AN ANALYSIS OF FACTORS AFFECTING IMPLEMENTATION OF SAP IN SOUTH AFRICA PUBLIC SECTOR"

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ABSTRACT

SAP enterprise resource planning (ERP) implementations in the South African public sector have faced many challenges and the majority of them have failed to achieve their intended purposes. They have failed to be finished within the project plan, and within the budgeted time, and are largely unable to meet the expectations of the users to the extent that the real value and returns on the IT investments have not been realised. SAP ERP implementation failure is defined in many ways; a project that is abandoned is a clear example of a failed project, a system implementation that has been delivered exceeding its budget and planned time is also classified as a failed project as it can lead to serious financial consequences for the company. A SAP ERP project that does not deliver the intended benefits to the users is also defined as failed. Therefore, the purpose of this study is to explore impacts of success factors on SAP ERP implementation in KwaZulu-Natal. The Technology-Organisational-Environment (TOE) framework was used and nine success factors were classified into these three domains and measured against the dependent variable, Implementation Success. A quantitative, cross-sectional survey was carried out and data was gathered data from forty-seven SAP-system users from three state-owned entities in KwaZulu-Natal province of South Africa. Tests of reliability and validity were done, and the data analysis was carried out using the Statistical Package for the Social Sciences (SPSS), version 22. The findings of the research showed that technological factors have a significant influence on implementation success. Lack of thorough data migration through various iterations of cleansed master and transactional data will lead to a new system with incorrect data. The degree of ERP flexibility was identified as a measure of implementation success, the higher the flexibility the higher the level of success. Systems that are largely inflexible and which require a high degree of customisation cause a lot of inefficiencies. Organisational factors such as change management, training, or business-process re-engineering showed a significant influence on the successful implementation of SAP systems. Respondents indicated that these factors are critical in ensuring that the SAP ERP system implementation is successful. The research findings for environmental factors showed that there is a positive relationship between vendor support and implementation success. Experienced vendors who have deep and specific knowledge of their systems, and are continuously involved with their clients, have evidenced successful implementations. However, top management support and project governance did not show any significant influence on the success of an SAP ERP implementation.

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ABBREVIATIONS

ERP	Enterprise Resource Planning
HANA	High Performance Analytic Appliance
R/1-3	Release 1, 2, 3
KZN	KwaZulu-Natal
GDP	Gross Domestic Product
TOE	Technology Organization and Environment
ABAP	Advanced Business Application Programming
IDC	International Development Corporation
ICT	Information Communication and Technology
IT	Information Technology
BPM	Business Process Mapping
UAT	User Acceptance Testing
IMPSUC	Implementation Success
SAP	Systems Application and Products

Chapter 1 : INTRODUCTION TO THE STUDY

1.1 Introduction

This chapter provides an explanation of how the research is structured. It begins with a detailed description of the background of the research area, outlining the need to carry out the research. This is followed by a definition of the research problem which explains why the researcher is choosing to study the South African public-sector entities, selected specifically from KwaZulu-Natal. The researcher then defines the research objectives and research questions which are based primarily on the three domains – technology, organisational and environmental. Chapter 1 includes a summary of each of the study's chapters; furthermore, restrictions or limitations that might affect the outcomes of the study are discussed.

1.2 Background of the Study

SAP, formerly (Systems-Application and Products), is a highly acknowledged, multinational software company, well known for its enterprise resource planning (ERP) system. SAP invented the SAP ERP system in 1979 when the application was built on standard business software, based on mainframe technology, which later developed to client/server technology in 1992 – also known as SAP R/3, and then later moved to SAP Netweaver Technology which gave birth to SAP ERP which is part of a larger family known as the SAP Business Suite, (Pollock & Williams, 2008)

More recently, in 2015, the SAP ERP moved further to a new business suite called SAP S/4HANA, which was necessitated by the need to make software that was compatible with the new wave of hardware (high In-Memory Databases) (Michelle, 2000). SAP is leading the pack of ERP Applications with a six percent market share and $5.3 billion in ERP product revenues. FIS Global ERP and Oracle ERP follow this with four and three percent market share respectively (Seethamraju, 2015).

An ERP system is a software that has large capabilities and functionalities linked to one database; these functionalities (modules) perform basic organisational functions like production, finance, procurement, sales, distribution, payroll and human resources, (Columbus, 2013). However, ERP systems are extremely complex and difficult to implement and, according to Matende and Ogao (2013), many companies have experienced unexpected failures. Many researchers have come to the conclusion that failure is common and integral to ERP projects' implementation, and the chances of success in an ERP project are not guaranteed even in best-case situations (Atukwase, 2015). ERP implementation is a lengthy and complex

process and unsuccessful implementations may have serious negative effects on business performance.

SAP ERP implementation failure is defined in many ways; a project that is abandoned is a clear example of a failed project; a project delivery that exceeds its budget and time allocation is also a failed project as it can lead to serious financial consequences for the company; an ERP project that does not deliver the intended benefits to the users is also defined as a failed ERP implement (Al-Mashari, Zairi, & Management, 2000).

The studies done so far on ERP implementation have provided a strong theoretical background to ERP research. However, an analysis of the available literature indicates insufficient research in investigating the factors affecting SAP ERP implementation in KwaZulu-Natal. There are many SAP ERP implementations happening in KwaZulu-Natal, particularly in the public sector and corporate world, and in most of these the clients have failed to realise the value of their investment, as alleged by many factors.

KwaZulu-Natal is the third largest province in South Africa in terms of its Gross Domestic Product (GDP). Numerous SAP ERP implementations are taking place in the province for major metros (Msunduzi and uMhlatuze), as well as other state-owned entities such as Umgeni Water, KZN Legislature, KZN Ezemvelo Wildlife and Chief Albert Luthuli hospital. Most of these SAP implementations have gone live and have serious issues which are compromising their functioning. The momentum of SAP ERP implementations is increasing and, as SAP ERP system implementations cost hundreds of millions of rand in hardware, software, implementation and support, it is essential to avoid having a defective system.

1.3 Research Problem

A number of academic studies were carried out to understand the factors that lead to successful ERP Implementation and various reasons were classified under technological, organisational, environmental (TOE) and cultural factors – which might contribute to a successful implementation (Ram, Corkindale, & Wu, 2013). However, no specific study has been conducted in KwaZulu-Natal on factors affecting SAP ERP implementation. This study will investigate the TOE factors leading to SAP ERP implementation success in KwaZulu-Natal.

Most of the recent research done in this field has identified that at least fifty percent of ERP implementation projects fail to reap benefits (Tobie, Etoundi, & Zoa, 2016). The literature, discussed in Chapter Two, outlines the causes of failure in systems implementation but is not specific to SAP ERP implementation failure, particularly in KwaZulu-Natal. KwaZulu-Natal

is an economic hub of South Africa that does substantial trade with several landlocked southern African Countries, such as Botswana, Zimbabwe, Zambia, Malawi and Democratic Republic of Congo.

Unlike in developed countries, apart from Irakoze (2016) qualitative study on ERP implementation success in South Africa, little research on the implementation of ERP's has been done in Africa, and KwaZulu-Natal in particular as also noted by Mushavhanamadi & Mbohwa, 2013. This study will measure the same factors as those in Irakoze's study (2016), using quantitative methodology, with a specific focus on the SAP ERP implementation in the KwaZulu-Natal public sector.

1.4 Research Question

- ✓ To what extent does the 'technological context' (SAP ERP flexibility and suitability) as well as data accuracy lead to the success of SAP system implementation in KwaZulu-Natal?
- ✓ How does the 'organisational context' (management, communication, training etc.) lead to the success of SAP's system implementation in KwaZulu-Natal?
- ✓ What is the effect of 'environmental context' (vendor support and project management) on the successful implementation of SAP ERP projects in KwaZulu-Natal?

1.5 Research Objectives

- ✓ To outline the impact of Organisational, Technological and Environmental (TOE) factors on the successful delivery of SAP ERP Projects;
- ✓ To determine other factors that are contributing to SAP ERP system failures in KwaZulu-Natal;
- ✓ To highlight the remedial actions to be considered to avoid project failures and pave the way for the establishment of an SAP technological and skills base in KwaZulu-Natal.

1.6 Research Structure

This research dissertation comprises five chapters, outlined below. Chapter 1 is a presentation of the introduction to the research study. Chapter 2 will provide an analysis of previous studies and will focus on the success factors leading to the success of the project. Chapter 3 will introduce a model used to formulate the conceptual framework, and follow a quantitative

approach in forming a methodological basis and giving reasons why a particular research methodology has been chosen Chou and Chang (2008). The chapter explains the reasons why the researcher has opted for quantitative methodology as a way of data gathering. Chapter 4 is a presentation of findings and it will outline the research's theoretical framework and will validate the nine SAP ERP implementation success factors. Chapter 5 is a summary of the research findings and contains recommendations for further research.

1.7 Chapter Summary

This chapter dealt with the background of the study's research on the factors leading to SAP system implementation success in KwaZulu-Natal. The research problem was defined and discussed, and the research objectives were outlined. Finally, the researcher discussed the structure that the research will follow, from introduction until the conclusion and recommendations.

Chapter 2 : LITERATURE REVIEW

2.1 Introduction

This chapter outlines literature from previous research informing the basis of this study, that is, the analysis of success factors influencing the implementation of SAP system in KwaZulu-Natal.

The chapter is structured into eight sections. Section 2.2 will discuss the definition of SAP ERP system and Section 2.3 outlines the literature on SAP ERP implementation in the South African public and private sector with a mention of the major entities running on SAP ERP, such as municipalities, banks, and mining as well as energy sectors. Section 2.4 explains the terms that will be used in this research such as ERP, ERP failure, etc. Section 2.4 will also engage the literature and explain, with reference to empirical evidence, some of the factors that lead to ERP implementation failure and success. Section 2.5 will focus on the information system success and failure theories. Section 2.6 will identify the conceptual framework guiding this study and Section 2.7 will address the success indicators (metrics) that provide guidance on how to measure success of a system implementation. Section 2.8 highlights gaps that have prompted the researcher to carry out this research, and Section 2.9 is the summary of the chapter's contents.

2.2 Definition of terms

The following section outlines the definition of the SAP system and how the SAP system is being adopted in KwaZulu-Natal.

2.2.1 SAP ERP System

SAP is an ERP information system owned by SAP AG, based in Walldorf in Germany. SAP used to be an acronym for "Systems, Applications and Products in Data Processing" (Kulkarni & Sharma, 2015). 'SAP' is no longer an acronym but a name and a strong brand. SAP was founded around 1972 by five IBM engineers, Hop, Wellenreuther, Hector, Tschira and Plattner. SAP is an enterprise wide resource system, meaning that it supports functional areas such as, procurement, logistics, project systems, selling and distribution, customer relationship management, banking manufacturing and utilities. SAP also supports a wide range of industries such as defence, banking, utilities, universities, manufacturing, aviation, government and so on. Currently, a large number of enterprises are using the SAP software for their daily activities ((Magal & Word, 2011).

SAP first came to Africa in 1982 and has its headquarters in Woodmead, Johannesburg in South Africa. SAP has a significant presence in 51 African countries and has five regional offices in in West Africa (Nigeria), East Africa (Kenya), North Africa (Algeria), and Francophone and Lusophone regions, with a total of more than 1300 clients across all industries.

SAP ERP evolved in three stages: R1, R2 and R3; the letter R stands for Release (or version). The table below shows the functionality of each release and when it was available in the market (Columbus, 2013).

Table 2-1: Presentation of SAP system versions.

Release No.	Release Year	Layers	Number of Servers
R/1	1972	i. Presentation Layer ii. Application Layer iii. Database Layer	One Server
R/2	1979	i. Presentation Layer ii. Application Layer iii. Database Layer	Two servers: 1. Presentation 2. Application and Database
R/3	1983	i. Presentation Layer ii. Application Layer iii. Database Layer	Three Servers: i. Presentation Layer ii. Application Layer iii. Database Layer
SAP ERP ECC6		i. Presentation Layer ii. Application Layer Database Layer	Client/Server ABAP/4 Three Servers: i. Presentation Layer ii. Application Layer iii. Database Layer
SAP HANA	2015	Index Server using SQL Script Universal Journal ABAP Core Data Services Layers (CDS).	One Server (Index Server)

The following are definitions of the SAP Version releases according to the SAP Website as well as the SAP Online Help Site:

SAP R/1: This is the original version of SAP Software which was started in 1972 and was given the name R/1 system. The acronym R is for real-time data processing and this was made possible by the three-tier 'architectural' design, encompassing 'Presentation, Application and Database', which were installed in one system (Appelrath & Ritter, 2013).

SAP R/2: In 1979 the second version of SAP (R/2) was introduced into the market and used IBM's database and was modelled along a dialogue-oriented business application. This release had the ability to work with multiple languages and currencies. The release is composed of 2 tiers or servers which house three layers or components namely 'Presentation, Application and Database' and these reside in the 2 separate servers as follows; first server – Presentation, second server – Application + Database (Appelrath et al., 2010).

SAP R/3: With SAP R/3, SAP introduced Client/Server architecture in a three-tier landscape with three servers for presentation, application and database (Appelrath et al., 2010).

SAP ERP ECC6 Central Component: It is the SAP R/3 which was renamed SAP ERP and later renamed Enterprise Central Component or ECC. It has version such as mySAP 2005 or SAP ECC6.0. The introduction of mySAP ERP edition in 2004 brought a complete new architecture. The SAP business warehouse, SAP Strategic Enterprise Management and Internet Transactions Server were also merged into SAP ECC, allowing users to run them under one instance. Architectural changes were also made to support an enterprise service architecture to transition customers to a services oriented architecture.

SAP HANA: SAP has now moved to SAP HANA (high performance analytic appliance) where all the three landscapes have been moved into one landscape to allow for big data and fast data storage and retrieval. SAP HANA is an 'in memory' data platform which is deployed on the premises (company's server) or on demand (cloud based by service providers); it is an extremely innovative in-memory relational database management system, which relies on main memory for computer data storage and does not rely on disk storage mechanisms. SAP HANA runs on multiple core CPUs, with fast communication between processor cores containing terabytes of main memory. Within SAP HANA, the database tables are a 2-dimensional structure organised in rows and columns, although traditionally computer memory is organised in a linear structure. However, importantly, SAP HANA supports both row/column and linear structures. SAP HANA has also been designed to perform parallel processing, specifically basic calculations such as analytical joins, scans and aggregations, in parallel. SAP HANA, with its scanning speed of several gigabytes per second, makes it possible to calculate

aggregates of large amounts of data at the click of a button, with high performance (Appelrath et al., 2010).

Figure 2-1 shows the typical modules (components) of an SAP system using an R/3 Client server network (Appelrath et al., 2010).

Figure 2-1: SAP Modules Overview (Appelrath & Ritter, 2013)

2.3 SAP Implementation in the South African Private and Public Sector

According to Lidow, Strydom, de Rooij, and Reusch (2012), SAP has been in South Africa for more than 20 years and it has based its growth and survival on four pillars, namely:

2.3.1 Accelerating Industry Growth – This is a focus on all major industries such as public sector, transport, telecommunications, energy, utilities, and financial services;

2.3.2 SME Growth – this focus was necessitated by the fact that SMMEs contribute to more than 45% of South Africa's GDP;

2.3.3 Innovation – the thrust of innovation has been due to the need to address challenges facing South Africa through technology offerings such as data analytics, SAP HANA, SAP Cloud and so on;

2.3.4 Reducing Unemployment – SAP has embarked on a large scholarship programme known as SAP Skills for Africa, aimed at developing skills that are much needed in providing SAP solutions across all countries in Africa.

Table 2-2: Public Entities Using SAP system in South Africa

Company Name	Sector
1. City of Cape Town 2. City of Johannesburg 3. Msunduzi Municipality 4. Amathole Rural District Municipality 5. Capricorn ((Polokwane) District Municipality 6. Nelson Mandela Bay Municipality 7. Tshwane District Municipality 8. Umhlatuze Municipality	Public Sector - Municipalities
9. KZN Legislature 10. Mpumalanga Legislature 11. Gauteng Legislature	Legislature
12. South Africa Revenue Services 13. SENTECH 14. Transnet Group and all subsidiaries 15. Ezemvelo Wildlife 16. Umgeni Water 17. Water Trading Entity (Department of Water) 18. Compensation Fund 19. Chief Albert Luthuli Hospital 20. Eskom	State-Owned Entities
21. JD Group 22. Dischem Pharmacies 23. Distell 24. Exxaro	Private Sector

Company Name	Sector
25. ISUZU 26. Engen 27. BAT	
28. Standard Bank 29. Nedbank 30. Barclays/ABSA 31. DBSA 32. Discovery Bank 33. Bidvest	Financial Sector

Table 2.2 shows some of the major companies that have been using SAP for a long time in South Africa; the above entities are a few of the many companies that run on SAP in South Africa. According to International Data Corporation report dated 5 September 2017, SAP is the leading ERP vendor with 48% of the market share, followed by Oracle with a 20% share, then by Sage with 18% and fourth and fifth are Microsoft Dynamics and Syspro which had 5.3% and 3.5% respectively, Lechesa, Seymour, and Schuler (2012).

2.4 Literature review on the implementation of ERP systems.

Many factors were identified to be critical to the successful implementation of ERP systems in the past four decades (Esteves & Pastor-Collado, 2001). According to Esteves et al. (2001), awareness of these factors assists consultants and system implementers in the planning and execution of projects. Success and failure factors are "factors which, if adopted correctly, can largely improve project implementation success" (Esteves & Pastor-Collado, 2001). This study considers critical success and failure factors from previous research, and provides further analysis.

Garcia-Sanchez and Pérez-Bernal (2007) explained systems implementation as a complex and often very risky venture, due mainly to complexities around systems implementation and high expectations from the purchasers of such systems. It was also noted that several entities do not know how to effectively manage an ERP implementation (Asemi & Jazi, 2010). They also found that critical success factors in developing and developed countries seem to be similar except with regards to national cultures which tend to affect system implementation differently.

ERP implementation has recently become very popular, but research has found that regardless of its popularity, the rate of failure is very high. It has been found that the rate of failure of ERP implementation remains within a 67-90% range (Ahmed, Ahmad, Azhar, & Mallikarjuna, 2003). Research done by (Wong, Scarbrough, Chau, & Davison, 2005) found that at least 60% of ERPs are classified as failures; failure of ERP can lead to failure of a business resulting to bankruptcy. According to (Wang, Lin, Jiang, & Klein, 2007), at least 65% of ERP implementations are not able to meet the customer expectations.

There is no single definition of failure – a project that is classified as successful in one company can be regarded as a failure in another. ERP failure or success is defined in terms of two aspects. On one hand, the system implementation itself may be measured, with project success assessed through consideration of factors such as cost and time while on the other hand, outcomes are measured by the output or achievement of the envisaged goals such as integration of business process, streamlined processes, and increased throughput which enables efficient and quick decision making (Ram et al., 2013).

Akeel and Wynn (2015) classified failure and success of implementing ERP systems into three measurable outcomes, namely:

1. **Total failure,** where the client commits funds but does not implement the system, or the system implementation project is abandoned before it can go live;

2. **Partial Failure,** where the system is implemented and goes live but few objectives are achieved and there are many undesirable outcomes;

3. **Success,** where a system has been implemented successfully and the desired output expectations have been met.

Other researchers, particularly (V. B. Gargeya & C. Brady, 2005), concluded that ERP system failure can be classified into either partial failure or complete failure. Complete failure is where the project is abandoned/terminated before it goes live while partial failure involves continuing with the project until it is completed. This normally takes a lot of financial resources and time and may lead to high implementation costs; the project may fail to achieve the return on investments and, even if it went live, the levels of user satisfaction may be poor.

Previous researchers have focused more on the ERP implementation procedures and have given recommendations on preventing ERP failures. (Umble & Umble, 2002) are the first researchers to publish about analysing ERP failures and they identified several factors leading to implementation failure. These include lack of skilled resources, lack of business-process re-engineering, absence of project leadership, lack of top management support and so on.

This has caused this researcher to critically and thoroughly review literature, and single out dominant critical success and failure factors which can be applicable to African economies.

A critical review of thirty-six papers was done and the researcher identified various critical success and failure factors and classified them into the categories tabled below.

Table 2-3: Summary of Research Done per Factor Category

No.	Description of Category	References
1.	Senior Management Support	(Moon, 2007) (Holland & Light, 1999) (Ross & Vitale, 2000)
2.	Project Management	(Welti, 1999)
3.	Project Governance	(Wang & Chen, 2006) (Badewi & Shehab, 2016) (Fitz-Gerald & Carroll, 2003) (Muller, 2017)
4.	Change Management and Communication	(Aladwani, 2001) (Scapens & Jazayeri, 2003) (Kemp & Low, 2008)

No.	Description of Category	References
		(Huq, Huq, & Cutright, 2006)
5.	Training	(Gargeya & Brady, 2005) (Bhatti, 2005)
6.	Business Process Mapping and Engineering	(Al-Mashari et al., 2000) (Panayiotou, Gayialis, Evangelopoulos, & Katimertzoglou, 2015) (Daneva, 2004)
7.	Vendor Support and Implementation resources	(Fui-Hoon Nah, Lee-Shang Lau, & Kuang, 2001) (Liang Zhang, Lee, Zhang, & Banerjee, 2003) (Somers & Nelson, 2001)
8.	User Acceptance	(Lim, Pan, & Tan, 2005)
9.	Knowledge Transfer	(Haines & Goodhue, 2003) (Lee & Lee, 2000)
10.	ERP Flexibility and Suitability	(Kumar & Malik, 2012) (Wei & Wang, 2004)
11.	Degree of Customisation	(Olson, Chae, & Sheu, 2013)
12.	Data Quality and Data Migration	(Bradley, 2007)

The following is the description of the classification of each of the factors inhibiting the success of an ERP Project.

I. Senior Management Support

Various factors that influence project success have been identified in previous research. These include how the project governance structure is set up, departmental conflicts, absence of organisational transformation to fit the required information system, misalignment of the organisational culture and the way the standard system is expected to operate, mismatch between the ICT department and the requirements of business, ill-defined strategic goals and turbulent managerial positions. Hassan and Mathiassen (2018) noted that for an ERP to be successful it should be well planned and the organisation should be prepared to be re-engineered, and aware that productivity may go down before it can go up. Hassan et al. (2018) also concluded that, to be successful, an ERP implementation should involve planning,

organising, leading, and coordinating. Of importance is the fact that an entity implementing an ERP should consider taking advice from implementation-partner consultants and should assemble a team of dedicated project members, with good team attitude, who should receive support from top-level leadership.

According to (Al-Mashari & Al-Mosheleh, 2015), many ERP implementations are regarded as failures because of failure to achieve agreed organisational goals. They found that the lack of alignment between business strategy, IT Strategy and particularly the ERP Implementation roadmap contributed immensely to this. This was confirmed by Umble (2002) who stated that entities should have clear reasons why they are implementing an ERP system and should have clarity on, and record, the critical business functions that the ERP should address. A study of the ERP implementation in Iranian industries by (Al-Mashari & Al-Mosheleh, 2015) concluded that lack of IT strategy aligned to corporate strategy is a leading factor in ERP failures.

One of the ways that business owners can avoid implementation failure is by cascading the vision of the organisation to all stakeholders and employees. They also need to go a step further and define the role to be played by the new system in the structure of the organisation. Luijten et al. (2014) explained that top managers should instil a mind-set for change through acknowledging that learning has to be done at all levels, managerial and operational.

Huang and Palvia (2001) identified the top ten risks that lead to system implementation failure and classified the top one as "lack of management commitment". Esteves et al. (2001) concurred with this and indicated that there is need for management support that is committed as well as participation of middle managers and availability of resources seconded to the project on a full-time basis. Esteves et al. (2001) further noted that the executives have a responsibility for approving ERP project initiatives and ERP funding. Top management support is critical for the employee's commitment to the ERP success through good awareness campaigns about the importance of ERP.

Top managers have certain responsibilities that they have to fulfil as part of the project execution, such as top down communication of strategy, showing an interest in the system and establishing the need and purpose of the ERP system. Lack of top-management support or commitment impedes project-implementation success and this has been classified as one of the greatest risks to ERP project implementation. The study carried out by Gefen and Keil (1998) found 73% of the respondents on ERP failure indicated lack of top management support as a crucial factor.

II. Project Management

Project management and governance factors include, among others, conflicts between organisation (client) and consultants (implementation team), conflict between organisation (client) and the ERP Software Vendor, absence of fulltime resources, poor project leadership, lack of project risk management, inability to control costs, unnecessary project delays and too many requirements. (Saravanan & Sundar, 2015) indicated that the major causes of ERP project failure are the failure to plan and lead, including monitoring and management of the project. They attributed this to the complexity of some projects and the fact that projects are constituted of individuals of diverse cultures encompassing different users, management levels, different functions and differing interests.

The role of project management is to ensure that ERP implementation follows a certain agreed methodology for example, if it is SAP it can follow Accelerated SAP (ASAP) Methodology. (Dezdar & Ainin, 2011) noted that because of the complex structure of ERP projects, good project management skills are vital to ensure project success. Lack of such leadership can be disastrous.

(Dezdar & Ainin, 2011) further grouped ERP project failure into the following classifications namely process failure, unmet expectation, absence of interaction and correspondence failure. (Aloini, Dulmin, & Mininno, 2007) advised project managers to firstly, prioritise choosing the project team members, and secondly, link this exercise with the project life cycle, for example experienced experts should be part of the earlier scoping and system design and not involved only later in the project life cycle.

III. Lack of Project Governance

Governance refers to the processes put in place by senior managers to ensure that top management is involved in project execution. According to (Fitz-Gerald & Carroll, 2005), there are two groups of people who manage an organisation, namely, the executive management comprising the board of directors (board) and senior managers. The mandate of the board leadership is to make sure that senior managers work in the best interest of shareholders. The IT Governance Institute defines the board as "the way in which companies are directed or controlled, and encompasses issues such as the responsibilities of directors, and the relationship between shareholder, directors and auditors" IT Governance Institute (2007:12). The senior management is therefore engaged to run the business for the benefit of the shareholders. The responsibility of the board can be further broken down to that of providing ERP advocacy,

ensuring the project is sufficiently resourced, that there is project compliance, and that the board and executive are held responsible for the adverse result of project failure.

Broadbent (2007) described IT Governance as the way in which those in power will make use of information technology in monitoring, controlling, and directing the organisation and thereby achieving the goals of the organisation. In terms of the IT Governance Institute (2007:23), "IT Governance is the responsibility of the Board and executive management, it is an integral part of enterprise governance, it consists of leadership and organisational structures and processes that ensure that the organisation's IT sustains and extends the organisation's strategies and objectives".

Various researchers have discovered that many ERP projects have failed because of insufficient project management. Risks that arise during system implementations are largely ignored during the implementation phases of the projects. Table 2.4, below, itemises the research findings on project governance.

Table 2-4: Summary of Research on Project Risk Factor

Project Risk and Success Factor	Research Author
Lack of defined scope and objectives	(Garg & Garg, 2013)
Lack of sound project management visibility	(Willcocks & Griffiths, 2012)
Lack of defined project management methodology	(Dwivedi et al., 2013)
Inexperienced project leader	(Fitz-Gerald & Carroll, 2003)
Small and unclear milestones	(Fitz-Gerald & Carroll, 2003)
Lack of project planning and management	(Keil, Cule, Lyytinen, & Schmidt, 1998)
Clear roles and responsibilities	(Barker & Frolick, 2003)

IV. Change Management and Communication

Various factors have been identified by researchers as leading to project failures; these are resistance to change, lack of skills and training, poor employee engagement, lack of communication, absence of change management, low morale and impossible expectations. Another aspect that leads to ERP implementation failure is poor employee morale and motivation for example, structurally, some entities are not able to pay and retain capable and experienced staff, especially government departments (Proctor & Doukakis, 2003).

Olugbara, Kalema, and Kekwaletswe (2014) defined change management as a tactic of anticipating change that is expected to come with the implementation of the ERP system and then effectively managing it. Whenever a new system is implemented, there should be a change-management team that ensures that there is organisational readiness for the massive change that will be coming. The change management team will also ensure that the resistance to change will be dealt with in its earliest form.

Communication was also cited by Tarhini, Ammar, Tarhini, and Masa'deh (2015) as one aspect that is difficult to manage during ERP system implementation. According to (Dlodlo, 2011), project communication starts as early as possible, and not only among senior managers and project team members, but across the whole entity outlining project scope, status of the project and objectives of each phase. A lot of ERP implementation suffers because the management teams underestimate the complexity and fail to understand the change process. (Aloini, Dulmin, & Mininno, 2012) found out that project costs are often very high and projects fail to achieve intended benefits mainly because of failure by managers to manage change. Research has discovered that employees are able to determine if the ERP will succeed or fail. Saleem, Hussain, Nazeer, Yaseen, and Hayat (2016) also noted that there are some managers who do not want to change their existing business processes of ERP to the new ones being implemented as they prefer the traditional ways.

V. User Training

One major issue impacting system implementation is the inability by the training team to conduct an employee-readiness assessment before the project commences. The purpose of this assessment is to check if employees are ready for the new system. "It is widely accepted that ERP Implementation is very risky if it is undertaken without full preparation and or detailed feasibility study", (Shen, Chen, & Wang, 2016). To take care of the level of preparedness, organisations are encouraged to conduct an assessment of the preparedness of an organisation by pursuing an organisational readiness review process. This is often spearheaded by the change, training and communication team.

According to Noudoostbeni, Ismail, Jenatabadi, and Yasin (2010), users need to be given adequate training. During system implementation, entities are encouraged to provide heavy support to their people. On-the-job and academy training should be put in place with extensive ERP training tools and demo systems that will enable users of the system to have confidence in the system. According to Dorobat and Nastase (2010), an organisation should strive to get

employees educated and trained and continue to keep them informed of the project implementation process. They identified inadequate commitment to training as leading to project failure since it requires a budget, has to be scheduled, and also requires total commitment from the client and the implementation partner should also make available experienced consultants who will be able to advise on preparing for the implementation.

VI. Business Process Re-engineering (BPR)

According to Olugbara et al. (2014), implementers of the ERP system should use techniques to match business processes and the business requirement. However, research by Wang (2016) found that the implementation client (the buyer of the ERP system) is not involved in the early stages of ERP implementation and does not participate intensively in the business re-design process. As a result, this leads to incorrect business process design which in turn produces a poorly-designed system. Saravanan and Sundar (2015) also noted that another symptom of not doing business-process re-engineering correctly is that the system will not be accepted by the users as it may miss functionality that will be required by the business or have functionality that is not desired or expected by business. However, it was also noted that there is no system that can fully meet all the user requirements and therefore has to be a limit on what requirements should be prioritised, and who makes the decisions around preferred requirements. This should be done to avoid scope creep and failure to finish the ERP system implementation.

According to Chang (2016), one of the problems identified in the research for this topic is that gathering of system requirements and interpreting them into business requirements is done in a hurry, this is further compounded by the fact that system implementation projects often start too late, resulting in users failing to understand how their business process will fit within the ERP system because of the limitation of time and other pressures. Chen (2001), noted that entities implementing ERP's should be geared up to changing their old ways of doing business and fitting them into the newly-acquired system so that there is minimum customisation.

Poorly done business-process re-engineering can sometimes lead to hard coding of the system as a 'quick fix'. Zach, Munkvold, and Olsen (2014) advised that hard coding the systems should be avoided so that the system remains flexible to version upgrades and releases. Zach et al (2014) went further and indicated that today's businesses need to take advantage of process-modelling tools to assist in customising without doing too many changes to the standard code.

Shen et al. (2016) concluded that many companies changed the way they run their businesses in order to fit in the new ERP requirements and functionality adopted as the best practice approach in defining new requirements. However, they recommended incremental re-engineering and implementation as ERP projects take a long time to be completed. (Ahmed et al., 2003) further noted that in today's practice, the focus on ERP implementation is not only the business-process re-engineering to match with the ERP best practices but extends to the transformation of employees to knowledgeable workers who may reap the benefits from the re-created business processes.

Zaglago, Apulu, Chapman, and Shah (2013), identified various reasons for ERP implementation failure, and among these they identified Business Process Mapping (BPM) as a leading factor in a successful system implementation. They concluded that BPM failure leads to ERP failure; table 2.5 shows the causes of BPM failure as identified by specified authors.

Table 2-5: Summary of the Research on Business Process Mapping & Re-engineering

No.	Cause	Authors
1.	Vague BPM methodology	(Bandara, Indulska, Chong, & Sadiq, 2007)
2.	Cross-functional teams	(Fui-Hoon Nah et al., 2001)
3.	Lack of user participation	(Parr, Shanks, & Darke, 1999)
4.	Ineffective process design	(Sumner, 2000)
5.	Lack of proper training and education	(Bingi, Sharma, & Godla, 1999)
6.	Lack of resource, leadership and communication	(Sumner, 2000)
7.	Resistance to change	(Aladwani, 2001)
8.	Defining wrong objectives and selecting the wrong process	(Umble, Haft, & Umble, 2003)
9.	ERP software misfit	(Soh, Kien, & Tay-Yap, 2000)
10.	Parallel reengineering	(Holland & Light, 1999)

VII. Vendor Support and Implementation Resources

Zaglago et al. (2013: 07) were of the opinion that: "Implementation resources refer to the assets or resources which allow an organisation to perform certain actions". Olugbara et al., 2014; Zaglago et al., 2013), indicated that most ERP implementations have poorly-skilled consultants

who fail to grasp business requirements and offer expert advice. They also noted that ERP implementation in Iranian industries followed a trend where lack of choice of good vendors who are skilled and capable contributed often to ERP implementation disasters. Iran, at a certain time, was under international embargo (sanctions) and, as a consequence, capable ERP implementers were prohibited from operating in the country. In some countries the same trend has been noticed even though the countries are not experiencing sanctions (financial and trade restrictions); there are countries with empowerment requirements which favour local companies which do not have the requisite skills to pull the massive ERP implementations through successfully and, as a result (as in the Iranian cases), the entities end up choosing from a limited number of vendors who are challenged in terms of capacity and experience. The authors recommended that a properly-undertaken training programme for users should have a strategy that clearly outlines its purpose, and skills to be imparted which should be practical in the workplace, and on-the-job support should follow.

VIII. User Acceptance

User Acceptance Testing (UAT) is a technique which identifies the users of the system as early as possible and actively involves them in defining the requirements that they need, testing the functionality as it gets developed or customised, (Tarhini, Ammar, & Tarhini, 2015). Tarhini et al. (2015) further explained that since employees are the most affected by a system change, it is important to have a UAT testing strategy in place and engage employees early and continuously throughout the project life cycle. If employees are involved from the start and if some of them are seconded to the ERP implementation project office on a permanent basis, it would be easier for them to accept the system upon completion as they will now be understanding the system better.

(Tarhini, Ammar, & Tarhini, 2015) also observed that, as a result of tight project schedules with unrealistic deadlines, where a lot has to be accomplished and delivered within limited time, the testing of the system and user acceptance is often over-looked or done hastily. UAT is normally done in a rush and this results in low-quality output of the system. The notion that user-acceptance testing is an indicator of the readiness of the ERP system for 'Going Live' should be maintained; if the system passes UAT then it can be classified as ready to Go Live. However, as pressures mount to meet the Go Live deadlines, a lot of issues which may be critical to the smooth operation of the business will begin to be 'swept under the carpet', and these will only be experienced once the system is live. Tarhini (2015) further noted that as the Go Live date approaches, the workload of project-team members and users increases

tremendously as they try to fix issues and defects and cope with daily operations; this has a toll on the quality of testing and eventually leads to project failure.

IX. Knowledge Transfer

Ahmed et al. (2003) emphasised the need to have employees who have their work as top priority and who focus on the entity's mission and objectives as a priority for the organisation's success. As an approach that was first propagated by (Chetcuti, 2008) in building teams, it was found to be necessary to start with grouping employees who generally like each other and who can work well cross-functionally. During the implementation of the project, project team members from the implementation partners will then be able to impart their knowledge with their business counterparts and the whole duration of the implementation will be used for that purpose, such that at the end of the project there is acceptance and confidence in the usage of the system.

Training is normally given insufficient budget and time as well as human resources. (Ahmed et al., 2003) identified that a good training plan, that takes into account the new system features is essential. He further recommended that every user of the system should be given adequate training on the new business processes and information on how the new ERP will affect the organisational operations. Kim, Lee, and Gosain (2005), concluded that there is generally insufficient training and lack of comprehension of the way a system will impact on the current business processes; these contribute to failure in ERP system implementation.

Wong et al. (2005) discovered that in many cases consultants were inexperienced in using the ERP system they were implementing as, most of the time, they had practiced only during training sessions. They also observed the trend of training material being too brief and largely unhelpful. Interviews held with project managers identified that the knowledge-transfer processes were highly ineffective, and the result was that the business users were not able to get enough knowledge to be able to run the systems on their own.

X. ERP Suitability and flexibility

ERP suitability and flexibility is defined as the extent to which an ERP can be modified or changed to meet the ever-changing business requirements. Šūpulniece, Boguševiča, Petrakova, and Grabis (2013) went on to indicate that in practice today, many ERP systems are developed with a "plug-in" that allows for special customer requirements which may not be universal and therefore are not standardised. They argued that ERP systems should have this ability, making it easier to bring additional functionality. According to Bhatti and Khan (2010), "ERP

flexibility is mainly presented by the ability that the system offers the users in order to adapt to possible or future changes in its requirements. Due to the fast growth of markets, it is important that flexibility is achieved by ERP in order to accommodate future changes".

One of the reasons, as pointed out by Hawari and Heeks (2010), leading to ERP implementation failure is poor ERP selection and evaluation process, leading to the selection of an unsuitable ERP system. In most cases, the chosen system may not match the business requirements. The new system may fail to manage high data volumes and large classes and volumes of master data. The measure of such failure of an ERP is experienced in low system utilisation levels and the project team may end up performing heavy customisation on the system so that it can accommodate current and future business requirements.

XI. Degree of Customisation

According to Mijac, Picek, and Stapic (2013), the higher levels of system customisation and complexity contributes a lot to ERP implementation failure. Too much customisation makes the system difficult to change later and developers will have difficulty in trying to understand the programmes which will not be easy to upgrade in future. Sudhaman and Thangavel (2015), emphasised the need to align the level of customisation to the ERP system in order to bring out the functionality of the system to meet the entity's needs. However, Sudhaman and Thangavel (2015), also observed that too much customisation takes up a lot of resources in terms of labour hours and data costs, and can lead to scope creep. They also found that it is necessary for the system vendor and the clients to agree on the level of customisation beforehand and allow expert advice to be given.

According to help.sap.com (Unknown, 2017), SAP ERP systems do not accept customisations which comprise more than thirty percent of the standard system. They will not be able to support the system as it would have deviated significantly from the standard system. The major contributory factor is that the customised functionality needs to be tested thoroughly, and as many times as possible, to check for all possible bugs and sometimes the developments may still fail because of the client's ever-changing requirements.

A highly-customised system in the form of programme enhancement and report customisation results in heavy delays in implementation as customisation consumes a lot of time, exceeds the budget and contributes to an unstable system; poor customisation and unresolved errors are a recipe for ERP failure.

XII. Data Quality and Data Migration

System implementations are not successful because of the failure to conduct data migration activities on time, resulting in poor quality data loaded into the system or even failure to load some of the data or critical elements of data in the ERP because some of the fields may not exist, or the fields may be too short to accommodate the new set of data. “Data migration can take 30% of the total project resources yet the amount of attention given to it is very small, the cost of data migration tends to be unseen, until it is far too late into the project schedule” (Ram et al., 2013; Saini, Nigam, & Misra, 2013).

According to Malaurent and Avison (2015), ERP modules are highly integrated meaning that incorrect master data in one area can impact delivery of another area. For example, in a municipality, meters are an ***asset*** in the assets module and a ***piece of equipment*** in the plant maintenance module and a ***device*** in the revenue module; as a result of seamless integration in an ERP if one of the data sets is misaligned, other areas will be negatively affected leading to ERP failure. This can lead to incorrect meter readings and residents may even refuse to pay bills.

One of the issues, highlighted by Kalema (2014), is that an ERP can fail due to poor configuration data, which refers to ERP settings that control how systems would work and feed into each other, for example inventory settings such as "First In First Out”, and “Last In First Out”, planning settings “master production plan” and customer order entry for invoicing. These change during the implementation and the longer the implementation takes, the larger the problems that result may be. When master data structures are poorly set, the success of the ERP is negatively affected.

According to Glowalla and Sunyaev (2014), many organisations implement ERP systems so that they rectify data-quality problems. In most cases, the organisation will be moving from disparate systems to one ERP and the aggregation of such data into common data accepted by the ERP is a problem which can lead to ERP failure if not handled well. Lu Zhang, Huang, Xu, and Technology (2012) also noted that organisations that introduced data-quality training, communication and data-quality controls were more successful in their ERP implementations.

2.5 Information System Theories Pertaining to this Study.

2.5.1 Technology, Organisation and Environment Context (TOE) Framework

Odhiambo (2013), stated that it is important to have a good knowledge of the contextual settings of low-income countries so as to be able to implement an ERP system properly. He went on to say that a system implementation is affected by the state of the entity and its

environment. The major thrust of the Technology-Organisation-Environment (TOE) framework) is to "gain an understanding of the circumstances which surround an entity" Baker (2012).

According to Oliveira and Martins (2011), technological context focuses on the embracing of new and existing technologies which are relevant to the organisation. Boulineau et al. (2008), explained Organisational Context in the form of the entity's size, scope and number of employees employed by the organisation. In his definition of environmental factors, Bernroider (2008) refers to the eco-system in which an organisation exists and operates; this could be in the form of competitors, government regulation and the industry at large. Figure 2-2 TOE Framework shows the TOE Framework, (Tornatzky, Fleischer, & Chakrabarti, 1990).

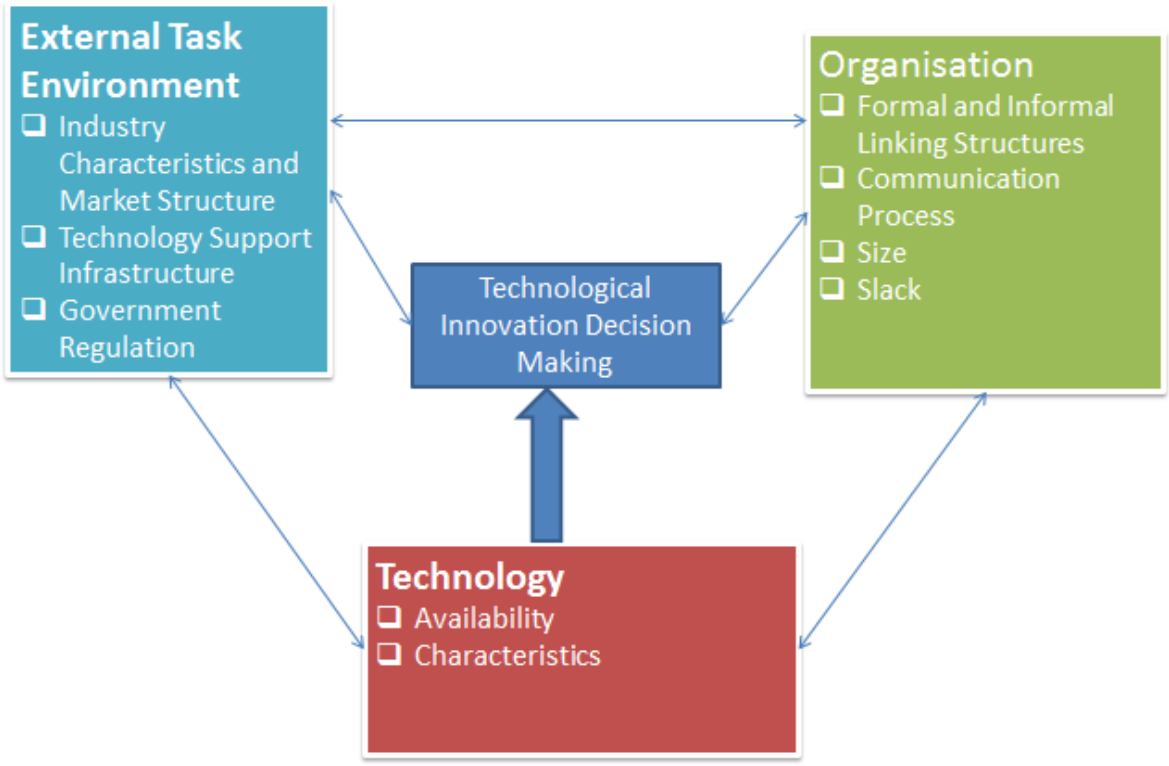

Figure 2-2: TOE Framework.

Lotfy (2015) suggested that ERP implementation success factors can be analysed using the domains of the TOE framework (model). He classified various dominant success and failure factors into the three dimensions (Technological, Organisational and Environmental) as shown in Table 2-6: Classification of Dominant Success Factors.

Table 2-6: Classification of Dominant Success Factors.

Contexts	Dominant Success Factor
Technological Context	i. ERP Flexibility ii. Data Migration iii. Degree of Customization and Flexibility
Organizational Context	iv. Senior Management Support v. Change Management and Communication vi. User Training vii. Business Process Re-Engineering viii. User Acceptance ix. Knowledge Transfer
Environmental Context	x. Project Governance xi. Vendor Support and Implementation Resources

2.5.2 DeLone and McLean Information System Success Model (1992).

DeLone and McLean (1992), developed an interactive model which they used for identification of indicators that contribute to Information Systems (IS) implementation success. Goodhue and Thompson (1995), undertook research during the period 1981 to 1987, which involved 180 research papers, to identify the six major dimensions of successful systems implementation. Delone and McLean (1992) defined six domains of system implementation success which are: the quality of the system, quality of the information, satisfaction of users, system use, impact on the organization and impact on individuals. Figure 2-3: DeLone and Mclean Model illustrates how these dimensions are related.

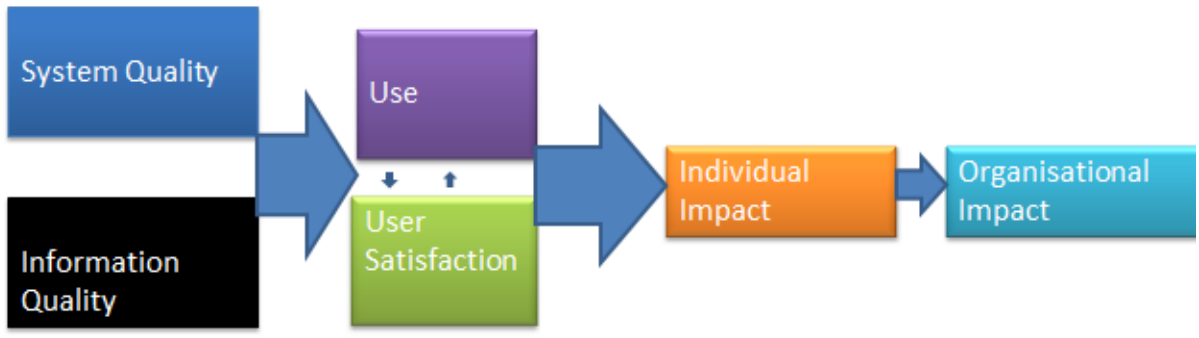

Figure 2-3: DeLone and McLean Information System Success Model (1992).

The dimensions are defined as follows:

I. **System Quality** – the measure of the information processing system

II. **Information Quality** – the measure of information system output

III. **Use** – the recipient consumption of the output of an information system

IV. **User Satisfaction** – the recipient response to the use of the output of an information system

V. **Individual Impact** – the measure of the effect of information on the behavior of the recipient.

VI. **Organizational impact** – the measure of the effect of information on organizational performance. (DeLone & McLean, 1992)

However, the study that was carried out by (Bossen, Jensen, & Udsen, 2013), declared DeLone and McLean's theory as not adequate because it was not tested scientifically on the dimensions and it lacks empirical evidence.

2.5.3 Updated DeLone and McLean Information Systems Success Model (2002, 2003).

DeLone and McLean conducted further research of their literature and put a major emphasis on service quality. Figure 2-4: Updated D&M IS Success Model shows the IS success model as propagated by McLean (2003).

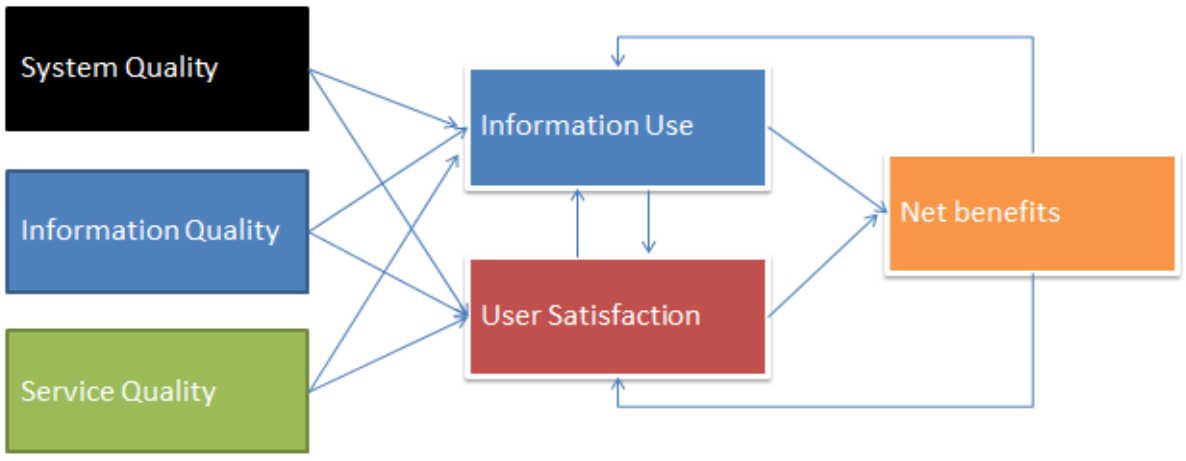

Figure 2-4: Updated D&M IS Success Model (2002, 2003).

I. System Quality

The quality of the system is defined as the manner in which the system performs its intended functions, (Bharati & Chaudhury, 2004). As indicated by DeLone and McLean (2003), system quality comprises specific system abilities which enable the users to make informed decisions, for example, they should be easy to use and easy to understand and learn (Whittal, Robichaud, Thordarson, McLean, & Psychology, 2008). System quality also covers system flexibility which is explained as a possibility of changing or enhancing the system functionality in cases where there are new requirements from business, (Nelson, Todd, & Wixom, 2005). Ease of use is explained as how simple it is for a new user to use the application while ease of learning is known as the extent or level of effort required to understand an ERP system. Ideally it should not require a lot of effort (DeLone & McLean, 2003).

II. Information Quality

This is also referred to as the acceptability of the output of the data from the system. McLean (2008) indicated that information quality measures how the users are satisfied with the system output, for example, the reports should contain accurate information; if the information extracted is not accurate then there will be trust and integrity issues and the system can fail, (Althonayan & Papazafeiropoulou, 2011). Quality of information is further categorized into five aspects namely accuracy of data, timeliness, completeness, structure and relevancy (DeLone & McLean, 2003). Accuracy is the user satisfaction that is derived when the output of the information is correct. Timelines refer to the way users of the system would expect the information to be up to date (current). Completeness refers to how comprehensive the output of the information is from the system. Relevancy refers to the way users look at how the information is presented, in terms of user friendliness and ability to make quick decisions (DeLone & McLean, 2003).

III. Service Quality

This refers to the internal and outside support that is provided by a vendor or internal IT support department to the users of the system (Petter & McLean, 2008). The quality of service is broken down into four categories namely reliability, empathy, responsiveness and assurance as derived from Petter & McLean (2008). Reliability is a measure of how business perceives its IT support from a vendor. DeLone & McLean (2003) defined empathy as being the behavior of the service provider in understanding the needs of the users and the speed of responses given in addressing their needs, as well as the support given to the users in their times of need. In most cases, users request service providers to provide urgent assistance but service providers may classify it

differently and take a longer time to address the user requirements. This causes users to classify their service providers as not reliable and providers of poor service.

IV. Use, Intention to Use and User Satisfaction

DeLone and McLean (2003) indicated that measuring use is a complex activity with many dimensions. User satisfaction refers to the feelings of users and perceptions as well as attitudes towards ERP system activities that they are involved in (Raymond, 2011). DeLone and Mclean (2003) further described user satisfaction as the response shown by users to system use as well as how they utilize and regularly refer to the system in their daily work.

V. Net Benefits

Net benefits refers to the gains achieved through the use of a system (Althonayan, 2008). The measurement of the benefits or consequences will depend on the purpose or the business case of the system, which is normally prepared in advance in a document, that is being evaluated (Pitter & McLean, 2008). DeLone and McLean (2003) combined impact measures and formed a single category termed "net benefits". 'Net benefits' is a preferred term to 'impact' because impact may signify negative or positive effects and there will be confusion when some benefits are bad. Another point of discussion in terms of net benefits is the beneficiary. There are different participants in system implementation who have different expectations of what they call benefits accruing to them.

2.6 Conceptual Framework

The conceptual framework explores the success factors which affect entities' ability to successfully implement SAP ERP in KwaZulu-Natal. As indicated by (Alaskari, Ahmad, & Pinedo-Cuenca, 2014), dominant system implementation success factors are not sufficient. To create a proper conceptual framework for SAP ERP implementation success in KwaZulu-Natal, this research combined the TOE Framework, the DeLone and Mclean Updated Information Systems Success Model (2002, 2003) and also used the compiled nine system success factors identified in the literature discussed above.

Figure 2-5: Conceptual framework, explains the conceptual framework of the success of SAP ERP implementation in KwaZulu-Natal. The arrows from the nine factors to the Implementation Success show the relationship of these success factors, classified into technology, organizational and environmental and implementation success.

The Conceptual framework has largely been based on the TOE Framework and the Information System Success Model (ISSM). The 9 success factors have been split into the 3

dimensions of the TOE Framework and these are mapped into success factors which are largely derived from the literature reviewed above. Success factors have not been included in the model. However, the success criteria that is used in the Information System Success model is included as part of the model.

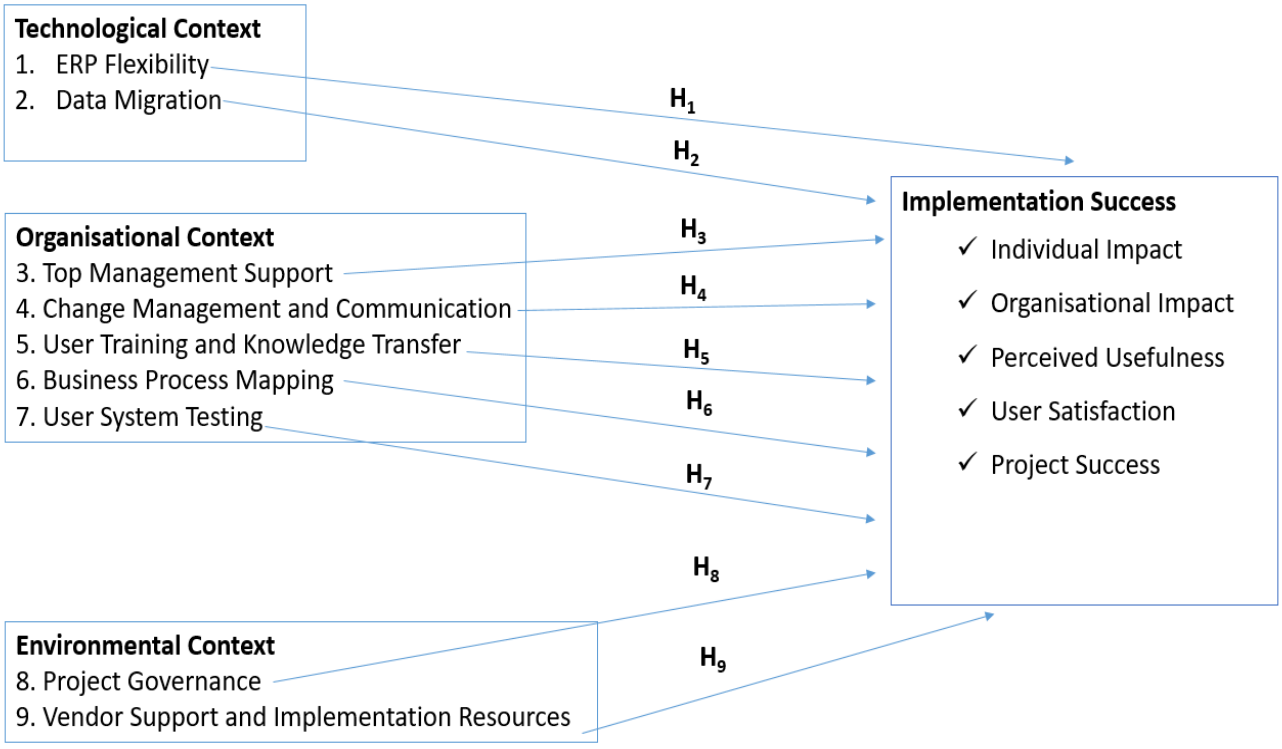

Figure 2-5: Conceptual Framework

The research hypotheses based on figure 2-5: Conceptual Framework are:

Hypothesis H_1

There is a significant positive relationship between ERP flexibility and Implementation Success.

Hypothesis H_2

There is a significant positive relationship between data migration and Implementation Success.

Hypothesis H_3

There is a significant positive relationship between Top Management Support and Implementation Success.

Hypothesis H_4

There is a significant positive relationship between change management and communication and Implementation Success.

Hypothesis H_5

There is a significant positive relationship between user training and knowledge transfer and Implementation Success.

Hypothesis H_6

There is a significant positive relationship between Business Process Mapping and Implementation Success.

Hypothesis H_7

There is a significant positive relationship between System User Testing and Implementation Success.

Hypothesis H_8

There is a significant positive relationship between Project Governance and Implementation Success.

Hypothesis H_9

There is a significant positive relationship between Vendor Support and Implementation Resources and Implementation Success.

2.7 Success Indicators

2.7.1 Perceived usefulness

This is defined by Venkatesh and Davis (2000) as "the degree to which a person believes that using a particular system would enhance his or her job performance". Hess, McNab, and Basoglu (2014) also referred to useful as the "ability to take advantage of the system benefits" and indicated that there should be a good connection between perceived usefulness and how the information system is being used, as has been extensively verified in information system research. All the studies conducted for this study assumed that there is a direct relationship of perceived usefulness with intention to use as well as the use of the ERP systems.

2.7.2 User Satisfaction

Previous research has shown that the satisfaction of users plays a critical role in measuring information success, (Rajan & Baral, 2015). It is clear that an information system is successful

if its users are satisfied. According to Rajan et al (2015), there is a correlation between intention to use, or actual use, with project success.

2.7.3 Individual Impact

Impact does not have a clear definition as a measure of ERP implementation success. However, there is a close relationship with employee's performance, and as a result, improving users' performance is clear evidence that the system has an impact. According to DeLone and Mclean (2008), positive impact of the system on an individual can be measured when the way in which decisions being made is understood, an improvement in decision making can be noted, and if there is a noticeable difference in the user activity in the system, and an improved perception by the top management regarding the system.

2.7.4 Organisational Impact

This refers to how the information systems affects business performance. Ram et al. (2013), conducted various research studies using different metrics to measure the performance of entities. Examples of organizational impact include: cost reduction, increase in sales volumes, and increase in return on investments, as well how the system is used to resolve business deficiencies and able to generate tangible benefits.

2.7.5 Project Success

There are certain measures of project success that, in this study, are used to measure whether an information-system implementation project is successful; these are measured in terms of delivery time, actual expenditure, quality of the system and deviation from the original scope.

2.8 Research Gap

"It has been discovered in most recent research that more than fifty percent of ERP Implementation projects fail to reap benefits" (Mukwasi, Seymour, & Enterprises, 2012). Mala (2015), stated that ERP failure can lead to the bankruptcy of an organization. Currently the research that was conducted in this field has not been focused on southern Africa and has not been specific to SAP implementation failures, although a sharp increase in SAP system implementations in municipalities and state-owned entities in South Africa is being witnessed. According to (Mushavhanamadi & Mbohwa, 2013), unlike in developed countries, little research on ERP systems implementation was carried out in Africa, and South Africa in particular. It is therefore important to carry out this study on factors affecting SAP ERP implementation in KwaZulu-Natal.

2.9 Chapter Summary

In the need to promote the field of SAP, this research has given serious attention to SAP ERP implementation in KwaZulu-Natal. This chapter emphasized the factors affecting ERP implementation success as identified in various studies across the globe.

Chapter 3 : RESEACH METHODOLOGY

3.1 Introduction

This chapter will discuss how this research has been designed and the research approach taken by the researcher. The researcher followed a quantitative research approach and collected data using an online questionnaire; data was analysed using an SPSS data-analysis tool. The following chapter (4) explains this in detail.

3.2 Research Design

This study used a questionnaire (survey) approach as it is useful and effective for non-experimental research , Latip, Omar, Jing, and Shahrom (2017). This was used to establish factors leading to the success of SAP ERP implementation at state-owned entities in KwaZulu-Natal. Mathers, Fox, and Hunn (2007) outlined the advantages of using a questionnaire; one of these is that it has internal and external validity. A survey can reach a wide selection of users and the results of the selected population can be representative of the whole population. Surveys have ethical advantages as they do not expose individuals and are flexible in that respondents can respond without any undue influence or intimidation.

3.3 Research Approach

Of the two broad categories of research methodology (quantitative and qualitative), this research followed the quantitative approach. Quantitative research relies primarily on collection of quantitative data where researchers put their theories to the test and the data collected have to be accurate and fit into rating scales. Conversely, qualitative research hinges on the collection of qualitative information through conducting interviews, observation, taking notes in the field and asking open ended questions. In this study the researcher used quantitative research because it quantifies factors that are projectable to a larger population. The other reasons why the researcher chose quantitative study is that it is economical, easier to render than qualitative enquiries, and obtains quick responses. Data that are gathered using quantitative methodology are easily measured using statistical tools.

3.2.1 The Survey Questionnaire Layout

A questionnaire is a series of questions a participant is requested to answer. A participant can be given an opportunity to answer questions that require a description of events or may provide responses that are based on a Likert scale, for example ‘strongly agree’, ‘neutral’ etc. The questionnaire used in this study consisted of mainly Likert scale data.

The structure of the questionnaire had an introduction and three sections that covered demographics data, ERP success factors, and SAP ERP implementation evaluation.

Table 3-1: Questionnaire Layout

Section	Topic	Items	Question Type	Intended participant
Part 1	Demographic Information	6	Nominal scale Dichotomous scale - option (Tick the correct box)	Using online surveys.
Part 2 A	Organisational Context Factors	29	5-point Likert Scale from "strongly disagree" to "strongly agree"	Using online surveys.
Part 2 B	Environmental Context Factors	7	5-point Likert Scale from "strongly disagree" to "strongly agree"	Using online surveys.
Part 2 C	Technological Context Factors	8	5-point Likert Scale from "strongly disagree" to "strongly agree"	Using online surveys.
Part 3	Implementation Success	16	5-point Likert Scale from "strongly disagree" to "strongly agree"	Using online surveys.

Part 1: **Demographic Information**

The researcher included information on gender (male/female), current position in the company (11 categories), qualification (5 categories), work experience (5 categories), and nature of SAP implementation in their companies (3 categories) and whether they received training (2 categories). None of the questions had dependency on any preceding questions.

Part 2A: **Organisational Context Factors**

In this section, questions were asked to investigate organisational factors affecting SAP implementation. There were classified into Top Management Support (TMS), Change Management and Communication (CMC), User Training and Knowledge Transfer (TKT), Business Process Mapping (BPM) and System Testing.

Part 2B: Environmental Context

The purpose of the questions in this section was to investigate the environmental factors affecting SAP ERP implementation in KwaZulu-Natal. Respondents were required to indicate how project management and vendor support and implementation methodology contributed to the success of their projects. A total of seven questions were used to highlight the effect of the environmental factors on implementation success.

Part 2C: Technological Context

This section investigated the effect of technological factors on implementation success focusing on ERP flexibility and data migration. A total of eight questions was asked to investigate this aspect.

3.4 Research Population

The term population refers to the entire target group that the researcher is going to research (Gilbert (2008). It is also known as the total number of respondents in an area where the study will be done. In this research, the population was comprised of all the users of the SAP ERP system for Msunduzi Municipality, Umgeni Water and KZN Legislature; the users came from various departments and various ranks within their workplace. The research targeted only users of SAP's system and therefore users of other systems were not allowed to take part in the research.

3.5 Sampling

Due to the large population size, the researcher could not gather responses from all the users of SAP within the selected three state-owned entities. Although the researcher had the option of using a census where all the users of the SAP ERP system would be given a chance to respond to the questionnaires, this was an impossible task due to the potentially large number of respondents. Moreover, a census has limitations of time and costs (Buckingham & Saunders, 2004). "A census study occurs if the entire population is very small or it is reasonable to include the entire population", (Baffour, King, & Valente, 2013). It is called a census because every member of the population is given a chance to respond to the questionnaire. To overcome the challenges noted with a census, the researcher adopted a sampling approach to reduce costs, time and human resources effort (Lin, Tang, Yao, & Systems, 2013). Sampling is also explained as a scientific approach in which a sample representing the entire population is extracted and used to predict the behaviour of the entire population (Gentles, Charles, Ploeg, & McKibbon, 2015).

3.6 Sampling Techniques

There are two broad classifications of sampling techniques namely probability and non-probability sampling (Fox & Bayat, 2008). Probability sampling involves all the participants and each have an equal and known chance of being selected as respondents in the study. It is also known as random or quantitative sampling where the respondents are selected based on chance or probability following the principles of random selection (Sekaran & Bougie, 2010). According to van den Bergh et al. (2012), "probability sampling can be classified into simple random, systematic random, stratified random, cluster and multi-stage". The alternative, non-probability sampling or qualitative sampling involves the selection of respondents based on the judgement of the person conducting the research, (Rajkoomar, 2013). Good examples of non-probability sampling are snowball, purposive, self, and convenient and quota sampling.

The researcher used non-probability sampling, in particular quota sampling. In this sampling approach, respondents were identified proportionately to the target population. According to (Yang & Banamah, 2014), quota sampling is done in two stages. In stage one the researcher identifies the population and stage two the population is divided into similar groups (strata) and a calculation is done of the proportion of the group to the target population. The first stage involved the identification of the three state-owned enterprises in KwaZulu-Natal province, which represented a municipality, a provincial department and a water management authority. The researcher chose 150 users per entity. Stage two involved grouping these respondents into various classifications, namely project sponsor, project manager, change/training manager, business process leads, super-users and system users.

3.7 Sample Frame and Size

Of the three entities, the desired sample was 150 and the sample had three project managers, three project sponsors, three change/training managers, 33 business process leads, 33 super-users and 75 system users making a total of 150 respondents out of a population of at least 240 users. The figure of 150 respondents was calculated based on a confidence level of 95% and confidence interval of 5.

3.8 Data Collection

The researcher used non-probability sampling to establish the target organisations to be researched and specifically used purposive sampling and quota sampling to pick respondents for the interview. This was decided on because the selection is dependent on the researcher's judgement and is made by choice and not chance. The researcher picked all the system users

for SAP knowing beforehand that not all of them will respond. According to Gallego and Delincé (2010), non-probability sampling has advantages of usability meaning that you can have small samples which are time and cost effective.

The questionnaires were distributed by the researcher through an online survey to cover many respondents in a short space of time. The researcher explained the purpose of the study and its planned use and requested respondents' consent to be part of the study. The questionnaires were distributed to the users of the SAP system in the three entities in KwaZulu-Natal, identified above.

Table 3-2: List of the Type of Respondents per Category.

Category	SAP Client (System Buyer)
1	Project Sponsor * 3
2.	Project Manager * 3
3.	Change and Training Manager * 3
4.	Business Process Leads * 33
5.	Super Users * 33
6.	Users * 75

The researcher ensured that the project implementers received the questionnaires through emails, using an automated tool that sends a survey. Logistically, the researcher obtained the phone numbers and email addresses of all the intended respondents and used the online dispatch tool to send and receive feedback from the respondents. He followed up with emails and phone calls to make sure that all feedback had been received.

3.9 Analysis of Quantitative Data

According to De Vaus and de Vaus (2013), there are "three broad factors that affect how data is analysed", which include "the level of measurement of variables, the use of data for descriptive or inferential purposes and ethical considerations". In this study, the researcher used descriptive statistics, such as means and standard deviations, whose frequencies were represented in tables and graphs. Wilcoxon tests were also carried out to check if there was significant agreement or disagreement for the various items in the questionnaire. The researcher also used linear regression analysis to estimate the coefficients of the linear equation involving several independent variables (the 9 success factors) that best predict the value of the dependent

variable, IMPSUC, and a One-Sample Kolmogorov-Smirnov Test to test for normality. The analysis of these were facilitated by the use of the statistical software SPSS V24.

3.10 Reliability and Validity

The researcher assessed the reliability and validity of the study model in order to interpret it properly. According to Csikszentmihalyi and Larson (2014), reliability means consistency; if you run the same test six times, you will get the same results. He further explained that a test is classified as valid if it measures what it is supposed to measure and a test which is valid is reliable. In this study consistency and validity were measured and the single measures were formed by calculating the average agreement of scores in each construct. As a result, few items were dropped from the composite measure because they did not consistently measure what the other items in the scale were measuring and thus affect reliability.

The researcher conducted a pilot study inorder to check the validity of the questionnaire. The researcher conducted a 'mock version' (trial), also known as a feasibility/pilot study, in preparation for the complete study. Polit (2015) indicated that a pilot study is a mock test of the research instruments, questionnaires, and interview plans. This research's pilot study was conducted when the reseacher had a good understanding of the research study, its objectives, questions and methods.

The pilot was tested on 10 SAP ERP system members working on a project site. This group represented all the IT ERP-system project stakeholders including project manager, change manager, business process owners, super users, users, trainers, functional consultants as well as technical consultants. The entity that was used in the pilot study is not among those used in the final research.

The aim of the pilot study was to:

- ✓ Understand the feasibility of the project in terms of time, cost and unforeseen events;
- ✓ Improve the study design before perfoming the actual study.

Useful feedback was received and the questionnaire was adjusted, taking note of the respondents' suggestions. A few questions which were initially not clear were clarified and some questions which seemed repetitive were replaced with others.

3.11 Ethical Considerations

Ethical consideration is critical for this research. The rights of respondents need to be respected and permission had to be sought from the three entities on which the research was centred.

According to Gilbert (2008), it is important to preserve the rights and integrity of human respondents involved in a research study. Umgeni Water, Msunduzi Municipality and KZN Legislature gave written authority to the researcher to conduct research and informed the SAP ERP users to expect some emails from the researcher. However, in the three cases the users were given the liberty to either respond to the questionnaire or not. This study was also sanctioned by the University of KwaZulu-Natal (UKZN) ethics committee, which granted ethical clearance (see Appendix C). According to Creswell and Poth (2017), respondents should be given sufficient details about any research before participating so that they do not feel used or exploited which may be regarded as unethical.

3.12 Chapter Summary

The researcher described the research design, approach and population of the study, and also explained sampling, sampling techniques and sample frame and size. The data-collection process, as well as the analysis of the quantitative data, and types of analysis such as regression, were explained. The researcher went on to highlight the ethical consideration governing data collection.

Chapter 4 : DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

The information that was analysed in this chapter was generated from a questionnaire which was made up of 66 questions divided into three, namely demographic data, ERP success and failure factors, and implementation success measures. In general, the researcher wanted to understand the factors that led to SAP ERP Implementation success in the public sector in KwaZulu-Natal.

4.2 Data Collection

The survey was carried out in KwaZulu-Natal over a period of three months (April to June 2018) on three state-owned entities that included a large municipality, a water management entity and a parliamentary entity, all of which run on a SAP ERP system. One hundred and fifty questionnaires were sent out in one week. All the questionnaires were sent out via a web-link sent through emails. Forty-seven of the questionnaires were received from the participating entities, indicating a response rate of 31%.

4.3 Biographic Analysis

4.3.1 Qualification of respondents

Table 4-1: Qualifications of Respondents.

Qualification	Matric	Certificate	Diploma	Degree	Masters/PhD	Total
Number	5	1	8	20	13	47
Percentage	10.6	2.1	17	42.6	27.7	100

The majority of the respondents, constituting more than 70%, were degree holders with 28% of them having a master's qualification and above. The remaining candidates all had qualifications ranging from matric to diploma.

4.3.2 Experience in using SAP

Table 4-2: Respondent Experience in Using SAP

	<5 years	5 - <10 years	10 - <20 years	20 - <30 years	Total
No.	17	15	13	2	47
Percentage	36.2	31.9	27.7	4.3	100

From Table 4-2: Respondent experience in using SAP, there are 17 (36%) respondents who have SAP user experience of less than 5 years, with 32% having between 5 and 10 years' experience in SAP. However, there is also a large number (28%) that have between 10 and 20 years' experience, with only 4% having up to 30 years SAP user experience.

4.3.3 Nature of SAP Implementation

Figure 4-1: Respondent Experience in using SAP shows the respondents' role in the implementation of SAP. All respondents indicated that they were involved in at least one of the three categories of projects and some of them were involved in all three categories. There were about 34% of the respondents who indicated that their project was a pure SAP implementation, while 33% indicated that they were involved in SAP upgrade (from old to newer version) and the rest, which constituted 29%, were involved in SAP enhancements (mini-projects) to correct certain processes and reports.

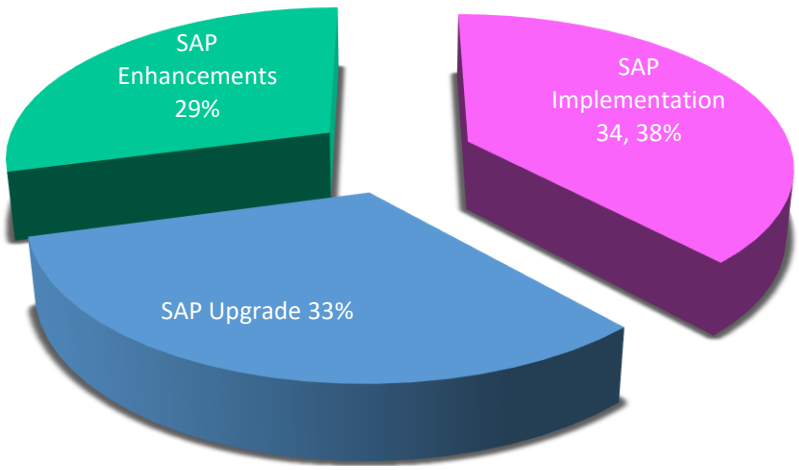

Figure 4-1: Respondent Experience in Using SAP.

4.4 Descriptive Analysis of ERP Success

4.4.1 Organisational Context

4.4.1.1 Top Management Support

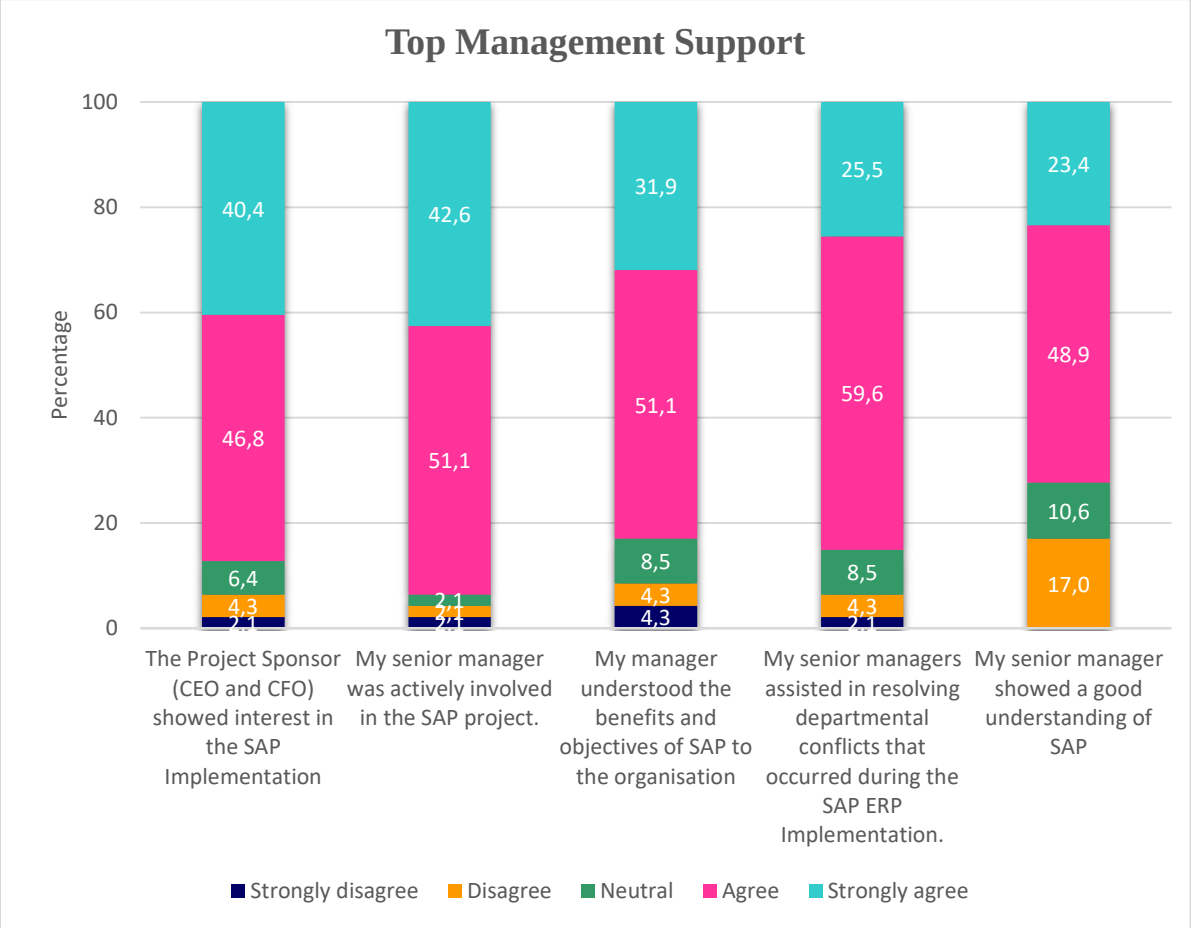

Figure 4-2: Top Management Support.

Figure 4-2: Top Management Support shows that the majority of the respondents agreed that there was top management support within their projects; 46.8% agreed that the project sponsor showed interest in the SAP implementations with 40.4% strongly agreeing. About 51.1% of the respondents agreed and 42.6% strongly agreed that their senior managers understood the benefit of SAP and were actively involved in the SAP project. A larger number of respondents (59.6%) agreed that their senior manager assisted in resolving departmental conflicts with a further 25.5% strongly agreeing. Almost 49% agreed that their senior managers showed a good understanding of SAP with a further 23.4% strongly agreeing. However, 17% also disagreed that senior managers showed a good understanding of SAP.

The results of the Wilcoxon test indicated that there was significant agreement that the project sponsor showed interest in the SAP implementation (z = -5.247. p < 0.0005, ***m*** = 4.19); senior

managers were actively involved in the project (***z*** = -5.544, ***p*** < 0.005, ***m*** = 4.30); managers understood the benefits and objectives of SAP to the organisation (***z*** = -4.703, ***p*** < 0.0005, ***m*** = 4.02); managers assisted in resolving departmental conflicts (***z*** = -5.122, ***p*** < 0.0005, ***m*** = 4.02), and managers showed a good understanding of SAP (***z*** = -4.267, ***p*** < 0.005, ***m*** = 3.79).

4.4.1.2 Change Management and Communication

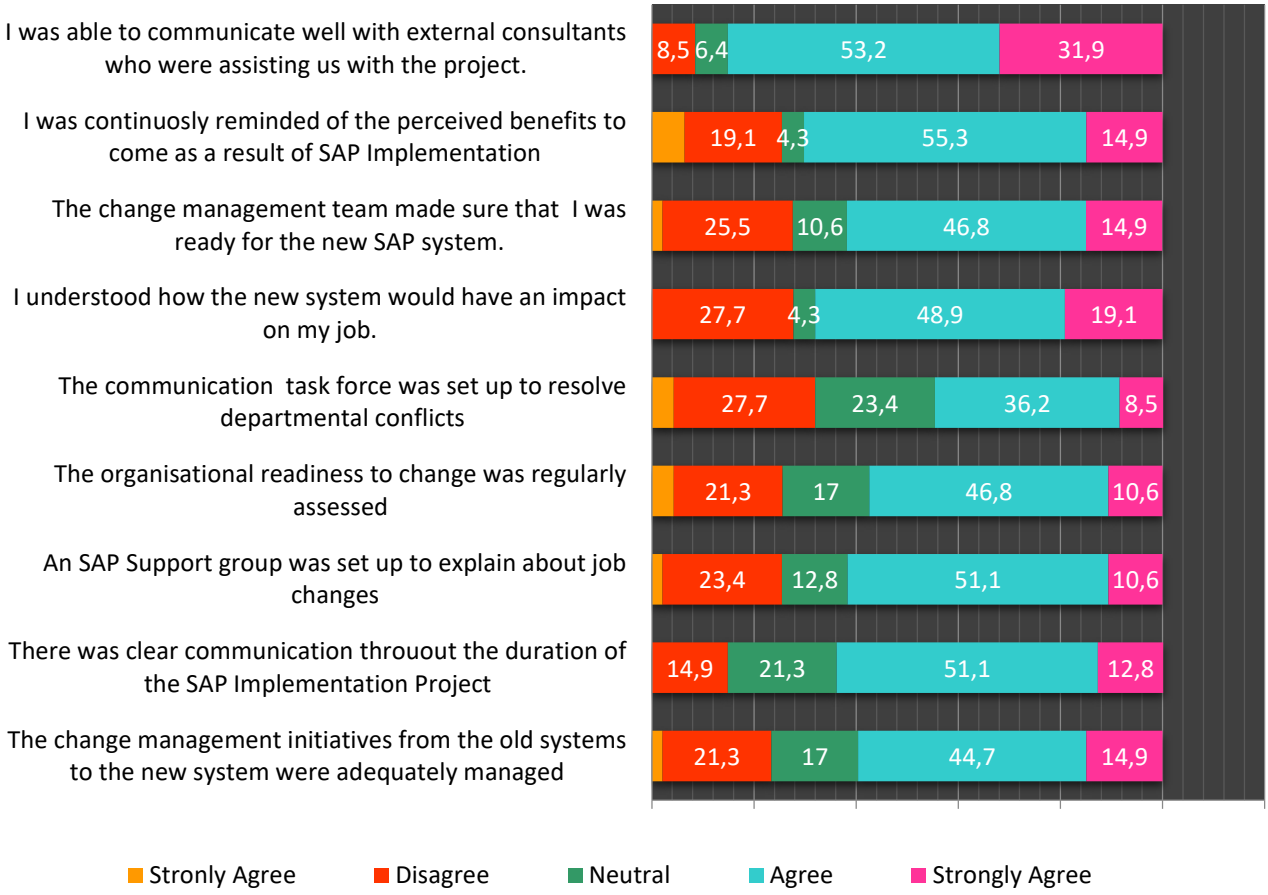

Figure 4-3: Change Management and Communication Factors.

Figure 4-3: Change Management and Communication factors, shows the analysis of the responses of the change management and communication factors. The results indicate that the respondents were able to communicate well with external consultants on their projects with 53.2% of the respondents agreeing and 31.9% strongly agreeing. The respondents were also agreeable that they were continuously reminded of the benefits of SAP with 55.3% in agreement and 14.9% who strongly agreed. The respondents expressed that their management team ensured that they were ready for SAP – 46.8% agreed and 14.9% strongly agreed. A notable percentage of the respondents 8.5% indicated that there was a communication task force in place and that they understood how the new system would impact on their jobs. Of the

users, 36.2% agreed to a set-up of a communication task force and 27.7% disagreed with 23.4% remaining neutral and the balance of 8% strongly agreeing.

Most of the respondents indicated that there was a regular assessment of the organisational readiness to change with 46.8% agreeing and 10.6% strongly agreeing. The respondents also agreed that change management activities were adequately managed with 44.7% in agreement and 14.9% in strong agreement. Fifty one percent of the respondents indicated agreement that there was clear communication throughout the duration of the project and that a SAP support group was set up to explain about SAP changes. However, for both communication and setting up of a support group, almost a quarter of the respondents disagreed that this was adequately done.

The results of the Wilcoxon Test (Appendix A, Table 6.2) showed a significant agreement among SAP users that the change management activities from the old system to new were adequately done ($z = -2.898$, $p < 0.004$, $m = 3.49$). The respondents also significantly agreed that there was clear communication throughout the duration of the SAP implementation project ($z = -3.901$, $p < 0.0005$, $m = 3.62$) and that they understood how the new system would have an impact on their job ($z = -3.344$, $p < 0.001$, $m = 3.45$).

The respondents also significantly agreed that the change management team made sure that they were ready for the new system ($z = -2.721$, $p < 0.007$, $m = 3.38$) and that they were continually reminded of the perceived benefits that will be realised as a result of implementing SAP ($z = -2.810$ $p < 0.005$, $m = 3.42$). Respondents also significantly agreed that they were able to communicate well with external consultants who were assisting with the implementation ($z = -5.289$ $p < 0.0005$, $m = 3.43$). The respondents also expressed significant agreement that a SAP support group was set up to explain about job changes ($z = -2.728$, $p < 0.006$, $m = 3.60$), however, there was insignificant agreement that the organisational readiness to change was regularly assessed ($z = -2.295$, $p < 0.022$, $m = 3.47$).

4.4.1.3 User Training and Knowledge Transfer

As per Figure 4-4: User Training and Knowledge Transfer, there is 51.1% agreement by respondents that training-needs assessment was done, with 25.5% in strong agreement. The respondents also agreed that a training program was put in place and adhered to, with 14.9% strongly agreeing. About 46.8% of the respondents agreed that they received adequate training on the new system with 12.8% strongly agreeing.

With regards to development of training materials specifically for their jobs, the respondents indicated 6.4% strong disagreement and 29.8% disagreement, 14.9 % of the respondents were neutral, 34.0% agreed and 14.9% strongly agreed.

A sizeable number of the respondents indicated that they disagree (38.3%) that their training material reflected changing system requirements, with 10.6% strongly disagreeing. Only 29.8% of respondents agreed and 8.5% strongly agreed.

In terms of sufficient training having been provided, 40.4% agreed and 14.9% disagreed. The respondents also indicated that their trainers knew their training content and were helpful, with 42.6% of them agreeing and 21.3% strongly agreeing.

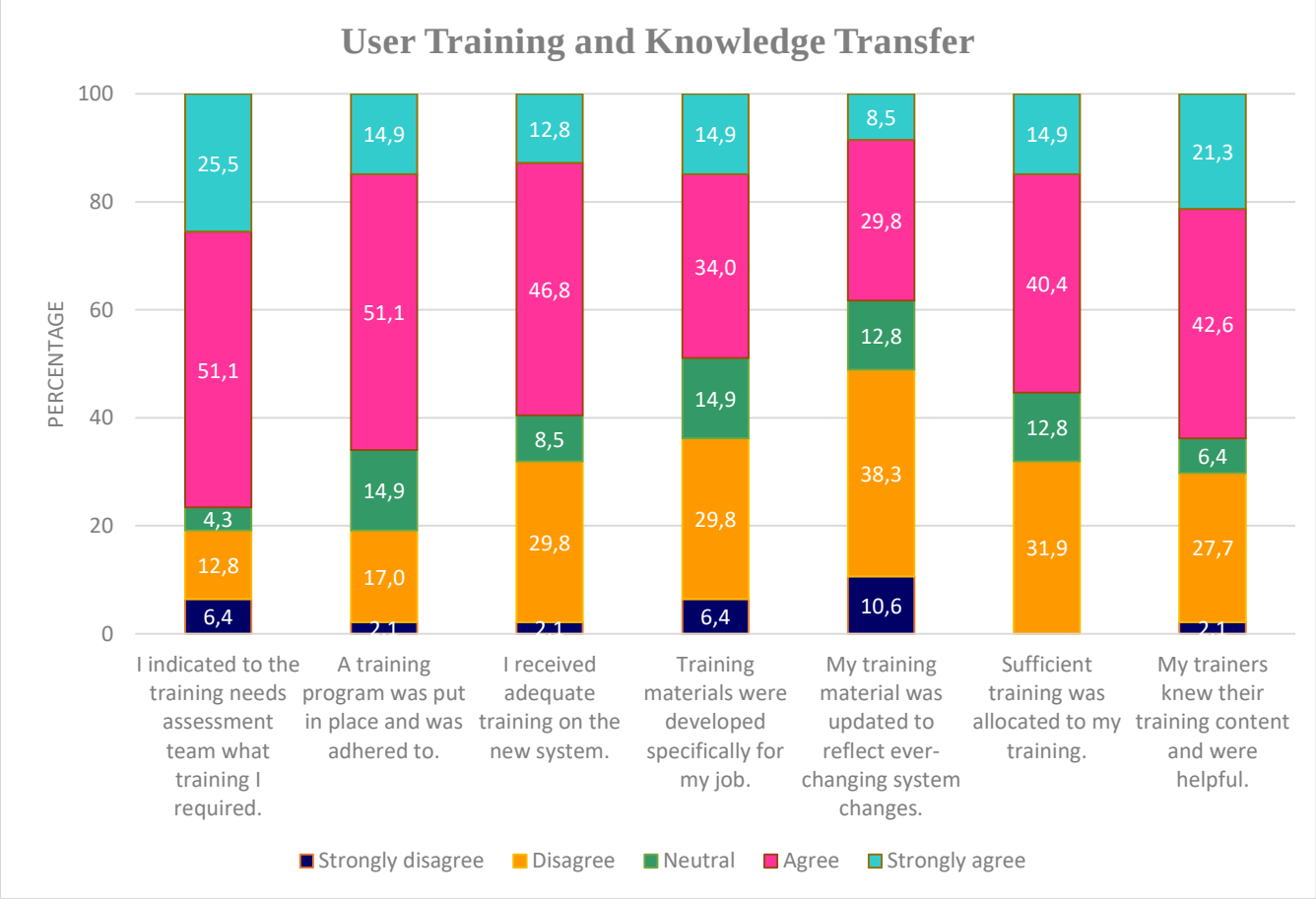

Figure 4-4: User Training and Knowledge Transfer.

As per Table 6-3 (see Appendix A), the results of the Wilcoxon test showed a significant agreement among SAP users that they informed the training team of the kind of training they needed (z = -3.655, $p < 0.0005$, **m** = 3.77) and that a training programme was put in place and adhered to (z = -3.470, $p < 0.001$, **m** = 3.60).

The respondents also significantly agreed that adequate training was granted on the new system (***z*** = -2.269, ***p*** < 0.023, **m =** 3.38) and sufficient time was allocated to the training (***z*** = -2.346, ***p*** < 0.019, **m =** 3.38). The SAP users also significantly agreed that their trainers knew their training content and were helpful (***z*** = -2.900, ***p*** < 0.004, **m =** 3.38). However, there was no significant agreement that training materials were developed specifically for their jobs (***z*** = -1.229, ***p*** < 0.219, **m =** 3.21) and no significant disagreement that training materials were updated to show ever-changing system requirements (***z*** = -0.710, ***p*** < 0.478, **m =** 2.87).

4.4.1.4 Business Process Mapping

As per figure 4-5 Business Process Mapping, the majority of the respondents expressed that they defined business processes for their roles and ensured that these were in line with other areas of business, with 42.6% of respondents in agreement and 40.4% strongly agreeing. Forty six percent of respondents agreed that they captured and documented their business processes accurately with a further 8.5% in strong agreement. The respondents also advised that they understood how their business processes could fit into SAP with 40.4% of respondents in agreement and 23.4% strongly agreeing. With regards to the current SAP business process as a reflection of their business, 44.7% of the respondents agreed that this was so and a further 12.8% strongly agreed.

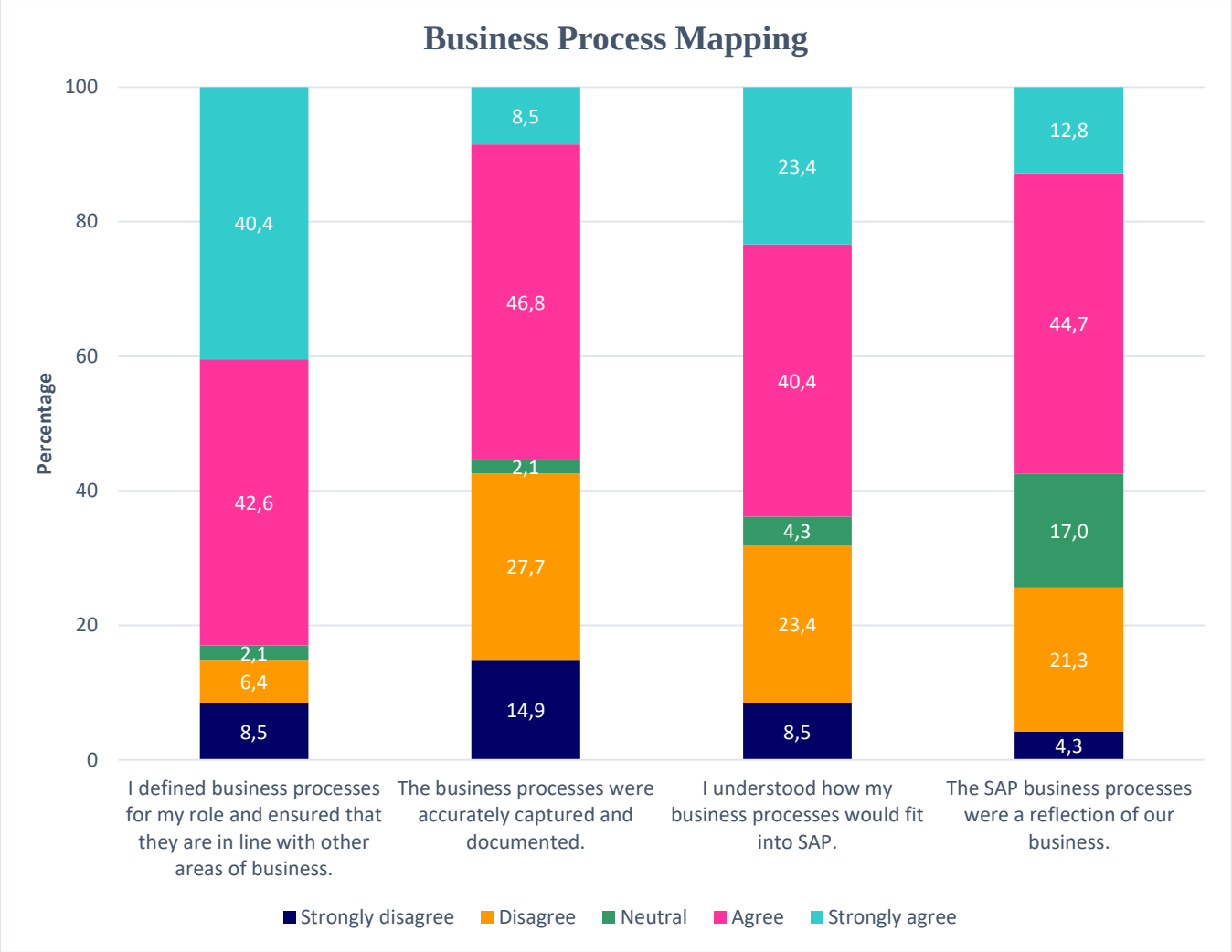

Figure 4-5: Business Process Mapping.

The results of the Wilcoxon tests (see Appendix A, Table 6-4) show a significant agreement among SAP users that they defined business processes to ensure that they are in line with other areas of business (z = -4.108, p < 0.0005, **m** = 4); understood how their business processes would fit into SAP (z = -2.295, p < 0.022, **m** = 3.47), and that SAP business processes were a reflection of their business (z = -2.369, p < 0.018, **m** = 3.40). However, there was no significant agreement regarding the accurate capturing and documentation of business processes (z = -0.226, p < 0.821, **m** = 3.06).

4.4.1.5 System Testing

The respondents showed an interesting trend regarding system testing: 38.3% indicated that they strongly disagree that all user acceptance testing and integration testing defects were solved before going live, and 19.1% disagreed. However, 23.4% agreed and 10.6% strongly agreed.

Almost 38.8% of the respondents strongly disagreed that all their business processes were tested to ensure they were functioning and 21.3% disagreed. However, 27.7% agreed and 6.4% strongly agreed.

Another observation regarding adequate integration testing of business process, as shown on figure 4-6: System Testing, is that 34% of the respondents strongly disagreed, 21.3% disagreed, 10.6% were neutral, 23.4% agreed and 10.6% strongly agreed.

Thirty two percent of the respondents agreed that adequate unit testing was carried out, with 10.6% strongly agreeing, 19.1% remained neutral and 12.8% strongly disagreeing.

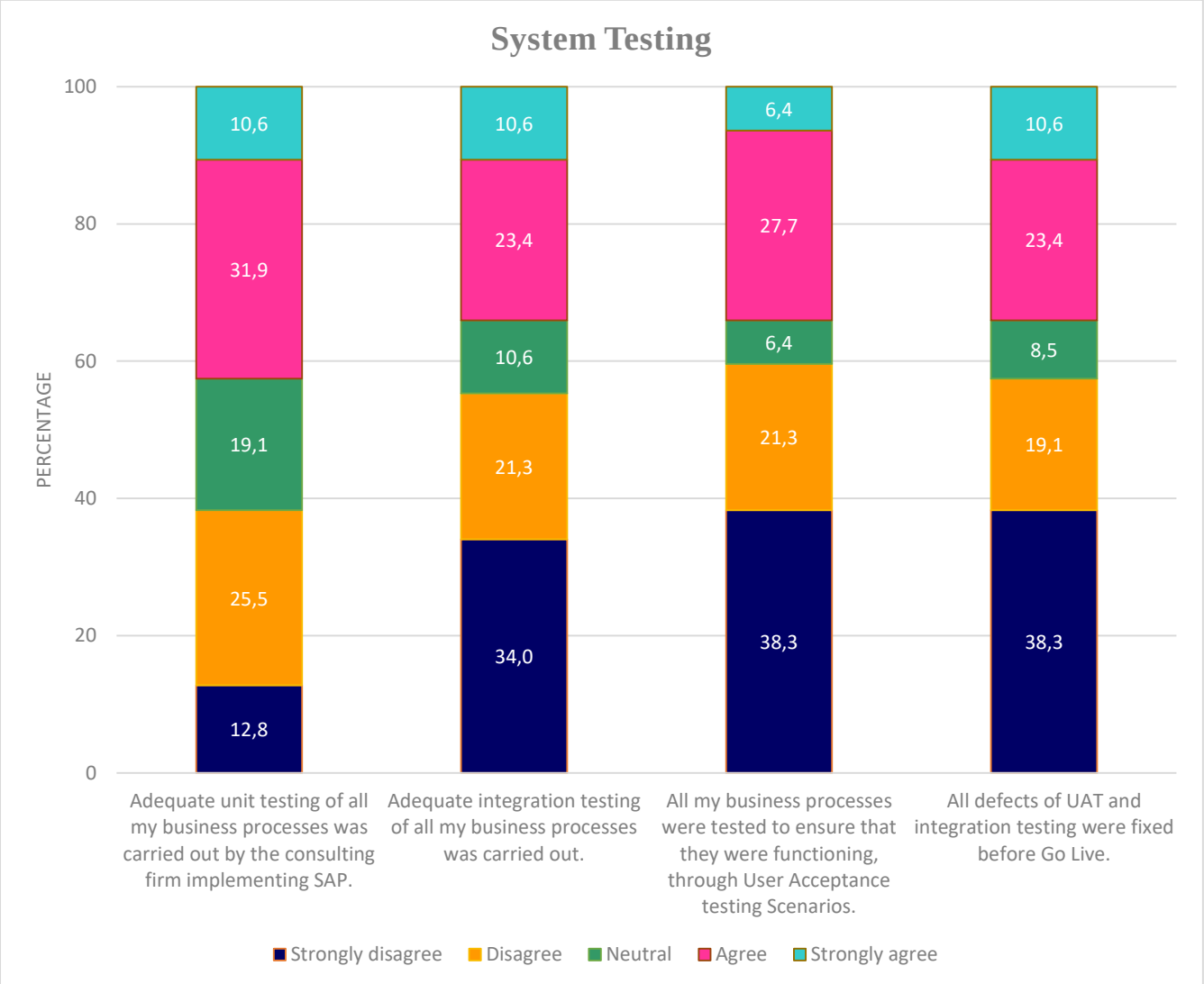

Figure 4-6: System Testing

The results of the Wilcoxon test (Appendix A, Table 6-5) shows an insignificant agreement to the fact that adequate unit testing of all business processes was carried out, (z = -0.068, p < 0.945, **m** = 3.02). However, there is a significant agreement that adequate integration testing

of all business processes was carried out (***z*** = -2.199, ***p*** < 0.028, **m** = 2.55), and there was also significant disagreement, through user acceptance testing (***z*** = -2.854, ***p*** < 0.004, **m** = 2.43), with the statement that all the business processes were tested to ensure that they were functioning well. The Wilcoxon analysis also showed a significant disagreement with the statement that all the defects of UAT and Integration testing were fixed before Go Live (***z*** = -2.461, ***p*** < 0.014, **m** = 2.49).

4.4.2 Environmental Context

4.4.2.1 Project Governance (Project Management)

Figure 4-7: Project Governance analysis, shows the results of the Project Governance variable. The majority of the respondents agreed that there was a project plan with clear start and finish dates, with 61.7% agreeing and 21.3% strongly agreeing. Many respondents (44.7%) also agreed that their duties and responsibility on the project were clear and 21.3% strongly agreed. In terms of project risks being well documented and communicated to project stakeholders, 55.3% of the respondents agreed and 12.8% strongly agreed. The respondents advised that all the areas of business operation were represented in the project team with 4.9% agreeing and 10.6% strongly agreeing. However, 21.3% of the respondents disagreed.

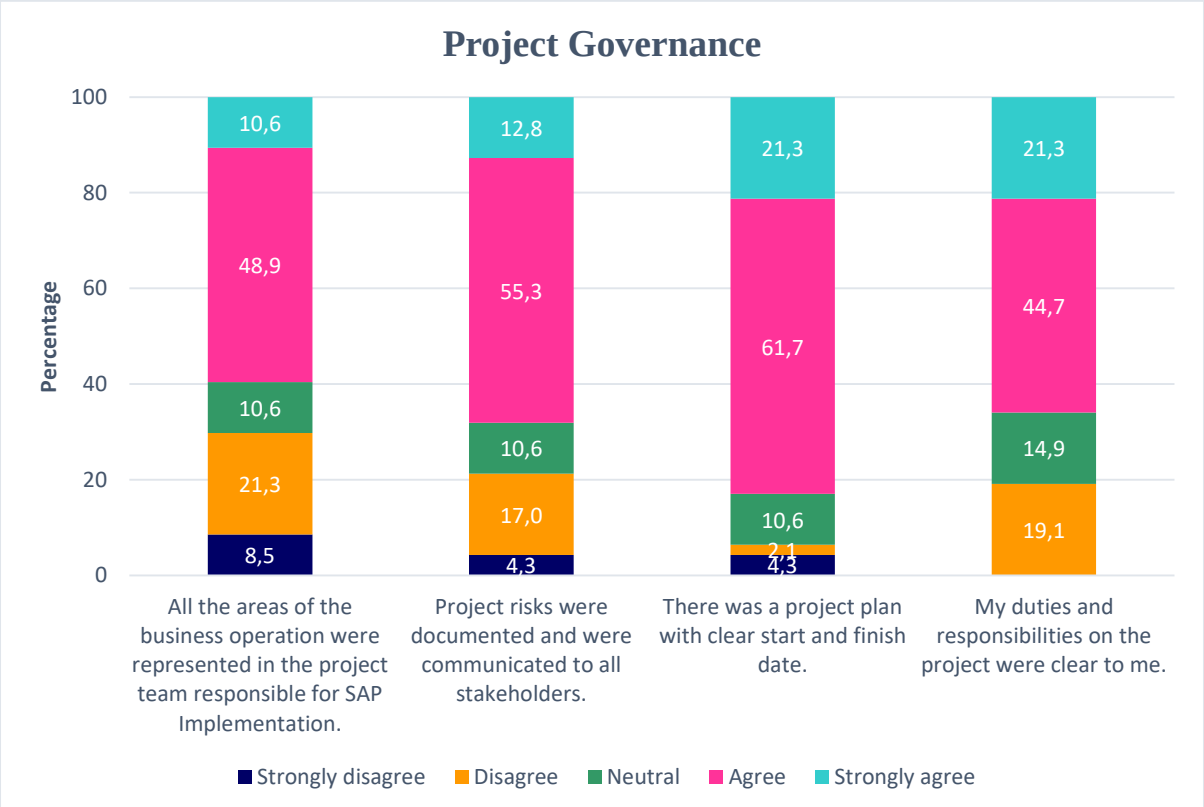

Figure 4-7: Project Governance Analysis

The results of the Wilcoxon Test (Appendix A, Table 6-6) show a significant agreement that project risks were documented and communicated to all stakeholders (***z*** = -3.143, ***p*** < 0.002, ***m*** = 3.55); the project plan had clear start and finish dates (***z*** = -4.767, ***p*** < 0.005, ***m*** = 3.94), and duties and responsibilities of respondents were very clear (***z*** = -3.844, ***p*** < 0.005, ***m*** = 3.68). The results of the Wilcoxon Test (Appendix A, Table 6-6) show that there was no significant agreement that all the areas of business operation were represented in the project team responsible for SAP Implementation (z = -1.725, p < 0.084, m = 3.32).

4.4.2.2 Vendor Support and Implementation Methodology

Thirty two percent of the respondents disagreed that they were confident with the system, with 8.5% strongly disagreeing. Of the respondents, 27.1% agreed and 19.1% strongly agreed.

With regards to the consultants being available to offer support when required, 27.7% participants disagreed, 4.3% strongly disagreed, 40.4% agreed and 17% strongly agreed.

Twenty five percent of respondents disagreed with the fact that the implementation team was knowledgeable and skilled, with 6.4% strongly disagreeing. Further to this, 19.1% of the respondents remained neutral, with 34% agreeing and 14.9% strongly agreeing.

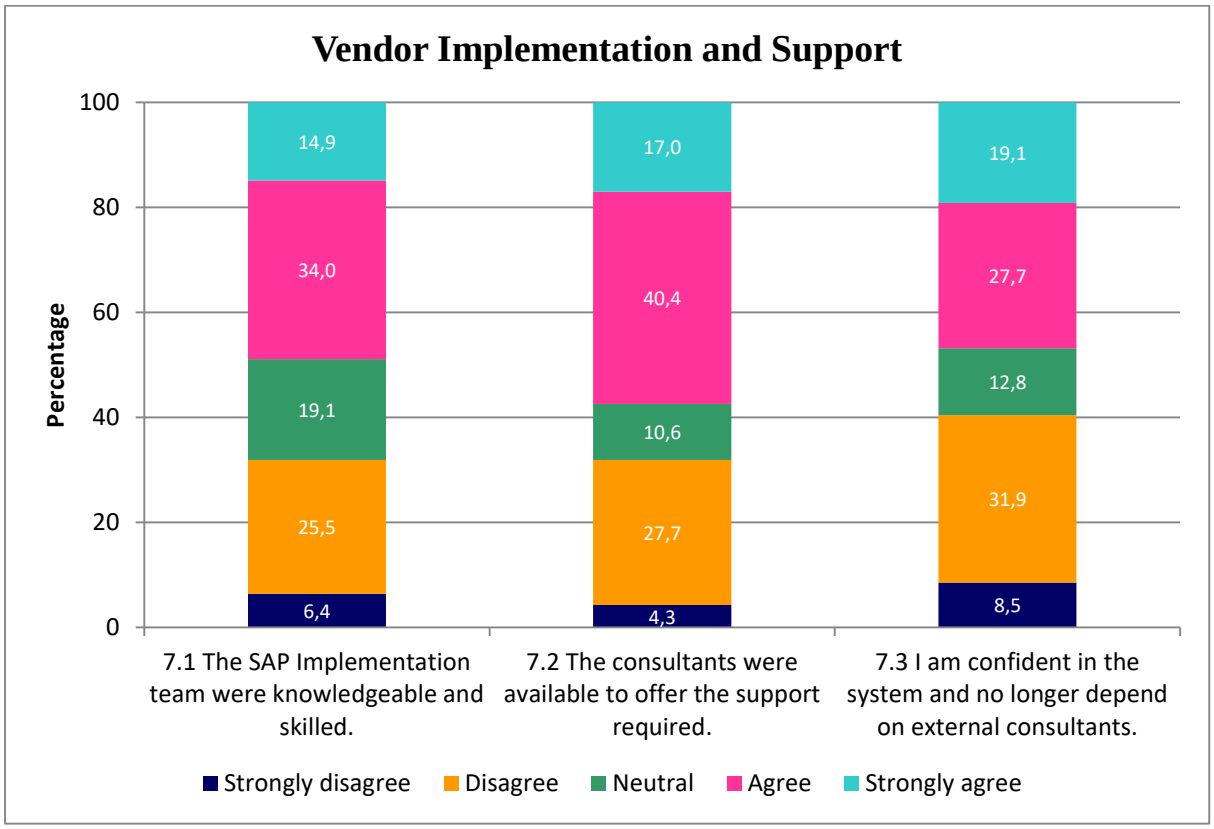

Figure 4-8: Vendor Support and Implementation Methodology

The results of the Wilcoxon Test (Appendix A, Table 6-7) shows significant agreement that the consultants were available to offer the support required (***z*** = 2.147, ***p*** < 0.032, **m** = 3.38).

However, there is no significant agreement by the users that the SAP consultants were knowledgeable and skilled (***z*** = -1.468, ***p*** < 0.142, **m** = 3.26). There was also no significant agreement that the respondents were confident in the system and no longer depend on external consultants (***z*** = -989, ***p*** < 0.323, **m** = 3.17).

4.4.3 Technological Factors

4.4.3.1 ERP Flexibility

As shown in Figure 4-9: ERP Flexibility, 46.8% of the respondents disagreed that the SAP system can accommodate new requirements in a short space of time, and 6.4% strongly disagreed; 23.4% of the respondents agreed and 12.8% strongly agreed.

With regards to the scalability and flexibility of the system, 10.6% of the respondents remained neutral and 34% and 8.5% disagreed and strongly disagreed respectively. However, 27.7% of the respondents agreed and 19.1% strongly agreed.

Twenty three percent of the respondents disagreed and 14.9% strongly disagreed that the internal support team was able to implement SAP upgrades on its own. A further 36.2% agreed and 8.5% strongly agreed.

Forty three percent of the respondents agreed that the SAP internal support team offers ideas on how IT can be leveraged and 10.6% strongly agreed. However, 17% disagreed with this

statement and 17% strongly disagreed.

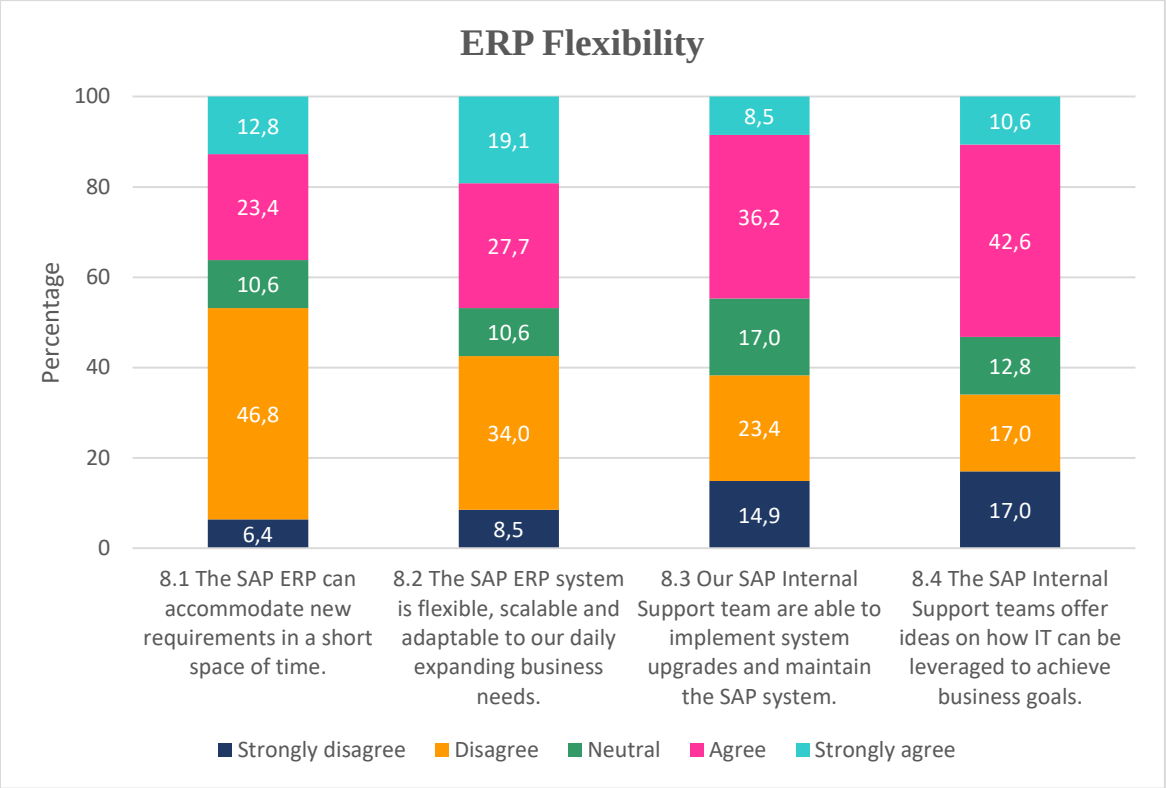

Figure 4-9: ERP Flexibility Analysis

The results of the Wilcoxon test (Appendix A, Table 6-8) showed no significant disagreement that the SAP can accommodate new requirements in a short space of time (***z*** = -0.486, ***p*** < 0.627, **m** = 2.89). The SAP users also showed no significant agreement that the SAP system is flexible, scalable and adaptable to their daily expanding business needs (***z*** = -0.883, ***p*** < 0.377; **m** = 3.15). There was neither agreement nor disagreement that the SAP internal support team was able to implement upgrades and maintain the SAP system (***z*** = -0.110, ***p*** < 0.912; m = 3). The respondents also showed no significant agreement that the SAP internal support teams offered ideas on how to effect leverage to achieve business goals (***z*** = -0.467, ***p*** < 0.640; **m** = 3.13).

4.4.3.2 Data Migration

As per Figure 4-10: Data Migration Analysis, most of the respondents agreed that the data were verified before and after loading, 48% agreed and 14.9% strongly agreed. However, with regards to practising load iterations (mock-runs), 34% of the respondents strongly disagreed that they had practised, with 17% disagreeing while 10.6% remained neutral. A significant number of interviewees indicated that their data was thoroughly cleaned before data uploads – 25.5% strongly agreed and 42.6% agreed. It has been noted also that 8.5% of the respondents strongly disagreed that the new system could accommodate all the data requirements of the old systems, while 34% disagreed, and 12.8% remained neutral.

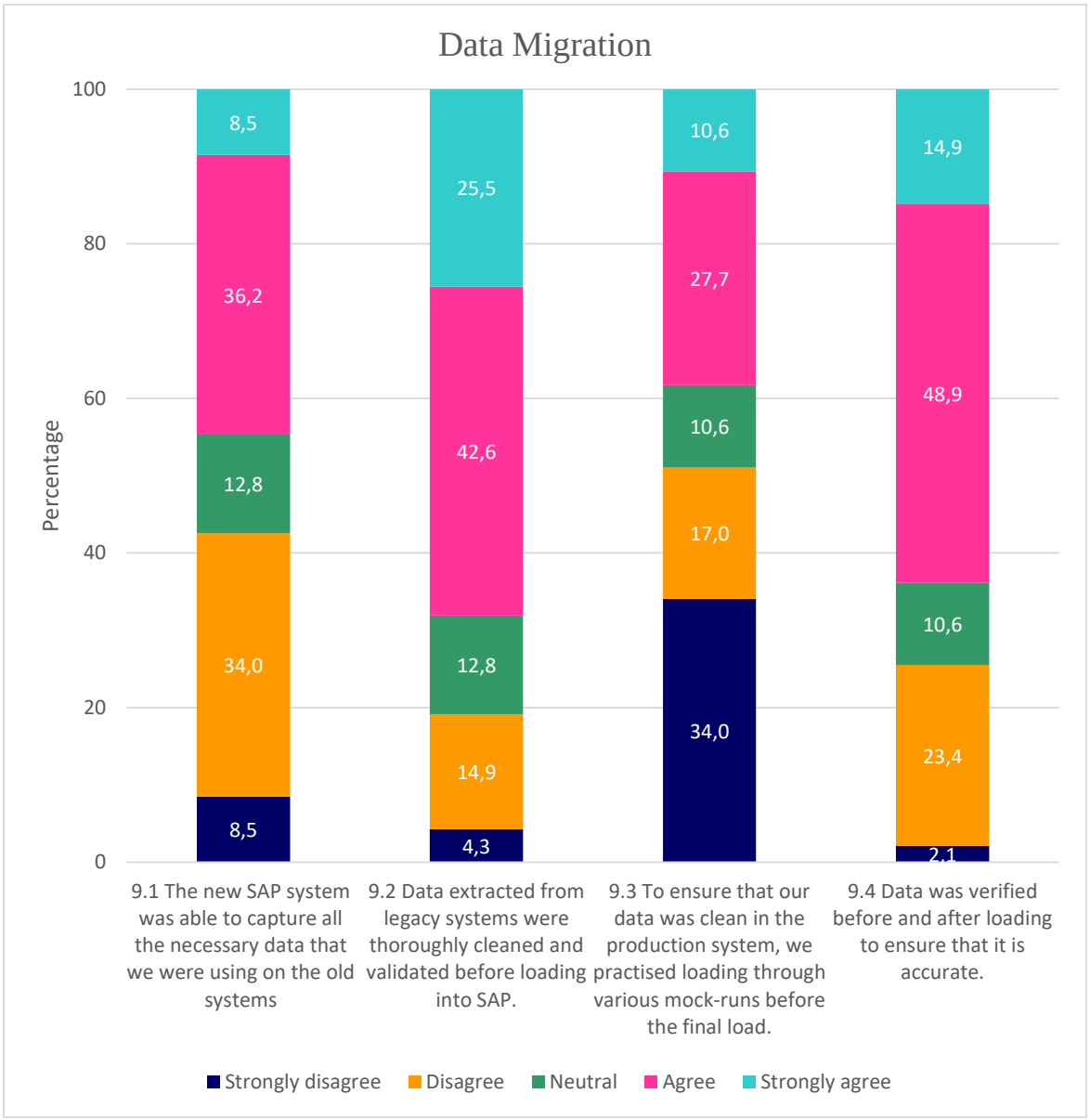

Figure 4-10: Data Migration Analysis

The output from the Wilcoxon test (Appendix A, Table 6-9) shows a significant agreement that data extracted from legacy systems were thoroughly cleansed and validated before loading ($z = -3.557$, $p < 0.05$;

m = 3.70) and that data were verified before and after loading to ensure that it they were accurate (***z*** = -2.955, ***p*** < 0.003; **m** = 3.51).

However, there is also significant disagreement that data loading was done through various mock-runs before the final load (***z*** = -1.915, ***p*** < 0.05; **m** = 2.64). The users also showed no significant agreement that the system was able to capture all the necessary data that was being used in the old system (***z*** = -0.118, ***p*** < 0.906; **m** = 3.02).

4.4.3 Implementation Success

4.4.3.1 Individual Impact

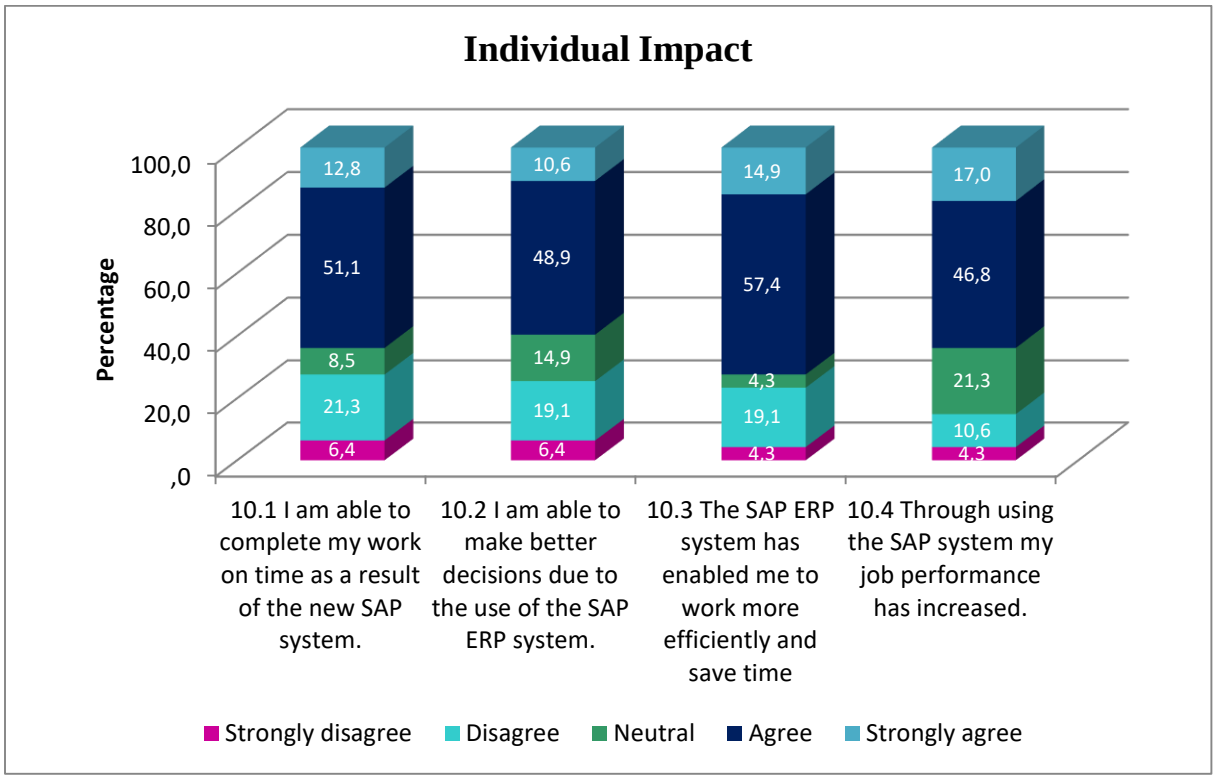

Figure 4-11: Analysis of Individual Impact

The interviewees indicated that they were able to complete their work assignments as a result of the SAP system, with 51.1% agreeing and 12.8% strongly agreeing. Respondents also strongly agreed (10.6%) and agreed (48.9%) that they were able to make better decisions with SAP.

The trend for strong agreement continued, with 14.9% indicating that the system has made them work more efficiently and 57.4% agreeing with that statement. In terms of performance, the respondents (46.8%) agreed that their work output improved with the use of SAP and 17% strongly agreed.

The results of the Wilcoxon test show significant agreement that the users were able to complete their work on time as a result of implementing the new system (***z*** = -2.332, ***p*** < 0.020; **m** = 3.43) and that they were able to make better decisions due to the use of SAP (***z*** = -2.184, ***p*** < 0.029; **m** = 3.38). There is also significant

agreement that the ERP system enabled the users to work more effectively and save time (***z*** = -3.247, ***p*** < 0.001; **m** = 3.60). Furthermore, the users showed a significant agreement that their job performance increased with the use of SAP (***z*** = -3.439, ***p*** < 0.001; **m** = 3.62).

4.4.3.2 Organizational Impact

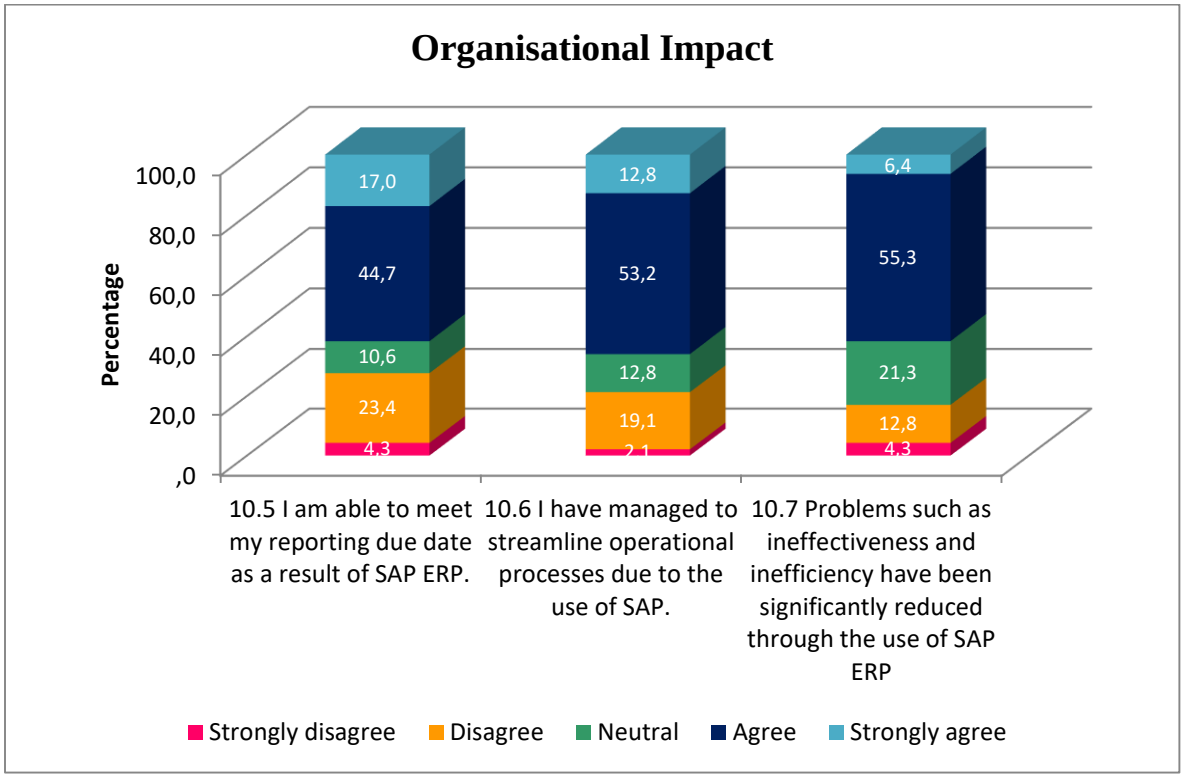

Figure 4-12: Analysis of Organisational Impact

It is suggested from figure 4-12: Analysis of Organizational Impact that the ERP implementation projects had a positive organizational impact. Most of the respondents agreed (55.3%) that problems of inefficiency and ineffectiveness were a thing of the past with SAP and 6.4% strongly agreed with this.

Around two thirds of the respondents supported the statement that operational processes have been streamlined as a result of SAP, with 53% of the respondents agreeing to this and 12.8% strongly agreeing. However, 19.1% disagreed and 2.1% strongly disagreed. With regard to meeting reporting deadlines, 23.4% and 4.3% disagreed and strongly disagreed, respectively, and 44.7% agreed and 17% strongly agreed.

The results of the Wilcoxon test show significant agreement that the reporting due date was now being met as a result of using SAP (***z*** = -2.584, ***p*** < 0.010; **m** = 3.47) and that operational processes had been streamlined as a result of SAP (***z*** = -3.281, ***p*** < 0.001; **m** = 3.55). There was also significant agreement that problems associated with ineffectiveness and efficiency had been reduced (***z*** = -2.997, ***p*** < 0.003; **m** = 3.47).

4.4.3.3 Perceived Usefulness

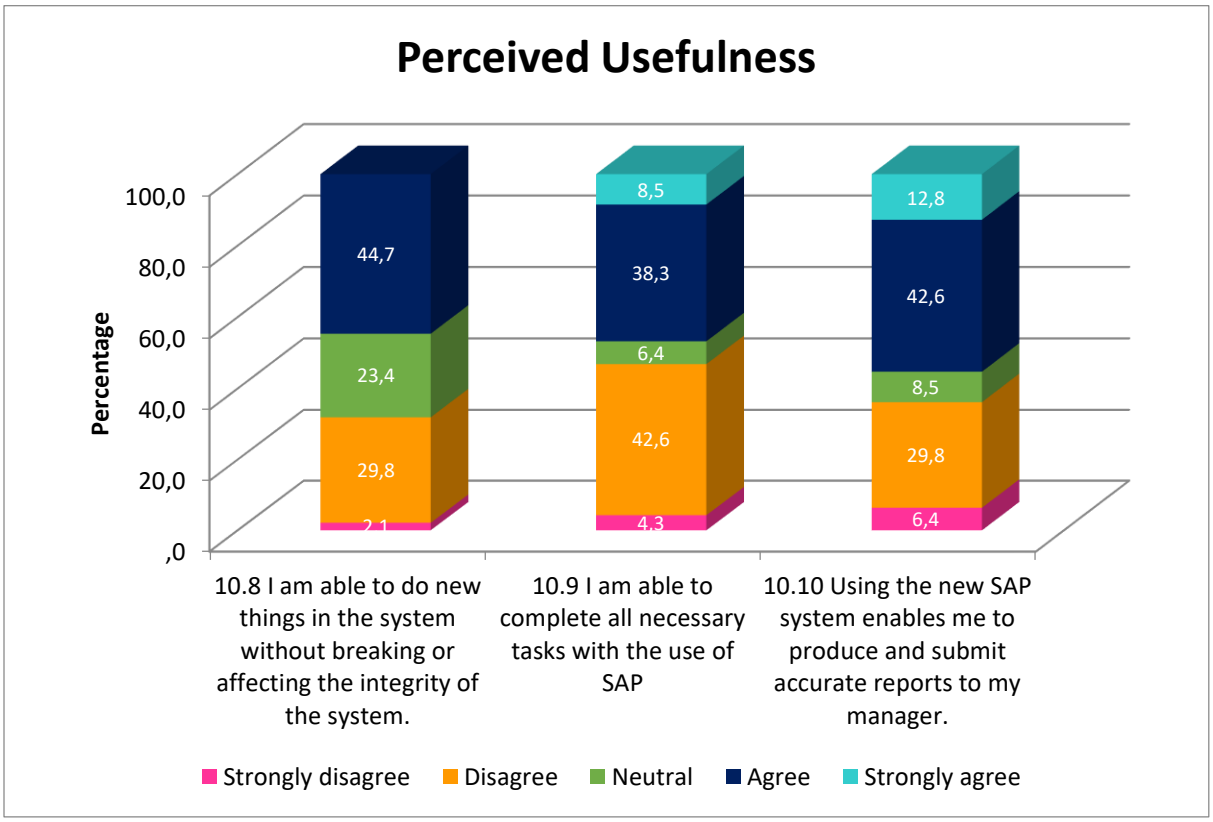

Figure 4-13: Analysis of Perceived Usefulness

Regarding the 'usefulness' category, 23.4% of the respondents were neutral regarding their ability to do new things in SAP without breaking the system, 29.8% disagreed and 2.1% strongly disagreed. About 47.4% of the respondents agreed that they are able to do new things in SAP without breaking the system, while 29.8% disagreed and 23.4% remained neutral.

Almost 43% of the respondents disagreed that they were able to complete all their daily tasks following the introduction of SAP, and 4.3% strongly disagreed. Of those supporting the statement, 38.3% agreed and 8.5% strongly agreed that they were able to complete all necessary tasks with the use of SAP. Just over 42% of the respondents agreed that using the new SAP system enabled them to produce and submit accurate reports, with 12.8% strongly agreeing to this; however, 29.8% of the respondents disagreed and 6.4% strongly disagreed.

The results from the Wilcoxon test show no significant agreement that users were able to perform negative and regression testing of the system without breaking the system ($\boldsymbol{z}$ = -0.801, $\boldsymbol{p}$ < 0.423; **m** = 3.11) and that users were able to complete all tasks with the increased use of SAP ($\boldsymbol{z}$ = -0.2791, $\boldsymbol{p}$ < 0.780; **m** = 3.04). However, there was also no significant agreement that, with the use of the new SAP, users were able to produce and submit accurate reports to their managers ($\boldsymbol{z}$ = -1.430, $\boldsymbol{p}$ < 0.153; **m** = 3.26).

4.4.3.4 User Satisfaction

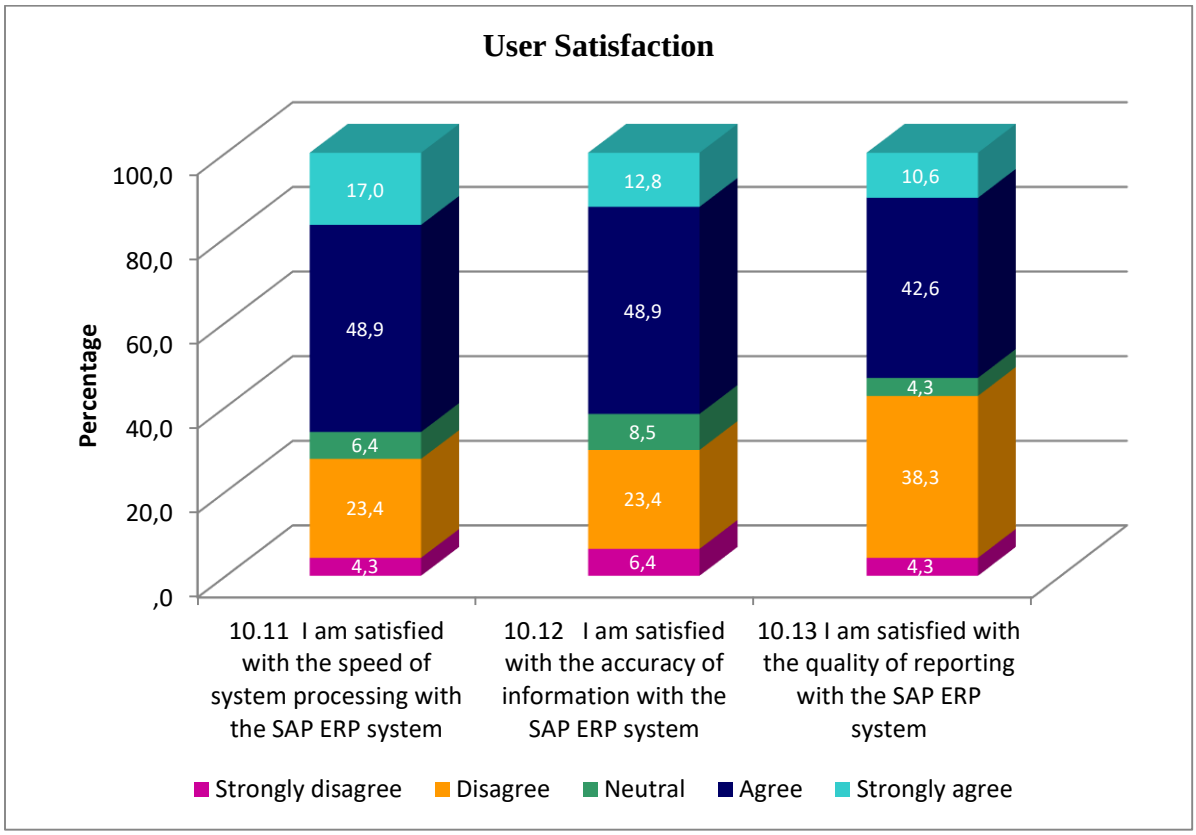

Figure 4-14: User Satisfaction

In measuring user satisfaction, 38.3% of the respondents disagreed that they were satisfied with the quality of the reporting with the SAP ERP system, although 42.6% agreed and 10.6% strongly agreed. Regarding the statement that respondents were satisfied with the system's accuracy of information, 12.8% of the respondents strongly agreed and 48.9% agreed with 6.4% strong disagreeing and 23.4% disagreeing.

The respondents generally agreed (48.9%) that they were satisfied with the speed of system processing and 17% strongly agreed; 23.4% disagreed and 4.3% strongly disagreed with this.

Using the Wilcoxon test, the respondents significantly agreed that they were satisfied with the speed of the system ($\boldsymbol{z}$ = -2.771, $\boldsymbol{p}$ < 0.006; **m** = 3.51) and that they were satisfied with the accuracy of the information within the SAP system ($\boldsymbol{z}$ = -2.106, $\boldsymbol{p}$ < 0.035; **m** = 3.38). There is no significant agreement with the satisfaction of the respondents to the quality of reporting with the SAP ERP system ($\boldsymbol{z}$ = -1.008, $\boldsymbol{p}$ < 0.313; **m** = 3.17).

4.4.3.5 Project Success

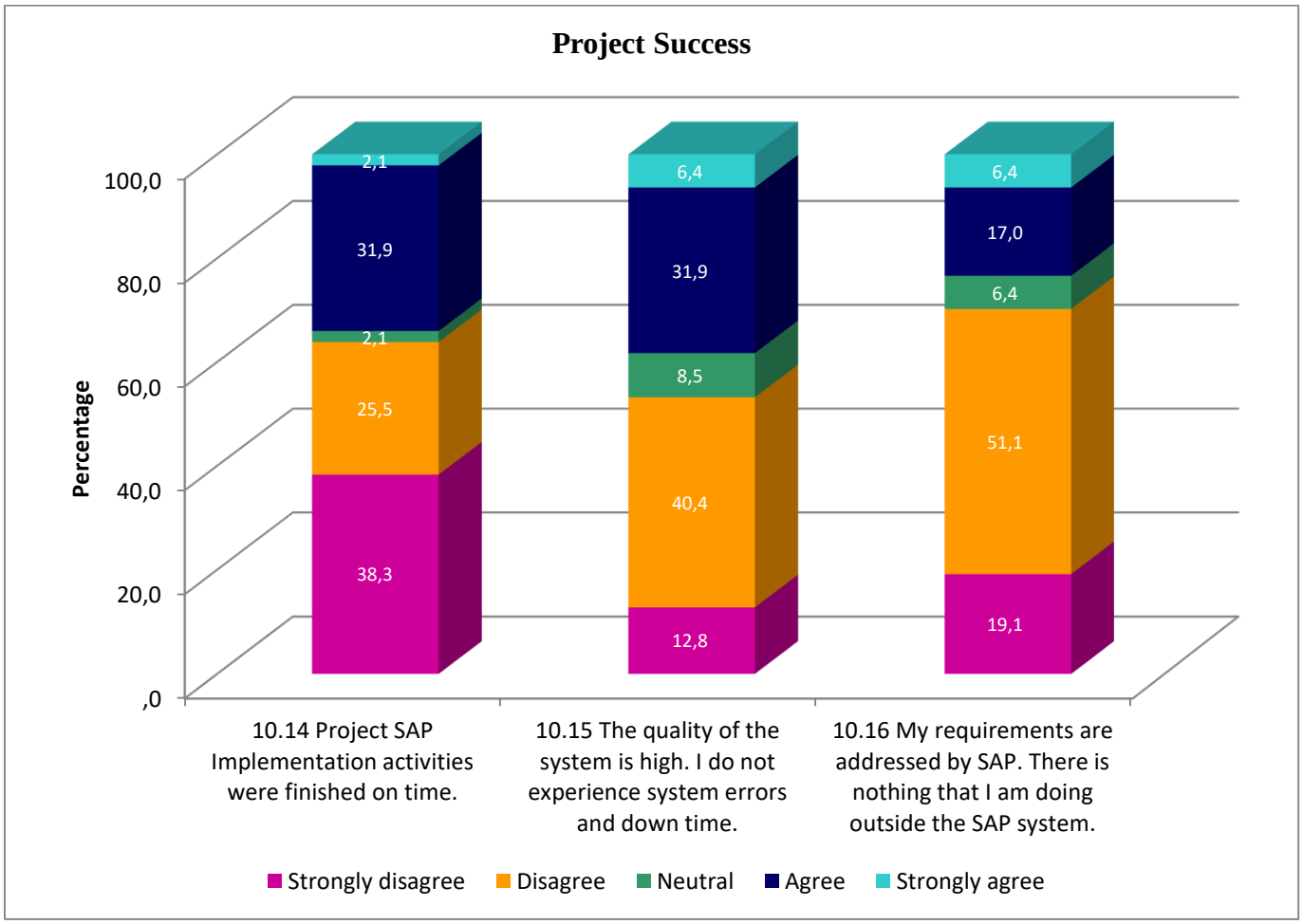

Figure 4-15: Project Success

The respondents mostly disagreed (51.1%) that their requirements were addressed by SAP and that they were doing nothing outside the SAP system, and (19.1%) strongly disagreed with this statement; only 6.4% strongly agreed and 17% agreed. The majority of the respondents also disagreed with the quality of the SAP system, with 40.4% disagreeing that its quality is high and that they do not experience system errors and downtime, and 12.8% strongly disagreeing; 6.4% strongly agreed and 31.9% agreed. In terms of completion of project implementation on time, 38.3% strongly disagreed and 25.5% disagreed; only 31.9% agreed with a further 2.1% strongly agreeing.

The analysis through the Wilcoxon test shows a significant disagreement by the respondents that the SAP project implementation was finished on time (z = -3.318, p < 0.001; **m** = 2.34); however, there was no significant disagreement that the quality of the system was high with no errors and down time (z = -1.205, p < 0.228; **m** = 2.79). There was significant disagreement that all the requirements of the respondents were met such that they did not do anything outside the system (z = -3.041, p < 0.002; **m** = 2.40).

4.5 Reliability Testing

4.5.1 The analysis of the Success Factors (Independent Variables) to the Dependent Variable (Implementation Success – IMPSUC).

In order to address the objectives, the researcher had a single measure for each construct/section. These single measures were tested for reliability using Cronbach's alpha. The single measures were then formed by calculating the average agreement scores within each construct.

Table 4-3: Cronbach's reliability test shows a summary of the reliability of each single measure. A few individual responses which compromised reliability were removed from the composite measure since they did not consistently measure what the other items in the scale were measuring. According to Tavakol (2014), if Cronbach's alpha is > = 0.7 the researcher can continue to carry out statistical tests on these variables. Except for the project governance variable, all other variables were > 0.7. Since the Cronbach's alpha was 0.641 for project governance, the researcher deemed it close enough to 0.7 to be used in the regression analysis below.

Table 4-3: Cronbach's Reliability Test.

Construct	Items included	Cronbach's alpha	Label	Excluded item
Top Management Support	1.1 – 1.5	.815	TMS	
Change Management and Communication	2.1 – 2.8	.885	CMC	2.9
User Training and Knowledge Transfer	3.1 – 3.7	.901	TKT	
Business Process Mapping	4.2 – 4.4	.795	BPM	4.1
System Testing	5.1 – 5.4	.959	ST	
Project Governance	6.6 -6.4	.641	PG	6.1 – 6.2
Vendor Support and Implementation	7.1 -7.3	.883	VSI	
ERP Flexibility	8.1 – 8.4	.872	ERP	
Data Migration	9.1, 9.3-9.4	.798	DM	9.2
IMPSUC		.958		

4.6 Regression Analysis

4.6.1 Understanding the effect of each independent variable against the dependent variable (IMPSUC)

To determine the effect of each factor of the context (Technological, Organisational and Environmental - TOE) on the Dependent Variable (IMPSUC), regression analysis was used. For this analysis, a collapsed measure for implementation success was used (IMPSUC) and it was tested for reliability and found to be reliable (alpha = .958). Table 4-4 shows the results of the regression analysis.

The assumptions of regression analysis in this study is that in all cases, linearity, normally distributed residuals and homoscedasticity and outliers were checked and considered adequate. The results of the test of normality (One Sample Kolmogorov-Smirnov) are on Table 6.11 of statistical analysis.

Table 4-4: Regression Analysis

	Success Factor	B (Coefficient)	F (Anova)	Sig (Anova)
1	**(Constant)**	1,298		
	ERP Flexibility (ERP)	0,635	65,023	0,000
2	**(Constant)**	1,365		
	Data Migration (DM)	0,607	72,488	0,000
3	**(Constant)**	3,788		
	Top Management Support (TMS)	-0,177	0,37	-0,546
4	**(Constant)**	1,791		
	Change Management and Communication (CMC)	0,416	7,014	0,011
5	**(Constant)**	0,751		
	Training and Knowledge Transfer (TKT)	0,731	54,084	0,000
6	**(Constant)**	0,986		
	Business Process Mapping (BPM)	0,678	75,742	0,000
7	**(Constant)**	1,855		
	System Testing (ST)	0,525	65,597	0,000
8	**(Constant)**	2,353		
	Project Governance (PG)	0,231	2,118	0,152
9	**(Constant)**	1,269		
	Vendor Support and Implementation (VSI)	0,6	46,359	0,000

Hypothesis H_1 (ERP Flexibility (ERP).

There is a significant positive relationship between ERP flexibility and IMPSUC (Anova F = 65.023, p =.000). ERP Flexibility accounts for 59.1% (R2 = .591) of the variance in IMPSUC. ERP flexibility is a significant predictor of successful implementation (β = .769). For every increase in ERP flexibility, implementation success will increase by 0.635 unit (Appendix A, Table 6-1).

Hypothesis H_2 (Data Migration)

There is a significant positive relationship between data migration and IMPSUC (Anova F = 72.488, p =.000). Data migration accounts for 61.7% (R2 = .617) of the variance in IMPSUC. Data migration is a significant predictor of successful implementation (β = .785). For every increase in data migration, implementation success will increase by 0.607 unit (Appendix A, Table 6-2).

Hypothesis H_3 (Top Management Support)

There is no significant positive relationship between top management support and IMPSUC (Anova F = .370, p =.546), (Appendix A, Table 6-3).

Hypothesis H_4 (Change Management and Communication)

There is a significant positive relationship between change management and communication and IMPSUC (Anova F = 7.014, p =.011). Change management and communication accounts for 13.5% (R2 = .315) of the variance in IMPSUC. Data migration is a significant predictor of successful implementation (β = .416).

For every unit increase in change management and communication, implementation success will increase by 0.416 unit (Appendix A, Table 6-4).

Hypothesis H_5 - (Knowledge Transfer and Training)

There is a significant positive relationship between knowledge transfer and training and IMPSUC (Anova F = 54.084, p =.000). Knowledge transfer and training accounts for 54.6% (R2 = .546) of the variance in IMPSUC. Knowledge management and training is a significant predictor of successful implementation (β = .739). For every unit increase in knowledge transfer and training, implementation success will increase by 0.731 unit (Appendix A, Table 6-5).

Hypothesis H_6 (Business Process Mapping)

There is a significant positive relationship between business-process mapping and IMPSUC (Anova F = 75.742, p =.000). Business-process mapping accounts for 62.7% (R2 = .627) of the variance in IMPSUC. Business-process mapping is a significant predictor of successful implementation (β = .792). For every unit increase in business-process mapping, implementation success will increase by 0.678 unit (Appendix A, Table 6-6).

Hypothesis H_7 (System Testing)

There is a significant positive relationship between system testing and IMPSUC (Anova F = 65.597, p =.000). System testing accounts for 58.4% (R2 = .584) of the variance in IMPSUC. System testing is a significant predictor of successful implementation (β = .770). For every unit increase in system testing, implementation success will increase by 0.525 unit (Appendix A, Table 6-7).

Hypothesis H_8 (Project Governance)

There is no significant positive relationship between project governance and IMPSUC (Anova F = 2.118, p =.152), (Appendix A, Table 6-8).

Hypothesis H_9 (Vendor Support and Implementation Methodology)

There is a significant positive relationship between vendor support and implementation methodology and IMPSUC (Anova F = 46.359, p =.000). System testing accounts for 50.7% (R2 = .507) of the variance in IMPSUC. System testing is a significant predictor of successful implementation (β = .712). For every unit increase in system testing, implementation success will increase by 0.6 unit (Appendix A, Table 6-9).

Table 4-5 highlights the hypotheses that were supported after regression analysis. Hypotheses supported had a $p < 0.05$ and hypotheses not supported had a $p > 0.05$. Figure 4-16 (below) illustrates the updated conceptual model, indicating the factors that are significant in ERP implementation success.

Table 4-5: Summary of Hypothesis Testing

Hypothesis	Relationship tested	Results
H_1	There is a significant positive relationship between ERP flexibility and the success of IMPSUC.	Supported ($p < 0.05$)
H_2	There is a significant positive relationship between data migration and the success of IMPSUC.	Supported ($p < 0.05$)
H_3	There is no significant positive relationship between Top Management Support and the success of IMPSUC.	Not Supported ($p > 0.05$)
H_4	There is a significant positive relationship between change management and communication and the success of IMPSUC.	Supported ($p < 0.05$)
H_5	There is a significant positive relationship between user training and knowledge transfer and the success of IMPSUC.	Supported ($p < 0.05$)
H_6	There is a significant positive relationship between Business Process Mapping and the success of IMPSUC.	Supported ($p < 0.05$)
H_7	There is a significant positive relationship between Business Process Mapping and the success of IMPSUC.	Supported ($p < 0.05$)
H_8	There is a no significant positive relationship between Project Governance and the success of IMPSUC.	Not Supported ($p > 0.05$)
H_9	There is a significant positive relationship between Vendor Support and Implementation Resources and the success of IMPSUC.	Supported ($p < 0.05$)

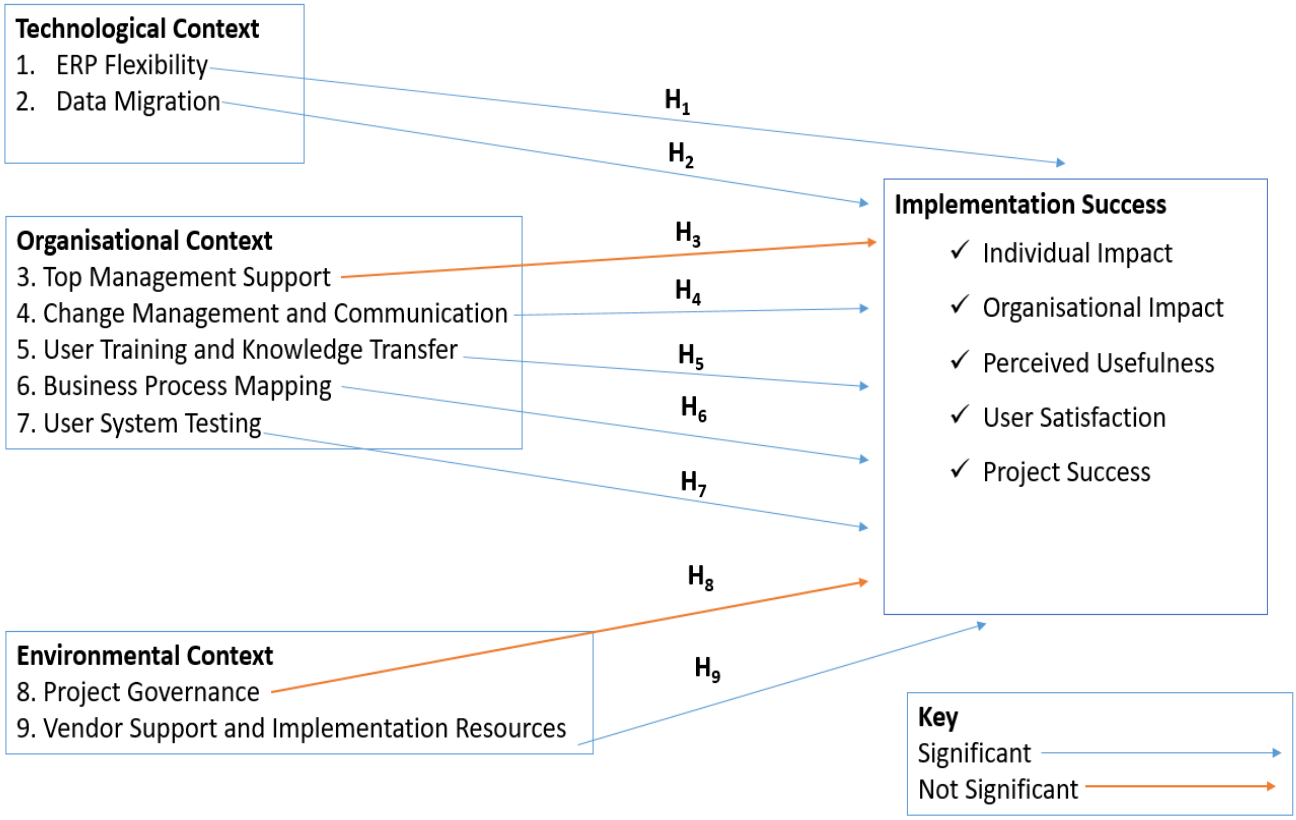

Figure 4-16: Revised Conceptual Model after Regression analysis

4.7 Summary

There was a general significant agreement that organisational, environmental and technological factors led to an increase in the success of SAP ERP implementation. This was evidenced by factors such as data migration, ERP flexibility, vendor support and implementation, system testing, business-process mapping, knowledge management and training as well as change management and communication. However, an increase in the efforts of top management (Top Management Support) as well as an increase in the focus on project governance did not show a corresponding increase in the successful implementation of the ERP projects.

Chapter 5 : SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The implementation of SAP ERP in the South African Public Sector is a high-value investment which if not managed successfully will lead to poor returns on IT investments. Although there are standard factors that are used in measuring success, these factors are influenced by human behaviours, perceptions and attitudes. In measuring implementation success, the researcher had to classify factors into organisational, environmental and technological, and measure how these have contributed to the success or failure of SAP ERP implementation in KwaZulu-Natal.

5.2 Summary of Key findings

The main objectives of this research were to outline the effect of the TOE factors on the successful delivery of SAP ERP systems in KwaZulu-Natal and to determine other factors contributing to SAP system implementation failure as well as to highlight remedial actions to avoid ERP implementation failures. The results obtained have mainly been in line with these objectives.

5.2.1 To what extent do the Technological Factors contribute to the success of SAP implementation in KwaZulu-Natal?

The majority of the users of the system who responded to the research agreed that technological factors led to implementation success. Some classified their SAP systems as a failure because they were not flexible and adaptable to their expanding daily needs, they also lamented that their internal support teams were not able to implement SAP upgrades and maintain the SAP system and found themselves helpless in many cases. However, they felt that their SAP internal support teams were able to provide ideas on how IT can be leveraged to improve business goals.

The respondents also showed that technological factors have a great influence on ERP project success. They agreed that data-migration initiatives can cause project success or failure. The respondents indicated that their projects were successful because they managed to clean all their data from legacy systems and validated it before loading into SAP and they also extracted the same information from the system and verified it with the source file.

From the regression testing performed, there was significant agreement that technological factors lead to the successful implementation of SAP in KwaZulu-Natal. ERP flexibility and data migration were significant contributors to ERP success.

Studies by Biewenga and Akca (2017) have shown that data migration is a critical factor in ERP success. Zhang, Lee and Huang (2005) also indicated that the move by entities towards ERP has prompted the need to maintain higher levels of data integrity and a good data-migration process which is critical to the ERP project's successful implementation. They further explained that ERP systems rely on quality data and historical data is required for business continuity.

Nofal et al. (2012) advised that ERP systems that are highly customised and less flexible lead to frustration and may not perform the intended purpose and can be classified as a failure. He indicated that most of the time, decision makers think that they are buying a packaged solution when it is in fact a framework with which you can build a solution. This may cause projects to be delayed and have cost overuns.

5.2.2 How do the Organisational Factors contribute to the success of SAP Implementation in KwaZulu-Natal?

Several respondents cited top management support as one of the pillars of SAP ERP implementation support. They expressed that project sponsors played a significant role in the direction of the project, and that their managers were actively involved in the project, understood the benefits and objectives of SAP and assisted in the resolving of project-related interdepartmental conflicts, notwithstanding the fact that most of the senior managers had no good understanding of SAP. However, the results of regression analysis did not support the validity of this, as discussed below.

Change Management and communication is a factor that can lead to project failures if not handled properly in ERP projects. The users largely attributed the success of their projects to the fact that change management initiatives were adequately managed, there was clear communication throughout the duration of the project, organisational readiness for the change was regularly assessed, system impact on jobs was communicated and the change management team ensured that the users were ready for the system. According to the participants, activities such as continuously reminding project team members and all the employees regarding the perceived benefits of the new SAP implementation played a very good role in successful SAP ERP implementation.

Substantial training and knowledge transfer took place during SAP ERP project implementation and the users were given an opportunity to specify their training needs, had visibility of the training programme and agreed that their trainers had sufficient knowledge of their training content. However, some respondents indicated that inadequate training was given to users, the training materials were not updated to be in sync with the changes to the system and the training material was not job specific. These factors have proved to have a negative effect on the implementation success.

Effective business-process mapping has a positive effect on ERP project success. Although the respondents managed to actively participate in defining their business processes and aligning them with other areas of business, adequate capturing of these business processes and documenting them remained an area of concern. The ERP projects were largely successful because the users understood clearly how their business processes would fit into SAP and also how the SAP business process would fit into their own business process, commonly known as reverse engineering.

Top management support was highlighted by many researchers as a critical contributor to implementation success, these include studies done by Nah (2006). Business process re-engineering was also cited as a major critical factor in ERP success. Zhange et al. (2003) said this is due to the fact that most ERP implementations are deployed based on best practice frameworks, and organisations are encouraged to adhere to the already defined business process for them to reap the benefits of these applications. Training of system users and adequate user-acceptance testing and training, as well as proper change management has been found to play a critical role in implementation success. The results indicated a strong relationship between these factors and implementation success.

However, the results of regression testing showed that top management support is not a significant contributer to implementation success ($\beta = -.090$); it was noted that an increase in focus by senior managers on the ERP project does not lead to a significant increase in the chances of successful implementation. One school of thought attributes this phenomen to a prevalent public sector practise, where there is political interference in the choosing and awarding of vendor contracts. This negatively affects how Top Management will be able to manage the service providers and the end result is that top management fail to take charge and loose interest in these projects.

5.2.3 How do the Environmental Factors contribute to the success of SAP Implementation in KwaZulu-Natal?

It has been noted that there was no significant positive relationship between Project Governance and the success of IMPSUC. This was largely due to the fact that all areas of business were not represented on the project team, project risks were not documented, and in most cases risk mitigation and control was weak, leading to ERP project failure. The respondents indicated that although they had project managers leading them, they did not fully understand the duties of their project managers and even their own responsibilities.

The result of the regression testing showed that there was significant agreement that vendor support and implementation methodology positively influence the success of SAP ERP implementation. The efficiency and effectiveness of consultants of the SAP ERP project implementaion played a crucial role in ERP success. The respondents attributed success of the projects to the fact that the consultants were available to offer the required support and that the implementaion teams were knowledgeable and skilled. However, some of the users remained less confident with the system, and still depend heavily on the external consultants.

The finding that project governance did not positively influence implementation success is not in accordance with previous research studies, conducted by Nah, Zuckweiler and Lau (2003) and Holland (2013), who indicated that ERP systems are complicated and require good project managers with technical, managerial and interpersonal skills. The same study by Holland (2013) also emphasised the importance of support given by system implementers (vendors) to ERP projects. This research finds that there is a positive relationship between vendor support and implementation success, that is the more the system vendors support the ERP post go live the more the system will be successful in terms of adoption. Experienced vendors have deep knowledge of their systems and their involvement from initial stages of designing the implementation plan will increase the chances of implementation success.

5.3 Limitation

Data was collected and analysed from 47 users, from three state-owned entities in KwaZulu-Natal. These findings cannot be generalised to other entities that use SAP ERP in KwaZulu-Natal, as well as in greater South Africa, because of different settings and resources. Some entities in KwaZulu-Natal tend to be mature in their IT systems while some are facing various forms of challenges regardless of whether they are new to SAP or have been using SAP for a long time.

A larger sample size of state-owned entities and consideration of more users per entity could influence the findings and prove helpful as it would increase the breadth of generalisation to a wider population in KwaZulu-Natal. Similar research also needs to be expanded and carried out at a national level and could be expanded to the broader usage of ERP, and not specifically SAP's ERP.

The different stages of SAP ERP implementation played a significant role in the research. Markus, Axline, Petrie, and Tanis (2000), advised that ERP projects are divided into three phases, namely project phase, 'shakedown' phase and 'onward and upward' phase. The focus of this research was on the client, regardless of what phase the project was in, and the results were muddled as one of the projects, which was mid-way, scored more negativity on the Top Management Support and Project Management categories.

5.4 Recommendation and Future Studies

The findings of this research are important for professionals leading SAP and non-SAP ERP implementation projects. Various factors researched in this study have shown a positive influence on implementation success and this will assist project leaders to manage their projects better.

Project managers making decisions for the first time in SAP ERP system implementation should take advantage of the results of this study to assist them to anticipate problems and enable them to quickly gauge their chances of success. Project managers need to ensure that the project team has representation from business, and these business representatives should liaise between business-process owners and implementation consultants. Project managers should also keep risk registers showing clear tracking, from the inception of the project, of all costs. All project-team members seconded from business to the ERP project office should be trained and participate in a well-documented knowledge-transfer process, and assessed for their familiarity with the process on completion, so that they are better able to support their business when system implementers finish the implementation.

Top management support should be visible in the project from the initial stages. Initiatives should be carried out, focussing on change management and communication, to inform senior managers of what is happening on the project. Many senior managers do not have knowledge of what is happening at the project office, and they need to be continuously informed of the benefits of the SAP ERP implementation, and actively involved in dispute resolutions between the various teams.

System users should be involved in training-needs assessment from the initial stages of the implementation project. Top management should employ a training manager as early as possible to coordinate business to ensure that all training needs are documented, and ensure that a training schedule is in place, is realistic, and accommodates all training courses as well as all trainees. Users should be given sufficient training, and an assessment of training effectiveness should be carried out before the projects go live.

Business-process owners should participate in the project during the blueprint phase and ensure that all their business processes have been identified and that there is integration of various streams (functional modules). Business-process owners should clearly understand how their processes will fit into SAP ERP and vice-versa but should be able to allow the standard system to take precedence over customisation. They should also do an audit, after the implementation, of whether or not the new SAP ERP system is fit for their business needs. Furthermore, business-process owners should make sure that users within their departments have performed in-depth testing of their processes so as to identify bugs early.

Vendor implementation teams should bring in consultants who are knowledgeable and skilled to carry out the implementation as well as training. Consultants who are not skilled are not able to understand and

interpret business requirements into SAP standard. Senior management and project managers should verify the knowledge and experience of vendor consultants.

However, more research needs to be done on the impact of data cleansing on SAP ERP implementation success. Lack of thorough cleansing of legacy data can have far-reaching negative consequences for the implementation success. Further research also needs to be done on ERP flexibility and scalability to expanding business needs as a measure of ERP success. Although this seems to support Sandberg's (2008) findings that highly customised and less flexible systems may not perform their intended purpose and thereby lead to frustration, a more detailed analysis is required as most of these large ERP system providers would have done a lot of research in standardising their systems to make them best practice. A negative review could point to an issue of lack of change management of the new systems rather than flexibility.

Further research needs to be done on the effects of top management support and project management on implementation success. It is tempting to believe that these two critical success factors are likely to positively influence project implementation success. This area should be researched further and the scope expanded to the rest of South Africa, focusing just on the domains of top management support and project management, together or exclusively.

There are other factors which also need to be regarded among the ERP success factors such as correct budgeting, acquisition of correct systems, vendor consolidation and organisational culture which could not be dealt with in this research but are still critical for success of SAP ERP implementation.

5.5 Conclusion

The research was designed to gauge the effect of TOE factors on SAP ERP implementation success using the TOE Framework (Model). The results from the study showed that technological factors (ERP flexibility and data migration) positively contributed to implementation success. The results also showed that organizational factors such as change management, communication, user training, knowledge transfer, business-process mapping and system testing (all except for top management support) contributed to the success of SAP ERP implementation in KwaZulu-Natal. The results of the research also showed that environmental factors such as vendor support and implementation resources, with the exception of project governance, had a positive influence on implementation success.

This study's finding revealed that factors, such as top management support and project governance, did not show a positive influence on implementation success. However, this seems to be counterintuitive considering the participants' responses, which would suggest these factors deserve further research. Given the positive correlation between the independent variables (success factors) and the dependent variable

(Implementation Success), and the magnitude of the financial investment into IT that is required by SAP ERP, there is need to do a strong business case before commencing any implementation.

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Appendix A: Statistical Analysis Results

Table 6-1: ERP Flexibility Test Statistic

	The SAP ERP can accommodate new requirements in a short space of time.	The SAP ERP system is flexible, scalable and adaptable to our daily expanding business needs.	Our SAP Internal Support team are able to implement system upgrades and maintain the SAP system.	The SAP Internal Support teams offer ideas on how IT can be leveraged to achieve business goals.
Z	-.486[a]	-.883[b]	-.110[a]	-.467[b]
Asymp. Sig. (2-tailed)	.627	.377	.912	.640

a. Based on negative ranks.

b. Based on positive ranks.

c. Wilcoxon Signed Ranks Test

Table 6-2: Data Migration Test Statistic

	9.1 The new SAP system was able to capture all the necessary data that we were using on the old systems	9.2 Data extracted from legacy systems were thoroughly cleaned and validated before loading into SAP.	9.4 To ensure that our data was clean in the production system, we practised loading through various mock-runs before the final load.	9.5 Data was verified before and after loading to ensure that it is accurate.
Z	-.118[a]	-3.557[a]	-1.915[b]	-2.955[a]
Asymp. Sig. (2-tailed)	.906	.000	.055	.003

a. Based on positive ranks.

b. Based on negative ranks.

c. Wilcoxon Signed Ranks Test

Table 6-3: Top Management Support Test Statistic

	1.1 The Project Sponsor (CEO and CFO) showed interest in the SAP Implementation	1.2 My senior manager was actively involved in the SAP project.	1.3 My manager understood the benefits and objectives of SAP to the organisation	1.4 My senior managers assisted in resolving departmental conflicts that occurred during the SAP ERP Implementation.	1.5 My senior manager showed a good understanding of SAP
Z	-5.247[a]	-5.544[a]	-4.703[a]	-5.122[a]	-4.267[a]
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000

a. Based on positive ranks.

b. Wilcoxon Signed Ranks Test

Table 6-4: Change Management and Communication Test Statistic

	2.1 The change management activities from the old system to the new system were adequately managed.	2.2 There was clear communication throughout the duration of the SAP Implementation Project.	2.3 An SAP Support group was set up to explain about SAP job changes.	2.4 The organisational readiness to change was regularly assessed.	2.5 A communication task force was set up to resolve departmental conflicts.	2.6 I understood how the new system would have an impact on my job.	2.7 The change management team made sure that I was ready for the new SAP system.	2.8 I was continually reminded of the perceived benefits to come as a result of implementing SAP.	2.9 I was able to communicate well with external consultants who were assisting us with the implementation
Z	-2.898[a]	-3.901[a]	-2.728[a]	-2.295[a]	-1.093[a]	-3.344[a]	-2.721[a]	-2.810[a]	-5.289[a]
Asymp. Sig. (2-tailed)	.004	.000	.006	.022	.275	.001	.007	.005	.000
a. Based on positive ranks.									
b. Wilcoxon Signed Ranks Test									

Table 6-5 Training and Knowledge Transfer Test Statistic.

	3.1 I indicated to the training needs assessment team what training I required.	3.2 A training program was put in place and was adhered to.	3.3 I received adequate training on the new system.	3.4 Training materials were developed specifically for my job.	3.5 My training material was updated to reflect ever-changing system changes.	3.6 Sufficient training was allocated to my training.	3.7 My trainers knew their training content and were helpful.
Z	-3.655[a]	-3.470[a]	-2.269[a]	-1.229[a]	-.710[b]	-2.346[a]	-2.900[a]
Asymp. Sig. (2-tailed)	.000	.001	.023	.219	.478	.019	.004
a. Based on positive ranks.							
b. Based on negative ranks.							
c. Wilcoxon Signed Ranks Test							

Table 6-6: Business Process Mapping Test Statistic

	4.1 I defined business processes for my role and ensured that they are in line with other areas of business.	4.2 The business processes were accurately captured and documented.	4.3 I understood how my business processes would fit into SAP.	4.4 The SAP business processes were a reflection of our business.
Z	-4.108[a]	-.226[a]	-2.295[a]	-2.369[a]
Asymp. Sig. (2-tailed)	.000	.821	.022	.018
a. Based on positive ranks.				
b. Wilcoxon Signed Ranks Test				

Table 6-7: System Testing Statistic

	5.1 Adequate unit testing of all my business processes was carried out by the consulting firm implementing SAP	5.2 Adequate integration testing of all my business processes was carried out.	5.3 All my business processes were tested to ensure that they were functioning, through User Acceptance testing Scenarios.	5.4 All defects of UAT and integration testing were fixed before Go Live.
Z	-.068[a]	-2.199[b]	-2.854[b]	-2.461[b]
Asymp. Sig. (2-tailed)	.945	.028	.004	.014
a. Based on positive ranks.				
b. Wilcoxon Signed Ranks Test				

Table 6-8: Project Governance Test Statistic

	6.1 All the areas of the business operation were represented in the project team responsible for SAP Implementation.	6.2 Project risks were documented and were communicated to all stakeholders.	6.3 There was a project plan with clear start and finish date.	6.4 My duties and responsibilities on the project were clear to me.
Z	-1.725[a]	-3.143[a]	-4.767[a]	-3.844[a]
Asymp. Sig. (2-tailed)	.084	.002	.000	.000
a. Based on positive ranks.				
b. Wilcoxon Signed Ranks Test				

Table 6-9: Vendor Implementation and Support Test Statistic

	The SAP Implementation team were knowledgeable and skilled.	The consultants were available to offer the support required.	I am confident in the system and no longer depend on external consultants.
Z	-1.468[a]	-2.147[a]	-.989[a]
Asymp. Sig. (2-tailed)	ns.142	si.032	ns.323
a. Based on positive ranks.			
b. Wilcoxon Signed Ranks Test			

Table 6-10: Wilcoxon Test Results for Implementation Success

Question	Z	Asymp. Sig. (2-tailed)
10.1 I am able to complete my work on time as a result of the new SAP system.	-2.332[a]	.020
10.2 I am able to make better decisions due to the use of the SAP ERP system.	-2.184[a]	.029
10.3 The SAP ERP system has enabled me to work more efficiently and save time	-3.247[a]	.001
10.4 Through using the SAP system my job performance has increased.	-3.439[a]	.001
10.5 I am able to meet my reporting due date as a result of SAP ERP.	-2.584[a]	.010
10.6 I have managed to streamline operational processes due to the use of SAP.	-3.281[a]	.001
10.7 Problems such as ineffectiveness and inefficiency have been significantly reduced through the use of SAP ERP	-2.997[a]	.003
10.8 I am able to do new things in the system without breaking or affecting the integrity of the system.	-.801[a]	.423
10.9 I am able to complete all necessary tasks with the use of SAP	-.279[a]	.780
10.10 Using the new SAP system enables me to produce and submit accurate reports to my manager.	-1.430[a]	.153
10.11 I am satisfied with the speed of system processing with the SAP ERP system	-2.771[a]	.006
10.12 I am satisfied with the accuracy of information with the SAP ERP system	-2.106[a]	.035
10.13 I am satisfied with the quality of reporting with the SAP ERP system	-1.008[a]	.313
10.14 Project SAP Implementation activities were finished on time.	-3.318[b]	.001
10.15 The quality of the system is high. I do not experience system errors and down time.	-1.205[b]	.228
10.16 My requirements are addressed by SAP. There is nothing that I am doing outside the SAP system.	-3.041[b]	.002

Table 6-11: One Sample Kolmogorov-Smirnov Test of Normality

One-Sample Kolmogorov-Smirnov Test																
		TMS	CMC	TKT	BPM	ST	PG	VSI	ERP	DM	II	OI	PU	PS	US	IMPSUC
N		47	47	47	47	47	47	47	47	47	47	47	47	47	47	47
Normal Parameters[a,,b]	Mean	4.0638	3.4628	3.3921	3.3121	2.6223	3.8085	3.2695	3.0426	3.0745	3.5053	3.4965	3.1809	2.5106	3.3546	3.2312
	Std. Deviation	.69044	.79225	.90619	1.04813	1.31657	.82458	1.06467	1.08513	1.16086	1.02614	.95521	.89337	1.06968	1.09545	.89700
Most Extreme Differences	Absolute	.187	.157	.112	.234	.150	.188	.137	.153	.149	.217	.190	.182	.215	.233	.159
	Positive	.124	.100	.080	.144	.150	.116	.111	.108	.125	.123	.086	.141	.215	.129	.121
	Negative	-.187	-.157	-.112	-.234	-.150	-.188	-.137	-.153	-.149	-.217	-.190	-.182	-.141	-.233	-.159
Kolmogorov-Smirnov Z		1.279	1.077	.766	1.601	1.030	1.286	.937	1.047	1.022	1.488	1.305	1.248	1.476	1.596	1.090
Asymp. Sig. (2-tailed)		.076	.197	.600	.012	.240	.073	.344	.223	.247	.024	.066	.089	.026	.012	.186
a. Test distribution is Normal.																
b. Calculated from data.																

Those in yellow are not normal and the Wilcoxon signed ranks test applies to them. The others are all normal and the original analysis applies to them.

Appendix B: Interview Questions

QUESTIONNAIRE on *"An analysis of factors affecting Implementation of SAP in KwaZulu-Natal Public Sector"*

Introduction and participant consent

Dear Participant

I am a Masters of Commerce in Information Technology Student at University of KwaZulu-Natal (School of Information Technology and Governance) and I hereby request your kind participation in my dissertation process. The study is about the factors leading to failure of SAP Implementation in the Public Sector in KwaZulu-Natal Province.

All data collected will be treated with confidentiality and the anonymity of all participating individuals and Organisations will be observed at all times. The data will be used for the purpose of the present study only. I therefore encourage you to answer all questions as honestly and completely as possible.

Your participation is entirely voluntary and you may withdraw at any time if you feel the need to do so, if you are agreeable sign on the space provided in the next page to confirm your willingness to participate in this study.

Kind regards

……

Obert Muyambi (061 708 7622)

I hereby wilfully consent to participating in this study

Participant's signature: ……

Date ……..

Please answer the following questions by placing a cross (x) in the relevant block or writing down your response in the provided space

PART 1: DEMOGRAPHICS DATA

1. What is your gender?

Male	Female

2. What is your current position in your company?

Chief Information Officer		Project Manager		Change Manager		Process Owner	
Process Lead		Super-User		System User		Chief Financial Officer	
Programmer		Finance Manager		Internal Auditor		Other	

3. What is your highest qualification?

Matric	Certificate	Diploma	Degree	Masters/PhD

4. How long have you been using SAP in your organisation

< 5 years	5 - <10 years	10 - <20 years	20 - <30 years	30+ years

5. Select the nature of the SAP Implementation at your organisation

SAP Fresh Implementation	SAP Upgrade	SAP Enhancements

6. Have you been trained in any SAP course?

Yes	No

PART 2: SAP ERP SUCCESS AND FAILURE FACTORS

Indicate your level of agreement with the following perceptions and opinions regarding the implementation of SAP at your workplace

Part 2 A: Organisational Context

1. Top Management Support		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.1	The Project Sponsor (CEO and CFO) showed interest in the SAP Implementation					
1.2	My senior manager was actively involved in the SAP project.					
1.3	My manager understood the benefits and objectives of SAP to the organisation					
1.4	My senior managers assisted in resolving departmental conflicts that occurred during the SAP ERP Implementation.					
1.5	My senior manager showed a good understanding of SAP					

2. Change Management and Communication		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
2.1	The change management activities from the old system to the new system were adequately managed.					
2.2	There was clear communication throughout the duration of the SAP Implementation Project.					
2.3	An SAP Support group was set up to explain about SAP job changes.					
2.4	The organisational readiness to change was regularly assessed.					
2.5	A communication task force was set up to resolve departmental conflicts.					
2.6	I understood how the new system would have an impact on my job.					
2.7	The change management team made sure that I was ready for the new SAP system.					
2.8	I was continually reminded of the perceived benefits to come as a result of implementing SAP.					
2.9	I was able to communicate well with external consultants who were assisting us with the implementation					

3. User Training and Knowledge Transfer		Strongly	Disagree	Neutral	Agree	Strongly agree
3.1	I indicated to the training needs assessment team what training I required.					
3.2	A training program was put in place and was adhered to.					
3.3	I received adequate training on the new system.					
3.4	Training materials were developed specifically for my job.					
3.5	My training material was updated to reflect ever-changing system changes.					
3.6	Sufficient training was allocated to my training.					
3.7	My trainers knew their training content and were helpful.					

4. Business Process Mapping		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
4.1	I defined business processes for my role and ensured that they are in line with other areas of business.					
4.2	The business processes were accurately captured and documented.					
4.3	I understood how my business processes would fit into SAP.					
4.4	The SAP business processes were a reflection of our business.					

5. System testing		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5.1	Adequate unit testing of all my business processes was carried out by the consulting firm implementing SAP.					
5.2	Adequate integration testing of all my business processes was carried out.					
5.3	All my business processes were tested to ensure that they were functioning, through User Acceptance testing Scenarios.					
5.4	All defects of UAT and integration testing were fixed before Go Live.					

Part 2 B: Environmental Context

6. Project Governance (Project Management)		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
6.1	All the areas of the business operation were represented in the project team responsible for SAP Implementation.					
6.2	Project risks were documented and were communicated to all stakeholders.					
6.3	There was a project plan with clear start and finish date.					
6.4	My duties and responsibilities on the project were clear to me.					

7. Vendor Support and Implementation Methodology		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
7.1	The SAP Implementation team were knowledgeable and skilled.					
7.2	The consultants were available to offer the support required.					
7.3	I am confident in the system and no longer depend on external consultants.					

Part 2 C: Technological Context

8. ERP Flexibility		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8.1	The SAP ERP can accommodate new requirements in a short space of time.					
8.2	The SAP ERP system is flexible, scalable and adaptable to our daily expanding business needs.					
8.3	Our SAP Internal Support team are able to implement system upgrades and maintain the SAP system.					
8.4	The SAP Internal Support teams offer ideas on how IT can be leveraged to achieve business goals.					

9. Data Migration		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.1	The new SAP system was able to capture all the necessary data that we were using on the old systems					
9.2	Data extracted from legacy systems were thoroughly cleaned and validated before loading into SAP.					
9.4	To ensure that our data was clean in the production system, we practised loading through various mock-runs before the final load.					
9.5	Data was verified before and after loading to ensure that it is accurate.					

Part 3: Implementation success

Individual Impact		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
10.1	I am able to complete my work on time as a result of the new SAP system.					
10.2	I am able to make better decisions due to the use of the SAP ERP system.					
10.3	The SAP ERP system has enabled me to work more efficiently and save time					
10.4	Through using the SAP system my job performance has increased.					
Organisational Impact		**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
10.4	I am able to meet my reporting due date as a result of SAP ERP.					
10.5	I have managed to streamline operational processes due to the use of SAP.					
10.7	Problems such as ineffectiveness and inefficiency have been significantly reduced through the use of SAP ERP					
Perceived Usefulness		**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
10.8	I am able to do new things in the system without breaking or affecting the integrity of the system.					
10.9	I am able to complete all necessary tasks with the use of SAP					
10.10	Using the new SAP system enables me to produce and submit accurate reports to my manager.					

User Satisfaction		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
10.11	I am satisfied with the speed of system processing with the SAP ERP system					
10.12	I am satisfied with the accuracy of information with the SAP ERP system					
10.13	I am satisfied with the quality of reporting with the SAP ERP system					
Project Success		**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
10.14	Project SAP Implementation activities were finished on time.					
10.15	The quality of the system is high. I do not experience system errors and down time.					
10.16	My requirements are addressed by SAP. There is nothing that I am doing outside the SAP system.					

Thank you very much for your participation.

Appendix C: Ethical Clearance Letter

18 April 2018

Mr Obert Muyambi (217079487)
School of Management, IT & Governance
Westville Campus

Dear Mr Muyambi,

Protocol reference number: HSS/0314/018M
Project title: Factors affecting SAP Implementations in South African Public Sector

Approval Notification – Expedited Application

In response to your application received on 11 April 2018, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and **FULL APPROVAL** was granted for the protocol.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....
Professor Shenuka Singh (Chair)

/ms

Cc Supervisor: Mr Ashley Marimuthu
Cc Academic Leader Research: Professor Isabel Martins
Cc School Administrator: Ms Angela Pearce

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