirements elicitation framework. The first section will commence by discussing the issue of inference quality in mixed methods studies.

7.2 Ligitimation in mixed methods

QUAL and QUAN approaches need to use a nomenclature when defining validity in mixed methods research since inferences are made in researches regardless of the interpretation used which may be deductive or inductive (Corrigan and Onwuegbuzie, 2020). One solution is to use a term that is attractive to both QUAL and QUAN researchers and the term is legitimation (Long, 2017; Moon, 2019; Corrigan and Onwuegbuzie, 2020). Inference quality is associated with two research facets: design quality and the interpretive rigor, the design quality focus on the standards used for the methodological evaluation whilst, the interpretive rigor focus on the standards for evaluating the validity of conclusions (Corrigan and Onwuegbuzie, 2020). Inference quality help with inference transferability, generalizability of the QUAL and QUAN findings which may take the following forms; population transferability (that is transferable to other groups), ecological transferability (that is transferable to other contexts), temporal transferability (that is transferable to other time periods), (Corrigan and Onwuegbuzie, 2020).

The research questions of the study were addressed using the Mixed Methods Research (MMR). QUAL and QUAN data was used to obtain a deep understanding of ERP requirements elicitation at universities in Zimbabwe. The table 7-1shows that the research made use of a single paradigm perspective. The overall study, MMR adopted the pragmatism paradigm, where in the first phase, interpretivism qualitative data collection and analysis was done and in the second phase, positivism quantitative data collection and analysis was done also.

The following table 7-1 shows the inference quality steps used in this study.

Table 7-1 Mixed methods design

	Property	**Decision consideration**	**Design decisions which may affect current decision**	**Design decision and reference to the study**
	Research questions	QUAL and QUAN were not enough to address the research problem, hence MMR was adopted	None	Literature review • What are some of the weaknesses of the existing frameworks used in ERP requirements elicitation at universities? Qualitative research questions were • What are the needs for a framework developed to assist universities during ERP requirements elicitation at universities? • How could ERP requirements elicitation at universities be enhanced? Quantitative research question was • To what extent do the ERP requirements elicitation framework assist universities during ERP requirements elicitation? MMR question was • How could ERP requirements elicitation at universities be done optimally? (See Chapter 1 section 1.6)
Step 1:	Purposes of MMR	• MMR help researchers to seek sequential results from different methods • MMR was used to obtain sequential views of the same phenomenon	Research questions	Sequential exploratory results from QUAL findings phase: constructs and hypotheses (see Chapter 5 section 5.4 and 5.7) and validating of the framework from the QUAN phase (see section 6.10).
	Epistemological perspective	Paradigmatic assumptions were used in both QUAL and QUAN components	Research questions and purposes of	Single paradigm stance (See Chapter 4 section 4.3)

			mixed methods research	
	Paradigmatic assumptions	The researcher believed in research questions and utilized diverse methodological approaches from diverse worlviews	Research questions and purposes of MMR	Pragmatism (Interpretivism was used in QUAL and positivism in QUAN components of the study). (see ANNEXURE G for QUAL and ANNEXURE H for QUAN)
Step 2: Strategies for MMR designs	Design of the investigation strategy	The aim of the mixed methods study was to develop constructs and hypotheses and validate the framework	Research questions, paradigmatic assumptions	Study: Exploratory investigation (See Chapter 5 section 5.7 and Chapter 6 section 6.10)
	Strands or phases of the research	The study employed multiple phases	Purposes of MMR	Multistrand design (see Chapter 4 section 4.5)
	Mixing strategies	The QUAL and QUAN components were mixed at the data-analysis and inferential stages.	Purposes of MMR, strands/phases of research	Partially mixed methods (see Chapter 5 section 5.4) and (see chapter 6 section 6.9)
	Time orientation	The researcher commenced with the QUAL and followed by the QUAN.	Research questions, strands/phases of research.	Sequential exploratory design (see Chapter 4 section 4.3.2)
	Methodological approach priority	The QUAL and QUAN components were equally crucial.	Research questions, strands/phases of research.	Equivalent status design (see Chapter 4 section 4.6) and (Chapter 7 section 7.2)
Step 3: Strategies for collecting and analysing MMR data	Strategies for sampling design	The samples of QUAL and QUAN components differed but however, they came from the same population	Design of the investigation strategy, time orientation	Non probalility expert sampling with sequential design and parallel samples (see Chapter 5 section 5.2 for QUAL sample) and (see Chapter 6 section 6.3 for the QUAN sample).
	Strategies for data collection	• QUAL data in phase 1 • QUAN data in phase 2	Strategies for sampling design, time orientation, strands/phases of research	Phase 1: semi structured interview questions ((see Chapter 5 section 5.2). Phase 2: Close ended questionnaire (see Chapter 6 section 6.3).
	Strategies for data analysis	• The researcher analysed the QUAL data first and from the QUAL findings, the researcher developed constructs and formulated the hypotheses that were tested in the QUAN phase • The QUAN tested the hypotheses generated	time orientation, Strategies for data collection, strands/phases of research	Sequential QUAL-QUAN analysis (see Chapter 5 section 5.4 for QUAL data analysis) and (see Chapter 5 section 5.7 for hypotheses development) (See Chapter 6 section 6.10 for hypotheses testing).

		from the QUAN findings		
Step 4: Draw meta-inferences from the MMR results	Reasoning types	In this study, the researcher focussed on developing and testing the hypotheses	Design-investigation strategy	Inductive (QUAL) and deductive (QUAN) reasoning.
Step 5: Assess the quality of meta-inferences	Inference quality	• The QUAL inferences met the appropriate QUAL standards. •The QUAN inferences met the appropriate QUAN standards. • The researcher assessed the quality of meta-inferences	Primary design strategies, strategies for data-collection, strategies for data analysis	Sample integration (QUAL and QUAN)
Step 6: Discussion on potential threats and remedies	Inference quality	The researcher discussed all potential threats to inference quality and provided remedies where necessary	Strategies for data collection, Strategies for data analysis	Sample integration threat

In MMR the quality of inferences depends on the qualitative and quantitative strands' strengths. The purposes of the MMR was development, where results of phase 1 (QUAL) assisted in informing the findings of phase 2 (QUAN). The participants from the phase 1 were 12 and the reseacher utilised codes that were very close to the language of the participant in the interview transcript. The researcher also made a number of iteratives to ensure no codes were missed in the process. Results of phase 1 (see Chapter 5 section 5.4), the findings were used to develop the hypotheses (see Chapter 5 section 5.7) that were tested in phase 2. Phase 2 had 275 respondents, the QUAN instrument was tested for reliability using Cronbach's alpha to measure the internal consistency of the items. The Cronbach's Alpha coefficient ($\alpha = 0.846$), which suggested a high internal consistency in the study (see Chapter 6 section 6.3). The instrument was also tested for validity and EFA was used. EFA was utilized to explore relationships between survey items (see Chapter 6 section 6.5). The results of phase 2 showed that the constructs that were derived from phase 1 were all supported (see Chapter 6 section 6.10).

7.2.1 Meta inferences from mixed methods results

The study developed a conceptual framework based on previous frameworks (see Chapter 3 section 3.4). The coneptual framework was used as the basis for QUAL and QUAN phases in this study. The researcher developed the QUAL inferences first and then followed by the QUAN inferences. The QUAL data analysis revealed six constructs that affected ERP requirements

elicitation at universities (see Chapter 5 section 5.4). The QUAL constructs were used to develop hypotheses that were tested in the QUAN phase. Integrating the QUAL and QUAN research strands has incrementally added value to ERP requirements elicitation at universities. The mixed methods design assisted the researcher in exploring factors that affect ERP requirements elicitation at universities. The factors that affect ERP requirements at universities are summarized in table 7-2. The table followed the development of QUAL inferences, QUAN inferences and meta-inferences as recommended by Venkatesh (2016).

Table 7-2 Development of QUAL inferences, QUAN inferences and Meta inferences (adapted from Venkatesh, 2016)

Context	QUAL inferences	QUAN inferences	Meta inferences	Explanation
Normative belief structures	Sociological perspectives affect ERP requirements elicitation	Consistent with the QUAL findings	Sociological perspectives was positively associated with ERP requirements elicitation	Sociological perspectives affect ERP requirements elicitation (Schaarschmidt et al, 2015; Fischer and Senft, 2016)
Attitudinal belief structures	Stakeholder perception affect ERP requirements elicitation	Consistent with the QUAL findings	Stakeholder perception was positively associated with ERP requirements elicitation	Stakeholder perception had a positive low correlation with the ERP requirements elicitation which shows that it was significant
Normative belief structures	Domain knowledge affect ERP requirements elicitation	Consistent with the QUAL findings	Domain knowledge was positively associated with ERP requirements elicitation	Domain knowledge affect ERP requirements elicitation (Valvas and Milani, 2015; Abu-Shanab et al, 2015)
Control belief structures	Stakeholder role affect ERP requirements elicitation	Consistent with the QUAL findings	Stakeholder role was positively associated with ERP requirements elicitation	Stakeholder role affect ERP requirements elicitation (Anwar and Razali, 2015; Nisar et al, 2015)
Control belief structures	Stakeholder characteristics affect ERP requirements elicitation	Consistent with the QUAL findings	Stakeholder characteristics was positively associated with ERP requirements elicitation	Stakeholder characteristics affect ERP requirements elicitation (Al-Zawahreh and Almakadmeh, 2015; Darwish, 2016)
Normative belief structures	Elicitation techniques affect ERP requirements elicitation	Consistent with the QUAL findings	Elicitation techniques was positively associated with ERP requirements elicitation	Elicitation techniques affect ERP requirements elicitation (Horkoff and Yu, 2013; Kessi et al, 2014).
Control belief structures	Level of education affect ERP requirements elicitation	Consistent with the QUAL findings	Level of education was positively associated with ERP requirements elicitation	-
	Stakeholder position affect ERP	Consistent with the QUAL findings	Stakeholder position was	

Control belief structures	requirements elicitation		positively associated with ERP requirements elicitation	-

7.2.1 Assessing the quality of Meta inferences

The results from both QUAL and QUAN were consistent (see section 7.2.1) which attests to the mixed methods data quality. The appropriate research design which was informed by the research question was chosen in this study. The researcher assessed the quality of meta inferences following the guidelines postulated by Venkatesh (2013). Table 7-3 show the quality of meta inferences.

Table 7-3 Quality of Meta inferences (adapted from Venkatesh, 2016)

Criteria	Indicators
Design suitability	• The study commenced with the QUAL phase and partially addressed two research questions. Research question 1: What are the needs for a framework developed to assist universities during ERP requirements elicitation at universities? Research question 2: How could ERP requirements elicitation at universities be enhanced? These two research questions were partially addressed in the QUAL phase because the existing literature did not provide adequate information on ERP requirements elicitation at universities in Zimbabwe. • The MMR purposes was met by developing constructs and hypotheses from the QUAL findings and use the QUAN phase to test the hypotheses derived from the QUAL phase (see Chapter 5 section 5.7).
Design adequacy	• The researcher utilized two sources of data. 1) the semi structured interviews and 2) The close ended questionnaire. • The interviewers followed the same procedures to mantain consistency during the QUAL data collection phase,. • The measuring instrument for the QUAN phase was carefully developed based on findings from the QUAL phase and pilot tested before being distributed to respondents
Analytical adequacy	• Sequential mixed methods was adopted for the study • QUAL data was analyzed using ATLAS.ti version 8.0. ATLAS was chosen so that the researcher could generate themes from the data (Friese at al, 2018) • QUAN data was analyzed using SPSS version 21. SPSS was chosen because it is a widely used software for statistical analysis (Ong and Puteh, 2017).
Integrative efficacy	• The meta inferences were informed by tringulating the QUAL and QUAN findings (see Table 7-2). • The consistent findings were also explained using supporting literature.
Inference transferability	• Inferences were consistent with the initial hypotheses formulated from the QUAL findings. • The framework is generalizable to the Zimbabwean context. • The inferences may be applicable to study other ERP requirements elicitation related issues.
Integrative correspondence	• The study's purpose was represented by the meta inferences. • The study's primary purpose was to develop an enhanced ERP requirements elicitation framework by involving the stakeholders.

	• In the QUAL phase, the researcher identified the factors that affect ERP requirements elicitation at universities. The factors were then tested in the QUAN phase

The researcher recognized that there are possible threats to the inference quality of the MMR, the table 7-4 show some of the threats and the postulated remedial actions adopted in this study.

Table 7-4 Threats to inference quality (adapted from Venkatesh, 2016)

Area	Ligitimation type	Threats	Remedial action
Data collection	Sample integration threat	Different participants selected for QUAL and QUAN data collection	The researcher ensured that the sampling frame used for QUAL and QUAN data collection were from the same population.
		Unequal samples sizes for QUAL and QUAN dataset	Both the QUAL and QUAN studies had fairly large samples sizes. (See Chapter 5 section 5.2) and (see Chapter 6 section 6.3)
Data analysis	Multiple validities threat	Validity issues not addressed in the study	Both studies QUAL and QUAN addressed the validity issues

The following section discusses the meta- inferences of this study in detail.

7.3 Meta inferences discussion

The research study's aim was to develop and validate an ERP requirements elicitation framework using sequential mixed methods, commencing with the QUAL data collection and analysis then proceeding to QUAN data collection and analysis. The discussion in this section is informed by the meta- inferences from table 7-2, the six components sociological perspectives, stakeholder perception, domain knowledge, stakeholder role, stakeholder characteristics and elicitation techniques were all positively associated with ERP requirements elicitation.

7.3.1 Sociological perspectives

The participants interviewed during the QUAL phase supported the need for sociological perspectives to be considered during ERP requirements elicitation. This is supported by the

interview extracts from participants on the importance of sociological perspectives during ERP requirements elicitation, (see Chapter 5 section 5.4.10).

The QUAN results were also consistent with the QUAL, the analysis of variance showed significant differences with the age, level of education and institution (see Chapter 6, section 6.8.2). This suggests that there was an association among the age, level of education and institution with the sociological perspectives. Also, the sociological perspectives had a high positive correlation with stakeholder characteristics, ERP requirements elicitation and elicitation techniques, (see Chapter 6 section 6.9). This suggests that any change in these constructs will result in a change in the same direction to the sociological perspective variable.

Sociological perspectives affect ERP requirements elicitation and this is in line with other scholars (Schaarschmidt et al, 2015; Fischer and Senft, 2016). So the QUAL and QUAN findings showed the importance of sociological perspectives to be considered during ERP requirements elicitation (see Chapter 2 section 2.4.2).

7.3.2 Stakeholder perceptions

Most of the participants interviewed during the QUAL phase concurred for the need for the stakeholder's perceptions to be considered during ERP requirements elicitation (see Chapter 5 section 5.4.7). The participants also concurred that it is crucial to involve the stakeholders' perceptions during ERP requirements elicitation so that the ERP system will meet the expected outcome.

The QUAN results were also consistent with the QUAL results as they reviewed that ERP requirements elicitation should involve the stakeholders, stakeholders overlook crucial requirements and that stakeholders need ERP requirements knowledge to participate in requirements elicitation (see Chapter 6 section 6.5.1). Stakeholder perception had a positive low correlation with the ERP requirements elicitation (see Chapter 6 section 6.9.1). This suggests that the stakeholder perception had a significant effect on ERP requirements elicitation. Jia & Capretz (2018) also concur with the results by stating that requirements can be extracted using the requirements engineer and the stakeholder's perceptions and failure to address their perceptions may lead to software project failures.

7.3.3 Domain knowledge

The QUAL phase stressed the need for domain knowledge understanding for ERP requirements to be extracted from the stakeholders. This can be supported by the interview extracts from

participants on the importance of domain knowledge understanding during ERP requirements elicitation (see Chapter 5 section 5.4.1).

The QUAN phase, the domain knowledge construct had the highest factor loading of .958 on domain knowledge helps in reducing confusion associated with terminology in a specific domain when asking questions during ERP requirements elicitation while domain knowledge of requirements engineer help in asking relevant questions during ERP requirements elicitation had the lowest factor loading of .574. The Domain knowledge had a moderate positive correlation with the requirements elicitation (r = .388).

The QUAL and QUAN results were consistent with the literature on the importance of domain knowledge in ERP requirements elicitation (see Chapter 2 section 2.4.6). The following authors also highlighted the importance of domain knowledge during ERP requirements elicitation (Valvas and Milani, 2015; Abu-Shanab et al, 2015). The domain knowledge is highly subjective from an organizational perspective since stakeholders have diverse perceptions of the importance of domain understanding during ERP requirements elicitation. This notion is supported by the fact that domain knowledge did not correlate with any other constructs except the ERP requirements elicitation variable, (see Chapter 6 section 6.9.1).

7.3.4 Stakeholder role

The QUAL results from the participants interviewed concurred that the stakeholder role is very important during ERP requirements elicitation (see Chapter 5 section 5.4.3). The participants argued that categorizing stakeholders during ERP requirements elicitation would prevent cases of missed ERP requirements and this would enhance the extracted ERP requirements.

The QUAL results showed that the analysis of variance showed significant differences with the age and institution (see Chapter 6 sections 6.8.1 and 6.8.4). This also suggests that there was an association between the age and the institution with the stakeholder role. The stakeholder role had a positive high correlation with elicitation techniques, ERP requirements elicitation, and sociological perspectives (see Chapter 6 section 6.9.1). This suggests that any change in these constructs will be followed by a change in the stakeholder role.

The QUAL and the QUAN results are also consistent with the literature with regards to the importance of stakeholder role in ERP requirements elicitation. The QUAL and QUAN results support the categorization of stakeholders into different categories to preclude missed ERP requirements (see Chapter 2 section 2.5). The results also support the diverse views from different stakeholders which is crucial in enhancing the quality of the elicitated ERP requirements (see Chapter 2 section 2.5).

Various authors also postulated that stakeholder role is very important during ERP requirements elicitation (Anwar and Razali, 2015; Nisar et al, 2015; Katonya and Sommerville, 2000; Sadiq and Jain, 2014).

7.3.5 Stakeholder characteristics

The QUAL results from the participants interviewed concurred that diversity in the stakeholder composition improves the elicitated ERP requirements. Also, the participants noted that stakeholder characteristics influence the ERP requirements elicitation process (see Chapter 5 section 5.4.6).

Quantitatively, the stakeholder characteristics such as the level of education, age, gender, and stakeholder role and domain knowledge had high factor loadings (see Chapter 6 section 6.5). The T-test done showed significant differences with the position variable, with non-students in support of stakeholder characteristics than the students (see Chapter 6 section 6.7). This suggests that there was an association between the position and the stakeholder characteristics. The analysis of variance showed significant differences with the age, level of education and institution (see Chapter 6, sections 6.8.1, 6.8.3 and 6.8.4). This also suggests that there was an association among age, level of education and the institution with the perception of stakeholder characteristics. The stakeholder characteristics had a positive moderate correlation with the elicitation techniques and the ERP requirements elicitation (see Chapter 6 section 6.9.1). This suggests that any change in these constructs will result in a change in the stakeholder characteristics.

The QUAL and the QUAN results are also consistent with the literature with regards to the importance of stakeholder characteristics in ERP requirements elicitation. The QUAL and the QUAN results support for diversity in stakeholder composition during ERP requirements elicitation (see Chapter 3 section 3.5.5).

7.3.6 Elicitation technique

The QUAL results from the participants interviewed concurred that the elicitation technique is important during ERP requirements elicitation (see Chapter 5 section 5.4.13). The participants argued that using different elicitation techniques work in different situations. Therefore, one ERP elicitation technique will not extract all the stakeholders' requirements, there is a need for a pluralist approach. The participants also argued that using different elicitation techniques helps in extracting overlooked ERP requirements.

The QUAN results, the analysis of variance showed significant differences with the level of education (see Chapter 6 sections 6.8.1 and 6.8.2). This suggests that there was an association between the level of education and the elicitation technique. The elicitation technique had a positive high correlation with the stakeholder role, ERP requirements elicitation and the sociological perspectives (see Chapter 6 section 6.9.1). This suggests that any change in these constructs would also be followed by a change in the elicitation technique.

The QUAL and QUAN results are also consistent with the literature with regards to the importance of elicitation techniques in ERP requirements elicitation. Personas, Scenarios, Goals and Viewpoints, help in extracting ERP requirements from the stakeholders (Benner et al, 2014; Horkoff and Yu, 2013; Kessi et al, 2014).

7.3.7 ERP requirements elicitation

The participants interviewed from the QUAL results concurred that ERP requirements elicitation is affected by the following factors; domain knowledge understanding, sociological perspectives, stakeholder role, stakeholder characteristics and elicitation techniques (see Chapter 5 section 5.4.9 to section 5.4.14).

The QUAN results clarify that the elicitation techniques, stakeholder role and the sociological perspectives had a positive high correlation with the ERP requirements elicitation variable. This suggests that any change in any of these constructs is followed by a change in the ERP requirements elicitation variable. The domain knowledge and stakeholders characteristics had positive moderate correlations with the ERP requirements elicitation variable. Lastly, the stakeholder perception had a positive low correlation with the ERP requirements elicitation which suggests that the construct does affect the ERP requirements elicitation (see Chapter 6 section 6.9.1).

7.4 ERP requirements elicitation framework

The refined ERP requirements elicitation framework shown in Figure 7.1 has seven components. The ERP requirements elicitation framework was informed by the findings from the QUAL and QUAN phases (see Chapter 5 and 6). The retained components are shown in figure 7-1 below.

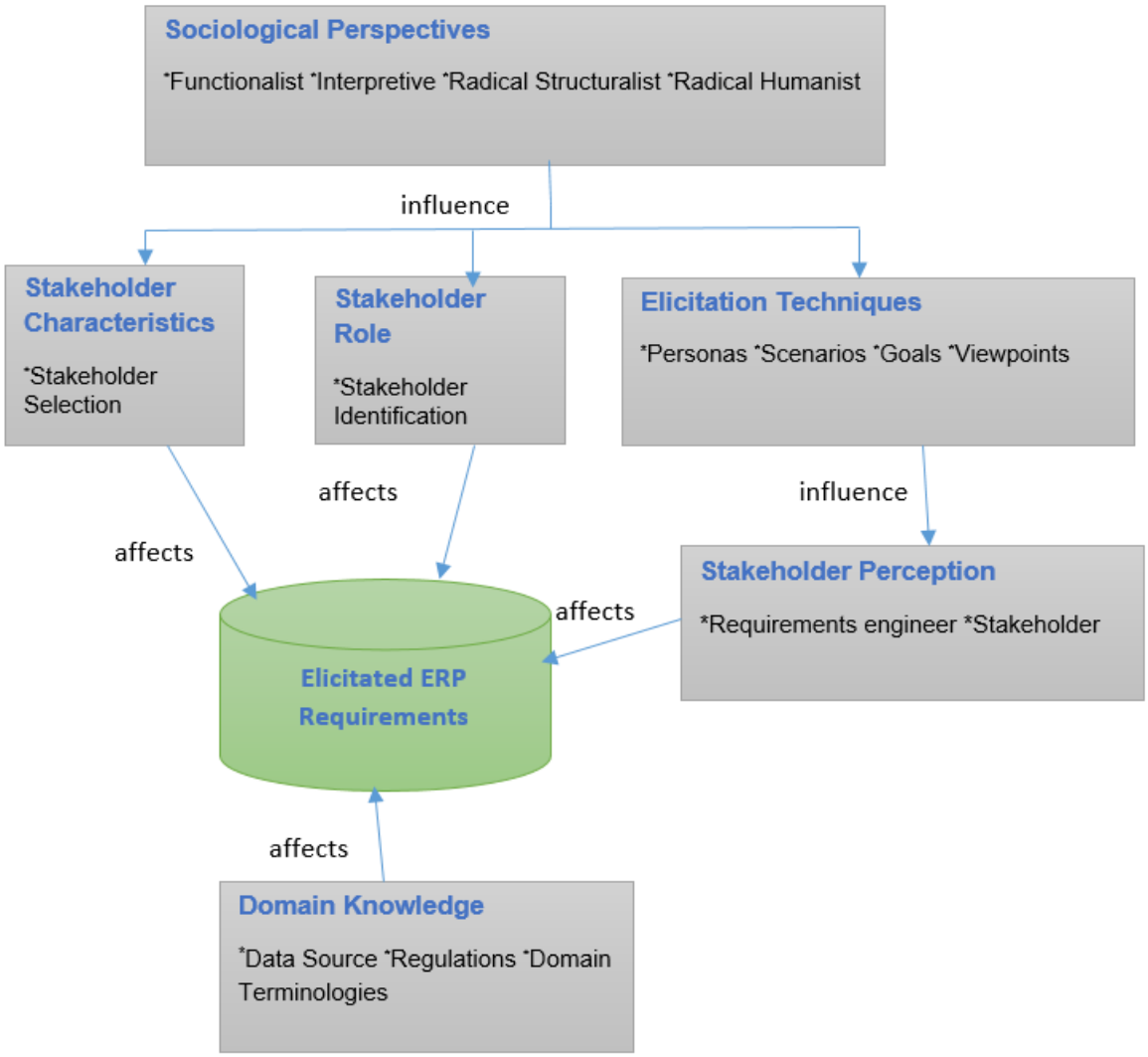


Figure 7-1: ERP Requirements Elicitation Framework

7.4.1 How the ERP requirements elicitation framework was derived

The ERP requirements elicitation framework was informed from the literature review on the strengths and weaknesses of the existing ERP frameworks (see Chapter 2 section 2.5 and Chapter 2 section 2.5.5). The framework was also informed by the theories that underpin ERP requirements elicitation (see Chapter 2 section 2.4 and Chapter 3 section 3.2). The elicitation framework was drawn based on the how the components correlated to each other (see Chapter 6 section 6.9.1). The following section discuss the components in the elicitation framework.

7.4.2 Sociological perspective component

The sociological perspective component of the framework (Figure 7.1) advocates that ERP requirements elicitation is a social activity hence there is a need to rely on stakeholders'

involvement for fundamental ERP requirements to be elicitated. The component acknowledges that organisations are complex and there is a need to examine the stakeholders' social needs for ERP requirements to be extracted. The component advocates for different approaches to different organisational contexts for rich ERP requirements to be extracted. Universities are complex institutions and the component influence the following elicitation techniques, stakeholder characteristics and stakeholder role during ERP requirements elicitation. The sociological perspective component affects ERP requirements elicitation process at universities.

7.4.3 Stakeholder role component

The stakeholder role component of the framework (Figure 7.1) advocates that stakeholders need to be categorised into different groups based on the stakeholders' role to minimize missed ERP requirements. The process of grouping stakeholders into different groups helps in identifying the diverse stakeholders in the organisation. The stakeholders' role component ensures that all the diverse stakeholders' roles within an organisation are represented during ERP requirements elicitation. The stakeholder role is influenced by the sociological perspective component. The stakeholder role component affects ERP requirements elicitation process at universities.

7.4.4 Stakeholder characteristics component

The stakeholder characteristics component of the framework (Figure 7.1) advocates that stakeholders need to be selected on the basis of some attributes that affect ERP requirements elicitation like the stakeholder's level of education and stakeholder position (see Chapter 6 section 6.11.5). The requirements engineer is bound to use the stakeholders' characteristics in selecting stakeholders for inclusion in the protocols for ERP requirements elicitation. The stakeholder characteristics is influenced by the sociological perspective component. The stakeholder characteristics component affects ERP requirements elicitation process at universities.

7.4.5 Elicitation technique component

The elicitation technique component of the framework (Figure 7.1) advocates that different elicitation techniques work best under different situations so one size fits all technique will not proffer much help in ERP requirements elicitation. The component advocates for personas, scenarios, goals and viewpoints (see Chapter 2 sections 2.6.1) to be used to extract ERP requirements of the stakeholders during the elicitation process. The elicitation techinique is influenced by the sociological perspective component and the elicitation technique also influences the stakeholder perception component. The elicitation technique component affects ERP requirements elicitation process at universities.

7.4.6 Stakeholder perception component

The stakeholder perception component of the framework (Figure 7.1) advocates for stakeholder perceptions to be taken on board during ERP requirements elicitation process. The stakeholder perception component ensures that the stakeholders and the requirements engineers' perceptions have to be understood before the ERP requirements elicitation process commences so as to prevent missing ERP requirements. The stakeholder perception is influenced by the elicitation technique used to extract the requirements. The stakeholder perception component affects ERP requirements elicitation process at universities.

7.4.7 Domain knowledge component

The domain knowledge component of the framework (Figure 7.1) advocates for a deep understanding of the domain terminologies by both the requirements engineer and the stakeholders so that crucial ERP requirements are not missed. The domain knowledge component also advocates for the use of different data sources so that ERP requirements are mot missed during the elicitation stage. The domain component also advocates for the assessment of the government regulations so that statutory laws are not violated by the new ERP system. The domain knowledge component affects ERP requirements elicitation process at universities.

7.4.8 ERP requirements elicitation component

The ERP requirements elicitation component of the framework (Figure 7.1) advocates that the ERP requirements elicitation component is affected by the following components of the framework (see Chapter 6 section 6.9.1) sociological perspectives, stakeholder role, stakeholder characteristics, elicitation technique, stakeholder perceptions and the domain knowledge.

In summary, the framework suggests that ERP requirements elicitation is a social activity and there is a need for stakeholders' social issues to be addressed so that rich ERP requirements may be extracted. The framework also suggested the elicitation techniques be used in extracting ERP requirements from the stakeholders.The framework also suggests that the stakeholder's percetions need to be taken on board to preclude missing ERP requirements. The framework also addresses the shortcomings of the existing framework by first articulating the various roles played by stakeholders in the organization. The framework then suggested selection criteria be employed when selecting stakeholders to be involved in ERP requirements elicitation based on the stakeholders' characteristics. The framework also suggests that the domain knowledge is

fundamental during ERP requirements elicitation so that holistic ERP requirements are extracted from the stakeholders. The ERP requirements elicitation framework has the potential to ameliorate the ERP requirements elicitation at universities which is a major issue since stakeholders are not currently being involved.

7.5 Validation interviews

The final framework was refined after taking into consideration the results from the QUAL and QUAN stages and interviews done with five experts from the previous qualitative sample (see Chapter 5 table 5.1). The five experts chosen were as follows: two ERP developers, one consultant and two computing lecturers. The purpose of the validation interviews with the experts was to obtain their opinions on the final ERP requirements elicitation framework. The questions directed at the experts during the validation interviews were aligned to the results of the findings and particularly with the final ERP requirements elicitation framework. The following section presents and reviews the experts' opinions.

7.5.1 Sociological perspective component

The experts interviewed were asked to give their opinions on the sociological perspective component of the framework. The experts agreed that it is crucial to involve the stakeholders in ERP requirements elicitation but however it is also necessary to take into consideration their psychological issues as they may affect the quality of the extracted ERP requirements. Stakeholders come from different social backgrounds and they need to be examined to check if their social contexts do affect the ERP requirements elicitation process.

"…ERP requirements should not be extracted from the stakeholder in isolation with the stakeholder's social context…" ***BST2-01.***

"*The sociological component of the framework is very necessary because you will find out that certain stakeholders withhold important requirements because they feel they are nothing in the organization but the moment they are recognized you will get very important requirements from them"* **CST3-01.**

7.5.2 Stakeholder role component

The experts interviewed were asked to give their opinions on the stakeholder's role component of the framework. The experts agreed that it is very important to identify the various roles played by the stakeholders at the organization so that critical roles are not missed which may impact the extracted ERP requirements.

" …I feel it is important to identify the various roles played by different stakeholders at the university so that we do not miss important roles…" ***CST3-01.***

"The stakeholder's role means we have represented every stakeholder in the organization so here we are sure that the ERP system will meet the requirements of all the stakeholders in the organisation". **AST3-01**

7.5.3 Stakeholder characteristics component

The experts interviewed were asked to give their opinions on the stakeholder's characteristics component of the framework. The experts concurred that the selection criteria postulated in the framework help in coming up with a diverse stakeholder composition with different traits which will ultimately ameliorate the quality of the extracted ERP requirements.

"…I think the stakeholder selection criteria suggested in this framework is unique because it caters for inclusiveness in stakeholder composition which brings a component of diversity in the requirements, which I think is very good in ERP systems". **EST4 -01.**

"The selection criteria suggested by the stakeholder characteristics is good because at least we have something that we can use to select the stakeholders with…" **AST3 -01**

7.5.4 Elicitation technique component

The experts interviewed were asked to give their opinions on the elicitation technique component of the framework. The experts highlighted that using different elicitation techniques during ERP requirements elicitation will reduce cases of missed ERP requirements. One size fits all elicitation technique will miss critical ERP requirements and some stakeholders may proffer rich ERP requirements when using one elicitation technique than the other.

"…Diversity in elicitation techniques is good because using one technique we might miss some requirements from stakeholders who will not be comfortable with the technique used" **EST4 -01**

7.5.5 Stakeholder perception component

The experts interviewed were asked to give their opinions on the stakeholder's perception component of the framework. Two experts gave their opinions regarding this component as shown below.

"…the stakeholder's perceptions need to be obtained during ERP requirements elicitation as they determine the success of failure of the elicitation process" ***BST2-01.***

"in every aspect of our lives, the feedback of the people who use the system is very crucial so that the system will meet the expectations of the users". **AST3 -01.**

7.5.6 Domain knowledge component

The experts interviewed were asked to give their opinions on the domain knowledge component of the framework. The experts concurred that domain knowledge is very crucial in ERP requirements elicitation for both the requirements engineer and the stakeholders so that cases of missed and overlooked ERP requirements would be precluded.

"…The domain knowledge is very important in ERP requirements elicitation because it assists the requirements engineer in capturing the problem domain and organization's business processes and rules will be articulated from the domain knowledge". **EST4 -01.**

"…*The domain I think is good to be included in this framework because cases of missed ERP requirements will be prevented if the requirements engineer is knowledgeable with the application domain because all available data sources will be visited."* **CST3-02.**

All the five interviewed experts were happy with the final ERP requirements elicitation framework. The final version of the ERP requirements elicitation framework is an incremental contribution to the body of knowledge by this research.

7.5.7 Was the research problem addressed by the framework?

The research problem of the study was highlighted in Chapter 1 (see section 1.3). The research questions were outlined in Chapter 1 (see section 1.6). The sub research questions were four with one main research question. The sub research question 1) was addressed from the literature review where the researcher managed to identify the weaknesses and strengths of existing ERP frameworks (see Chapter 2 section 2.5.5). The sub research question 2 and 3 were partially addressed in the QUAL phase (see Chapter 5 section 5.5). The QUAL phase developed the constructs and hypotheses that were tested in QUAN phase (see Chapter 6 section 6.9.1 and section 6.10). The ERP requirements elicitation framework was derived from the sequential findings of QUAL and QUAN phases and the framework was informed by the correlations of factors (see Chapter 6 section 6.9.1). The sub research question 4) was addressed by developing the ERP requirements elicitation framework that assist universities during ERP requirements elicitation. The main research question was addressed after meeting the four sub research questions, the ERP requirements at universities can be done optimally by using the ERP requirements elicitation framework.

7.6 Chapter summary

This penultimate chapter presented the integrated results from the qualitative and the quantitative phases and the results were crucial in developing the ERP requirements elicitation framework. The integrated results focus on the opinions of the participants and the opinions of the participants were utilized to develop the ERP requirements elicitation framework (see Chapter 6 section 6.9.1).

The results verified that using one approach does not tell the story in full on ERP requirements elicitation, the qualitative results helped the researcher to understand the importance of the sociological perspectives in ERP requirements elicitation so the mixed methods brought a holistic view on ERP requirements elicitation from different world views. The results suggest that using different elicitation techniques during ERP requirements elicitation will reduce cases of missed ERP requirements. The results also suggest that there is need to identify the various roles played by diverse stakeholders at the organization so that critical roles are not missed which may impact the extracted ERP requirements. The results also suggest that diverse stakeholder composition with different traits may ultimately ameliorate the quality of the extracted ERP requirements. The results also suggest that the stakeholders and the requirements engineers' perceptions have to be understood before the ERP requirements elicitation process commences so as to prevent missing ERP requirements. Lastly, the domain knowledge is very important in ERP requirements elicitation to identify the diverse sources of ERP requirements to preclude missed ERP requirements.

The next section offers a conclusion derived from the analysis of the research components presented in this study.

CHAPTER 8 CONCLUSION, REFLECTIONS AND RECOMMENDATIONS

8.1 Introduction

The objectives of the study were to develop and validate an ERP requirements elicitation framework to assist universities during the ERP requirements elicitation process. The study responded articulately to the research questions. Chapter 2 from the literature review identified the strengths and weaknesses of the current ERP requirements elicitation frameworks, the researcher also suggested some improvements that the existing ERP requirements frameworks should address the challenges of ERP requirements elicitation. Chapter 3 proposed an improved ERP requirements elicitation framework that could assist universities with requirements elicitation.

Chapter 4 provided the research methodology used in the study to validate the ERP requirements elicitation framework. An appropriate methodology was selected to address the research problem. Chapter 5 presented the qualitative results of the study which is the first phase in validating the framework. Chapter 6 presented the quantitative results of the study, which is the second phase in validating the framework. Chapter 7 integrated results from the qualitative and quantitative phases. Chapter 8 is an overview on how the research responded to the research questions, the contributions of the research to the body of knowledge, the limitations of the research and the future study areas.

8.2 Discussion

The study developed and validated an ERP requirements elicitation framework that assists universities during ERP requirements elicitation. The ERP requirements elicitation framework was developed after a thorough analysis of the existing ERP requirements elicitation frameworks and the developed ERP requirements elicitation of this study eliminated the weaknesses and built on the strengths of the existing frameworks (see Chapter 2 section 2.5.5).

The study revealed that Universities are complex enterprises that require a pluralist approach to understanding the adopted sociological perspectives of the framework. ERP requirements elicitation is a social activity and there is a need to understand the stakeholder's psychological issues that affect the quality of the elicitated ERP requirements. The study postulated that a holistic approach should be adopted when dealing with ERP requirements elicitation so that all the stakeholders, even the marginalised stakeholders' requirements are catered for. The adopted stakeholder's role in the framework confirmed that stakeholders need to be categorised so that critical stakeholder's roles are not left out during ERP requirements elicitation. The study suggests

that when stakeholder's roles are identified, cases of missed and overlooked ERP requirements are essentially reduced. The adopted stakeholder's characteristics of the framework verified that stakeholder selection during ERP requirements elicitation should be based on the characteristics of the stakeholders. Stakeholder's characteristics do affect the quality of the extracted ERP requirements. The adopted elicitation techniques of the framework revealed there is a need for diversity in elicitation techniques during ERP requirements elicitation so that rich requirements may be extracted. The study adopted Domain knowledge understanding in the framework is critical during ERP requirements elicitation to preclude overlooked ERP requirements.

8.3 Was the main research question answered by the study?

The main research question is made up of four sub questions, and this section discusses the sub-research questions that make up the main research question. The first-sub research question is discussed next.

- **What are some of the weaknesses of the existing frameworks used in ERP requirements elicitation in universities?**

  Chapter 2 of this study looked at the various ERP requirements elicitation frameworks, the study examined the strengths and the weaknesses of the existing frameworks (see Chapter 2 sections 2.5). The weaknesses and strengths of the existing frameworks helped in developing an improved ERP requirements elicitation framework in Chapter 3. The validation results suggest that the proposed ERP requirements elicitation framework is capable of solving ERP requirements elicitation issues (see Chapter 7 section 7.5). (See Chapter 7 section 7.5.7) on how the ERP requirements elicitation framework addressed this research question. The second sub- research question is discussed next.

- **What are the needs for a framework developed to assist universities during ERP requirements elicitation at universities?**

  Chapter 2 identified some of the challenges of the existing frameworks in addressing the ERP requirements elicitation at universities. Chapter 3 proposed a preliminary ERP requirements elicitation framework that may address the challenges of the current frameworks. Findings from Chapter 5 and 6 (see Chapter 5 section 5.4) and (see Chapter 6 section 6.9) corroborated on the key issues that the framework should address. The key issues are shown in the ERP requirements elicitation framework (see Chapter 7 section 7.4). (See Chapter 7 section 7.5.7) on how the ERP requirements elicitation framework addressed this research question.The third sub research question is discussed next.

- **How could ERP requirements elicitation in universities be enhanced?**

ERP requirements elicitation at universities may be effectively carried out by following the proposed ERP requirements elicitation framework (see Chapter 7 section 7.4). Each component addresses a specific problem space in the ERP requirements elicitation process. (See Chapter 7 section 7.5.7) on how the ERP requirements elicitation framework addressed this research question.The next section discusses the next sub research question.

- **To what extent do the ERP requirements elicitation framework assist universities during ERP requirements elicitation?**

Chapter 3 proposed an ERP requirements elicitation framework which was informed from the strengths and weaknesses of the existing ERP frameworks (see Chapter 2 section 2.11). The ERP requirements elicitation framework proposed in this study was validated by the qualitative and quantitative findings (see Chapter 7 section 7.4.) The feedback from the experts interviewed also attested that the ERP requirements elicitation framework will assist universities during the ERP requirements elicitation process. (See Chapter 7 section 7.5.7) on how the ERP requirements elicitation framework addressed this research question.

The main research question

- **How could ERP requirements elicitation at universities be done?**

ERP requirements elicitation at universities can be done by using a framework built on a holistic approach. The sub research questions helped in answering this main research question. (See Chapter 7 section 7.5.7) on how the ERP requirements elicitation framework addressed this research question.The next section discusses to what extent the study addressed the research aim and objectives.

8.4 To what extent did the research meet the research aim and objectives?

The study aimed to develop an ERP requirements elicitation framework to assist universities during ERP requirements elicitation. Chapter 3 proposed an ERP requirements elicitation framework which was developed from the literature survey. The proposed framework was validated by the sequential exploratory mixed methods approach. The results from the integrated findings of the QUAL and QUAN phases were used to refine the framework (see Chapter 7 section 7.2). The next section amplifies and revisits the objectives of the study to establish the extent to which this study responded to them.

- **To identify the weaknesses of the existing frameworks used in universities in requirements elicitation.**

The objective was met in Chapter 2 by the literature review that was done and existing ERP frameworks were examined and their strengths and weaknesses were observed (see Chapter 2 section 2.5). The weaknesses of the existing ERP frameworks helped in the development of the preliminary ERP requirements elicitation framework presented in Chapter 3 (see Chapter 3 section 3.3).

- **To determine the needs for a university during ERP requirements elicitation.**

The study met this objective in Chapter 3 by the preliminary ERP requirements elicitation framework proposed. The QUAL findings helped to understand the partial needs of the various participants during ERP requirements elicitation process. The questions from the QUAL phase were informed by the QUAL findings. The QUAN results from the study helped in teting the hypotheses formulated from the QUAL findings. The mixed methods approach was instrumental in obtaining a deeper understanding of the ERP requirements elicitation process at universities by combing the two strands QUAL and QUAN phases.

- **To develop an improved ERP requirements elicitation framework to assist universities during requirements elicitation.**

This objective was met in Chapter 3 by the preliminary ERP requirements elicitation framework. Chapter 5 did the first partial validation using the QUAL results and Chapter 6 did the second validation using the QUAN results. The last validation was done using the integration of QUAL and QUAN findings (see Chapter 7 section 7.2). Meta inferences were derived that were used to develop the ERP requirements elicitation framework (see Chapter 7 section 7.3).

- **To evaluate the ERP requirements elicitation framework developed in this study.**

This objective was met in Chapter 7 by interviewing experts to give their feedback on the proposed ERP requirements elicitation framework. The first partial validation of the proposed ERP requirements elicitation framework was done in Chapter 5 using the QUAL findings (see section 5.4) and the second evaluation was done in Chapter 6 using the QUAN results (see section 6.9.1 and 6.10). The last validation was done using the integration of QUAL and QUAN findings (see Chapter 7 sections 7.2 and section 7.4).

8.5 Reflections

The research journey was complex, but the task set has been executed in full. The data gathering was a challenge because the anticipated research participants were extremely busy most of the time. The researcher resorted to using gatekeepers to facilitate convening meeting during the

qualitative and quantitative phases. In the quantitative phase, the respondents took their time to bring back the completed questionnaires. There were initial challenges with qualitative data analysis but video tutorials on how to carry out the analysis using ATLAS.ti version 8 were significantly useful. Quantitative analysis did not present too much trouble and some assistance with the regression analysis and interpretation enabled a fuller integration of these results into the ambit of the research process and final estimation of constructs.

8.6 Research contribution

The study contributes significantly to the existing body of knowledge. The study contributions are in three facets: knowledge, theory and practical.

8.6.1 Knowledge contribution

The study incrementally adds knowledge to the existing body, especially in ERP requirements elicitation. The study examined factors that affect ERP requirements elicitation at universities in Chapters 2 and 3. Many researchers have suggested various techniques and frameworks that could be used to address the software crisis but the suggested frameworks have had weaknesses that failed to address the software challenge. The study critically observed the strengths and weaknesses of the existing ERP frameworks (see Chapter 2 section 2.5). The strengths and weaknesses of the existing ERP frameworks informed the research in developing an improved preliminary ERP requirements elicitation framework presented in Chapter 3 section 3.3.

8.6.2 Theory contribution

The study integrated different theories in developing the ERP requirements elicitation (see Chapter 2 section 2.4). It borrowed the stakeholder theory from Freeman (1984). The stakeholder theory advocates for stakeholder interests be taken on board when organisations make strategic decisions. However, there is still a gap in the literature that needs to be closed on the selection criteria that should be adopted when selecting stakeholders. This study suggested an improved stakeholder selection criteria that could assist universities during ERP requirements elicitation.

The study also integrated the Burrel and Morgan (1979) conceptualisations and reshaped the sociological paradigms. Requirements elicitation is a social activity and many researchers have not fused the sociological perspectives component into requirements elicitation. The sociological perspectives could assist the requirements engineer in understanding the epistemological assumptions of the stakeholders so that rich requirements may be extracted. The use of sociological perspectives in this study is regarded as a theoretical contribution to the body of knowledge.

The theory also integrated the Human Activity Systems (HAS) that advocates for different dimensions when addressing a problem space. The theory assists the requirements engineer in identifying some unknown stakeholders that could be used during the ERP requirements elicitation process. The development of the proposed ERP requirements elicitation framework was informed by this theory. The study also integrated the Doman theory which postulates that for successful ERP requirements elicitation process, the sources of requirements needs to be examined to preclude missed ERP requirements.

8.6.3 Practical contribution

The study incrementally contributes to practice in ERP requirements elicitation in Zimbabwe and other countries with similar settings to those in Zimbabwean universities. The proposed ERP requirements elicitation framework could assist universities during ERP requirements elicitation. The main practical contributions from this study are the insights obtained from the four study units on ERP requirements elicitation at universities in Zimbabwe. This means that for rich ERP requirements to be extracted from the stakeholders, there is a need for domain knowledge by both the requirements engineer and the stakeholder. The sociological perspectives of the stakeholders need to be examined. There is a need for stakeholder identification and selection. Lastly, different elicitation techniques need to be used so that overlooked requirements could be extracted from the stakeholders.

8.9 Assessing the contribution

Whetten (1989), in his article "*What constitutes a theoretical contribution?"* postulated four crucial components that should be assessed as part of the theoretical contribution of a research study. They are as follows:

- **What?** What factors or constructs should be included in the contribution made by the researcher? Whetten postulated two criteria to be used here; one is to include the right factors comprehensively and the other is the parsimony, excluding factors that add little additional value.
- **How?** How are these right factors related to one another?
- **Why?** What are the underlying assumptions of the model or theory? Also the proposed conceptualization should be of interest to other researchers in the field.
- **Who, where and when?** These inquiries define the boundaries of the research generalisation.

Based on Whetten's framework for theoretical contribution evaluation, the following questions are used to assess the theoretical contribution of the study:

What is new in this research?

The contribution here is two-fold. Firstly, the literature review on ERP requirements elicitation and the contribution made by different theories on ERP requirements elicitation that informed the ERP requirements elicitation framework (see Chapter 2 section 2.4) for theoretical review and (see Chapter 2 section 2.5) for existing ERP requirements frameworks.

The other contribution emerged from the insights obtained from the four study units that helped in validating the ERP requirements elicitation framework. The framework may be used to assist universities during the ERP requirements elicitation process.

How are the factors related?

The research made a graphical representation of the framework so that other researchers may follow them without difficulty. Whetten (1989) postulated that a visual representation of the conceptualized idea clarifies the author's thinking and increases other authors' understanding. The framework components were related using the correlation diagram in Chapter 6 section 6.9. The experts' interviews done in the study attest that all the different components used in the framework are crucial for successful ERP requirements elicitation process.

Is the topic of interest to other researchers?

In Zimbabwe, most of the universities develop their ERP systems. To this end, it was important to develop an ERP requirements elicitation framework that could be used by universities during the ERP requirements elicitation process. ERP requirements elicitation has been of interest to different researchers in the field of Information Systems. The research is of particular interest to computing lecturers, PhD and Master's students, including ERP developers, University management, ERP consultants and other interested researchers in Information Systems. This is an active research area in the field of Information Systems and the research community at large. So this study contributes to the discourse in the development of new thinking with regards ERP requirements elicitation.

8.10 Recommendations

The findings from the study suggest several recommendations.

I. The study recommends the involvement of the stakeholders during the ERP requirements elicitation process. Various stakeholder categories need to be identified so that all the are represented during the ERP requirements elicitation process.
II. The study recommends the identification of various data sources and crucial government regulations that should not be violated during the ERP requirements elicitation process.
III. Requirements elicitation is a social activity and there is a need to examine the sociological perspectives of the stakeholders so that holistic ERP requirements may be extracted.
IV. The study recommends that stakeholders need to be identified using their different roles in the organization.
V. Stakeholders need to be selected using their characteristics during the ERP requirements elicitation process as developed in this specific study.
VI. There is a need to use different elicitation techniques during ERP requirements elicitation so that overlooked ERP requirements may be extracted from the stakeholders concerned.

The study presented several recommendations that may be taken on board during ERP requirements elicitation process. For the successful ERP requirements to be extracted from stakeholders, the requirements engineer should be very fluent with the ERP requirements elicitation process.

8.11 Limitations of the study

Although the study contributed to the development of an improved ERP requirements elicitation framework, some limitations need to be outlined. Results from case study researches are difficult to generalize, so there is a need to obtain data from a large sample to comprehend the opinions of various stakeholders and then subsequently generalise the findings. So there is an opportunity for further research so that at least 60% of the universities in Zimbabwe are covered. The study also used expert sampling which execluded other stakeholders in universities who could have been involved in the study. The other limitation was that the framework was only validated by five ERP experts, there was a need for the framework to be tested during the ERP requirements elicitation process. Notwithstanding the above-mentioned limitations, the study developed an improved ERP requirements elicitation framework that may assist universities during their ERP requirements elicitation process.

8.12 Future research

The research limitation on the use of the case study in this study may be used as an initial Launchpad for future research. There is a need to use a survey and cover at most 60% of the universities in Zimbabwe so that various stakeholders' opinions may be captured on the ERP requirements elicitation process. Future research can also can also examine inhouse ERP

equirements elicitation from different countries. The ERP requirements elicitation framework ought to be tested to improve the ERP requirements elicitation process. In addition there is need to use the confirmation and test the ERP requirements elicitation framework using structural equation modeling.

8.13 Conclusion

This section presents the concluding remarks for the study. The study provides the lens to be used in examining the sociological perspectives of the stakeholders since stakeholders come from different social backgrounds which may affect the quality of the extracted ERP requirements. The study highlighted the need to examine the problem space from different viewpoints so that the best approach addresses the problem at hand. The study also highlighted the need to take on board the stakeholder's perceptions during elicitation process so that overlooked ERP requirements may be extracted. The study advocates that domain knowledge is key in identifying all the data sources required during the ERP requirements elicitation process. Also, the domain knowledge assists the requirements engineer in making sure the extracted ERP requirements are in line with government regulations.

The study highlighted the need to identify diverse stakeholders in the organisation so that all are represented during the ERP requirements elicitation process. Many studies overlook the importance of stakeholder selection criteria, so this study provided an assessment of the existing frameworks used in ERP requirements elicitation and their weaknesses were identified. The weaknesses in the existing ERP requirements frameworks informed the development of an improved ERP requirements elicitation framework. The study also highlighted the importance of using different elicitation techniques so that rich ERP requirements may be captured.

REFERENCES

1. Aasem, M., Ramzan, M. and Jaffar, A., 2010, June. Analysis and optimization of software requirements prioritization techniques. In Information and Emerging Technologies (ICIET), 2010 International Conference on (pp. 1-6). IEEE.
2. Abawi, K,2013. Data Collection Instruments (Questionnaire & Interview), Geneva Workshop 2013.
3. Abd Elmonem, M.A., Nasr, E.S. and Geith, M.H., 2016. Benefits and challenges of cloud ERP systems–A systematic literature review. *Future Computing and Informatics Journal*, *1*(1-2), pp.1-9.
4. Abdinnour, S. and Saeed, K., 2015. User perceptions towards an ERP system: Comparing the post-implementation phase to the pre-implementation phase. *Journal of Enterprise Information Management*, 28(2), pp.243-259.
5. Abdullah, N.N.B., Honiden, S., Sharp, H., Nuseibeh, B. and Notkin, D., 2011, July. Communication patterns of agile requirements engineering. In Proceedings of the 1st workshop on agile requirements engineering (p. 1). ACM.
6. Abecker, A., Mentzas, G., Legal, M., Ntioudis, S. and Papavassiliou, G., 2001, September. Business-process oriented delivery of knowledge through domain ontologies. In *12th International Workshop on Database and Expert Systems Applications* (pp. 442-446). IEEE.
7. Abelein, U. and Paech, B., 2015. Understanding the influence of user participation and involvement on system success–A systematic mapping study. Empirical Software Engineering, 20(1), pp.28-81.
8. Abras, C., Maloney-Krichmar, D. and Preece, J., 2004. User-centered design. Bainbridge, W. *Encyclopedia of Human-Computer Interaction*. Thousand Oaks: Sage Publications, 37(4), pp.445-456.
9. Abugabah, A. and Sanzogni, L., 2010. Enterprise Resource Planning (ERP) system in higher education: A literature review and implications. *International Journal of Human and Social Sciences*, 5(6), pp.395-399.
10. Abugabah, A., Sanzogni, L. and Alfarraj, O., 2015. Evaluating the impact of ERP systems in higher education. *The International Journal of Information and Learning Technology*.
11. Abu-Shanab, E., Abu-Shehab, R. and Khairallah, M., 2015. Critical success factors for ERP implementation: The case of Jordan. *The International Arab Journal of e-Technology*, 4(1), pp.1-7.
12. Achimugu, P., Selamat, A., Ibrahim, R. and Mahrin, M.N.R., 2014. A systematic literature review of software requirements prioritization research. *Information and Software Technology*, 56(6), pp.568-585.
13. Adade-Boafo, A., 2018. Successful strategies for implementing an enterprise resource planning system.
14. Ahmad, M., Belloir, N. and Bruel, J.M., 2015. Modeling and verification of functional and non-functional requirements of ambient self-adaptive systems. *Journal of Systems and Software*, 107, pp.50-70.
15. Ahmad, M.M. and Cuenca, R.P., 2013. Critical success factors for ERP implementation in SMEs. *Robotics and Computer-Integrated Manufacturing*, 29(3), pp.104-111.
16. Ahsan, M., Motla, Y.H. and Azeem, M.W., 2015 An Ontology-based Approach for Handling the Issues in Requirement Engineering. *Pakistan Academy of Sciences*, p.187.

17. Ala'a Hawari and Heeks, R., 2010. Explaining ERP Failure in Developing Countries: A Jordanian Case Study. University of Manchester, Institute for Development Policy and Management.
18. Alawneh, A., Al-Refai, H. and Batiha, K., 2013. Measuring user satisfaction from e-Government services: Lessons from Jordan. *Government Information Quarterly*, 30(3), pp.277-288.
19. Alebrahim, A. and Heisel, M., 2014, Intertwining Relationship Between Requirements, Architecture, and Domain Knowledge. ICSEA 2014 : The Ninth International Conference on Software Engineering Advances.
20. Alebrahim, A., 2017. *Bridging the Gap between Requirements Engineering and Software Architecture: A Problem-Oriented and Quality-Driven Method*. Springer.
21. Alexander, I.F. and Beus-Dukic, L., 2009. *Discovering requirements: How to specify products and services*. John Wiley & Sons.
22. Alhajaj, K., 2018. *Exploring the implementation of ERP as a complex innovation: The case of the kingdom of Saudi Arabia* (Doctoral dissertation, University of the West of England).
23. Ali, R., Dalpiaz, F. and Giorgini, P., 2010. A goal-based framework for contextual requirements modeling and analysis. *Requirements Engineering*, 15(4), pp.439-458.
24. Ali, Z. and Bhaskar, S.B., 2016. Basic statistical tools in research and data analysis. *Indian Journal of Anaesthesia*, 60(9), p.662.
25. Aliyu, A.A., Bello, M.U., Kasim, R. and Martin, D., 2014. Positivist and non-positivist paradigm in social science research: Conflicting paradigms or perfect partners. *J. Mgmt. & Sustainability*, *4*, p.79.
26. Aljahdali, S., Bano, J. and Hundewale, N., 2011. Goal oriented requirements engineering-a review. In 24th International Conference on Computer Applications in Industry and Engineering, Honolulu, Hawaii, USA, CAINE (pp. 16-18).
27. Aljohani, A.M., Peng, A. and Nunes, M., 2015. Critical factors leading to ERP replacement in Higher Education Institutions in Saudi Arabia: Preliminary results. iConference 2015 Proceedings.
28. Alman, D. 2013. Human Activity System (HAS) Mapping. Online. [Accessed September 2017]. https://www.slideshare.net/davidalman/human-activity-system-has-mapping
29. Almigheerbi, T.S., Ramsey, D.M. and Lamek, A., 2020. An Empirical Analysis of Critical Success Factors for CD-ERP Model. *JCP*, *15*(2), pp.37-47.
30. Almisned, F. and Keppens, J., 2010. Requirements analysis: Evaluating kaos models. *Journal of Software Engineering and Applications*, 3(9), p.869.
31. Alshazly, A.A., Elfatatry, A.M. and Abougabal, M.S., 2014. Detecting defects in software requirements specification. *Alexandria Engineering Journal*, 53(3), pp.513-527.
32. Alsulami, M., Rahim, M. and Scheepers, H., 2014. Consolidating Understanding of ERP Conflicts: a Dialectic Perspective. In PACIS (p. 331).
33. Althonayan, M. and Papazafeiropoulou, A., 2013, January. Evaluating the performance on ERP systems in King Saud University (KSU): A stakeholders' perspective. In System Sciences (HICSS), 2013 46th Hawaii International Conference on (pp. 4074-4083). IEEE.
34. Al-Zawahreh, H. and Almakadmeh, K., 2015, November. Procedural model of requirements elicitation techniques. In Proceedings of the International Conference on Intelligent Information Processing, Security and Advanced Communication (pp. 1-6).

35. Ameller, D., Franch, X. and Cabot, J., 2010, September. Dealing with non-functional requirements in model-driven development. In Requirements Engineering Conference (RE), 2010 18th IEEE International (pp. 189-198). IEEE.
36. Amid, A., Moalagh, M. and Ravasan, A.Z., 2012. Identification and classification of ERP critical failure factors in Iranian industries. *Information Systems*, 37(3), pp.227-237.
37. Amoako-Gyampah, K. and Salam, A.F., 2004. An extension of the technology acceptance model in an ERP implementation environment. *Information & Management*, 41(6), pp.731-745.
38. Anda, B. and Sjøberg, D.I., 2002, July. Towards an inspection technique for use case models. In Proceedings of the 14th international conference on Software engineering and knowledge engineering (pp. 127-134). ACM.
39. Andale, 2015. Statistics how to. Online [Accessed October 2017]. http://www.statisticshowto.com/purposive-sampling/
40. Anderson, M., Banker, R.D., Menon, N.M. and Romero, J.A., 2011. Implementing enterprise resource planning systems: organizational performance and the duration of the implementation. *Information Technology and Management*, *12*(3), pp.197-212.
41. Andoh-Baidoo, F.K., 2017. Context-specific theorizing in ICT4D research.
42. Anney, V.N., 2014. Ensuring the quality of the findings of qualitative research: Looking at trustworthiness criteria.
43. Antony, J. and Fergusson, C., 2004. Six Sigma in the software industry: results from a pilot study. *Managerial Auditing Journal*, 19(8), pp.1025-1032.
44. Anwar, F. and Razali, R., 2015. A practical guideline of selecting stakeholders for requirements elicitation-an empirical study. *International Journal of Software Engineering and Its Applications*, 9(2), pp.95-106.
45. Anwar, F. and Razali, R., 2016. Stakeholders selection model for software requirements elicitation. *American Journal of Applied Sciences*, 13(6), pp.726-738.
46. Aoyama, M., 2007, October. Persona-scenario-goal methodology for user-centered requirements engineering. In Requirements Engineering Conference, 2007. RE'07. 15th IEEE International (pp. 185-194). IEEE.
47. Aranda, A.M., Dieste, O. and Juristo, N., 2015. Effect of domain knowledge on elicitation effectiveness: an internally replicated controlled experiment. *IEEE Transactions on Software Engineering*, *42*(5), pp.427-451.
48. Ardalan, K., 2010. Globalization and War: Four Paradigmatic Views. *Transcience: A Journal of Global Studies*, 1(2), pp.18-49.
49. Asgar, T.S. and King, T.M., 2016. Formalizing Requirements in ERP Software Implementations. Lecture Notes on Software Engineering, 4(1), p.34.
50. Ashworth, A., 2004. Criminal justice act 2003:(2) Criminal justice reform: Principles, human rights and public protection. *Criminal Law Review*, (JUL.), pp.516-532.
51. Asnar, Y., Giorgini, P. and Mylopoulos, J., 2011. Goal-driven risk assessment in requirements engineering. *Requirements Engineering*, 16(2), pp.101-116.
52. Asuncion, C.H., 2009. Goal-driven service mediation solution. (Master's thesis, University of Twente)

53. Atkinson, C., Gutheil, M. and Kiko, K., 2006. On the Relationship of Ontologies and Models. *In Proceedings of the International Workshop on Meta-Modeling* , pp.47-60.
54. Au, N., Ngai, E.W. and Cheng, T.E., 2002. A critical review of end-user information system satisfaction research and a new research framework. *Omega*, 30(6), pp.451-478.
55. Au, N., Ngai, E.W. and Cheng, T.E., 2008. Extending the understanding of end user information systems satisfaction formation: An equitable needs fulfillment model approach. *MIS Quarterly*, pp.43-66.
56. Auer-Srnka, K.J. and Koeszegi, S., 2007. From words to numbers: how to transform qualitative data into meaningful quantitative results. *Schmalenbach Business Review*, 59(1), pp. 29-57.
57. Babar, M.I., Ramzan, M. and Ghayyur, S.A., 2011, July. Challenges and future trends in software requirements prioritization. In Computer Networks and Information Technology (ICCNIT), 2011 International Conference on (pp. 319-324). IEEE.
58. Babbie, E.R., 2007. *The Practice of Social Research*. Thomson Wadsworth, Belmont, CA.
59. Bagnall, P., Dewsbury, G. and Sommerville, I., 2005. The limits of Personas. In Proceedings of the 5th Annual DIRC Research Conference (pp. 39-40).
60. Baguma, R., Stone, R.G., Lubega, J.T. and van der Weide, T.P., 2009, July. Integrating accessibility and functional requirements. In International Conference on Universal Access in Human-Computer Interaction (pp. 635-644). Springer, Berlin, Heidelberg.
61. Bailey, J., 2008. First steps in qualitative data analysis: transcribing. *Family Practice*, 25(2), pp.127-131.
62. Balakrishnan, E. and Jaafar, A.B., 2012 Significance of Competency in Sea Crisis.
63. Bano, M. and Zowghi, D., 2013, April. User involvement in software development and system success: a systematic literature review. In Proceedings of the 17th International Conference on Evaluation and Assessment in Software Engineering (pp. 125-130). ACM.
64. Bano, M. and Zowghi, D., 2015. A systematic review on the relationship between user involvement and system success. *Information and Software Technology*, 58, pp.148-169.
65. Bano, M., 2014, August. Aligning services and requirements with user feedback. In 2014 IEEE 22nd International Requirements Engineering Conference (RE) (pp. 473-478). IEEE.
66. Bano, Muneera, et al. "Causes of requirement change-a systematic literature review." Evaluation & Assessment in Software Engineering (EASE 2012), 16th International Conference on. IET, 2012.
67. Baskerville, R. and Myers, M.D., 2004. Special issue on action research in information systems: Making IS research relevant to practice: Foreword. *MIS Quarterly*, pp.329-335.
68. Batra, M and Bhatnagar, A. 2015. Descriptive Literature Review of Requirements Engineering Models. *International Journal of advanced Research in Computer Science and Software Engineering* (Volume 5, Issue 2, pp. 289-293).
69. Bavani, M.K. and Ahmad, R., 2008. Personas based Support Tool for Requirements Elicitation.
70. Baxter, G. and Sommerville, I., 2011. Socio-technical systems: From design methods to systems engineering. *Interacting with Computers*, 23(1), pp.4-17.
71. Beekhuyzen, J., Goodwin, M. and Nielsen, J., 2001. A Snapshot of ERP Adoption in Australian Universities. Queensland, Australia, Griffith University, pp.1058-1062.

72. Belvedere, V., Grando, A. and Ronen, B., 2013. Cognitive Biases, Heuristics, and Overdesign: An Investigation on the Unconscious Mistakes of Industrial Designers and on Their Effects on Product Offering. In *Behavioral Issues in Operations Managemen*t (pp. 125-139). Springer London.
73. Benner, K.M., Feather, M.S., Johnson, W.L. and Zorman, L.A., 2014. Utilizing scenarios in the software development process. *Information System Development Process*, 30, pp.117-134.
74. Berander, P. and Andrews, A., 2005. Requirements prioritization. *Engineering and Managing Software Requirements*, 11(1), pp.79-101.
75. Berman, E.A., 2017. An Exploratory Sequential Mixed Methods Approach to Understanding Researchers' Data Management Practices at UVM: Findings from the Qualitative Phase. *Journal of eScience Librarianship*, 6(1), p.5.
76. Berner, M., 2015. Systematic Literature Review "Enterprise Systems Chartering"–Review Procedure and Analysis Results.
77. Bevan, N., 2009. Usability. In Encyclopedia of Database Systems (pp. 3247-3251). Springer US.
78. Bhat, J.M., Shroff, B. and Bandi, R.K., 2013. User perceptions, motivations and implications on ERP usage: An Indian Higher Education Context. In Enterprise Information Systems of the Future (pp. 90-105). Springer Berlin Heidelberg.
79. Bhattacharya, M., Wamba, S.F. and Kamdjoug, J.R.K., 2019. Exploring the determinants of ERP adoption intention: The case of ERP-enabled emergency service. *International Journal of Technology Diffusion (IJTD)*, *10*(4), pp.58-76.
80. Bhatti, T., 2014. Critical Success Factors for the Acquisition of Enterprise Systems: Empirical Validation. In Proceedings of the International Conference on Information Resources Management (CONFIRM).
81. Bhatti, T., 2015. Exploring factors influencing the adoption of mobile commerce. *The Journal of Internet Banking and Commerce*, 2007.
82. Biabani, S.A.A., Shafie, E. and Khozium, M.O., 2017. Indirect Holography Breast Cancer Detection System (IH-BCDS) Using VORD. *European Scientific Journal, ESJ,* 13(9).
83. Bickel, P.J. and Lehmann, E.L., 2012. Descriptive statistics for nonparametric models: Introduction.. In Selected Works of EL Lehmann (pp. 465-471). Springer US.
84. Bitsini, N., 2016. *Investigating the impact of institutional forces on the operations of an organisation-implemented ERP system in a developing country* (Master's thesis, University of Cape Town).
85. Bjørner, D., 2007, September. Domain theory: practice and theories a discussion of possible research topics. In International Colloquium on Theoretical Aspects of Computing (pp. 1-17). Springer Berlin Heidelberg.
86. Boehm, B. and Kitapci, H., 2006. The WinWin approach: Using a requirements negotiation tool for rationale capture and use. In *Rationale management in software engineering* (pp. 173-190). Springer Berlin Heidelberg.
87. Boehm, B., Egyed, A., Kwan, J., Port, D., Shah, A. and Madachy, R., 1998. Using the WinWin spiral model: A case study. *Computer*, 31(7), pp.33-44.
88. Boehm, B., Grunbacher, P. and Briggs, R., 2007. Developing groupware for requirements negotiation: Lessons learned. *Software Engineering*, pp.301-314.

89. Boehm, B., Lane, J.A., Koolmanojwong, S. and Turner, R., 2014. *The incremental commitment spiral model: Principles and practices for successful systems and software*. Addison-Wesley Professional.
90. Bogonko, B.M. and Ogalo, J., 2019. User Involvement in the Implementation of the Enterprise Resource Planning Systems in Public Universities. *East African Journal of Information Technology*, *1*(2), pp.1-15.
91. Bormane, L., Gržibovska, J., Bērziša, S. and Grabis, J., 2016. Impact of Requirements Elicitation Processes on Success of Information System Development Projects. *Information Technology and Management Science*, 19(1), pp.57-64.
92. Brechko, D., Maksyshko, N.N. and Ivanov, S., 2020, September. Development of Elements of ERP-system of Association of Co-owners of Multi-apartment. In *2020 10th International Conference on Advanced Computer Information Technologies (ACIT)* (pp. 567-572). IEEE.
93. Breitman, K.K. and do Prado Leite, J.C.S., 2003, September. Ontology as a requirements engineering product. In Requirements Engineering Conference, 2003. Proceedings. 11th IEEE International (pp. 309-319). IEEE.
94. Brown, M.E. and Mitchell, M.S., 2010. Ethical and unethical leadership: Exploring new avenues for future research. *Business Ethics Quarterly*, 20(4), pp.583-616.
95. Brown, S.A., Venkatesh, V. and Goyal, S., 2014. Expectation Confirmation in Information Systems Research: A Test of Six Competing Models. *MIS Quarterly*, 38(3), pp.729-756.
96. Brown, T.A. and Moore, M.T., 2012. Confirmatory factor analysis. *Handbook of structural equation modeling*, pp.361-379.
97. Broy, M., 2013. Domain modeling and domain engineering: Key tasks in requirements engineering. In *Perspectives on the Future of Software Engineering* (pp. 15-30). Springer, Berlin, Heidelberg.
98. Bryman, A., 2006. Integrating quantitative and qualitative research: How is it done?. *Qualitative Research*, 6(1), pp.97-113.
99. Buede, D.M. and Miller, W.D., 2016. *The engineering design of systems: Models and methods*. John Wiley & Sons.
100. Bukohwo, E.M. and Wajiga, G., 2010. Software Failures and Risk Management Practices in Nigeria, Kenya and Zimbabwe: A Survey. *International Journal Computing Information 2(6), pp. 1078-1081*.
101. Burge, S., 2015. An Overview of the Soft Systems Methodology.
102. Burgess, K., Kerr, D.V. and Houghton, L., 2013. Paradigmatic approaches used in enterprise resource planning systems research: A systematic literature review. *Australasian Journal of Information Systems*, *18*(1).
103. Burgstaller, F., Steiner, D. and Schrefl, M., 2016, August. Modeling Context for Business Rule Management. In Business Informatics (CBI), 2016 IEEE 18th Conference on (Vol. 1, pp. 262-271). IEEE.
104. Burmeister, E. and Aitken, L.M., 2012. Sample size: How many is enough?. *Australian Critical Care*, 25(4), pp.271-274.
105. Burnay, C., Jureta, I.J. and Faulkner, S., 2014. What stakeholders will or will not say: A theoretical and empirical study of topic importance in Requirements Engineering elicitation interviews. *Information Systems*, 46, pp.61-81.

106. Burrell, G. and Morgan, G., 2017. *Sociological paradigms and organisational analysis: Elements of the sociology of corporate life*. Routledge.

107. Buxto JN, Randell B (1969) *Software engineering techniques: Report on a conference sponsored*. Scientific Affairs Division, NATO.

108. Calero, C., Ruiz, F. and Piattini, M. eds., 2006. *Ontologies for software engineering and software technology*. Springer Science & Business Media.

109. Carroll, J.M., 1995. *Scenario-based design: envisioning work and technology in system development.* John Wiley & Sons, Inc..

110. Castañeda, V., Ballejos, L., Caliusco, M.L. and Galli, M.R., 2010. The use of ontologies in requirements engineering. *Global Journal of Research in Engineering*, 10(6).

111. Cattell, R.B. and Horn, J.L., 1978. A check on the theory of fluid and crystallized intelligence with description of new subtest designs. *Journal of Educational Measurement*, 15(3), pp.139-164.

112. Ceccucci, W., Peslak, A. and Sendall, P., 2010. An empirical study of behavioural factors influencing text messaging intention. *The Journal of Information Technology Management*, 21(1), p.16.

113. Celar, S., Turic, M. and Vickovic, L., 2010. Stakeholder Analysis: Process Modell. DAAAM International Scientific Book, p.489.

114. Chakraborty, S., Sarker, S. and Sarker, S., 2010. An exploration into the process of requirements elicitation: A grounded approach. *Journal of the Association for Information Systems*, 11(4), p.1.

115. Chan, M.L., 2017. An explicit pragmatic approach to integrative data analysis strategies for mixed methods research. *International Journal of Linguistics*, *9*(3), pp.166-184.

116. Chandrasekaran, B., Josephson, J.R. and Benjamins, V.R., 1998. *The ontology of tasks and methods.*

117. Chang, M.K., Cheung, W., Cheng, C.H. and Yeung, J.H., 2008. Understanding ERP system adoption from the user's perspective. *International Journal of Production Economics*, *113*(2), pp.928-942.

118. Chaushi, B.A., Dika, Z. and Chaushi, A., 2017. Improving institutional services through university ERP: A study of the academic planning module development at SEEU. *SEEU Review*, *12*(2), pp.62-81.

119. Checkland, P. and Poulter, J., 2010. Soft systems methodology. In *Systems approaches to managing change: A practical guide* (pp. 191-242). Springer London.

120. Checkland, P., 1999. *Systems thinking, systems practice; Soft systems methodology: A 30 year retrospective*. West Sussex, England: John Wiley and Sons.

121. Chen, F., Power, N. and Collins, J.J., 2016. A Stakeholder Contribution Pattern in Requirements Decision-Making: An Empirical Study in Enterprise Development. In Requirements Engineering Conference Workshops (REW), IEEE International (pp. 289-295). IEEE.

122. Cheng, B.H. and Atlee, J.M., 2007, May. Research directions in requirements engineering. In *Future of Software Engineering* (pp. 285-303). IEEE Computer Society.

123. Cherfi, S.S.S., Ayad, S. and Comyn-Wattiau, I., 2013. Aligning business process models and domain knowledge: A meta-modeling approach. In *Advances in Databases and Information Systems* (pp. 45-56). Springer, Berlin, Heidelberg.

124. Chevalier, J.M. and Buckles, D.J., 2008. SAS2 social analysis systems: A guide to collaborative inquiry and social engagement. IDRC.

125. Chiu, T.K. and Wang, Y.H., 2015. Determinants of social disclosure quality in Taiwan: An application of stakeholder theory. *Journal of business ethics*, *129*(2), pp.379-398.

126. Chowdhury, M.S., Ahmmed, F. and Hossain, M., 2020. Methodological Dilemma in Microfifinance Research: Applicability of a Qualitative Case Study Design. *Qualitative Report*, *25*(2).

127. Chung, L. and do Prado Leite, J.C.S., 2009. On non-functional requirements in software engineering. In Conceptual modeling: Foundations and applications (pp. 363-379). Springer Berlin Heidelberg.

128. Chung, L., Nixon, B.A., Yu, E. and Mylopoulos, J., 2012. Non-functional requirements in software engineering (Vol. 5). Springer Science & Business Media.

129. Chuttur, M.Y., 2009. Overview of the technology acceptance model: Origins, developments and future directions. *Working Papers on Information Systems*, 9(37), pp.9-37.

130. Cigniti, 2017. REQUIREMENTS TESTING FRAMEWORK. Online: [Accessed April 2017]. http://www.cigniti.com/requirements-testing-framework/

131. Cimiano, P., Mädche, A., Staab, S. and Völker, J., 2009. Ontology learning. In *Handbook on ontologies* (pp. 245-267). Springer Berlin Heidelberg.

132. Clark, H.H., 1996. *Using language*. Cambridge University Press.

133. Clark, R. and Andrews, J., 2012. Bringing engineering education to life: an empirical approach.

134. Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th Edition). London: Routledge.

135. Cooper, A., 2004. The inmates are running the asylum:[Why high-tech products drive us crazy and how to restore the sanity]. Indianapolis, IN, USA:: Sams.

136. Cooper, A., Reimann, R. and Cronin, D., 2003. Modeling users: Personas and goals. Erschienen in About Face, 2, pp.55-74.

137. Corrigan, J.A. and Onwuegbuzie, A.J., 2020. Toward a meta-framework for conducting mixed methods representation analyses to optimize meta-inferences. *The Qualitative Report*, *25*(3), pp.785-812.

138. Coughlan, J., Lycett, M. and Macredie, R.D., 2003. Communication issues in requirements elicitation: A content analysis of stakeholder experiences*. Information and Software Technology,* 45(8), pp.525-537.

139. Cousineau, D. and Chartier, S., 2010. Outliers detection and treatment: A review. *International Journal of Psychological Research*, *3*(1), pp.58-67.

140. Creswell, J.W. and Clark, V.L.P., 2007. Designing and conducting mixed methods research.

141. Creswell, J.W. and Poth, C.N., 2016. *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

142. Croasmun, J. T., & Ostrom, L. (2011). Using Likert-Type Scales in the Social Sciences. *Journal of Adult Education*, 40(1), 19–22.

143. Crotty, M. (1998). *The Foundations of Social Research: Meaning and Perspective in the Research Process.* St Leonards: Allen & Unwin.

144. Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A. and Sheikh, A., 2011. The case study approach. *BMC Medical Research Methodology*, 11(1), p.100.

145. Cruzes, D.S., Dybå, T., Runeson, P. and Höst, M., 2015. Case studies synthesis: a thematic, cross-case, and narrative synthesis worked example. *Empirical Software Engineering*, 20(6), pp.1634-1665.

146. Cunliffe, A.L., 2011. Crafting qualitative research: Morgan and Smircich 30 years on. *Organizational Research Methods*, 14(4), pp.647-673.

147. Daellenbach, H.G., 2001, November. Hard OR, soft OR, problem structuring methods, critical systems thinking: a primer. In Proceedings of the ORSNZ Conference Twenty Naught One, University of Canterbury, Christchurch, New Zealand.

148. Damian, D., Lanubile, F. and Mallardo, T., 2006, May. The role of asynchronous discussions in increasing the effectiveness of remote synchronous requirements negotiations. In Proceedings of the 28th International Conference on Software engineering (pp. 917-920). ACM.

149. Daneva, M. and Wieringa, R.J., 2006. A requirements engineering framework for cross-organizational ERP systems. *Requirements Engineering*, 11(3), pp.194-204.

150. Daneva, M., 2003. Six degrees of success or failure in ERP requirements engineering: experiences with the ASAP process. In International Workshop on COTS and Product Software: Why Requirements are so important (Vol. 11).

151. Daneva, M., 2004. ERP requirements engineering practice: Lessons learned. *IEEE Software*, 21(2), pp.26-33.

152. Daneva, M., 2007, August. Understanding success and failure profiles of ERP requirements engineering: An empirical study. In Software Engineering and Advanced Applications, 2007. 33rd EUROMICRO Conference on (pp. 237-243). IEEE.

153. Daoud, J.I., 2017, December. Multicollinearity and regression analysis. In *Journal of Physics: Conference Series* (Vol. 949, No. 1, p. 012009). IOP Publishing.

154. Darwish, N.R., Mohamed, A.A. and Abdelghany, A.S., 2016. A hybrid machine learning model for selecting suitable requirements elicitation techniques. *International Journal of Computer Science and Information Security*, 14(6), pp.1-12.

155. Das, K.R. and Imon, A.H.M.R., 2016. A brief review of tests for normality. *American Journal of Theoretical and Applied Statistics*, 5(1), pp.5-12.

156. Davis, A., 2013. *Just enough requirements management: Where software development meets marketing*. Addison-Wesley.

157. Davis, F.D., Bagozzi, R.P. and Warshaw, P.R., 1989. User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), pp.982-1003.

158. De Gooyert, V., Rouwette, E., Van Kranenburg, H. and Freeman, E., 2017. Reviewing the role of stakeholders in operational research: A stakeholder theory perspective. *European Journal of Operational Research*, *262*(2), pp.402-410.

159. de Oliveira, K.M., Villela, K., Rocha, A.R. and Travassos, G.H., 2006. Use of ontologies in software development environments. In *Ontologies for Software Engineering and Software Technology* (pp. 275-309). Springer Berlin Heidelberg.

160. Deeptimahanti, D.K. and Sanyal, R., 2011, February. Semi-automatic generation of UML models from natural language requirements. In Proceedings of the 4th India Software Engineering Conference (pp. 165-174). ACM.

161. Delice, A., 2010. The Sampling Issues in Quantitative Research. *Educational Sciences: Theory and Practice*, 10(4), pp.2001-2018.

162. Deniz, M.S. and Alsaffar, A.A., 2013. Assessing the validity and reliability of a questionnaire on dietary fibre-related knowledge in a Turkish student population. *Journal of Health, Population and Nutrition,* 31(4), p.497.

163. Desai, V.M., 2018. Collaborative stakeholder engagement: An integration between theories of organizational legitimacy and learning. *Academy of Management Journal*, *61*(1), pp.220-244.

164. Dick, J., Hull, E. and Jackson, K., 2017. *Requirements engineering*. Springer.

165. Dishaw, M.T. and Strong, D.M., 1999. Extending the technology acceptance model with task–technology fit constructs. *Information & Management*, 36(1), pp.9-21.

166. Dobson, G. and Sawyer, P., 2006. Revisiting ontology-based requirements engineering in the age of the semantic web. In Proceedings of the International Seminar on Dependable Requirements Engineering of Computerised Systems at NPPs (pp. 27-29).

167. Doyle, L., Brady, A.M. and Byrne, G., 2009. An overview of mixed methods research. *Journal of research in nursing*, *14*(2), pp.175-185.

168. Dwivedi, Y.K., Wastell, D., Laumer, S., Henriksen, H.Z., Myers, M.D., Bunker, D., Elbanna, A., Ravishankar, M.N. and Srivastava, S.C., 2015. Research on information systems failures and successes: Status update and future directions*. Information Systems Frontiers,* 17(1), pp.143-157.

169. Easterbrook, S. and Aranda, J., 2006. Case studies for software engineers. ICSE'06.

170. Eden, C. and Ackermann, F., 2013. Problem structuring: on the nature of, and reaching agreement about, goals. *EURO Journal on Decision Processes*, 1(1-2), pp.7-28.

171. Egdair, I.M., Rajemi, M.F. and Nadarajan, S., 2015. Technology Factors, ERP System and Organization Performance in Developing Countries. *International Journal of Supply Chain Management*, 4(4).

172. Eisenhardt, K.M. and Graebner, M.E., 2007. Theory building from cases: Opportunities and challenges*. Academy of Management Journal*, 50(1), pp.25-32.

173. Eisenhardt, K.M., 1989. Building theories from case study research. Academy of management review, 14(4), pp.532-550.

174. Elragal, A. and Haddara, M., 2012. The Future of ERP Systems: look backward before moving forward. *Procedia Technology*, 5, pp.21-30.

175. Engeström, Y., 1999. 'Activity theory and individual and social transformation' in Perspectives on activity theory. Y. Engeström, R. Miettinen and RL Punamäki (eds), 19--38.

176. Erfurth, C. and Erfurth, I., 2014, August. Towards business alignment of IT services in universities: Challenges in elicitations of requirements for IT services. In Interrelations between Requirements Engineering and Business Process Management (REBPM), 2014 IEEE 1st International Workshop on the (pp. 11-14). IEEE.

177. Etikan, I., Musa, S.A. and Alkassim, R.S., 2016. Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics*, *5*(1), pp.1-4.

178. Eyitayo, O.T., 2014. Enterprise Resource Planning (ERP) Systems–Is Botswana Winning? A Question on Culture Effects. *Issues in Informing Science and Information Technology*, *11*, pp.47-55..
179. Fadlalla, A. and Amani, F., 2015. A keyword-based organizing framework for ERP intellectual contributions. Journal of Enterprise Information Management, 28(5), pp.637-657.
180. Faisandier, A., 2012. *System Architecture and Design* (Vol. 3). Belberaud, France: Sinergy'Com Publishers.
181. Fakeeh, K.A., 2015. The Realization of Cloud ERP Systems in Higher Education. *International Journal of Applied Information Systems*, *9*(5), pp.37-41.
182. Feiliang, R.E.N., 2012, December. A demo for constructing domain ontology from academic papers. In 24th International Conference on Computational Linguistics (p. 369).
183. Fensel, D., Motta, E., Decker, S. and Zdráhal, Z., 1997, October. Using ontologies for defining tasks, problem-solving methods and their mappings. In International Conference on Knowledge Engineering and Knowledge Management (pp. 113-128). Springer, Berlin, Heidelberg.
184. Fereday, J. and Muir-Cochrane, E., 2006. Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods,* 5(1), pp.80-92.
185. Ferrari, A., Spoletini, P. and Gnesi, S., 2016. Ambiguity and tacit knowledge in requirements elicitation interviews. *Requirements Engineering*, *21*(3), pp.333-355.
186. Filieri, A., Maggio, M., Angelopoulos, K., D'Ippolito, N., Gerostathopoulos, I., Hempel, A.B., Hoffmann, H., Jamshidi, P., Kalyvianaki, E., Klein, C. and Krikava, F., 2015, May. Software engineering meets control theory. In Proceedings of the 10th International Symposium on Software Engineering for Adaptive and Self-Managing Systems (pp. 71-82). IEEE Press.
187. Firesmith, D., 2007. Common Requirements Problems, Their Negative Consequences, and the Industry Best Practices to Help Solve Them. *Journal of Object Technology*, 6(1), pp.17-33.
188. Fischer, H. and Senft, B., 2016. Human-Centered Software Engineering as a Chance to Ensure Software Quality Within the Digitization of Human Workflows. In *Human-Centered and Error-Resilient Systems Development* (pp. 30-41). Springer, Cham.
189. Fitzgerald, B., 2012. Software crisis 2.0. *Computer, 45(4),* pp. 89-91.
190. Flick, U., 2015. *Introducing research methodology: A beginner's guide to doing a research project*. Sage.
191. Fox, N., Hunn, A. and Mathers, N., 2007. Sampling and sample size calculation. The NIHR RDS for the East Midlands/Yorkshire & the Humber.
192. Fraenkel, J.R., Wallen, N.E. and Hyun, H.H., 1993. *How to design and evaluate research in education* (Vol. 7). New York: McGraw-Hill.
193. Francis, J.J., Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., Eccles, M.P. and Grimshaw, J.M., 2010. What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychology and Health*, 25(10), pp.1229-1245.
194. Frank, M., 2012. Engineering systems thinking: Cognitive competencies of successful systems engineers. *Procedia Computer Science*, 8, pp.273-278.
195. Freeman, R. (1984). *Strategic Management. A Stakeholder Approach*. Boston: Pitman.

196. Freudenreich, B., Lüdeke-Freund, F. and Schaltegger, S., 2019. A stakeholder theory perspective on business models: Value creation for sustainability. *Journal of Business Ethics*, pp.1-16.

197. Friese, S., Soratto, J. and Pires, D., 2018. Carrying out a computer-aided thematic content analysis with ATLAS. ti.

198. Frost, J., 2015. Choosing Between a Nonparametric Test and a Parametric Test. Online. [Accessed November 2017]. http://blog.minitab.com/blog/adventures-in-statistics-2/choosing-between-a-nonparametric-test-and-a-parametric-test

199. Fuentes-Fernández, R., Gómez-Sanz, J.J. and Pavón, J., 2010. Understanding the human context in requirements elicitation. *Requirements Engineering*, 15(3), pp.267-283.

200. Gable, G., Sedera, D. and Chan, T., 2003. Enterprise systems success: a measurement model. ICIS 2003 Proceedings, p.48.

201. Gabriel, D., 2013. Inductive and Deductive approaches to research. Online. [Accessed October 2017]. http://deborahgabriel.com/2013/03/17/inductive-and-deductive-approaches-to-research/

202. Ganesh, L. and Mehta, A., 2010. Critical success factors for successful enterprise resource planning implementation at Indian SMEs. *International Journal of Business, Management and Social Sciences*, *1*(1), pp.65-78.

203. Gao, Y. and bin Chik, A.R., 2013. A Multiple Regression Analysis on Influencing Factors of Urban Services Growth in China. *Technology and Investment*, *4*(01), p.1.

204. Garcez, A., Duarte, R. and Eisenberg, Z., 2011. Production and analysis of video recordings in qualitative research. Educação e Pesquisa, 37(2), pp.249-261.

205. Garg, P. and Garg, A., 2013. An empirical study on critical failure factors for enterprise resource planning implementation in Indian retail sector. Business Process Management Journal, 19(3), pp.496-514.

206. Gargeya, V.B. and Brady, C., 2005. Success and failure factors of adopting SAP in ERP system implementation. *Business Process Management Journal*, 11(5), pp.501-516.

207. Gašević, D., Kaviani, N. and Milanović, M., 2009. Ontologies and software engineering. In *Handbook on Ontologies* (pp. 593-615). Springer Berlin Heidelberg.

208. Gebauer, J., 2008. User requirements of mobile technology: A summary of research results. *Information Knowledge Systems Management*, 7(1, 2), pp.101-119.

209. Georg, G., Mussbacher, G., Amyot, D., Petriu, D., Troup, L., Lozano-Fuentes, S. and France, R., 2015. Synergy between Activity Theory and goal/scenario modeling for requirements elicitation, analysis, and evolution. *Information and Software Technology*, 59, pp.109-135.

210. Georgiou, Y. and Kyza, E.A., 2017. The development and validation of the ARI questionnaire: An instrument for measuring immersion in location-based augmented reality settings. *International Journal of Human-Computer Studies*, *98*, pp.24-37.

211. Gervasi, V., Gacitua, R., Rouncefield, M., Sawyer, P., Kof, L., Ma, L., Piwek, P., De Roeck, A., Willis, A., Yang, H. and Nuseibeh, B., 2013. Unpacking tacit knowledge for requirements engineering. In *Managing Requirements Knowledge* (pp. 23-47). Springer, Berlin, Heidelberg.

212. Ghaisas, S. and Ajmeri, N., 2013. Knowledge-assisted ontology-based requirements evolution. In *Managing requirements knowledge* (pp. 143-167). Springer Berlin Heidelberg.

213. Ghazaleh, M.A., Abdallah, S. and Khan, M., 2019. Critical internal organization's forces influencing sustainability of post ERP in UAE service industry. *International Journal of Organizational Analysis*.

214. Giacobbi Jr, P.R., Poczwardowski, A. and Hager, P., 2005. A pragmatic research philosophy for sport and exercise psychology. *The Sport Psychologist*, 19(1), pp.18-31.

215. Giboin, A., 2011, February. From Individual to Collective Personas Modeling Realistic Groups and Communities of Users (and not Only Realistic Individual Users). In The Fourth International Conference on Advances in Computer-Human Interaction (ACHI 2011) (pp. 132-135).

216. Gill, P., Stewart, K., Treasure, E. and Chadwick, B., 2008. Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal*, 204(6), pp.291-295.

217. Gleich, B., Creighton, O. and Kof, L., 2010. Ambiguity detection: Towards a tool explaining ambiguity sources. Requirements Engineering: Foundation for Software Quality, pp.218-232.

218. Godfrey, P., 2010. How systems thinking contribute to systems engineering. What Is Systems Thinking, pp.1-6.

219. Goguen, J.A., 1995, May. Formal methods and social context in software development. In Colloquium on Trees in Algebra and Programming (pp. 62-81). Springer, Berlin, Heidelberg.

220. Golafshani, N., 2003. Understanding reliability and validity in qualitative research. The qualitative report, 8(4), pp.597-606.

221. Goldkuhl, G., 2008, December. What kind of pragmatism in information systems research. In AIS SIG Prag inaugural meeting.

222. Goldkuhl, G., 2011. Meanings of pragmatism: Ways to conduct information systems research. Action in Language, Organisations and Information Systems.

223. Goldkuhl, G., 2012. Pragmatism vs interpretivism in qualitative information systems research. European Journal of Information Systems, 21(2), pp.135-146.

224. Goodhue, D.L. and Thompson, R.L., 1995. Task-technology fit and individual performance. MIS quarterly, pp.213-236.

225. Goodwin, K. 2008. Getting From Research to Personas: Harnessing the Power of Data. Online. [Accessed September 2017]. https://www.cooper.com/journal/2002/11/getting_from_research_to_perso

226. Gordon, H.M.I., Miller, J., Gooding, D.A., Cowart, W. and Kosner, A.W., Cloud 9 Llc, 2017. Vital text analytics system for the enhancement of requirements engineering documents and other documents. U.S. Patent 9,678,949.

227. Gorschek, T., 2006. Requirements engineering supporting technical product management (Doctoral dissertation, Blekinge Institute of Technology).

228. Grabski, S.V., Leech, S.A. and Lu, B., 2001. Risks and controls in the implementation of ERP systems.

229. Grabski, S.V., Leech, S.A. and Schmidt, P.J., 2011. A review of ERP research: A future agenda for accounting information systems. *Journal of information systems*, *25*(1), pp.37-78.

230. Green, C.A., Duan, N., Gibbons, R.D., Hoagwood, K.E., Palinkas, L.A. and Wisdom, J.P., 2015. Approaches to mixed methods dissemination and implementation research: methods, strengths, caveats, and opportunities. Administration and Policy in Mental Health and Mental Health Services Research, 42(5), pp.508-523.

231. Greenwood, M. and Freeman, R.E., 2011. Ethics and HRM: The contribution of stakeholder theory. *Business & Professional Ethics Journal*, pp.269-292.

232. Greg, G., Kathleen, M. and Emily, N., 2012. Applied thematic analysis. Thousand Oaks, California. sag. pp11.

233. Gren, L. and Goldman, A., 2016, May. Useful statistical methods for human factors research in software engineering: a discussion on validation with quantitative data. In Proceedings of the 9th International Workshop on Cooperative and Human Aspects of Software Engineering (pp. 121-124). ACM.

234. Guba, E.G., 1981. Criteria for assessing the trustworthiness of naturalistic inquiries. ECTJ, 29(2), pp.75-91.

235. Guetterman, T.C., Fetters, M.D. and Creswell, J.W., 2015. Integrating quantitative and qualitative results in health science mixed methods research through joint displays. *The Annals of Family Medicine*, *13*(6), pp.554-561.

236. Gunjal, B., 2016. Managing Knowledge and Scholarly Assets in Academic Libraries: Issues and Challenges. Managing Knowledge and Scholarly Assets in Academic Libraries, p.270.

237. Gupta, S., Misra, S.C., Singh, A., Kumar, V. and Kumar, U., 2017. Identification of challenges and their ranking in the implementation of cloud ERP. *International Journal of Quality & Reliability Management*.

238. Hadar, I., Soffer, P. and Kenzi, K., 2014. The role of domain knowledge in requirements elicitation via interviews: an exploratory study. Requirements Engineering, 19(2), pp.143-159.

239. Haddara, M. and Elragal, A., 2013. ERP adoption cost factors identification and classification: a study in SMEs. *International Journal of Information Systems and Project Management*, 1(2), pp.5-21.

240. Haddara, M. and Moen, H., 2017. User resistance in ERP implementations: A literature review. *Procedia Computer Science*, *121*, pp.859-865.

241. Haislip, J.Z. and Richardson, V.J., 2015. The Effect of Customer Relationship Management Systems on Firm Performance.

242. Halaweh, M., 2012. Using grounded theory as a method for system requirements analysis. *JISTEM-Journal of Information Systems and Technology Management*, 9(1), pp.23-38.

243. Hamelin, R.D., Walden, D.D. and Krueger, M.E., 2010, July. 4.4. 2 INCOSE Systems Engineering Handbook v3. 2: Improving the Process for SE Practitioners. In *INCOSE International Symposium* (Vol. 20, No. 1, pp. 532-541).

244. Han, K.S., 2018. Analysis on Major Factors Affecting Intention Level to Renew Maintenance Contract–Focused on Foreign ERP Software. *International Journal of Advanced Science and Technology,* 115(1), pp.99-112.

245. Haron, H., Azim.,A and Haron, G.H., 2015. A Conceptual Model To Manage Lexical Ambiguity In Malay Textual Requirements. ARPN Journal of Engineering and Applied Sciences.

246. Harris, S.R., 2012. Supporting learning-in-use: some applications of activity theory to the analysis and design of ICT-enabled collaborative work and learning. Doctoral dissertation, University of Glamorgan.

247. Hashim, N.H. and Jones, M.L., 2007. Activity theory: A framework for qualitative analysis.

248. Hasnas, J., 2013. Whither stakeholder theory? A guide for the perplexed revisited. *Journal of business ethics*, *112*(1), pp.47-57.

249. Hathcoat J.D., Meixner C., Nicholas M.C. (2018) Ontology and Epistemology. In: Liamputtong P. (eds) Handbook of Research Methods in Health Social Sciences. Springer, Singapore

250. Hawari, A.A. and Heeks, R., 2010. Explaining ERP failure in a developing country: a Jordanian case study. Journal of Enterprise Information Management, 23(2), pp.135-160.

251. Hazman, M., El-Beltagy, S.R. and Rafea, A., 2011. A survey of ontology learning approaches. database, 7, p.6.

252. Heale, R. and Twycross, A., 2015. Validity and reliability in quantitative studies. Evidence-based nursing, pp.ebnurs-2015.

253. Heale, R. and Twycross, A., 2015. Validity and reliability in quantitative studies. Evidence-based nursing, pp.ebnurs-2015.

254. Hendren, K., Luo, Q.E. and Pandey, S.K., 2018. The state of mixed methods research in public administration and public policy. *Public Administration Review*, *78*(6), pp.904-916.

255. Hendricks, K.B., Singhal, V.R. and Stratman, J.K., 2007. The impact of enterprise systems on corporate performance: A study of ERP, SCM, and CRM system implementations. Journal of Operations Management, 25(1), pp.65-82.

256. Henson, R.K., 2001. Understanding internal consistency reliability estimates: A conceptual primer on coefficient alpha. *Measurement and evaluation in counseling and development,* 34(3), p.177.

257. Herlea, D.E., Jonker, C.M., Treur, J. and Wijngaards, N.J., 2002. A compositional knowledge level process model of requirements engineering. *International Journal of Software Engineering and Knowledge Engineering*, 12(01), pp.41-75.

258. Hindle, A., Alipour, A. and Stroulia, E., 2016. A contextual approach towards more accurate duplicate bug report detection and ranking. *Empirical Software Engineering*, *21*(2), pp.368-410.

259. Hirschheim, R. and Klein, H.K., 1989. Four paradigms of information systems development. Communications of the ACM, 32(10), pp.1199-1216.

260. Ho, J.K.K., 2014. A review of the multi-perspective, systems-based (MPSB) research with an MPSB knowledge supply chain framework. European Academic Research, 2(1), pp.705-729.

261. Hochreiner, C., Ma, Z., Kieseberg, P., Schrittwieser, S. and Weippl, E., 2014, April. Using model driven security approaches in web application development. In Information and Communication Technology-EurAsia Conference (pp. 419-431). Springer Berlin Heidelberg.

262. Holland, C.P. and Light, B., 1999. A critical success factors model for ERP implementation. IEEE software, 16(3), p.30.

263. Hong, Q.N., Gonzalez-Reyes, A. and Pluye, P., 2018. Improving the usefulness of a tool for appraising the quality of qualitative, quantitative and mixed methods studies, the Mixed Methods Appraisal Tool (MMAT). *Journal of evaluation in clinical practice*, *24*(3), pp.459-467.

264. Hong, W., Chan, F.K., Thong, J.Y., Chasalow, L.C. and Dhillon, G., 2014. A framework and guidelines for context-specific theorizing in information systems research. *Information systems research*, *25*(1), pp.111-136.

265. Horkoff, J. and Yu, E., 2013. Comparison and evaluation of goal-oriented satisfaction analysis techniques. Requirements Engineering, 18(3), pp.199-222.

266. Hosono, S., Hara, T., Shimomura, Y. and Ara, T., 2012, October. Prioritizing service functions with non-functional requirements. In Proceedings of the 2nd CIRP IPS2 Conference 2010; 14-15 April; Linköping; Sweden (No. 077, pp. 133-140). Linköping University Electronic Press.

267. Hosono, S., Hasegawa, M., Hara, T., Shimomura, Y. and Arai, T., 2009, March. A methodology of persona-centric service design. In Proceedings of the 19th CIRP Design Conference–Competitive Design. Cranfield University Press.

268. Huang, S.M., Chang, I.C., Li, S.H. and Lin, M.T., 2004. Assessing risk in ERP projects: identify and prioritize the factors. Industrial management & data systems, 104(8), pp.681-688.

269. Hughes, L.J., Mitchell, M.L. and Johnston, A.N., 2021. Moving forward: Barriers and enablers to failure to fail–A mixed methods meta-integration. *Nurse Education Today*, *98*, p.104666.

270. Hull, E., Jackson, K. and Dick, J., 2010. Requirements engineering. Springer Science & Business Media.

271. Hustad, E. and Olsen, D.H., 2014. ERP Implementation in an SME: a Failure Case. In Information Systems for Small and Medium-sized Enterprises (pp. 213-228). Springer Berlin Heidelberg.

272. Inayat, I., Salim, S.S., Marczak, S., Daneva, M. and Shamshirband, S., 2015. A systematic literature review on agile requirements engineering practices and challenges. Computers in human behavior, 51, pp.915-929.

273. Izhar, R., Izhar, S., Bhatti, S.N. and Jadi, A.M., 2018. Impact and Challenges of Requirements Management in Enterprise Resource Planning (ERP) via ERP Thesaurus.

274. J. McManus and T. Wood-Harper, 2015. A Study in Project Failure; BSC-The Chartered Institute for IT. Viewed 21 June 2016 http://www.bcs.org/content/ConWebDoc/19584.

275. Jackson, M.C., 2003. *Systems thinking: Creative holism for managers*. Chichester: Wiley.

276. Jackson, M.C., 2010. Reflections on the development and contribution of critical systems thinking and practice. Systems Research and Behavioral Science, 27(2), pp.133-139.

277. Jamshed, S., 2014. Qualitative research method-interviewing and observation. *Journal of basic and clinical pharmacy*, 5(4), p.87.

278. Janits, M., 2013. Practical Insights into Recurring Issues of Requirements Elicitation: The potential of systems analysis in addressing these issues.

279. Jansson, J. and Jonsson, F., 2015. Development of an ERP Requirements Specification Method by Applying Rapid Contextual Design: A Case Study of a Medium-sized Enterprise.

280. Jayawickrama, U., Liu, S. and Smith, M.H., 2017. Knowledge prioritisation for ERP implementation success. *Industrial Management & Data Systems*.

281. Jenz, D.E., 2003. Business process ontologies: Speeding up business process implementation. Jenz & Partner GmbH2003.

282. Jia, J. and Capretz, L.F., 2018. Direct and mediating influences of user-developer perception gaps in requirements understanding on user participation. Requirements Engineering, 23(2), pp.277-290.

283. Jick, T.D., 1979. Mixing qualitative and quantitative methods: Triangulation in action. Administrative science quarterly, 24(4), pp.602-611.

284. Johann, T. and Maalej, W., 2015, August. Democratic mass participation of users in Requirements Engineering?. In 2015 IEEE 23rd international requirements engineering conference (RE) (pp. 256-261). IEEE.

285. Johansson, B. and Carlsson, S.A., 2013. An Approach for Identifying Business Requirements for Development of Prospective ERP Systems. In Building Sustainable Information Systems (pp. 247-257). Springer US.

286. Johns, R. (2010). Likert items and scales. Survey Question Bank: Methods Fact Sheet, 1, 1–11.

287. Johnson, R.B. and Onwuegbuzie, A.J., 2004. Mixed methods research: A research paradigm whose time has come. Educational researcher, 33(7), pp.14-26.

288. Johnson, R.B. and Onwuegbuzie, A.J., 2004. Mixed methods research: A research paradigm whose time has come. *Educational researcher*, 33(7), pp.14-26.

289. Jokonya, O., 2014. A framework to assist organisations with information technology adoption governance (Doctoral dissertation, University of South Africa).

290. Jones, P.H., 2014. Systemic design principles for complex social systems. In Social systems and design (pp. 91-128). Springer Japan.

291. Jurisica, I., Mylopoulos, J. and Yu, E., 2004. Ontologies for knowledge management: an information systems perspective. Knowledge and Information systems, 6(4), pp.380-401.

292. Jurisica, I., Mylopoulos, J. and Yu, E., 2004. Ontologies for knowledge management: an information systems perspective. Knowledge and Information systems, 6(4), pp.380-401.

293. K. Pohl, 2010. Goal of Requirements Engineering: Establishing a Vision

294. Kaiya, H. and Saeki, M., 2006, September. Using domain ontology as domain knowledge for requirements elicitation. In Requirements Engineering, 14th IEEE International Conference (pp. 189-198). IEEE.

295. Kaiya, H. and Saeki, M., 2006, September. Using domain ontology as domain knowledge for requirements elicitation. In Requirements Engineering, 14th IEEE International Conference (pp. 189-198). IEEE.

296. Kaiya, H. and Saeki, M., 2006, September. Using domain ontology as domain knowledge for requirements elicitation. In Requirements Engineering, 14th IEEE International Conference (pp. 189-198). IEEE.

297. Kaiya, H., Horai, H. and Saeki, M., 2002. AGORA: Attributed goal-oriented requirements analysis method. In Requirements Engineering, 2002. Proceedings. IEEE Joint International Conference on (pp. 13-22). Ieee.

298. Kaiya, H., Shinbara, D., Kawano, J. and Saeki, M., 2005. Improving the detection of requirements discordances among stakeholders. Requirements Engineering, 10(4), pp.289-303.

299. Kalema Dr, B.M., Olugbara Prof, O.O. and Kekwaletswe Prof, R.M., 2014. Identifying critical success factors: The case of ERP systems in higher education. *The African Journal of Information Systems*, *6*(3), p.1.

300. Kamsties, E., 2005. Understanding ambiguity in requirements engineering. In Engineering and Managing Software Requirements (pp. 245-266). Springer Berlin Heidelberg.

301. Kamsties, E., Berry, D.M. and Paech, B., 2001, July. Detecting ambiguities in requirements documents using inspections. In Proceedings of the first workshop on inspection in software engineering (WISE'01) (pp. 68-80).

302. Kamsties, E., Berry, D.M. and Paech, B., 2001, July. Detecting ambiguities in requirements documents using inspections. In Proceedings of the first workshop on inspection in software engineering (WISE'01) (pp. 68-80).

303. Kanaracus, C., 2016. Oracle sued by university for alleged ERP failure, Online. [Accessed August 2016], http://www.computerworld.com/article/2508381/enterprise-applications/oracle-sued-by-university-for-alleged-erp-failure.html

304. Kardasis, P. and Loucopoulos, P., 2005. A roadmap for the elicitation of business rules in information systems projects. Business Process Management Journal, 11(4), pp.316-348.

305. Karia, N. and Soliman, M., 2017. Factors affecting enterprise resource planning (ERP) systems adoption among higher education institutions in Egypt. *International Journal of Advanced and Applied Sciences*, *4*(5), p.8.

306. Katina, P.F., Keating, C.B. and Ra'ed, M.J., 2014. System requirements engineering in complex situations. Requirements Engineering, 19(1), pp.45-62.

307. Kaur, R. and Sengupta, J., 2013. Software process models and analysis on failure of software development projects. arXiv preprint arXiv:1306.1068.

308. Kenzi, K., Soffer, P. and Hadar, I., 2010. The Role of Domain Knowledge in Requirements Elicitation: an Exploratory Study. In *MCIS* (p. 48).

309. Kessi, K., Oussalah, M. and Alimazighi, Z., 2014, March. Viewpoints for Requirement Engineering in a Cooperatif Information System (VpCIS). In WorldCIST (1) (pp. 299-308).

310. Khan, F., Jan, S.R., Tahir, M., Khan, S. and Ullah, F., 2016. Survey: Dealing Non-Functional Requirements at Architecture Level. VFAST Transactions on Software Engineering, 9(2), pp.7-13.

311. Khattak, A.M., Batool, R., Pervez, Z., Khan, A.M. and Lee, S., 2013. Ontology Evolution and Challenges. J. Inf. Sci. Eng., 29(5), pp.851-871.

312. Kilic, H.S., Zaim, S. and Delen, D., 2015. Selecting "The Best" ERP system for SMEs using a combination of ANP and PROMETHEE methods. Expert Systems with Applications, 42(5), pp.2343-2352.

313. Kim, Y.H., Kim, D.J. and Wachter, K., 2013. A study of mobile user engagement (MoEN): Engagement motivations, perceived value, satisfaction, and continued engagement intention. Decision Support Systems, 56, pp.361-370.

314. Kitamura, M., Hasegawa, R., Kaiya, H. and Saeki, M., 2008. A supporting tool for requirements elicitation using a domain ontology. In Software and data technologies (pp. 128-140). Springer, Berlin, Heidelberg.

315. Kitchenham, B., Madeyski, L. and Brereton, P., 2019, April. Problems with statistical practice in human-centric software engineering experiments. In Proceedings of the Evaluation and Assessment on Software Engineering (pp. 134-143). ACM.

316. Kivunja, C. and Kuyini, A.B., 2017. Understanding and applying research paradigms in educational contexts. *International Journal of Higher Education*, *6*(5), pp.26-41.

317. Klauer, K.J. and Phye, G.D., 2008. Inductive reasoning: A training approach. Review of Educational Research, 78(1), pp.85-123.

318. Knauss, E., El Boustani, C. and Flohr, T., 2009. Investigating the impact of software requirements specification quality on project success. In Product-Focused Software Process Improvement (pp. 28-42). Springer Berlin Heidelberg.

319. Knekta, E., Runyon, C. and Eddy, S., 2019. One size doesn't fit all: Using factor analysis to gather validity evidence when using surveys in your research. *CBE—Life Sciences Education*, *18*(1), p.rm1.

320. Kogetsidis, H., 2011. Systems approaches for organisational analysis. International journal of organizational analysis, 19(4), pp.276-287.

321. Kotonya, G. and Sommerville, I., 1996. Requirements engineering with viewpoints. Software Engineering Journal, 11(1), pp.5-18.

322. Kronbichler, S.A., Ostermann, H. and Staudinger, R., 2010. A comparison of erp-success measurement approaches. JISTEM-Journal of Information Systems and Technology Management, 7(2), pp.281-310.

323. Krouwel, M. and Op't Land, M., 2012. Using enterprise ontology as a basis for requirements for cross-organizationally usable applications. AIS Electronic Library (AISeL).

324. Kuehl, R. and Hawker, J.S.,2009. Requirements Analysis-Ambiguity.

325. Kuhn, T.S., 1970. *The Structure of Scientific Revolutions, 2nd enl. ed*. University of Chicago Press.

326. Kulkarni, U.R., Ravindran, S. and Freeze, R., 2006. A knowledge management success model: Theoretical development and empirical validation. Journal of management information systems, 23(3), pp.309-347.

327. Kumar, K. and Van Hillegersberg, J., 2000. ERP is now considered to be the price of entry for running a business, and at least at present, for being connected to other enterprises in a network economy: Communications of the ACM, Apr. 2000.

328. Kumlander, D., 2006, July. On software design and development supporting requirements formulation. In Proceedings of the 10th WSEAS International Conference on COMPUTERS (pp. 13-15).

329. Kwahk, K.Y. and Ahn, H., 2010. Moderating effects of localization differences on ERP use: A socio-technical systems perspective. *Computers in Human Behavior*, 26(2), pp.186-198.

330. Landrum, B. and Garza, G., 2015. Mending fences: Defining the domains and approaches of quantitative and qualitative research. *Qualitative psychology*, *2*(2), p.199.

331. Laplante, P.A., 2013. Requirements engineering for software and systems. CRC Press.

332. Latef, M., Aslam, T. and Sehar, P.,2018. Impact of domain knowledge in phase of requirement engineering. International Journal of Advanced Research and Development

333. Lather, P. (1991). *Getting smart: Feminist research and pedagogy with/in the postmodern*. New York: Routledge.

334. Lau, G.T., Law, K.H. and Wiederhold, G., 2006. A relatedness analysis of government regulations using domain knowledge and structural organization. *Information Retrieval*, *9*(6), pp.657-680.

335. Law, C.C. and Ngai, E.W., 2007. ERP systems adoption: An exploratory study of the organizational factors and impacts of ERP success. *Information & Management*, *44*(4), pp.418-432.

336. Lawrence, R.J., 2011. A comparison of the DeLone and McLean model of IS Success and the work system method: Three field studies in healthcare organizations (Doctoral dissertation).

337. Lee, A.H., Chen, S.C. and Kang, H.Y., 2020. A decision-making framework for evaluating enterprise resource planning systems in a high-tech industry. *Quality Technology & Quantitative Management*, *17*(3), pp.319-336.
338. Lee, S.W. and Gandhi, R.A., 2005, December. Ontology-based active requirements engineering framework. In Software Engineering Conference, 2005. APSEC'05. 12th Asia-Pacific (pp. 8-pp). IEEE.
339. Leedy, P.D. and Ormrod, J.E., 2005. Practical research. Pearson Custom.
340. LeRouge, C., Ma, J., Sneha, S. and Tolle, K., 2013. User profiles and personas in the design and development of consumer health technologies. *International Journal of Medical Informatics*, 82(11), pp.e251-e268.
341. Lewis, A., 2016. The top three ERP implementation disasters, Online. [Accessed August 2016], http://www.sharedserviceslink.com/blog/the-top-three-truly-shocking-erp-implementation-disasters
342. Liao, S.S. and Wang, H., Exploring Alternatives During Requirements Analysis.
343. Lim, S.L. and Finkelstein, A., 2011. StakeRare: using social networks and collaborative filtering for large-scale requirements elicitation. IEEE transactions on software engineering, 38(3), pp.707-735.
344. Lingard, H.C. and Rowlinson, S., 2005. Sample size in factor analysis: why size matters. Retrieved March, 6, p.2010.
345. Liu, L., 2016. Using Generic Inductive Approach in Qualitative Educational Research: A Case Study Analysis. *Journal of Education and Learning*, *5*(2), pp.129-135.
346. Long, F., 2009, May. Real or imaginary: The effectiveness of using personas in product design. In Proceedings of the Irish Ergonomics Society annual conference (Vol. 14). Irish Ergonomics Society.
347. Long, H., 2017. Validity in mixed methods research in education: the application of Habermas' critical theory. *International Journal of Research & Method in Education*, *40*(2), pp.201-213.
348. Lopez, A.Y. and Niu, N., 2010, July. Soft Systems in Requirements Engineering: A Case Study. In SEKE (pp. 38-41).
349. Lotfi, R. and Dastjerdi, A.G., 2016. The Use of Empirical Software Engineering to Solve the Software Crisis. Indian Journal of Science and Technology, 9(27).
350. Loucopoulos, P. and Karakostas, V., 1995. System requirements engineering. McGraw-Hill, Inc..
351. Lovejoy, A.O., 1908. The thirteen pragmatisms. I. The Journal of Philosophy, Psychology and Scientific Methods, 5(1), pp.5-12.
352. Lowry, P.B., Karuga, G.G. and Richardson, V.J., 2007. Assessing leading institutions, faculty, and articles in premier information systems research journals. Communications of the Association for Information Systems (CAIS), 20(16), pp.142-203.
353. Lu, I.Y., Kuo, T. and Lee, W.P., 2010. Examining the effects of information quality on behavioral intention of knowledge management system. 品質學報, 17(4), pp.297-309.
354. Maas, J.B., Fenema, P.C. and Soeters, J., 2014. ERP system usage: the role of control and empowerment. New Technology, Work and Employment, 29(1), pp.88-103.
355. Mafuwane, B.M., 2012. The contribution of instructional leadership to learner performance (Doctoral dissertation).

356. Mahanga, K.M. and Seymour, L.F., 2015. Enterprise resource planning teaching challenges faced by lecturers in Africa. In *Proceedings of the 9th IDIA conference, IDIA2015, Nungwi, Zanzibar* (pp. 343-353).
357. Mainardes, E.W., Alves, H. and Raposo, M., 2011. Stakeholder theory: issues to resolve. *Management decision*.
358. Majumdar, S.I., Rahman, M.S. and Rahman, M.M., 2014. Stakeholder prioritization in requirement engineering process: a case study on school management system. Computer Science and Engineering, 4(1), pp.17-27.
359. Makambe, U., 2017. Role of knowledge management enablers in facilitating knowledge management practices in selected private higher education institutions in Botswana (Doctoral dissertation).
360. Malahat Pouransafar, M. (2013). Failure Factors of ERP Projects in an Iranian Context. *IOSR Journal of Business and Management*, 9(4), pp.83-87.
361. Malan, D.D.J. and Lotriet, R., 2013. Management competencies of sport club managers in the North-West Province, South Africa.
362. Mannio, M. and Nikula, U., 2001, November. Requirements elicitation using a combination of prototypes and scenarios. In WER (pp. 283-296).
363. Marais, W.J. and Kruger, C.J., 2005. Implementation of an information system within a bureaucratic environment: an understanding of the human issues. *SA Journal of Information Management,* 7(1).
364. Mardiana, S., Tjakraatmadja, J.H. and Aprianingsih, A., 2015. DeLone-McLean Information System Success Model Revisited: The Separation of Intention to Use-Use and the Integration of Technology Acceptance Models. *International Journal of Economics and Financial Issues*, 5(1S).
365. Marshall, B., Cardon, P., Poddar, A. and Fontenot, R., 2013. Does sample size matter in qualitative research?: A review of qualitative interviews in IS research. *Journal of Computer Information Systems*, 54(1), pp.11-22.
366. Martin, S., Aurum, A., Jeffery, R. and Paech, B., 2002, December. Requirements engineering process models in practice. In 7th Australian workshop on requirements engineering. Deakin University, Melbourne, Australia (pp. 41-47).
367. Maskey, R., Fei, J. and Nguyen, H.O., 2018. Use of exploratory factor analysis in maritime research. *The Asian journal of shipping and logistics*, *34*(2), pp.91-111.
368. Mason, C.A., 2016. Advisor: Dr. C. Twomey (Doctoral dissertation, New Jersey City University).
369. Mason, M., 2010, August. Sample size and saturation in PhD studies using qualitative interviews. In Forum qualitative Sozialforschung/Forum: qualitative social research (Vol. 11, No. 3).
370. Matthews, T., Judge, T. and Whittaker, S., 2012, May. How do designers and user experience professionals actually perceive and use personas?. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 1219-1228). ACM.
371. Matyokurehwa, K., Mavetera, N. and Jokonya, O., 2017. Requirements engineering techniques: A systematic literature review. *International Journal of Soft Computing and Engineering*, *7*(1), pp.14-20.
372. Matyokurehwa, K., Mavetera, N. and Jokonya, O., 2018. Enterprise Resource Planning (ERP) Systems in Higher Education: A Deeper Look at their Failures and the Way Forward. *International Research in Education*. *6(2), pp 62-74.*

373. Mavetera, N. 2010. Philosophy of Social Science Research. *In Fundamentals of Scientific Research and Publishing: Research and Publication Book Series Volume 1[1] 2010: MA Mokoena & L Makondo Eds,* Book Chapter 3*,* The Platinum Pres

374. Mavetera, N. 2012. *Towards an ontology-driven software development approach: An unended quest*. PhD Thesis: Faculty of Engineering, Built Environment and Information Technology (EBIT), University of Pretoria Internal Publication, RSA.

375. Mavetera, N. 2017. *Computer Information Systems Persistent Struggles for Humanism: An Antithesis*. Inaugural Lecture, 27 July 2017. North West University internal publication

376. Mavetera, N. and Kroeze, J.H., 2010. An ontology-driven software development framework.

377. May, T., 2011. Social research. McGraw-Hill Education (UK).

378. McManus, J. and Wood-Harper, T., 2008. A study in project failure. British Computer Society< http://www. bcs. org/server. php.

379. Mekadmi, S. and Louati, R., 2018. An evaluation model of user satisfaction with enterprise resource planning systems. *The Electronic Journal of Information Systems Evaluation*, *21*(2), pp.143-157.

380. Mertens, D.M., 2014. *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods*. Sage publications.

381. Miaskiewicz, T. and Kozar, K.A., 2011. Personas and user-centered design: How can personas benefit product design processes?. Design Studies, 32(5), pp.417-430.

382. Mihai, R.S., Grabara, J., Okwiet, B. and Nowak, S., 2015. ERP-SPECIFIC FORM OF INTEGRATED APPLICATIONS. Applied Mechanics & Materials, (795).

383. Miles, S., 2017. Stakeholder theory classification: A theoretical and empirical evaluation of definitions. *Journal of Business Ethics*, *142*(3), pp.437-459.

384. Miller, G. and Williams, L., 2006. Personas: Moving beyond role-based requirements engineering. Microsoft and North Carolina State University.

385. Mitchell, P., 1997. Introduction to theory of mind: Children, autism and apes. Edward Arnold Publishers.

386. Mitchell, R.K., Van Buren III, H.J., Greenwood, M. and Freeman, R.E., 2015. Stakeholder inclusion and accounting for stakeholders. *Journal of Management Studies*, *52*(7), pp.851-877.

387. MITRE 2017. Systems Thinking. Online. [Accessed June 2017]. https://www.mitre.org/publications/systems-engineering-guide/enterprise-engineering/comprehensive-viewpoint/systems-thinking

388. Mkansi, M. and Acheampong, E.A., 2012. Research philosophy debates and classifications: students' dilemma. *Electronic Journal of Business Research Methods*, 10(2), pp.132-140.

389. Moe, C.E., Newman, M. and Sein, M.K., 2017. The public procurement of information systems: dialectics in requirements specification. *European Journal of Information Systems*, 26(2), pp.143-163.

390. Moon, M.D., 2019. Triangulation: A method to increase validity, reliability, and legitimation in clinical research. *Journal of Emergency Nursing*, *45*(1), pp.103-105.

391. Morgan, D.L., 2007. Paradigms lost and pragmatism regained methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*, 1(1), pp.48-76.

392. Morgan, D.L., 2014. Pragmatism as a paradigm for social research. *Qualitative inquiry*, *20*(8), pp.1045-1053.

393. Mukwasi, C.M. and Seymour, L.F., 2014. The growing trend of small to medium-sized enterprises adopting enterprise resource planning systems: an analysis of business cases in Zimbabwe and South Africa. Journal of Emerging Trends in Economics and Management Sciences, 5(7), p.138.

394. Mukwasi, C.M. and Seymour, L.F., 2015, May. Interdependent Enterprise Resource Planning risks in Small and Medium-sized Enterprises in developing countries. In IST-Africa Conference, 2015 (pp. 1-10). IEEE.

395. Mulla, N. and Girase, S., 2012. A new approach to requirement elicitation based on stakeholder recommendation and collaborative filtering. *International Journal of Software Engineering & Applications*, 3(3), p.51.

396. Murugesh, S., Jaya, A., 2012. A Step towards Software Requirements Elicitation from Unstructured Documents. The International Conference on Communication, Computing and Information Technology (ICCCMIT) 2012

397. Mussbacher, G., Ghanavati, S. and Amyot, D., 2009, August. Modeling and Analysis of URN Goals and Scenarios with jUCMNav. In Requirements Engineering Conference, 2009. RE'09. 17th IEEE International (pp. 383-384). IEEE

398. Mylopoulos, J., Chung, L. and Yu, E., 1999. From object-oriented to goal-oriented requirements analysis. Communications of the ACM, 42(1), pp.31-37.

399. Nandhakumar, J., Rossi, M. and Talvinen, J., 2005. The dynamics of contextual forces of ERP implementation. *The Journal of Strategic Information Systems*, *14*(2), pp.221-242.

400. Napitupulu, D., Kadar, J.A. and Jati, R.K., 2017. Validity testing of technology acceptance model based on factor analysis approach. Indonesian Journal of Electrical Engineering and Computer Science, 5(3), pp.697-704.

401. Ngai, E.W., Law, C.C. and Wat, F.K., 2008. Examining the critical success factors in the adoption of enterprise resource planning. Computers in Industry, 59(6), pp.548-564.

402. Nguema, C.G.A., 2018. *The role of audit functions in enterprise resource planning projects in a selected organisation in South Africa* (Doctoral dissertation, Cape Peninsula University of Technology).

403. Nguyen, L. and Shanks, G., 2009. A framework for understanding creativity in requirements engineering. Information and software technology, 51(3), pp.655-662.

404. Nijem, Q., 2013 Software Requirements Elicitation Tools for Service Oriented Architecture: Comparative Analysis. International Journal of Computing Academic Research (IJCAR) ISSN, pp.2305-9184.

405. Niknafs, A. and Berry, D.M., 2012, September. The impact of domain knowledge on the effectiveness of requirements idea generation during requirements elicitation. In *2012 20th IEEE International Requirements Engineering Conference (RE)* (pp. 181-190). IEEE.

406. Nisar, S., Nawaz, M. and Sirshar, M., 2015. Review analysis on requirement elicitation and its issues. Int. J. Comput. Commun. Syst. Eng.(IJCCSE), 2(3), pp.484-489.

407. Niu, N., Da Xu, L., Cheng, J.R.C. and Niu, Z., 2014. Analysis of architecturally significant requirements for enterprise systems. IEEE Systems Journal, 8(3), pp.850-857.

408. Niu, N., Lopez, A.Y. and Cheng, J.R., 2011. Using soft systems methodology to improve requirements practices: an exploratory case study. IET software, 5(6), pp.487-495.

409. Nizamani, S., Khoumbati, K., Ismaili, I.A. and Nizamani, S., 2014. A Conceptual Framework for ERP Evaluation in Universities of Pakistan. arXiv preprint. arXiv, 1402.

410. Norman, D., 2013. The design of everyday things: Revised and expanded edition. Basic Books (AZ).

411. Northrop, L., Clements, P., Bachmann, F., Bergey, J., Chastek, G., Cohen, S., Donohoe, P., Jones, L., Krut, R., Little, R. and McGregor, J., 2007. A framework for software product line practice, version 5.0. SEI.–2007–http://www. sei. cmu. edu/productlines/index. html.

412. Nuseibeh, B. and Easterbrook, S., 2000, May. Requirements engineering: a roadmap. In Proceedings of the Conference on the Future of Software Engineering (pp. 35-46). ACM.

413. Nwankpa, J. and Datta, P., 2012. Perceived audit quality from ERP implementations. Information Resources Management Journal (IRMJ), 25(1), pp.61-80.

414. Offen, R., 2002. Domain understanding is the key to successful system development. *Requirements engineering*, 7(3), pp.172-175.

415. Ogunyemi, OF., Olofinsao, A., 2014. A Case Study Analysis of Factors (Success and Failure) Affecting Enterprise Resource Planning System Implementation in Nigeria. Arc Journals. (pp. 109-116).

416. Okunoye, A., Frolick, M. and Crable, E., 2012. ERP Implementation in Higher Education: An Account of Pre. Cases on Technologies for Educational Leadership and Administration in Higher Education, p.128.

417. Olaronke, G.E., Olaleke, J.O. and Olajide, M.S., 2010. A Survey on Requirement Analysis in the Nigerian Context.

418. Oliveira, K., Galotta, C., Rocha, A.R., Travassos, G.H. and Menezes, C., 1999, November. Defining and building domain-oriented software development environments. In Proceedings of the International Conference on Software & Systems Engineering and their Applications (p. 1).

419. Oliveira, T. and Martins, M.F., 2011. Literature review of information technology adoption models at firm level. The Electronic Journal Information Systems Evaluation, 14(1), pp.110-121.

420. Olugbara, O.O., Kalema, B.M. and Kekwaletswe, R.M., 2014. Identifying critical success factors: the case of ERP systems in higher education.

421. Omoronyia, I., Sindre, G., Stålhane, T., Biffl, S., Moser, T. and Sunindyo, W., 2010, June. A domain ontology building process for guiding requirements elicitation. In International working conference on requirements engineering: Foundation for software quality (pp. 188-202). Springer, Berlin, Heidelberg.

422. Ong, M.H.A. and Puteh, F., 2017. Quantitative data analysis: Choosing between SPSS, PLS, and AMOS in social science research. *International Interdisciplinary Journal of Scientific Research*, *3*(1), pp.14-25.

423. Onwuegbuzie, A.J. and Johnson, R.B., 2006. The validity issue in mixed research. *Research in the Schools*, *13*(1), pp.48-63.

424. Onwuegbuzie, A.J., Bustamante, R.M. and Nelson, J.A., 2010. Mixed research as a tool for developing quantitative instruments. *Journal of mixed methods research*, *4*(1), pp.56-78.

425. Orcan, F., 2018. Exploratory and confirmatory factor analysis: Which one to use first. *Journal of Measurement and Evaluation in Education and Psychology*, *9*(4), pp.414-421.
426. Organ, J. and Stapleton, L., 2013. Information systems risk paradigms: towards a new theory on systems risk. IFAC Proceedings Volumes, 46(8), pp.116-121.
427. Orougi, S., 2015. Recent advances in enterprise resource planning. Accounting, 1(1), pp.37-42.
428. Osada, A., Ozawa, D., Kaiya, H. and Kaijiri, K., 2007, February. The role of domain knowledge representation in requirements elicitation. In *25th IASTED International Multi-Conference Software Engineering* (pp. 84-92).
429. Osman, N., 2018. A software requirement engineering framework to enhance critical success factors for ERP implementation. *International Journal of Computer Applications*, *180*(10), pp.pp-32.
430. Palinkas, L.A., Horwitz, S.M., Green, C.A., Wisdom, J.P., Duan, N. and Hoagwood, K., 2015. Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. Administration and Policy in Mental Health and Mental Health Services Research, 42(5), pp.533-544.
431. Pan, J., Ip, E.H. and Dubé, L., 2017. An alternative to post hoc model modification in confirmatory factor analysis: The Bayesian lasso. *Psychological methods*, *22*(4), p.687.
432. Panayiotou, N.A., Gayialis, S.P., Evangelopoulos, N.P. and Katimertzoglou, P.K., 2015. A business process modeling-enabled requirements engineering framework for ERP implementation. Business Process Management Journal, 21(3), pp.628-664.
433. Parker, J., 2012. Personas and Scenarios as a Requirements Elicitation Technique. Business Analysis. Online. [Accessed November 2019]. https://enfocussolutions.com/personas-and-scenarios-as-a-requirements-elicitation-technique/
434. Parnas, D.L., 1994, May. Software aging. In Proceedings of the 16th international conference on Software engineering (pp. 279-287). IEEE Computer Society Press.
435. Parr, A. and Shanks, G., 2000. A model of ERP project implementation. *Journal of information Technology*, 15(4), pp.289-303.
436. Parreira, P.A. and Penteado, R.A.D., 2015, November. Domain ontologies in the context of Requirements Engineering. In Computer Systems and Applications (AICCSA), 2015 IEEE/ACS 12th International Conference of (pp. 1-8). IEEE.
437. Parthasarathy, S. and Daneva, M., 2016. An approach to estimation of degree of customization for ERP projects using prioritized requirements. Journal of Systems and Software, 117, pp.471-487.
438. Parthasarathy, S. and Ramachandran, M., 2009. Requirements Management for ERP Projects. Organizational Advancements through Enterprise Information Systems: Emerging Applications and Developments: Emerging Applications and Developments, p.29.
439. Pastor, J.M.E.J. and Casanovas, J., 2003. A goal/question/metric research proposal to monitor user involvement and participation in ERP implementation projects. Information Technology and Organizations: Trends, Issues, Challenges and Solutions, 1, p.325.
440. Pavlou, P.A., 2003. Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International journal of electronic commerce*, 7(3), pp.101-134.
441. Peffers, K., Tuunanen, T., Rothenberger, M.A. and Chatterjee, S., 2007. A design science research methodology for information systems research. Journal of management information systems, 24(3), pp.45-77.

442. Pellegrinelli, S. and Murray-Webster, R., 2011. Multi-paradigmatic perspectives on a business transformation program. *Project Management Journal*, 42(6), pp.4-19.

443. Petrović, S.P., 2016. The emancipatory systems approach to structuring the coercive organizational problems. TEME: Casopis za Društvene Nauke, 40(2).

444. Petter, S., DeLone, W. and McLean, E., 2008. Measuring information systems success: models, dimensions, measures, and interrelationships. *European journal of information systems*, 17(3), pp.236-263.

445. Petter, S., DeLone, W. and McLean, E.R., 2012. The past, present, and future of" IS Success". Journal of the Association for Information Systems, 13(5), p.341.

446. Pham, L.T.M., 2018. Qualitative Approach to Research A Review Of Advantages and Disadvantages Of Three Paradigms: Positivism, Interpretivism And Critical Inquiry. *University of Adelaide*.

447. Pinggera, J., Zugal, S., Weber, B., Fahland, D., Weidlich, M., Mendling, J. and Reijers, H.A., 2010, November. How the structuring of domain knowledge helps casual process modelers. In *International conference on conceptual modeling* (pp. 445-451). Springer, Berlin, Heidelberg.

448. Pittke, F., Leopold, H. and Mendling, J., 2015. Automatic detection and resolution of lexical ambiguity in process models. IEEE Transactions on Software Engineering, 41(6), pp.526-544.

449. Plosch, R., Mayr, A. and Korner, C., 2010, September. Collecting quality requirements using quality models and goals. In Quality of Information and Communications Technology (QUATIC), 2010 Seventh International Conference on the (pp. 198-203). IEEE.

450. Pluye, P., Bengoechea, E.G., Granikov, V., Kaur, N. and Tang, D.L., 2018. A world of possibilities in mixed methods: review of the combinations of strategies used to integrate qualitative and quantitative phases, results and data. *Int J Mult Res Approaches*, *10*(1), pp.41-56.

451. Pohl, K., 2016. Requirements engineering fundamentals: a study guide for the certified professional for requirements engineering exam-foundation level-IREB compliant. Rocky Nook, Inc..

452. Portugal, R.L.Q., Engiel, P., Pivatelli, J. and do Prado Leite, J.C.S., 2016, May. Facing the challenges of teaching requirements engineering. In *2016 IEEE/ACM 38th International Conference on Software Engineering Companion (ICSE-C)* (pp. 461-470). IEEE.

453. Pozzebon, M., Mackrell, D. and Nielsen, S., 2014. Structuration bridging diffusion of innovations and gender relations theories: a case of paradigmatic pluralism in IS research. Information Systems Journal, 24(3), pp.229-248.

454. Punch, K.F., 2013. Introduction to social research: Quantitative and qualitative approaches. Sage.

455. Pyett, P.M., 2003. Validation of qualitative research in the “real world”. *Qualitative health research*, *13*(8), pp.1170-1179.

456. Qian, L., Schmidt, E.K. and Scott, R.L., 2015, December. ERP pre-implementation framework for Higher Education Institution: A case study in Purdue University. In Industrial Engineering and Engineering Management (IEEM), 2015 IEEE International Conference on (pp. 1546-1550). IEEE.

457. Rabaa'i, A.A., 2009. Identifying critical success factors of ERP Systems at the higher education sector.

458. Ramesh, B., Cao, L. and Baskerville, R., 2010. Agile requirements engineering practices and challenges: an empirical study. Information Systems Journal, 20(5), pp.449-480.

459. Randell, B., 1979, September. Software engineering in 1968. In Proceedings of the 4th international conference on Software engineering (pp. 1-10). IEEE Press.

460. Razali, R. and Anwar, F., 2011. Selecting the right stakeholders for requirements elicitation: a systematic approach. Journal of Theoretical and Applied Information Technology, 33(2), pp.250-257.

461. Reed, M.S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., Prell, C., Quinn, C.H. and Stringer, L.C., 2009. Who's in and why? A typology of stakeholder analysis methods for natural resource management. Journal of environmental management, 90(5), pp.1933-1949.

462. Reeves, S., Albert, M., Kuper, A. and Hodges, B.D., 2008. Why use theories in qualitative research. Bmj, 337(7670), pp.631-4.

463. Regev, G. and Wegmann, A., 2005, August. Where do goals come from: the underlying principles of goal-oriented requirements engineering. In Requirements Engineering, 2005. Proceedings. 13th IEEE International Conference on (pp. 353-362). IEEE.

464. Reio Jr, T.G. and Shuck, B., 2015. Exploratory factor analysis: implications for theory, research, and practice. *Advances in Developing Human Resources*, *17*(1), pp.12-25.

465. Reise, S.P., Waller, N.G. and Comrey, A.L., 2000. Factor analysis and scale revision. Psychological assessment, 12(3), p.287.

466. Renzel, D., Behrendt, M., Klamma, R. and Jarke, M., 2013, July. Requirements bazaar: Social requirements engineering for community-driven innovation. In Requirements Engineering Conference (RE), 2013 21st IEEE International (pp. 326-327). IEEE.

467. Respect, I.T., 2007. A KAOS Tutorial. Objectiver.

468. Riazi, A.M. and Candlin, C.N., 2014. Mixed-methods research in language teaching and learning: Opportunities, issues and challenges.

469. Ritchie, J., Lewis, J. and Elam, R.G., 2013. Selecting samples. Qualitative research practice: A guide for social science students and researchers, p.111.

470. Robertson, S. and Robertson, J., 2012. Mastering the requirements process: Getting requirements right. Addison-wesley.

471. Rocco, T.S., Bliss, L.A., Gallagher, S. and Pérez-Prado, A., 2003. Taking the next step: Mixed methods research in organizational systems. Information Technology, Learning, and Performance Journal, 21(1), p.19.

472. Rolland, C. and Prakash, N., 2001. Matching ERP system functionality to customer requirements. In Requirements Engineering, 2001. Proceedings. Fifth IEEE International Symposium on (pp. 66-75). IEEE.

473. Roode, J.D., 1993. Implications for teaching of a process-based research framework for information systems. In: L. Smith, ed., *Proceedings of the 8th Annual Conference of the International Academy for Information Management. Orlando, Florida*

474. Roos, A., 2012. Activity theory as a theoretical framework in the study of information practices in molecular medicine. Information research, 17(3).

475. Rosa, W., Packard, T., Krupanand, A., Bilbro, J.W. and Hodal, M.M., 2013. COTS integration and estimation for ERP. Journal of Systems and Software, 86(2), pp.538-550.

476. Rosson, M.B. and Carroll, J.M., 2012. Scenario-based design. In Human–Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications, Third Edition (pp. 1105-1124). CRC Press.

477. Rudhumbu, N., 2015. Managing curriculum change from the middle: How academic middle managers enact their role in higher education. International Journal of Higher Education, 4(1), p.106.

478. Runeson, P. and Höst, M., 2009. Guidelines for conducting and reporting case study research in software engineering. Empirical software engineering, 14(2), p.131.

479. Runeson, P., Host, M., Rainer, A. and Regnell, B., 2012. Case study research in software engineering: Guidelines and examples. John Wiley & Sons.

480. Runeson, P., Host, M., Rainer, A. and Regnell, B., 2012. Case study research in software engineering: Guidelines and examples. John Wiley & Sons.

481. Ryan, M.J., 2014, July. 1.2. 2 the role of stakeholders in requirements elicitation. In INCOSE International Symposium (Vol. 24, No. 1, pp. 16-26).

482. Ryan, M.J., 2014. The Role of Stakeholders in Requirements Elicitation.

483. Sadiq, M. and Jain, S.K., 2014, August. Stakeholder identification method in goal oriented requirements elicitation process. In Requirements Prioritization and Communication (RePriCo), 2014 IEEE 5th International Workshop on (pp. 25-33). IEEE.

484. Sadiq, M. and Jain, S.K., 2014, August. Stakeholder identification method in goal oriented requirements elicitation process. In 2014 IEEE 5th International Workshop on Requirements Prioritization and Communication (RePriCo) (pp. 25-33). IEEE.

485. Salem, A.M., 2010. Requirements analysis through viewpoints oriented requirements model (vord). International Journal of Advanced Computer Science and Applications, 1(5).

486. Salhotra, E., 2014. Stakeholder Salience in ERP Projects.

487. Salloum, S.A., Al-Emran, M. and Shaalan, K., 2018, August. The impact of knowledge sharing on information systems: a review. In *International Conference on Knowledge Management in Organizations* (pp. 94-106). Springer, Cham.

488. Santos, J.L.G.D., Erdmann, A.L., Meirelles, B.H.S., Lanzoni, G.M.D.M., Cunha, V.P.D. and Ross, R., 2017. INTEGRATING QUANTITATIVE AND QUALITATIVE DATA IN MIXED METHODS RESEARCH. Texto & Contexto-Enfermagem, 26(3).

489. SARUA university questionnaires, 2011. Zimbabwe Data profile 2012. Online. [Accessed October 2017].
http://www.sarua.org/files/Country%20Reports%202012/Zimbabwe%20data%20profile%20Eng.pdf

490. Sasidharan, S., 2019. Reconceptualizing knowledge networks for enterprise systems implementation: incorporating domain expertise of knowledge sources and knowledge flow intensity. *Information & Management*, *56*(3), pp.364-376.

491. Saunders, M., Lewis, P. and Thornhill, A., 2009. *Research methods for business students*. Pearson education.

492. Saunders, M.N., 2011. Research methods for business students, 5/e. Pearson Education India.

493. Savin-Baden, M. and Major, C.H., 2013. Qualitative research: The essential guide to theory and practice.

494. Schaarschmidt, M., Bertram, M., Walsh, G. and von Kortzflieisch, H.F., 2015. Customer Knowledge and Requirements Engineering in Customization Projects: A Multi-Method Case Study.

495. Schneidewind, L., Hörold, S., Mayas, C., Krömker, H., Falke, S. and Pucklitsch, T., 2012, June. How personas support requirements engineering. In Proceedings of the First International Workshop on Usability and Accessibility Focused Requirements Engineering (pp. 1-5). IEEE Press.

496. Schoonenboom, J. and Johnson, R.B., 2017. How to construct a mixed methods research design. *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie*, *69*(2), pp.107-131.

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

498. Seo, G., 2013. Challenges in implementing enterprise resource planning (ERP) system in large organizations: similarities and differences between corporate and university environment (Doctoral dissertation, Massachusetts Institute of Technology).

499. Serra, M., Psarra, S. and O'Brien, J., 2018. Social and physical characterization of urban contexts: Techniques and methods for quantification, classification and purposive sampling. *Urban Planning*, *3*(1), pp.58-74.

500. Setia, M.S., 2017. Methodology series module 10: Qualitative health research. *Indian journal of dermatology*, *62*(4), p.367.

501. Shanks, G., Parr, A., Hu, B., Corbitt, B., Thanasankit, T. and Seddon, P., 2000. Differences in critical success factors in ERP systems implementation in Australia and China: a cultural analysis. ECIS 2000 Proceedings, p.53.

502. Sharma, G., 2017. Pros and cons of different sampling techniques. *International journal of applied research*, *3*(7), pp.749-752.

503. Sharp, H., Finkelstein, A. and Galal, G., 1999. Stakeholder identification in the requirements engineering process. In Database and Expert Systems Applications, 1999. Proceedings. Tenth International Workshop on (pp. 387-391). Ieee.

504. Shenton, A.K., 2004. Strategies for ensuring trustworthiness in qualitative research projects. Education for information, 22(2), pp.63-75.

505. Shmueli, O., Pliskin, N. and Fink, L., 2015. Explaining over-requirement in software development projects: an experimental investigation of behavioral effects. International Journal of Project Management, 33(2), pp.380-394.

506. Siegemund, K., 2014. Contributions To Ontology-Driven Requirements Engineering (Doctoral dissertation, Saechsische Landesbibliothek-Staats-und Universitaetsbibliothek Dresden).

507. Siegemund, K., Thomas, E.J., Zhao, Y., Pan, J. and Assmann, U., 2011, October. Towards ontology-driven requirements engineering. In Workshop semantic web enabled software engineering at 10th international semantic web conference (ISWC), Bonn.

508. Sim, W.W. and Brouse, P.S., 2014. Empowering requirements engineering activities with personas. Procedia Computer Science, 28, pp.237-246.

509. Simonette, M.J., Sanches, F.L. and Spina, E., 2010. Soft Systems Engineering Tools in Requirements Elicitation. *system*, *1*, p.2.

510. Simović, A.P., Babarogić, S. and Pantelić, O., 2018, May. A domain-specific language for supporting event log extraction from ERP systems. In *2018 7th International Conference on Computers Communications and Control (ICCCC)* (pp. 12-16). IEEE.

511. Skoumpopoulou, D. and Robson, A., 2020. Systems change in UK HEIs: how do culture, management, users and systems align?. *Journal of Enterprise Information Management*.

512. Smith, B., 2018. Generalizability in qualitative research: Misunderstandings, opportunities and recommendations for the sport and exercise sciences. *Qualitative research in sport, exercise and health*, *10*(1), pp.137-149.
513. Soffer, P., 2003. Aligning an Enterprise System with Enterprise Requirements: An Iterative Process. In ICEIS (3) (pp. 147-155).
514. Soffer, P., Golany, B. and Dori, D., 2005. Aligning an ERP system with enterprise requirements: An object-process based approach. Computers in Industry, 56(6), pp.639-662.
515. Soliman, M. and Karai, N., 2015. Enterprise Resource Planning (ERP) System as an Innovative Technology in Higher Education Context in Egypt. International Journal of Computing Academic Research (IJCAR), 5, pp.265-269.
516. Somers, T.M. and Nelson, K., 2001, January. The impact of critical success factors across the stages of enterprise resource planning implementations. In System Sciences, 2001. Proceedings of the 34th Annual Hawaii International Conference on (pp. 10-pp). IEEE.
517. Sparkes, A.C., 2015. Developing mixed methods research in sport and exercise psychology: Critical reflections on five points of controversy. *Psychology of Sport and Exercise*, *16*, pp.49-59.
518. Steenhuis, H.J. and Bruijn, E.J., 2006. Building theories from case study research: the progressive case study.
519. Stefanou, C.J., 2001. A framework for the ex-ante evaluation of ERP software. European Journal of Information Systems, 10(4), pp.204-215.
520. Steinmetz, G., 2005. The Politics of Method in the Human Sciences: Positivism and Its Epistemological Others. AMERICAN HISTORICAL REVIEW, 110(5), p.1638.
521. Sternad, S. and Bobek, S., 2013. Impacts of TAM-based external factors on ERP acceptance. *Procedia Technology*, *9*, pp.33-42.
522. Streiner, D.L., 2003. Starting at the beginning: an introduction to coefficient alpha and internal consistency. Journal of personality assessment, 80(1), pp.99-103.
523. Sugianto, L.F. and Tojib, D.R., 2015. Modelling user satisfaction with an employee portal. International Journal of Business and Information, 1(2).
524. Sumner, M., 2000. Risk factors in enterprise-wide/ERP projects. Journal of information technology, 15(4), pp.317-327.
525. Sumner, M., 2015. EMR Implementation: Lessons Learned from ERP. In Enterprise Systems. Strategic, Organizational, and Technological Dimensions (pp. 19-44). Springer International Publishing.
526. Suri, K. and Mos, A., 2016. Human task monitoring and contextual analysis for domain specific business processes. *arXiv preprint arXiv:1610.05788*.
527. Sutcliffe A. User-centred requirements engineering. Springer Science & Business Media; 2012 Dec 6.
528. Sutcliffe, A. and Sawyer, P., 2013, July. Requirements elicitation: Towards the unknown unknowns. In Requirements Engineering Conference (RE), 2013 21st IEEE International (pp. 92-104). IEEE.
529. Sutcliffe, A., 1998. Scenario-based requirements analysis. Requirements engineering, 3(1), pp.48-65.

530. Sutcliffe, A., 2003, September. Scenario-based requirements engineering. In Requirements engineering conference, 2003. Proceedings. 11th IEEE international (pp. 320-329). IEEE.

531. Sutcliffe, A., 2010. Collaborative requirements engineering: bridging the gulfs between worlds. In Intentional Perspectives on Information Systems Engineering (pp. 355-376). Springer Berlin Heidelberg.

532. Sutcliffe, A., 2012. User-centred requirements engineering. Springer Science & Business Media.

533. Sutcliffe, A.G., Maiden, N.A., Minocha, S. and Manuel, D., 1998. Supporting scenario-based requirements engineering. IEEE Transactions on Software Engineering, 24(12), pp.1072-1088.

534. Tashakkori, A. and Creswell, J.W., 2007. The new era of mixed methods.

535. Tashakkori, A. and Teddlie, C., 2003. Handbook of mixed methods in the social and behavioral sciences.

536. Tavakol, M. and Dennick, R., 2011. Making sense of Cronbach's alpha. International journal of medical education, 2, p.53.

537. Tayal, S.P., 2013. Engineering design process. International Journal of Computer Science and Communication Engineering, pp.1-5.

538. Taylor, R., 1990. Interpretation of the correlation coefficient: a basic review. Journal of diagnostic medical sonography, 6(1), pp.35-39.

539. Teddlie, C. and Tashakkori, A., 2009. *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. Sage.

540. Thomas Wailgum, 2005, University ERP: Big Mess on Campus, Online. [Accessed October 2016], http://www.cio.com/article/2439102/enterprise-resource-planning/university-erp--big-mess-on-campus.html

541. Thomas, D.R., 2006. A general inductive approach for analyzing qualitative evaluation data. American journal of evaluation, 27(2), pp.237-246.

542. Tjong, S.F. and Berry, D.M., 2008, September. Can Rules of Inferences Resolve Coordination Ambiguity in Natural Language Requirements Specification?. In WER.

543. Tran, H.M.T. and Anvari, F., 2016. A five-dimensional requirements elicitation framework for e-Learning systems. International Journal of Information and Electronics Engineering, 6(3), p.185.

544. Trotter, R.T., 2012. Qualitative research sample design and sample size: Resolving and unresolved issues and inferential imperatives. Preventive medicine, 55(5), pp.398-400.

545. Turner III, D.W., 2010. Qualitative interview design: A practical guide for novice investigators. The qualitative report, 15(3), p.754.

546. Turner, A.M., Reeder, B. and Ramey, J., 2013. Scenarios, personas and user stories: User-centered evidence-based design representations of communicable disease investigations. Journal of biomedical informatics, 46(4), pp.575-584.

547. Uddin, M., Alam, M.S., Mamun, A.A., Khan, T.U.Z. and Akter, A., 2020. A study of the adoption and implementation of enterprise resource planning (ERP): Identification of moderators and mediator. *Journal of Open Innovation: Technology, Market, and Complexity*, *6*(1), p.2.

548. Ullah, A. and Lai, R., 2011. Modeling business goal for business/it alignment using requirements engineering. Journal of Computer Information Systems, 51(3), pp.21-28.

549. Ullah, A., Baharun, R.B., Nor, K. and Yasir, M., 2018. Overview of Enterprise Resource Planning (ERP) System in Higher Education Institutions (HEIs). *Advanced Science Letters*, *24*(6), pp.4399-4406.

550. Ullah, S., Iqbal, M. and Khan, A.M., 2011, July. A survey on issues in non-functional requirements elicitation. In Computer Networks and Information Technology (ICCNIT), 2011 International Conference on (pp. 333-340). IEEE.

551. University directory, 2016. Zimbabwe Universitites Directory, Online. [Accessed August 2016], http://www.university-directory.eu/Zimbabwe/Zimbabwe-Universities.html

552. University of Minnesota, 2017. Types of Statistical Tests. Online. [Accessed November 2017]. https://cyfar.org/types-statistical-tests

553. Uszok, A., Bradshaw, J.M., Lott, J., Johnson, M., Breedy, M., Vignati, M., Whittaker, K., Jakubowski, K., Bowcock, J. and Apgard, D., 2011, November. Toward a flexible ontology-based policy approach for network operations using the KAoS framework. In MILITARY COMMUNICATIONS CONFERENCE, 2011-MILCOM 2011 (pp. 1108-1114). IEEE.

554. Valaitis, R., Longaphy, J., Nair, K., Agarwal, G., Griffith, L., Kastner, M., Oliver, D., Ploeg, J., Straus, S. and Dolovich, L., 2014. Persona-scenario exercise for codesigning primary care interventions. Canadian Family Physician, 60(3), pp.294-296.

555. Valvas, S. and Milani, F., 2015, August. Requirement elicitation using business process models. In International Conference on Business Informatics Research (pp. 67-81). Springer, Cham.

556. Valverde, R. ed., 2012. Information Systems Reengineering for Modern Business Systems: ERP, Supply Chain and E-Commerce Management Solutions: ERP, Supply Chain and E-Commerce Management Solutions. IGI Global.

557. Van Lamsweerde, A., 2000, June. Requirements engineering in the year 00: a research perspective. In Proceedings of the 22nd international conference on Software engineering (pp. 5-19). ACM.

558. Van Lamsweerde, A., 2001. Goal-oriented requirements engineering: A guided tour. In Requirements Engineering, 2001. Proceedings. Fifth IEEE International Symposium on (pp. 249-262). IEEE.

559. van Teijlingen, E., 2014. Semi-structured interviews.

560. Vassev, E. and Hinchey, M., 2014. Autonomy Requirements Engineering for Space Missions. Heidelberg: Springer.

561. Venkatesh, V. and Davis, F.D., 2000. A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management science, 46(2), pp.186-204.

562. Venkatesh, V. and Zhang, X., 2010. Unified theory of acceptance and use of technology: US vs. China. Journal of Global Information Technology Management, 13(1), pp.5-27.

563. Venkatesh, V., Brown, S.A. and Bala, H., 2013. Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. MIS quarterly, 37(1).

564. Venkatesh, V., Brown, S.A. and Sullivan, Y.W., 2016. Guidelines for conducting mixed-methods research: An extension and illustration. *Journal of the Association for Information Systems*, *17*(7), p.2.

565. Vieira, A.A., Pedro, L., Santos, M.Y., Fernandes, J.M. and Dias, L.S., 2018, October. Data requirements elicitation in big data warehousing. In *European, Mediterranean, and Middle Eastern Conference on Information Systems* (pp. 106-113). Springer, Cham.

566. Vieira, R., Ferreira, D., Borbinha, J. and Gaspar, G., 2012. A requirements engineering analysis of MoReq. Records Management Journal, 22(3), pp.212-228.

567. Voegler, R., Peterburs, J., Bellebaum, C. and Straube, T., 2019. Modulation of feedback processing by social context in social anxiety disorder (SAD)–an event-related potentials (ERPs) study. *Scientific reports*, *9*(1), pp.1-14.

568. Vosloo, J.J., 2014. A sport management programme for educator training in accordance with the diverse needs of South African schools (Doctoral dissertation).

569. Wamicha, E.W. and Seymour, L.F.,2015. A higher education model for developing competencies for critical ERP implementation roles: the case of Kenya.

570. Wang, W., Liu, W. and Mingers, J., 2015. A systemic method for organisational stakeholder identification and analysis using Soft Systems Methodology (SSM). *European Journal of Operational Research*, *246*(2), pp.562-574.

571. Wang, Z., Chen, C.H., Zheng, P., Li, X. and Khoo, L.P., 2019. A graph-based context-aware requirement elicitation approach in smart product-service systems. *International Journal of Production Research*, pp.1-17.

572. Watkins, M.W., 2018. Exploratory factor analysis: A guide to best practice. *Journal of Black Psychology*, *44*(3), pp.219-246.

573. Watson, S.L. and Watson, W.R., 2011. Critical, emancipatory, and pluralistic research for education: A review of critical systems theory. Journal of Thought, 46(3/4), p.63.

574. Weijer, C., Grimshaw, J.M., Taljaard, M., Binik, A., Boruch, R., Brehaut, J.C., Donner, A., Eccles, M.P., Gallo, A., McRae, A.D. and Saginur, R., 2011. Ethical issues posed by cluster randomized trials in health research. Trials, 12(1), p.100.

575. Westfall, L., 2014. What, Why, Who, When, and How of Software Requirements. In Handbook of Research on Emerging Advancements and Technologies in Software Engineering (pp. 1-18). IGI Global.

576. Whetten, D.A., 1989. What constitutes a theoretical contribution?. Academy of management review, 14(4), pp.490-495.

577. Wiegers, K. and Beatty, J., 2013. Software requirements. Pearson Education.

578. Wieringa, R.J., 2003. Methodologies of requirements engineering research and practice: Position statement.

579. Willcocks, L.P., Sauer, C. and Lacity, M.C., 2016. Enacting Research Methods in Information Systems: Volume 2.

580. Williams, B., Onsman, A. and Brown, T., 2010. Exploratory factor analysis: A five-step guide for novices. Australasian Journal of Paramedicine, 8(3).

581. Willits, F.K., Theodori, G.L. and Luloff, A.E., 2016. Another look at Likert scales. Journal of Rural Social Sciences, 31(3), p.126.

582. Wisdom, J. and Creswell, J.W., 2013. Mixed methods: integrating quantitative and qualitative data collection and analysis while studying patient-centered medical home models. Rockville, MD: Agency for Healthcare Research and Quality.

583. Wong, A., Scarbrough, H., Chau, P. and Davison, R., 2005. Critical failure factors in ERP implementation. PACIS 2005 Proceedings, p.40.

584. Wong, W., Liu, W. and Bennamoun, M., 2012. Ontology learning from text: A look back and into the future. ACM Computing Surveys (CSUR), 44(4), p.20.

585. Woo, S.E., O'Boyle, E.H. and Spector, P.E., 2017. Best practices in developing, conducting, and evaluating inductive research.

586. Wu, H.S., 2018. Introduction to factor analysis.

587. Wu, J.H., Shin, S.S. and Heng, M.S., 2007. A methodology for ERP misfit analysis. Information & Management, 44(8), pp.666-680.

588. Xu, B., Xing, Z., Xia, X., Lo, D. and Li, S., 2018. Domain-specific cross-language relevant question retrieval. *Empirical Software Engineering*, *23*(2), pp.1084-1122.

589. Xue, Y., Liang, H., Boulton, W.R. and Snyder, C.A., 2005. ERP implementation failures in China: Case studies with implications for ERP vendors. *International journal of production economics*, 97(3), pp.279-295.

590. Yang, H., De Roeck, A., Gervasi, V., Willis, A. and Nuseibeh, B., 2011. Analysing anaphoric ambiguity in natural language requirements. Requirements engineering, 16(3), p.163.

591. Yin, R.K., 2009. How to do better case studies. *The SAGE handbook of applied social research methods*, *2*, pp.254-282.

592. Yin, R.K., 2013. *Case study research: Design and methods.* Sage publications.

593. Yu, E. and Mylopoulos, J., 1998, June. Why goal-oriented requirements engineering. In Proceedings of the 4th International Workshop on Requirements Engineering: Foundations of Software Quality (Vol. 15, pp. 15-22).

594. Yu, T.K. and Yu, T.Y., 2010. Modelling the factors that affect individuals' utilisation of online learning systems: An empirical study combining the task technology fit model with the theory of planned behaviour. British Journal of Educational Technology, 41(6), pp.1003-1017.

595. Zhang, L., Lee, M.K., Zhang, Z. and Banerjee, P., 2003, January. Critical success factors of enterprise resource planning systems implementation success in China. In System Sciences, 2003. Proceedings of the 36th Annual Hawaii International Conference on (pp. 10-pp). IEEE.

596. Zheng, Y., Zhao, K. and Stylianou, A., 2013. The impacts of information quality and system quality on users' continuance intention in information-exchange virtual communities: An empirical investigation. *Decision Support Systems*, 56, pp.513-524.

597. Zhou, S., Ng, S.T., Lee, S.H., Xu, F.J. and Yang, Y., 2019. A domain knowledge incorporated text mining approach for capturing user needs on BIM applications. *Engineering, Construction and Architectural Management*.

598. Zowghi, D. and Coulin, C., 2005. Requirements elicitation: A survey of techniques, approaches, and tools. In Engineering and managing software requirements (pp. 19-46). Springer Berlin Heidelberg.

599. Zowghi, D. and Gervasi, V., 2002, September. The Three Cs of requirements: consistency, completeness, and correctness. In International Workshop on Requirements Engineering: Foundations for Software Quality, Essen, Germany: Essener Informatik Beitiage (pp. 155-164).

ANNEXURE A: SAMPLE SIZE

MORGAN'S TABLE FOR SAMPLE SIZE

Population Size	Confidence = 95%				Confidence = 99%			
	Margin of Error				Margin of Error			
	5.0%	3.5%	2.5%	1.0%	5.0%	3.5%	2.5%	1.0%
10	10	10	10	10	10	10	10	10
20	19	20	20	20	19	20	20	20
30	28	29	29	30	29	29	30	30
50	44	47	48	50	47	48	49	50
75	63	69	72	74	67	71	73	75
100	80	89	94	99	87	93	96	99
150	108	126	137	148	122	135	142	149
200	132	160	177	196	154	174	186	198
250	152	190	215	244	182	211	229	246
300	169	217	251	291	207	246	270	295
400	196	265	318	384	250	309	348	391
500	217	306	377	475	285	365	421	485
600	234	340	432	565	315	416	490	579
700	248	370	481	653	341	462	554	672
800	260	396	526	739	363	503	615	763
1000	278	440	606	906	399	575	727	943
1200	291	474	674	1067	427	636	827	1119
1500	306	515	759	1297	460	712	959	1376
2000	322	563	869	1655	498	808	1141	1785
2500	333	597	952	1984	524	879	1288	2173
3500	346	641	1068	2565	558	977	1510	2890
5000	357	678	1176	3288	586	1066	1734	3842
7500	365	710	1275	4211	610	1147	1960	5165
10000	370	727	1332	4899	622	1193	2098	6239
25000	378	760	1448	6939	646	1285	2399	9972
50000	381	772	1491	8056	655	1318	2520	12455
75000	382	776	1506	8514	658	1330	2563	13583
100000	383	778	1513	8762	659	1336	2585	14227
250000	384	782	1527	9248	662	1347	2626	15555
500000	384	783	1532	9423	663	1350	2640	16055
1000000	384	783	1534	9512	663	1352	2647	16317
2500000	384	784	1536	9567	663	1353	2651	16478
10000000	384	784	1536	9594	663	1354	2653	16560
100000000	384	784	1537	9603	663	1354	2654	16584
300000000	384	784	1537	9603	663	1354	2654	16586

ANNEXURE B: ORGANIZATION CONSENT FORM

ORGANIZATION CONSENT FORM

Research Promoters

Name: Professor K. Gorejena Professor O. Jokonya

Institution: North West University University of the Western Cape

Email: Koga.Gorejena@nwu.ac.za jokonyao@hotmail.com

Contact number: +27 727892952 +27 733919863

Researcher Information

Name: Mr K. Matyokurehwa

Institution: North-West University

Email: kanosmatyo@gmail.com

Contact number: +263 774141206

Study Information

Research Title: A Framework for University Enhancing Enterprise Resource Planning System Requirements Elicitation Involving the Stakeholders

Objectives of the Research

i) To identify the weaknesses of the existing frameworks used in universities in requirements elicitation.

ii) To determine the needs for a university during ERP requirements elicitation.

iii) To develop an improved ERP requirements elicitation framework to assist universities during requirements elicitation.

iv) To evaluate the ERP requirements elicitation framework developed in this study.

Implications of the research: The proposed framework will enhance stakeholder selection in ERP requirements elicitation at universities and preclude ERP system failures in the future by capturing the requirements of ERP systems through stakeholder involvement. ERP requirements that are elicited succinctly through stakeholder involvement will translate into an ERP system meeting its expected outcomes.

Implications on Health and Safety: None

Participant Duration: One hour

Duration of study: Until December 2019

ANNEXURE C: PARTICIPANT RIGHTS

PARTICIPANT RIGHTS

Participants are not coerced to participate in the interview. The participants will be informed that the interview will be recorded, and no hidden cameras will be used. If participants are not comfortable with the interview being recorded, shorthand notes will be used. The participants will be informed that pseudonyms will be used to identify the interview. Participants will also be informed that if they feel they are not comfortable in answering a certain question (s), they are free not to answer them. The data obtained from the participants will be used solely for academic purposes, and the participants will be given the consent form. A copy of the interview data will be given to the participant upon request from the participant. Participants also have a right to withdraw from the study without giving any reasons and also they can request that their interview script be withdrawn from the study without giving any explanation.

ANNEXURE D: PARTICIPANT INFORMATION FORM

PARTICIPANT INFORMATION FORM

Dear Participant,

Good day! Thank you so much for taking your time and showing interest to participate in this PhD study. The objective of the research study is to develop an ERP requirements elicitation involving the stakeholder participation that will be used at universities to avert ERP project failures. Mr Kanos Matyokurehwa is the one researching the guidance of Prof K. Gorejena from the North West University and Prof O. Jokonya from the Western Cape University. Your participation is purely voluntary and the findings from this research will be used solely for academic purposes. You may withdraw from this study anytime that you so wish and you may also ask that the data obtained from your participation may not be used in the study without giving any explanation or reasons for doing that.

The study is based on ERP requirements elicitation involving the participation of stakeholders at universities. The study seeks to develop an ERP requirements elicitation framework that will be used at universities to curb ERP systems failures. The study will utilize a case study focussing on universities that develop their in-house ERP systems. Interviews and questionnaires will be used to obtain data from participants. The interview will not exceed an hour and during the interview, if

you find some questions that you are not comfortable in answering you can just say please may you go to the next question.

Your identity will not be revealed but the researcher will use pseudonyms to conceal your real identity. The data from this study will be kept very securely to preclude unauthorized access to the data. After the study, the data will be destroyed after completion of the study.

ANNEXURE E: PARTICIPANT AGREEMENT LETTER

PARTICIPANT AGREEMENT LETTER

I.....hereby agree to participate in the study being done by Mr Kanos Matyokurehwa. I have been explained the aim of the study and that my participation is voluntary. The data obtained from my participation will be handled confidentially and my identity will not be revealed. I also understand that I am not forced to answer all the questions during the study, some questions I am not comfortable in answering will ignore them.

The health and safety implications of the study have been explained to me. I am also aware that the data obtained from this study will be used for academic purposes only. I also have the right to review the information given to the researcher before the final thesis is submitted for examination. I have the right to withdraw anytime from the study and also may ask that the data obtained from my participation during the study may not be used in the study without stating any reasons for doing that.

I will also request a copy of the following after the interview:

Interview audiotape ☐

Interview transcribed ☐

Issues regarding my participation in this research are shown below:

I have read and understood the purpose of this study and I agree to participate in this interview.

---------- ----------

Signature of participant Date

---------- ----------

Signature of researcher Date

ANNEXURE F: PERMISSION REQUEST LETTER FOR DATA COLLECTION

PERMISSION REQUEST LETTER FOR DATA COLLECTION

Research Promoters

Name: Professor K. Gorejena Professor O. Jokonya

Institution: North West University University of the Western Cape

Email: Koga.Gorejena@nwu.ac.za jokonyao@hotmail.com

Contact number: +27 727892952 +27 733919863

Researcher Information

Name: Mr K. Matyokurehwa

Institution: North West University

Email: kanosmatyo@gmail.com

Contact number: +263 774141206

Study Information

Research Title: A Framework for Enhancing University Enterprise Resource Planning System Requirements Elicitation Involving the Stakeholders

Objectives of the Research

i) To identify the weaknesses of the existing frameworks used in universities in requirements elicitation.

ii) To determine the needs for a university during ERP requirements elicitation.

iii) To develop an improved ERP requirements elicitation framework to assist universities during requirements elicitation.

iv) To evaluate the ERP requirements elicitation framework developed in this study.

Implications of the research: The proposed framework will enhance stakeholder selection in ERP requirements elicitation at universities and preclude ERP system failures in the future by

capturing the requirements of ERP systems through stakeholder involvement. ERP requirements that are elicited succinctly through stakeholder involvement will translate in an ERP system meeting its expected outcomes.

Implications on Health and Safety: None

Participant Duration: One hour

Duration of study: Until December 2019

My name is Kanos Matyokurehwa, I am a PhD student in Information Systems with the North West University (South Africa). The research is under the guidance of Professor K. Gorejena of North West University and Professor O. Jokonya of the University of the Western Cape. I am kindly asking for permission to collect data from the staff members and students.

The study is divided into two phases, the first phase will start with the qualitative study and then followed by the quantitative study. The qualitative stage will take one month of data collection and the second stage the quantitative stage will take two months to collect the data. The data will be collected using semi-structured interviews for qualitative data and questionnaires for quantitative data. To enhance data accuracy, the semi-structured interviews will be audiotaped so that the participant's data will be captured without distortion. The identities of the participants will not be revealed and pseudonyms will be used when publishing articles developed from this study. The study does not have any anticipated health and safety risks.

The participants in the study will get a summary of the findings on request. The findings from this study will be published in internationally recognized journals. The participation of the university is purely voluntary and if the staff and students decide to withdraw from the study they can freely do so without prejudice.

I kindly request your permission to carry out my study with a few participants from the university. For further clarification regarding this study feel free to contact me and/or my PhD promoters Professor K. Gorejena and Professor O. Jokonya on the details above.

Yours faithfully

Matyokurehwa 20/01/19

---------- ----------

Kanos Matyokurehwa **Date**

PhD Candidate

ANNEXURE G: INTERVIEW GUIDE

Section A: Biographical Data

1. How long have you worked or studied at this institution?
2. You work or study under which Faculty and in which Department
3. What is your job title?
4. How old are you?
5. What is your highest qualification?

Section B: Stakeholder Perceptions on ERP Requirements Engineering

1. What do you think ERP requirements elicitation should be carried out so that the needs of the stakeholders are met?
2. How is the ERP system meeting your expected outcomes?
3. What is your opinion on this statement, stakeholders have difficulties in expressing their requirements that the system should meet?
4. How best can ERP requirements of stakeholders be captured since we cannot involve all the stakeholders during requirements elicitation?
5. What is your take on this statement: involving the stakeholders during ERP requirements engineering can improve the ERP system in meeting the expected outcomes?

Section C: Domain Analysis

1. How is the understanding of domain terminology and rules important when doing ERP requirements engineering?
2. What is your opinion on the effect of the environment on ERP requirements engineering?
3. How are the tasks and procedures currently being done using the ERP system help you in defining the requirements for the ERP system?
4. How is the understanding of the various roles played by different stakeholders in the domain helpful in extracting rich ERP requirements?
5. What is the impact of different sources of information on the quality of ERP requirements?
6. What is the importance of defining the ERP project boundary before ERP requirements can be captured?

Section D: Sociological perspectives

Functionalist Perspectives

1. What is your opinion on this statement: ERP requirements are well structured, they are technical and there is less reliance on stakeholders to give their input?
2. What is your opinion on this line of thought: when ERP requirements are clear and straight forward, managers are the only ones who should give requirements for the new system?

Interpretive Perspectives

1. What causes stakeholders to have diverse and sometimes conflicting ERP requirements?

2. What is your view on this statement: when stakeholders are having diverse perceptions on an ERP requirement, participative debates by the stakeholders may help in reaching a shared goal?

Radical Structuralist Perspectives

1. What is your view on taking on board marginalised stakeholders in the organization during ERP requirements engineering?
2. What is your opinion on this statement: when oppressed stakeholders' perceptions are considered during ERP requirements engineering, this may translate into the ERP system meeting the expected outcomes?

The Radical Humanist Perspectives

1. What is the importance of having different eliciting techniques when eliciting ERP requirements from the stakeholders?

Section E: Grouping Stakeholders

1. Why is it is important to group stakeholders according to different groups: For example, Primary stakeholders who use the system daily; Secondary stakeholders who rarely use the system and lastly the Tertiary stakeholders who do not use the system but however they are affected by the system?

Section F: Identification of Stakeholder types

1. How can the involvement of Dominant stakeholders (those with power and influence) help in ERP requirements engineering?
2. How can the involvement of Demanding stakeholders, those stakeholders with no power to influence ERP requirements but would want their requirements heard, help in ERP requirements engineering?
3. How can the involvement of Discretionary stakeholders, those stakeholders who do not influence ERP requirements but however they offer suggestions and facts and usually they are outside the organization, for example, the Consulting or Research organizations, help in ERP requirements engineering?
4. How can the involvement of Dormant stakeholders, those stakeholders with power, but remain passive but they can be directly or indirectly affected if their ERP requirements are not, help in ERP requirements engineering?
5. How can the involvement of Dependent stakeholders, those stakeholders that are very powerful but however they rely on other stakeholders for their requirements to be met, help in ERP requirements engineering?
6. How can the involvement of Dangerous stakeholders, those stakeholders who possess power and they can cause disruptions if their ERP requirements are not met, help in ERP requirements engineering?
7. How can the involvement of Definitive stakeholders, those stakeholders who are very powerful financially and usually they are the owners of the ERP project, help in ERP requirements engineering?
8. How can the involvement of Demean stakeholders or *marginalized stakeholders*, those stakeholders who have no power nor influence but they are treated as less important stakeholders in an organization, help in ERP requirements engineering?

Section G: Stakeholder Selection Criteria

1. What is the selection criterion that should be used when selecting stakeholders to be included in ERP requirements engineering?

Section H: Requirements Elicitation

Personas

1. What is your opinion on this statement that by allowing stakeholders to explain how they do their tasks each day can help in discovering hidden ERP requirements from stakeholders?
2. What is your take on this statement that by allowing stakeholders to explain what satisfies or frustrates them when they do their tasks can help in extracting ERP requirements?
3. What is your opinion on this statement that stakeholders' ERP requirements can be captured well if they are explained from different angles to reach a specific goal

Scenarios

1. What is your opinion on this statement that ERP business processes and rules can be identified if stakeholders are asked to explain the sequence of steps they need to do to reach a specific goal?
2. How will stakeholder explanation of their problems in doing a specific task help in discovering ERP requirements?
3. How will stakeholder explanation on how they intend to use the ERP system to accomplish a specific task will help in discovering ERP requirements?

Goals

1. What is your opinion on this statement that using goals can assist stakeholders to precisely elaborate their requirements especially the non-functional requirements like usability, performance and others?
2. What is your take on this statement that stakeholders often become aware of their ERP requirements when they identify a goal that should be done for example reserve a book and in the process, they can also identify sub-goals?

Viewpoints

1. What is your opinion that ERP requirements should come from different sources so that rich requirements may be captured?

Section I: Conclusion

1. What are the other issues that you would want to ask me that I did not discuss with you concerning ERP requirements engineering?
2. Do you have any other questions that you would want to ask me?

Thank you so much for your participation in this interview

ANNEXURE H: QUESTIONNAIRE

Developing a Framework for Enhancing University Enterprise Resource Planning System Requirements Elicitation Involving the Stakeholders

Dear Participant

This questionnaire is part of my PhD studies with the North West University and the title of my thesis is developing a Framework for Enhancing Enterprise Resource Planning System Requirements Elicitation Involving the Stakeholders.

The study aims to develop a framework that will be used in ERP requirements elicitation at universities involving the stakeholders. You are kindly requested to complete the questionnaire and there is no right or wrong answer. You are also **not forced to answer all the questions** if you feel you are not comfortable in answering certain questions. Please do not write anything on the questionnaire that will reveal your identity as your response is anonymous. The information obtained from this questionnaire will be used solely for academic purposes only. The questionnaire will take approximately 20 to 30 minutes to complete.

For any queries may be directed to my email: Mr. Matyokurehwa. kanosmatyo@gmail.com.

Thank you for your participation,

Mr Kanos Matyokurehwa

INSTRUCTIONS:

Please mark your choice with an "X" or "✓" in the field that corresponds to your answer, you are advised to select one option unless you are advised to select more than one option.

The questionnaire consists of seven sections as shown below:

SECTION A: Biographical Data

SECTION B: Stakeholder Perceptions

SECTION C: Domain Knowledge Understanding

SECTION D: Sociological Perspectives

SECTION E: Stakeholder's Role

SECTION F: Stakeholder's Characteristics

SECTION G: Requirements Elicitation Techniques

1. Age *Select option*

1	16 to 25 years	
2	26 to 35 years	
3	36 to 45 years	
4	Above 46 years	

2. Gender

1	Male	
2	Female	

3. What is your position?

1	Student	
2	Computing Lecturer	

3	ERP Developer or Management		
4	External Consultant		

4. Your highest level of education

1	O Level	
2	A Level	
3	Diploma	
4	Undergraduate Degree	
5	Postgraduate Degree	

5. Number of years using an ERP system

1	Less than 2 years	
2	3 to 5 years	
3	6 to 10 years	
4	Above 10 years	

6. Have you ever been involved in ERP requirements elicitation at this university or company?

1	Yes	
2	No	

7. Name of institution /company you are working for or studying at?

1	University A	

2	University B	
3	University C	
4	External Stakeholder or Consultant	

SECTION B: Stakeholder Perceptions

Please indicate your level of agreement with each of the following statements by ticking the appropriate option with an "X" or "✓".

Use the following scale:

1. **Strongly Disagree 2. Disagree 3. Agree 4. Strongly Agree**

Items	**1**	**2**	**3**	**4**
1. ERP requirements elicitation should involve the stakeholders so that their requirements are met				
2. The ERP system is meeting my expected outcomes				
3. Involving the stakeholders during ERP requirements engineering can improve the ERP system in meeting the stakeholder's requirements.				
4. Stakeholder overlook crucial ERP requirements during ERP requirements elicitation				
5. Diverse stakeholder's perceptions need to be accommodated during ERP requirements elicitation.				
6. Stakeholders need awareness on ERP requirements elicitation process to prevent unclear ERP requirements.				
7. Stakeholders have challenges in expressing their requirements during ERP requirements elicitation.				
8. Stakeholders need ERP requirements knowledge to participate in ERP				

	requirements elicitation process				

SECTION C: Domain Knowledge Understanding

Please indicate your level of agreement with each of the following statements by ticking the appropriate option with an “X” or “✓”.

Use the following scale:

1. **Strongly Disagree** **2. Disagree** **3. Agree** **4. Strongly Agree**

Items	1	2	3	4
1. Domain knowledge understanding affect the quality of elicitated ERP requirements.				
2. The domain knowledge of the requirements engineer will help in asking relevant questions during ERP requirements elicitation.				
3. Domain knowledge can significantly reduce the confusion associated with terminology in a specific domain when asking questions during ERP requirements elicitation.				
4. Domain knowledge will significantly reduce missing requirements during ERP requirements elicitation.				
5. ERP software projects may fail because requirements engineers fail to understand the domain during ERP requirements elicitation.				
6. Domain knowledge will help in understanding the rules and processes in that domain during ERP requirements elicitation.				
7. ERP requirements are derived from the application domain during requirements elicitation.				
8. Domain understanding is part of the problem solving in the application domain during ERP requirements elicitation.				
9. Domain knowledge will help in understanding the ERP system scope during ERP requirements elicitation.				
10. The requirements engineer must not be limited to the information found in the domain only but explore other ways to get information during ERP requirements elicitation				
11. Using different data sources during ERP requirements elicitation process will reduce cases of missed ERP requirements.				

SECTION D: Sociological Perspectives

Please indicate your level of agreement with each of the following statements by ticking the appropriate option with an "X" or "✓".

Use the following scale:

1. **Strongly Disagree 2. Disagree 3. Agree 4. Strongly Agree**

Items	**1**	**2**	**3**	**4**
1. Managers are the only ones who should give requirements during ERP requirements elicitation.				
2. ERP requirements elicitation is a social activity hence there is a need to rely on stakeholders' involvement to get rich ERP requirements				
3. Stakeholders with a low social status in the university should be included during ERP requirements elicitation.				
4. Stakeholders' social issues need to be addressed for rich ERP requirements to be extracted.				
5. Power relations within a university may affect the ERP requirements elicitation.				
6. Stakeholder's psychological issues may affect the quality of the ERP requirements that will be extracted during ERP requirements elicitation.				
7. ERP requirements are well structured and there is less reliance on stakeholders to give their requirements				
8. Stakeholder's involvement during ERP requirements elicitation will help in reducing missing requirements.				
9. Stakeholders who are close to the problem situation are assumed to be knowledgeable about the problem situation hence there is need to consider them when extracting ERP requirements				
10. Stakeholder's psychological issues may cause them to withhold very crucial requirements.				

11.	ERP requirements can be extracted from social relations such as organizational conflicts, leadership styles and power during ERP requirements elicitation.				
12.	Do you think it is necessary to understand how stakeholders do their daily tasks and their relationship with other workers in ERP requirements elicitation?				
13.	Stakeholder's action is socially bound and in that regard, the stakeholder's requirements should not be viewed in isolation with the social context.				

SECTION E: Stakeholder's Role

Please indicate your level of agreement with each of the following statements by ticking the appropriate option with an "X" or "✓".

Use the following scale:

1. Strongly Disagree 2. Disagree 3. Agree 4. Strongly Agree

Items	**1**	**2**	**3**	**4**
1. Dividing stakeholders into different groups will enhance the extracted ERP requirements				
2. Stakeholder's categorization will reduce cases of missed ERP requirements.				
3. Stakeholder categorization will reduce cases of overlooked ERP requirements.				
4. Dominant stakeholders [those with power in an institution] should be considered for ERP requirements elicitation.				
5. Demanding stakeholders [those with urgent requirements] should be considered for ERP requirements elicitation.				
6. Dependent stakeholders [those with less power but with crucial requirements] should be considered for ERP requirements elicitation				

	7. Dangerous stakeholders [those with power and with urgent requirements] should be considered for ERP requirements elicitation.					
	8. Definitive stakeholders [those with power, legitimacy and urgent requirements] should be considered for ERP requirements elicitation					
	9. Discretionary stakeholders [those with low power and low urgent requirements] should be considered for ERP requirements elicitation					
	10. Demean stakeholders [those with a low social status in the institution] should be considered for ERP requirements elicitation					

SECTION F: Stakeholder's Characteristics

Please indicate your level of agreement with each of the following statements by ticking the appropriate option with an "X" or "✓".

Use the following scale:

1. **Strongly Disagree 2. Disagree 3. Agree 4. Strongly Agree**

Items	**1**	**2**	**3**	**4**
Which of the following stakeholder's characteristics do you think should be used when selecting stakeholders during ERP requirements elicitation? Indicate your level of agreement on each characteristic.				
1. Stakeholder's age affects the quality of the elicitated ERP requirements				
2. Stakeholder's gender affects the quality of elicitated ERP requirements.				
3. Stakeholder's level of education affects the quality of the elicitated ERP requirements				
4. Stakeholder's experience affects the quality of the elicitated ERP requirements				
5. Stakeholder's communication skill affects the quality of the elicitated ERP requirements				

6.	Stakeholder's interest affects the quality of the elicitated ERP requirements				
7.	Stakeholder's culture affects the quality of the elicitated ERP requirements				
8.	Stakeholder's social embeddedness affects the quality of the elicitated ERP requirements				
9.	Stakeholder's role affects the quality of the elicitated ERP requirements				
10.	Stakeholder's domain knowledge affects the quality of elicitated ERP requirements.				
11.	Stakeholder's cognitive Style (how a stakeholder thinks, perceive and remembers information) affects ERP requirements elicitation.				

SECTION G: Requirements Elicitation Techniques

Please indicate your level of agreement with each of the following statements by ticking the appropriate option with an "X" or "✓".

Use the following scale:

1. **Strongly Disagree 2. Disagree 3. Agree 4. Strongly Agree**

Items	**1**	**2**	**3**	**4**
1. Using different requirements elicitation techniques will help in extracting rich ERP requirements.				
2. Different elicitation techniques work better under different situations.				

3. Creating fictitious characters called Personas that represent different stakeholders with different requirements may help in extracting rich ERP requirements.					
4. When stakeholders are asked to explain in detail the steps they should do to achieve a specific task may help in extracting ERP requirements.					
5. When stakeholders are asked to define goals for the new ERP system and also asked to explain why those goals are needed and how can those goals be achieved may help in extracting ERP requirements.					
6. ERP requirements cannot be extracted from a single angle but different angles so that rich requirements may be extracted.					
7. Using a single elicitation technique during ERP requirements elicitation will miss important ERP requirements.					
8. A requirements elicitation technique influence the extracted ERP requirements.					
9. Overlooked ERP requirements may be extracted by using different elicitation techniques					

ANNEXURE I: RESEARCH PROPOSAL PRESENTATION

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
MAFIKENG CAMPUS

Faculty of Commerce and Administration
Private Bag X2046, Mmabatho
South Africa, 2735
Tel: 018-3892554 Fax 018-3892090

FHDRC 5/2016

PHD COLLOQUIUM

The members of the colloquium appointed to attend the presentation of

Kanos Mafyokurehwa

on 16 November 2016 find it satisfactory and recommend that it be approved.

Type of presentation: Proposal

Approval: Approve with recommendations

PP: Thomp

Prof J B van Lill
Director:School of Management Sciences
Member of FHDRC

Prof N Mavetera
Director: School of Economics and Decision Sciences
Member of FHDRC

PP: [signature]

Prof S Swanepoel
Executive Dean of FCA
Member of FHDRC

Colloquium approval letter

ANNEXURE J: RESEARCH METHODOLOGY PRESENTATION

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
MAFIKENG CAMPUS

Faculty of Commerce and Administration
Private Bag X2046, Mmabatho
South Africa, 2735
Tel: 018-3892554 Fax 018-3892090

FHDRC 5/2018

PHD COLLOQUIUM

The members of the colloquium appointed to attend the presentation of

MR KANOS MATYOKURETHWA

on 7TH MARCH 20 18 find it satisfactory and recommend that it be approved.

Type of presentation: METHODOLOGY

Approval: Proceed with the corrections taken care of.

Prof B Tchereni
Research Professor
FEMS

Prof J Meyer
Professor at School of Business and Governance

Prof N Moroke
Deputy Dean of FEMS

Colloquium approval letter

ANNEXURE K: ETHICAL CLEARANCE LETTER

NWU®
NORTH-WEST UNIVERSITY
NOORDWES-UNIVERSITEIT
YUNIBESITI YA BOKONE-BOPHIRIMA

Private Bag X1290, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222
Fax: 018 299-4910
Web: http://www.nwu.ac.za

Research Ethics Regulatory Committee
Tel: 018 299-4849
Email: nkosinathi.machine@nwu.ac.za

29 January 2019

ETHICS APPROVAL LETTER OF STUDY

Based on approval by the **Economic and Management Sciences Research Ethics Committee (EMS-REC)** on 29/01/2019, the Economic and Management Sciences Research Ethics Committee hereby **approves** your study as indicated below. This implies that the North-West University Research Ethics Regulatory Committee (NWU-RERC) grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: A framework for enhancing enterprise resource p/anning's systems requirements engineering involving the stakeholders.
Study Leader/Supervisor (Principal Investigator)/Researcher: Prof N Mavetera & Prof O Jokonya
Student: K Matyokurehwa

Ethics number:

N	W	U	-	0	0	1	4	9	-	1	9	-	A	4
Institution				Study Number						Year			Status	

Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation

Application Type:
Commencement date: 29/01/2019 **Risk:** Low
Expiry date: 28/01/2020
Approval of the study is initially provided for a year, after which continuation of the study is dependent on receipt and review of the annual (or as otherwise stipulated) monitoring report and the concomitant issuing of a letter of continuation.

Special in process conditions of the research for approval (if applicable):

General conditions:

While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, the following general terms and conditions will apply:

- *The study leader/supervisor (principle investigator)/researcher must report in the prescribed format to the EMS-REC:*
  - *annually (or as otherwise requested) on the monitoring of the study, whereby a letter of continuation will be provided, and upon completion of the study; and*
  - *without any delay in case of any adverse event or incident (or any matter that interrupts sound ethical principles) during the course of the study.*
- *The approval applies strictly to the proposal as stipulated in the application form. Should any amendments to the proposal be deemed necessary during the course of the study, the study leader/researcher must apply for approval of these amendments at the EMS-REC, prior to implementation. Should there be any deviations from the study proposal without the necessary approval of such amendments, the ethics approval is immediately and automatically forfeited.*
- *Annually a number of studies may be randomly selected for an external audit.*
- *The date of approval indicates the first date that the study may be started.*
- *In the interest of ethical responsibility, the NWU-RERC and EMS-REC reserves the right to:*
  - *request access to any information or data at any time during the course or after completion of the study;*
  - *to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process;*
  - *withdraw or postpone approval if:*
    - *it becomes apparent that any relevant information was withheld from the EMS-REC or that information has been false or misrepresented;*
    - *submission of the annual (or otherwise stipulated) monitoring report, the required amendments, or reporting of adverse events or incidents was not done in a timely manner and accurately; and / or*
    - *new institutional rules, national legislation or international conventions deem it necessary.*

The EMS-REC would like to remain at your service as scientist and researcher, and wishes you well with your study. Please do not hesitate to contact the EMS-REC or the NWU-RERC for any further enquiries or requests for assistance.

Yours sincerely

Prof D Mello
Research Director and Ad-Hoc Chairperson for Backlog NWU Economic and Management Sciences Research Ethics Meeting

ANNEXURE L: EDITING CERTIFICATE

NORTH-WEST UNIVERSITY
NOORDWES-UNIVERSITEIT
UNIBESITI YA BOKONE-BOPHIRIMA

Office: 0183892451

FACULTY OF EDUCATION **Cell: 0729116600**

Date: 14th July, 2020

TO WHOM IT MAY CONCERN

CERTIFICATE OF EDITING

I, Muchativugwa Liberty Hove, confirm and certify that I have read and edited the entire thesis, **A Framework for Enhancing Enterprise Resource Planning System Requirements Elicitation Involving the Stakeholders**, by **Kanos Matyokurehwa**, **Orcid.org/0000-0002-1979-0255**, submitted in fulfilment of the requirements for the degree Doctor of Information Systems at the North-West University.

Kanos Matyokurehwa was promoted by **Professor Nehemiah Mavetera** and co-promoted by **Professor O. Jokonya.**

I hold a PhD in English Language and Literature in English and am qualified to edit such a thesis for cohesion and coherence. The views expressed herein, however, remain those of the researcher/s.

Yours sincerely

Professor M.L.Hove (PhD, MA, PGDE, PGCE, BA Honours – English)

NORTH-WEST UNIVERSITY
NOORDWES-UNIVERSITEIT
UNIBESITI YA BOKONE-BOPHIRIMA