UNIVERSITY OF KWAZULU-NATAL

Applying systems thinking in business process re-engineering for information technology projects: a case study of the university in South Africa

by

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DECLARATION

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GLOSSARY OF TERMS AND ACRONYMS

The below terms and abbreviations were applied in this thesis.

BPR	:	Business Process Re-engineering
EA	:	Enterprise Architecture
IT	:	Information Technology
ICT	:	Information Communication Technology
PIR	:	Post Implementation Review
User	:	The user is defined as an IT solution operator within the university, to execute his or her work duties

ABSTRACT

This study was a qualitative case study which examined strategies of infusing systems thinking in business process re-engineering (BPR) on information technology (IT) projects at a public university in South Africa. The university seeks to effectively cope with complex and messy situations in pursuit of process improvement by enabling holistic and systematic problem solving for sustainable solutions for BPR IT projects. The university under study relies on IT projects to enable seamless services to the university community while providing education digitally and effortlessly to all the university stakeholders such as students. This study contributed to understanding the interrelatedness, interconnectedness and interdependency of parts of the university as a system-in-focus, and that the sub-optimisation of one part may cripple other parts. Data were collected through semi-structured interviews, questionnaires and document analysis and the data collected were analysed in themes. This project added value in BPR IT projects when the projects are initiated and implemented by incorporate systems thinking. The study has also highlighted the inability of reductionism to deal with complexity, change, unpredictability and uncertainty.

As new managerialism continues to be infused in public institutions such as the universities, the study has assisted in enhancing our understanding of how complex the university is. This historical but paradigmatic study, which promoted creative holism, has contributed through its findings and recommendations, to the body of knowledge on the re-engineering of business processes in IT projects in order to reduce challenges experienced when initiating and implementing BPR projects in the public university in South Africa.

Given these issues, the study recommends that systems thinking should be infused with BPR IT projects at the public university in South Africa, to effectively deal with the complex challenges faced by BPR IT projects at the public university.

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CHAPTER 1: INTRODUCTION AND OVERVIEW OF THE STUDY

1.1 Introduction and background of the study

This study sought to investigate ways in which systems thinking could be incorporated into business process re-engineering (BPR) IT projects at a public university in South Africa, with specific reference to a public university located in the Gauteng Province, South Africa. Technology has become the new driving force for change, sustainability and success, and is rapidly expanding as a discipline to initiate and implement technology projects (Meredith and Mantel, 2011). Organisations are investing in IT (IT) to keep up with the global economy and to compete effectively with the rest of the world (Van Grembergen and De Haes, 2018). Universities, like any other business, need to be innovative, flexible and adaptable (Arundel, Bowen Butchart and Gatenby-Clark, 2016). Therefore, the university, like other businesses, relies on innovation using IT projects to deliver services effectively to its stakeholders.

A successful organisational leadership appreciates that growth is driven by innovation and quality (Gashi, and Kralj, 2017). However, BPR is faced with challenges that hinder its full potential to provide effective and efficient results (Rao, Mansingh and Osei-Bryson, 2012). As argued by Checkland and Pouter (2006), systems thinking is instrumental in addressing the challenges faced by the world and views problematic situations from a holistic perspective, rather than working in silos. The higher education sector has experienced cycles of fundamental problems in the past decade (Pucciarelli and Kaplan, 2016).

BPR has gained currency (Jinno, Abe and Iizuka, 2017) in terms of the rethinking and redesign of business processes (Negeri, 2014) to achieve improvements in business performance (Sanchez, Oliveira, Barbosa and Henriques, 2015; Sharma and Kumari, 2016; Van der Merwe, 2005), by providing quality service speedily and at a minimum cost (Negeri, 2014). However, Rousseau (2018) argues that complexity arises when there are increases in costs, failure rates and unintended negative consequences in system re-engineering projects. Therefore, the paradigm shift of process performance improvement should not be approached from a mechanistic viewpoint (Holliday, 2017).

BPR epitomises modern management (Al Shobaki and Naser, 2017), and Jackson (2003) argues that managers are sold quick-fix panaceas in the form of the latest management fads in BPR. Literature suggests that some institutions have successfully implemented BPR, as they achieved significant results, while the contrary is also true for others. In the case of the institution under study, BPR is one of the tools that was used to initiate and implement organisational changes in business processes and systems through IT. Hammer and Stanton (1995) suggest that BPR is the only solution that adapts well to change. As Jackson (2003) argues, problems present themselves individually, but are related to one another, and straightforward solutions cannot cope with complexity, change and diversity. Highsmith (2013) emphasises that systems thinking leaders do not pitch simple solutions to complex problems or situations, as they are not complex enough. However, BPR presents certain limitations, as it is systematic (Valiris and Glykas, 1999) and reductionist (Rosemann, 2014) by nature, and is unable to cope with and resolve complex challenges. BPR requires a cross-disciplinary (Rosemann, 2014) and a systemic approach to deal with change and complexity. Jackson (2003: xv) argues that being systemic means being able to look at problem situations and know how to resolve them from different points of view, and by employing different systems approaches in combination.

A university entails unique characteristics of a complex system (Papadimitriou, Branković and Đorđević, 2014), and the whole university is a system consisting of many sub-systems (Anderson, 1999). The institution being investigated in this study uses BPR to analyse and improve parts of the system. Jackson (2003) defines a system as a complex whole whose functions depend on its parts and the interactions between these parts. Anderson (1999) describes a complex organisation as a set of interdependent parts that together make up a whole, which is, in turn, interdependent with some larger environments. According to Rao, Mansingh and Osei-Bryson (2012), BPR is not a solution on its own, without consideration of the context in which the process is implemented. Barasa, Mbau and Gilson (2018) argue that complex adaptive systems exist in a dynamic state, with multiple interacting agents.

Complex adaptive systems require agile leaders who adopt various leadership styles in different situations, appreciate the complexity and embrace change. A university is a system

consisting of interconnected components that work together to make up a whole (Anderson, 1999). However, Senge (1990: 6) asserts that "learning organisations require a new view of leadership. He sees the traditional view of leaders (as special people who set the direction, make key decisions and energise the troops as deriving from a deeply individualistic and non-systemic worldview".

Organisations are complex, and the implementation of BPR without consideration of the interrelatedness of internal factors results in BPR project failure (Nicholds and Mo, 2015). BPR is used at the institution under study to identify parts for improvement, instead of examining the holistic view of the system-in-focus to understand the interrelatedness, interconnectedness and interdependency of these parts. Rousseau (2018) argues that it is crucial to understand the whole as a scientific foundation, rather than only understanding the parts, as this provides knowledge of how the sub-systems interconnect.

Complex adaptive systems are dynamic, open systems made up of individual agents that act independently, but whose actions are interconnected, so that when one agent changes, it has the potential to influence other agents and create a ripple effect across the system (Pham, 2017). The system is typically open, which means that its environment can influence it. Jongbloed, Enders and Salerno (2008) argue that a university is a system that is entrenched in national and regional systems. Open systems receive inputs from their environments, transform them and return them to the environments in the form of products (Jackson, 2003; Anderson, 1999).

The growing uncertainty, unpredictability and complexity that characterise society have become issues that organisations must grapple with daily (Pucciarelli and Kaplan, 2016), and institutions of higher education are no exception. Jongbloed et al. (2008) concur that a university should be viewed as a complex social actor. For BPR to cope with and effectively address complexity and change, this study posits that there is a need to nudge BPR into the transition zone between order and chaos, which is described by Jackson (2003) as the edge of chaos or zone of complexity as indicated by Stacey (2007).

Sycophancy, Santos, De Witte and Euwema (2016) argue that the higher education sector in South Africa is faced with issues such as change, diversity, globalisation, uncertainty, and complexity. Ng'ambi and Bozalek (2013) indicate that higher education has had to adapt in the preceding decade owing to emerging technologies in the sector. Pucciarelli and Kaplan (2016) concur by stating that IT and innovative solutions are changing the status quo in organisations. In the higher education sector, IT solutions contribute significantly to addressing most of the higher education sector's complex challenges.

South African higher education has undergone immense changes owing to globalism and pressures from local educational requirements (Ng'ambi et al., 2016). Universities in South Africa are expected to adapt to globalisation and other challenging components (Miller, McAdam and McAdam, 2014), and must be flexible and able to accelerate innovation. Furthermore, growing global complexity is posing new challenges (Carlisle and McMillan, 2017). Therefore, the South African education sector has been experiencing deep and vigorous transformation (Portnoi, 2015). This chapter includes the introduction and background to the study, a background to the institution under study, problem statement, theoretical framework, research objectives, research questions, and research methodology.

1.2 University background

As one of the oldest universities in South Africa, boasting more than 146 years of existence, the university has established several colleges under its support. The university prides itself on having paved new beginnings, by autonomously transforming tertiary education. The university has been shaping the futures and educational dreams of many people, by upholding the principle of equal opportunities for all.

The university also boasts graduating more than 20% of graduates in South Africa every year. The university has linked new technologies to enhance digital teaching and learning environments. Like any other institution of higher learning, the university is operating in an ever-changing environment that presents numerous challenges, ranging from politics to economic changes.

The university under study is a mega institution which has stood the test of time over many decades, without compromising on high-quality education. It has always been determined to

be a high-performance university. For the current academic year, the university has more than 400 000 students enrolled for various qualifications. The institution understudy has been focusing on migrating its academic strategies and mode of tuition delivery to the online environment for most of its courses, programmes and qualifications. In its 2015 strategy document, the university emphasized implementing and enhancing the technologies used by universities to improve the quality of service delivery to stakeholders and students throughout the world.

1.3 Problem statement

Higher education institutions are faced with numerous complex challenges (Matni, 2014). The university is seen as a complex system (Adkins, 2017) that responds to complex challenges (Jiang, 2008), by advocating for innovation as one of the means of mitigating challenges. Furthermore, new managerialism is infiltrating higher education (Deem, 2017), and public universities are embracing ideologies of new managerialism, which bring their factors of complexity (Deem, 2001). As defined by Ntshoe (2004), new managerialism is the permeation of private-sector ideas, practices and values into the world of public institutions such as universities. However, factors such as globalisation, internationalisation, entrepreneurialism, corporatism, and many others have an influence in terms of universities' functions.

The concept of BPR is also spreading adroitly throughout public sector institutions (Al Shobaki and Naser, 2017) and is known for achieving mixed results in terms of the desired objectives (Hammer and Champy, 1993). Many organisations experience difficulties when applying the business re-engineering method, owing to the natural differences that characterise the public sector with the application of these concepts (Al Shobaki and Naser, 2017). As Jackson (2003) suggests, managers are introduced to different management fads, such as BPR, customer relationship management, balanced scorecard, and continuous improvement. These quick fix-solutions, Jackson (2003) further argues, are rarely effective when there is significant complexity, change and uncertainty. Universities have bought into many of the above management fads, as mentioned by Jackson (2003), including BPR. BPR is a specific order of work activities across time and place, with a start and end, and clearly defined inputs and outputs (Panayiotou, Stavrou and Gayialis, 2017).

IT plays a fundamental role in BPR (Al Shobaki and Naser, 2017; Bhatt, 2000). However, the megatrends that influence universities, as in any other business, are political, economic, social, technological, environmental, and legal (Munigala, 2018), leading to changes in IT tools and processes (Thelen, 2015). The optimisation of the individual process has the potential to lead to a series of problems, thereby providing users with only a part of the necessary information (Panayiotou et al., 2017).

The application of IT tools by universities to improve operations has not been holistic enough. In terms of the systems approach, this represents reductionism. Systems thinking is holistic (Jackson, 2003) as it ensures that the parts of the organisation function together effectively to serve the needs of the whole system. Business re-engineering and systems thinking have enabled organisational managers to scrutinise their business systems (Van Ackere, Larsen and Morecroft, 1993).

According to Orlikowski et al. (2016), the re-engineering of a process or activity creates challenges as one part of the process is improved without considering the interconnectedness or interrelatedness with other parts of the system. The non-improved process or activity then creates bottlenecks owing to the failure to utilise systems thinking in re-engineering processes. Rao, Massing and Osei-Bryson (2012) assert that organisations have high expectations in BPR. However, BPR has a high failure rate of 70% in organisations, and one of the causes is the lack of understanding of the organisation's environment (Orlikowski et al., 2016).

The re-engineering of business processes is embedded in IT, which is used as a pillar for improvement in the university. However, the process of re-engineering is linear and simple in dealing with complex university processes as they display high degrees of interrelatedness, interconnectedness and interdependency. Moreover, the re-engineering of each business process is done in isolation, without considering what effect it has on other processes and the system-in-focus holistically, let alone the impact on recursive levels and external systems with which the system-in-focus interacts. This cross-sectional qualitative case study sought to investigate ways to infuse systems thinking into the re-engineering of

business processes at the university under study to eliminate business processes challenges which are improved in isolation and that result in more business process problems for the university under study such as process bottlenecks created owing to the interconnectedness of processes.

1.4 Purpose of the study

This study has drawn from BPR and systems thinking theories to answer the main research questions of the study, namely: How can systems thinking be infused in BPR IT projects at a public university to improve, contribute and enhance knowledge and achieve success in the public university's BPR projects?

This study aimed at adding value in BPR IT projects at the university when the projects are initiated and implemented by incorporating systems thinking in order to cope with complex and messy situations in the pursuit of process improvement. This study has also helped to understand the interrelatedness, interconnectedness and interdependency of parts of the system-in-focus, and that the sub-optimisation of one part may cripple other parts. The study also highlights the inability of reductionism to deal with complexity, change, unpredictability, and uncertainty. As new functionalism or new managerialism continues to permeate public institutions, the study assists in enhancing our understanding of how complex the university is. This historical but paradigmatic study, which promotes creative holism, contributes, through its findings and recommendations, to the body of knowledge on the re-engineering of business processes in IT projects in order to reduce challenges experienced when initiating and implementing BPR projects at the public university in South Africa.

1.5 Research objectives

The main objective of the study sought to investigate how systems thinking can be infused into re-engineering of business processes, the objectives were:

1.1.1. To establish the systemic impact of BPR on business processes and IT, and how it is managed at the institution under study.

1.1.2. To identify the strategies that are employed to understand the effects that BPR has on other sub-systems of the institution under study.

1.1.3. To investigate systems thinking approaches that can be used in BPR at the institution under the study to understand holism.

1.1.4. To identify the most suitable systems thinking approach to recommend recommended for infusion in BPR for the institution under study.

1.6 Research questions

This study had the following research questions which were answered**:**

1.6.1 What systemic impact does BPR have on business processes and IT, and how is it managed for the institution understudy?

1.6.2. What strategies are employed to understand the effects that business process re-engineering has on other sub-systems of the institution understudy?

1.6.3. Which systems thinking approaches can be used in business process re-engineering at the institution under study, in order to understand holism?

1.6.4. What would be the most suitable systems thinking approach to recommend for infusion in BPR for the institution understudy?

1.7 Theoretical framework

The theoretical framework of this study was positioned research in the discipline or subject in which the researcher is working, and gives direction to the study (Henning, Van Rensburg and Smit, 2013). As stated in Du Plooy-Cilliers, Davis and Bezuidenhout (2014), the theoretical framework is a gathering of thoughts and theories that are related to the phenomenon under investigation as a theoretical starting point to frame any research study. Importantly, this study drew from BPR and systems thinking theories to answer the main research questions of the study. Chapter 2 of the study has unpacked in detail the theoretical framework of the study.

1.8 Research methodology

This study was a qualitative case study, and Chapter 3 of the study has unpacked in detail the research methodology. As argued by Malhotra (2012), qualitative research provides a better understanding of the problem, and in this instance, it enabled the researcher to achieve a qualitative understanding of how systems thinking can be infused into BPR IT projects at

a South African university. Qualitative research allows the researcher to provide an elaborate interpretation of phenomena, and to crystallise the research problem ((Miles, Huberman and Saldana, 2013). Furthermore, it can achieve a high quality of theory generation and development through subsequent meticulousness in data analysis (Miles et al., 2013). Literature suggests that qualitative studies use open-ended questions and small samples.

1.9 Chapter outline

This study consists of five chapters, as illustrated below**:**

Chapter 1: Introduction and background to the study

This chapter provides an introduction and theoretical background to the study, including the problem statement, purpose, objectives, research questions, significance, limitations, methodology, and layout of the thesis.

Chapter 2: Theoretical framework

This chapter reviews extant research relating to the study in an attempt to answer research questions.

Chapter 3: Research design and methodology

This chapter outlines the research design and methodology employed in the study. In addition, it discusses the limitations and ethical considerations of the study.

Chapter 4: Presentation and discussion of the findings

This chapter presents and discusses the findings of the study in a logical sequence, in the order in which the objectives and purpose of the study were formulated and presented.

Chapter 5: Conclusions and recommendations

This chapter summarises the chapters of the study, presents conclusions, and makes recommendations based on the findings, as well as in terms of future research.

1.10 Chapter summary

This chapter presented the introduction of the study, the background to the institution under study, the background of the study, research objectives, research questions, research design, and research methodology. The following chapter presents reviewed relevant literature for this study.

CHAPTER 2: THEORETICAL FRAMEWORK

2.1 Introduction

According to Grant and Osanloo (2014), the theoretical framework serves as the structure in which the study is positioned. The theoretical framework is vital for acknowledgement of the theories which influenced the researcher's view of the world, and it provides the direction of the study (Straughair, 2019). In this study, BPR and systems theories are reviewed to answer the research questions, in which existing literature from published studies, academic articles and theses are used to synthesise the chapter. A study presents various limitations. However, it is not possible to review all the existing literature. Equally, the researcher committed to reviewing academic literature relevant to the study.

Organisations are overwhelmed with dynamics, complexities, innovation, globalisation, and other factors (Swartz, 2018). There are internal and external market factors that have flooded the organisations which result in various organisational challenges (Harper, 2018; Swart 2018; von Kutzschenbach, Schmid and Schoenenberger, 2018).

According to Hillborn (2004), "sensitive dependence on initial conditions, also known as the butterfly effect, refers to the notion that even minuscule changes in initial conditions can lead to dramatic changes in system behaviour. Organisations are under tremendous pressure to adapt and become more flexible, as complexity compels them to change how businesses are operating (Swartz, 2018). Globalisation, internationalisation and other factors of the market that broadly impact and influence how industries, including higher education, are dynamic and continuously evolving (Khan, Butt, Mebrahtu, Shirvani and Alam; 2018; Syed, Bandara, French and Stewart, 2018).

This study infused BPR with a systems approach for the holistic view of problem identification and problem-solving. This suggests that the study undertook to infuse systems approaches in the BPR in order to accommodate the holistic view and appreciate the feedback loops in the implementation. This chapter includes how higher education operates; investigates the university as a complex adaptive system; unpacks the business re-

engineering process; the transcendent elements of systems approaches considered for business re-engineering and summary of the chapter.

2.2 Overview of Business Processes Re-engineering (BPR)

BPR is a tool that has been used as far back as the 1990s, and it has achieved numerous organisational benefits, such as cutting costs, growing production and enhancing customer satisfaction (AbdEllatif and Farhan, 2017). As argued by Novikov et al. (2016), re-engineering dates back to the 80s, and comes originally from the West, with James Champy and Michael Hammer being regarded as the founders. BPR is the management recipe used for Western organisational survival (Earl, 1996), and it is one of the managerial tools that has been used to improve organisational performance for over 25 years (Ahmadi and Abadi, 2016; Mathew, Sulphey and Rajasekar, 2015). However, BPR focuses on a smaller scope to achieve change in the process management approach, for the process owner to be the primary driver of change in processes and IT systems (Leveson, 2011).

Hammer and Champy (1993) state that BPR has the following common themes:

- Numerous jobs are combined into one.
- Employees make decisions.
- Process activities are performed in a natural order.
- Work is only executed when necessary.
- There is a reduction in checks and controls.
- Processes have various multiplicities.
- There is minimal reconciliation.
- The case manager provides one point of contact.
- Centralised or decentralised operations are crucial.

According to Leveson (2011: 25), “BPR thinking needs to be looked at in a holistic approach to re-engineering that involves business processes, technology and social system issues”. Tony (2014) argues that BPR is about designing and analysing organisational processes and workflows. BPR involves drastically reconsidering and redesigning business processes to achieve improvements in quality, costs, and services by doing things in a new way (Hammer

and Champy, 1993). However, BPR is not easy to implement, as it is about the adjustment of business processes (Ahmadi and Abadi, 2016). Jackson (2003) posits that BPR is reductionist in nature and cannot solve complex problems. AbdEllatif and Farhan (2017) indicate that BPR creates a computer-based system because it emerged from management traditions such as systems thinking and scientific management. However, Leveson (2011) states that academics are immersed with the question of whether BPR forms part the management theory in the past decades, higher education has been engulfed by "globalisation, growing requirements to lifelong learning and fast and intense developments in information and communication technologies" (Tuncer and Açıkalın 2015:1). Technology enhancements have opened the paradigm for business process optimisation (Khan et al., 2018). There is a paradigm shift in higher education, which influences changes in the market model and culture in higher education in order to cope with ever-changing and competitive environments (Harper, 2018). Therefore, higher education institutions have continuously been under tremendous pressure to perform (Srikanthan and Dalrymple, 2003), to meet the need for the increasing demand for access to higher education with steadily decreasing funding on education (Mays, 2017). Kasemsap (2020) further accentuates that BPR improves the performance of public sector organisations, and it also effectively supports the organisation in achieving its goals of the organisation.

In South Africa, there is an increase in expectation for ease of access to higher education. Ntsoe (2004) highlights the challenges of permeation by new managerialism, which is the use of business ideas and private practice in the public institution. Mays (2017) argues that educational institutions of higher learning are also continually searching for possible solutions by utilising information communication and technology (ICT) to cope and, eliminate where possible, the competitive pressure to offer flexible and affordable learning opportunities. The university's role has presumably increased immeasurably to provide knowledge to the communities across the world (Srikanthan and Dalrymple, 2003).

According to Srikanthan and Dalrymple (2003), universities are working on finding solutions that are sustainable for the identified and existing challenges. In the twenty-first-century BPR is one of the tools used in higher education to eliminate or mitigate problems

that have engulfed the higher education sector world-over (Ashayeri, Keij and Bröker, 1998). As confirmed by Lin, Chen, and Ye (2018), BPR methodology can be used in higher learning institutions to solve some challenges effectively. According to Bertolini, Bevilacqua, Ciarapica and Postacchini (2015), the progressive changes create the need for management methods to resolve problems using tools such as BPR.

According to von Kutzschenbach et al. (2018), organisations have significant rapid challenges that result in them opting for BPR to achieve goals with agility. According to Jackson (2003), BPR is one of the management fads that provide quick fixes and less sustainable solutions to complex problems. He further argues that BPR solutions fail because it decomposes the whole into parts, thereby generating isolated or independent from the whole. Innovations such as BPR have failed in higher education institutions (Srikanthan and Dalrymple, 2003), and isolated process relating to projects create unsustainable solutions with more problems emanating from factors such as political, economic, competition or governance (Vom Brocke et al, 2014). Traditional methods of solving issues only assist with the maintenance of the status quo, and it does not create innovation that can deal with complexity and constant change (Srikanthan and Dalrymple, 2003). Lin et al. (2018) argue that BPR creates bottlenecks in management and service as one process is improved without considering other business processes. Yurtseven and Buchanan (2015) state that there are messy and complex problems that are not easily understood as either little, vague, incorrect or incomplete information is available to solve the problem(s) or to recommend a sustainable solution.

It is such challenges that require multifaceted interventions and systems thinking is necessary to deal with such problematical situations, though Serban (2015) argues that BPR is used for business improvement in environments that are complex with rapidly changing settings. This argument is further strengthened by Razalli, Hasnan and Noordin (2017) in which they say organisations globally are now facing challenges and hasty change wherein BPR is opted for as a methodology to improve and develop the organisations drastically. According to Ahmadi and Abadi (2016), BPR is central in enabling the business to agilely move towards implementing change(s) in order to adapt to challenges and complexities competently. However, systems thinking approach has been recommended on various

occasions as the practical approach to eliminating problems, as Moldavska and Welo (2015) state that challenges in many organisations emanate from reductionist approaches. Though many organisations have modern thinking, however, Sellers (2017) argues that leaders of these organisations create more complexities by employing traditional reductionist methods in solving problems instead of creative holism.

BPR is one of the improvement initiatives used by organisations in order to enhance performance, competitive advantage and survival (Melão and Pidd, 2000; Swart, 2018; Gamar and Agrawal, 2015). Many scholars have empirically and conceptually trawled and written about the permeation of the new managerialism or new functionalism, and the private sector organisations have initially used BPR. Nowadays, there has been a paradigm shift that saw BPR being used in the public sector to improve service delivery to the stakeholders (Swartz, 2018). Though it is used widely, BPR projects fail either before or after implementation owing to today's complexities and other factors (Sharma and Kumari, 2016; and Shays, 1994). This, therefore, begs the question of its ability to deal with complexity and problematical situation. Luoma (2009) alluded its failure in projects owing to the reductionist approach that lacks appreciation interconnections, interdependency and interrelatedness of parts in solving problems.

BPR should not be executed in the structured approach as it requires innovative and creative thinking that is new to businesses (Ross Arnold and Jon Wade 2016; Ahmadi and Abadi 2016). Ahmadi and Abadi (2016) maintain that redesigning the processes must not focus on only people, tasks, structures, and jobs; the main focus must be on processes. Some scholars have advocated the philosophy that promotes the business process improvement to improve a particular part of the whole at a specific moment, which Jackson (2003:3) refers to as 'sub-optimisation'. Luo, Zhang and Ren (1996) had seen that the philosophy mentioned above would not work any longer as businesses are more complex than ever before. According to Sellers (2017), systems thinking is beneficial in dealing with complexity. However, the literature suggests that systems thinking has not permeated business livelihoods as it should be.

There is a sense in which BPR has failed many times and has had a short-lived trend (Sellers, 2017). Luoma (2009) argues that the process to understand problems is undergirded by having the big picture to appreciate its holistic and interdependence of the system-in-focus. Swartz (2018) pontificates that BPR has numerous challenges that must be addressed. Hence Arnold and Wade (2017) advocate systems thinking as central to preventing further devastations. Sellers (2017) asserts that systems thinking is an appropriate methodology for modern thought leaders. According to Yurtseven and Buchanan (2015), the existing traditional and scientific methods that are still used to resolve challenges should infuse a systems-based approach. As Davenport (1994, cited in Bygstad et al) puts it, "all process innovation is admittedly a complex and non-linear phenomenon, but we can also understand it more concretely as the re-engineering of work through information technology" (2017:85).

2.3 University as a complex system

According to Altbach, Reisberg, and Rumbley (2009), globalisation is one of the factors that has hugely influenced the higher education sector. Ruben (2018) concurs that higher education is faced with many challenges, such as an increase in higher education demand, increases in university tuition fees and university-funding problems. Altbach, Reisberg, and Rumbley (2009) further highlight that the higher education sector is using technology to cope with globalisation. The higher education sector must start analysing the challenges in a more holistic view other than utilising the silo method to solve problems for effective solutions (Srikanthan and Dalrymple, 2003).

There are world challenges such as moving away from the traditional method of teaching that are compelling higher education institutions to adapt by implementing technology and innovation (Becker, Cummins, Davis, et al., 2017). Mohamedbhai (2014) further highlights that higher education in industrialised and European countries was only available for a few people such as males, the elites in the 1st half of the 20th century. However, there was a paradigm shift in the later 20th century, and higher education is now accessible to the masses owing to democratisation and other factors. Becker et al. (2017) maintain that university institutions are implementing technologies to meet the needs of an increasing number of students in institutions.

Altbach, Reisberg and Rumbley (2009) assert that higher education institutions are now responding to mass demand by moving towards providing distance education, and distance education is vastly improved by ICT in order to provide better service. The institution under the study is the largest and premier distance learning institution on the continent (Altbach et al., 2009). Higher education institutions are now spending a large amount of money to implement and maintain the ICT solutions in order to support the university's goals by providing quality face-to-face and online education (Mtebe and Raisamo 2014). Mohamedbhai (2014) further avers that several public universities depend on IT solutions to manage challenges such as massification.

According to Kumari, Rao, Reddy, and Kiranmai (2015), a countless number of higher education institutions are using technology and innovation methods which were previously only used in the private sector in order to meet requirements of the institutions. BPR is one of the innovative tools used by the higher education sector to enhance teaching and learning. The higher education sector has external challenges. As a result, the industry is implementing BPR in the higher education sector in order to improve efficiency and to rethinking the systems (Kumari et al., 2015).

Organisations are complex; they are faced with unrests and uncertainties. However, some leaders use non-linear thinking when resolving challenges, and these leaders are systems thinkers (Shangase, 2011). According to Darwin, Tetenbaum and Senge (2006), the traditional theory saw organisations as a closed system with boundaries. Organisations were viewed as protected from the environment, which is hostile. Organisational challenges are not resolved by linear methods or by leaders who rely on simple linear solutions to solve problems (Shangase, 2011). According to Shangase (2011), lack of systems thinking knowledge in an organisation can expand the organisational difficulties instead of resolving them. Senge and Scharmer (2008) state that this era has organisations which are faced by with overwhelming challenges that are being tackled in isolation, not in a systematic way.

2.4 Business Process Re-engineering (BPR)

BPR became popular in the 1990s, and it was introduced by Michael Hammer (Melão and Pidd 2000; Davernport, 1995; Esbenshade, Vidal, Fascilla and Ono, 2016; Hillon, and Mele, 2017; Swartz 2018; Harmon 2015; Wang 2015; Swartz 2018; and Lin, Chen, and Ye, 2018). BPR took over from initiatives which were advocating for automation of business processes, and that was popular before the 1990s (Swartz, 2018; Harmon, 2015). 'Business process is a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer; it is the stage of logically related tasks performed to achieve the business outcome' (Southern and Moutinho, 2018 quoted in Champy and Hammer (1993:35). According to Vom Brocke, Schmiedel, Recker, et al. (2014), business process-related issues such as process inputs, process outputs and process owners are discussed in organisations daily because processes are very crucial. A business process is defined as related tasks which are grouped together logically to support the aims of the organisations (AbdEllatif et al., 2018).

The automation of processes initiatives was named software automation because initiatives were IT-driven, and back then, IT was independent of business (Harmon, 2015). Moreover, Davenport (1995) argues that prior to the 1990s, re-engineering components already existed but BPR had not yet conceptualised and managed as the management tool or the concept. The BPR is the concept primarily used, but most of the times, the concept is misunderstood because the public, management and business consultants tend to abuse concepts (Bennis and Mische, 2017). Process modelling is used in BPR projects to understand the problems, but it is a very linear way of thinking for purposes of problem-solving (Vom Brocke et al., 2014). Concurs, Shays (1994) by stating that if BPR is used to solve problems, it is essential to consider that every problem is part of the system and it is necessary to recognise that the system has sub-systems and it is part of the larger system. Shays (1994) further indicates that BPR embodies the philosophies, which are based on 1) waste identification in processes and elimination, 2) process integration, 3) automation, and 4) process simplification. According to Kumari, Rao, Reddy, and Kiranmai (2015), the primary purpose of BPR is used to enhance the existing processes in an organisation to introduce effectiveness and efficiency.

According to AbdEllatif, Farhan and Shehata (2018), BPR is one of the significant solutions used by organisations used to improve the performance of business processes and additionally the performance of the organisations. According to Lin, Chen, and Ye (2018), BPR is used to identify, analyse and improve the processes for organisations. Ho (1996) further states that BPR has many challenges, and one of them is employee resistance to BPR projects and that result in a significant failure rate. BPR IT (IT) projects have been proven to the costs and time; this is because it is easy to improve business (Ahmadi and Abadi, 2016). However, according to Sharma and Kumari (2016), BPR is complicated to implement because technology is a critical part of the BPR. BPR projects have been highlighted to have a very high failure rate which is 70%. Their failure in BPR could be attributed to only focusing on the process improvement without considering the environment and any other impact (AbdEllatif et al., 2018).

One of the steps that are executed in the BPR approach includes documenting or mapping the current state (As-Is) of the business processes. Therefore, by understanding the current state of the challenges the organisations enable the business to investigate possible future solutions to enhance the performance (To-Be) processes (Rinaldi, Montanari and Bottani 2015; Jamel, Saadian and Nurcan, 2018). Many BPR projects have failed; organisations must look at other ways to deal with the complexities in this 21st century to respond with agile approaches (Hillon, and Mele, 2017). The BPR tools have limitations, and that has an impact on BPR projects. Consequently, BPR projects do not enhance and explore the desired results with the full potential at times (Shays,1994). Cha et al. (2015) concur that the efforts implemented by BPR have yielded to mixed rates of success to the intended results.

According to AbdEllatif et al., (2018), organisations are faced with many unexpected changes which occur in a swift pace, i.e. globalisation, technology change and customer requirements, that might result in failure of BPR in organisations. It is essential to note that the projects which are implemented in this 21st century require initiatives and implementation of mastery of complexity in mind as the precondition to have a successful project (Oswald, Köhler and Schmitt, 2018). According to Jamel, Saadian and Nurcan (2018), there are enormous challenges with BPR projects because of the constantly changing

organisational environment. Moreover, flexibility is significant in BPR because it supports the ever-changing atmosphere on the organisations.

In BPR projects, it is essential to consider variation, considering challenges beyond the process boundaries in a systemic and holistic approach to provide sustainable solutions (Sharma and Kumari, 2016; Alrabiah and Drew 2018; and Vom Brocke, et al., 2014). Samaranayake, Dadich, Hayes, and Sloan (2015) cited in Clegg (2006) aver that BPR must infuse a holistic modelling approach that advocates for systems thinking application in order to enhance business processes, the business achieves and effectively design business process. Gamar and Agrawal (2015) argue that BPR project(s) needs many resources in order to be successful.

According to Nicholds and Mo (2015), BPR projects are facing significant and constant changes in the environments. Moreover, business modelling methodologies need to be flexible to accommodate the forever-changing requirements of the BPR projects. BPR is an essential tool used to implemented change while infusing systematic management methodology (Kebede and Abetwe, 2017). In the same vein, Khoshlafz and Hekmati (2016) concur that BPR has shown success and no success in other projects. Therefore, it is essential to understand using the systematic approach the reasons for not being able to implement BPR projects with success. According to Lu, Chang, Yan and Lin (2016), BPR is used in an educational institution(s) to reexamine and differentiate the whole of the institution's processes for the advancement of the competitive advantage. The use of systems thinking is very crucial when attempting to improve efficiency and effectiveness when analysing business processes in large systems. Moreover, a systematic non-linear and holistic method is essential (Bhushan, 2017).

2.4.1 Using BPR in higher education

Higher education institutions are constantly rethinking and reconsidering IT services, and that has many potential benefits on the higher education sector (Miskon, Bandara and Fielt, 2017). According to Miskon et al. (2017), educational institutions are now embracing the corporate strategies of using BPR, as one of the tools to enable the institution is rapid growth. However, systematic thinking is key to managing the change effectively when using BPR.

According to Lu, Chang, Yan, and Lin (2016), there is an impact on the higher education sector because of trends related to globalisation and social changes worldwide. According to Lu et al. (2016), re-engineering of business processes is one of the forms used to implement change in institutions. Higher education institutions are now struggling to keep up with the changes, which are swift in the sector. Therefore, initiatives such as IT, structural innovation, and consolidation of teaching resources are essential to achieve excellence in higher education (Lu et al., 2016). Moreover, Miskon et al. (2017) assert that targeting a problem and trying to resolve it often results in problems being unsuccessfully resolved in an institution. As a result, the use of systematic innovation is critical because it solves problems for the institution, not for just a specific identified process. Some scholars have argued that the traditional methods of solving complex problems in the universities will work in a silo, thus incorporating system thinking approaches enables sustainable solutions (Yurtseven and Buchanan, 2015).

According to Kumari, Rao, Reddy and Kiranmai (2015), higher education institutions' decision to use BPR resulted in improvement in innovation, IT and effective business processes in performance. Boje, Hillon and Mele (2017) argue that the higher education sector has so many challenges such as lack of diversity, lack of skilled graduates, funding of students by the state, which is unsustainable. Therefore, the institutions implement BPR, and it is essential to note that it is unable to resolve the challenges the institution has; it ends up making things worse. According to Bhushan (2017), business processes are not solitary limited to business processes, but it is also an accurate representation of interconnected and interrelated of factors such as activities and resources.

2.5. Information technology (IT) as the enabler of a Business Process Engineer (BPR)

According to AbdEllatif et al. (2018), BPR is regarded as the information system development process. AbdEllatif et al. (2018) further state that BPR automates that manual processes with many human interventions, and it also replaces that organisation's existing legacy systems. IT plays an essential role in initiating and implementing BPR projects (Ahmadi and Abadi 2016; Huang, Lee, Chiu, and Yen, 2015). In the same vein, Gamar and Agrawal (2015: p2) concur with Hammer that "the role of IT in a BPR project is to challenge

the assumptions inherent in the work processes that have existed since long before the advent of the modern computer and communications technology".

According to Chang (2016), technology requisites complement the processes when re-engineering is implemented, technology in the 1990s is also labelled as a core enabler of BPR. Vom Brocke, et al. (2014) assert that BPR projects have benefited mainly in IT technology systems by also enabling support the proposed enterprises business process solutions. BPR projects necessitate IT awareness to understand the points of integration between IT systems and business processes efficiently (Sharma and Kumari, 2016).

Over the years, BPR has failed, and it has been labelled as a passing fad. Systems thinking does not advocate for breaking down the problem or the challenge into pieces (Rubenstein-Montano, et al., 2001). In addition, Sharma and Kumari (2016) predicted that most BPR projects which are already in progress or are about to start would fail because the objective of projects will not be achieved.

Systems thinking must be executed when executing IT projects to understand the holistic picture other than narrowing BPR to IT systems for problem-solving (Sharma and Kumari, 2016). According to Sharma and Kumari (2016), BPR projects impact multiple stakeholders and organisational processes. Moreover, BPR is conducted per-process instead of looking at numerous methods (holism perspective) that results in processes improvement in isolation, creating more challenges unintentionally. Owing to many factors which resulted in the failure of BPR, there is a need to look for a holistic way of working on BPR projects while considering the environment, understanding of people, understanding of people and customer requirements for success (AbdEllatif et al., 2018).

According to Vom Brocke et al. (2014), many technology standards or IT solutions can be used to permit business processes to be more efficient and effective. IT systems are very crucial to support organisational functions to enable entity growth (Park, 2018). Luo, Zhang and Ren (1996) assert that for organisations to survive in turbulent environments where rapid adaptability is required and the way of thinking must change, they must move from

mechanistic philosophy, stagnant system thinking and monocausal deduction to dynamic system thinking to adapt and do thinking within focusing on interactions within the functions with multidimensional deduction and dialectic philosophy in mind.

Business Process Management must use the holistic methodology that incorporates e.g. Strategic, Social, methodological, technical characteristics the focus should not be on only IT systems as enablers of the business processes (Vom Brocke et al., 2014). According to Viaene, De Hertoghand Jolyon, (2011), the world's best CIO's have recommended that IT must find paramount means to work collaboratively with business to realise enterprise value collectively. Higher education institutions have recently used BPR to improve processes in higher education, and technology is used as an enabler to implement academic performance and improvements (Kumari et al., 2015).

2.6 BPR IT project(s) limitations in higher education

According to Chan and Choi (1997:213), "BPR is an aggressive idea on innovating a business process or system. It encompasses change in systems, policies, organisation structures, and responsibility of workers to provide a valuable business process in dealing with customers, suppliers, products and services. In contrast to the traditional automation and long-term continuous improvement programmes, BPR seeks to gain dramatic improvement in performance within a short period".

BPR projects have shown a trend of failures when project results are compared with the project objectives, and BPR projects have shown challenges by producing feedbacks, which are complex with uncertainties and reaction (Hillon and Mele, 2017). Literature suggests that more projects, which fail, surpasses projects that are successful in various disciplines, including the BPR projects (Kader and Dwolatzky, 2016). Hillon and Mele (2017:1) further asked a critical question about using BPR to solve complex problems 'then what is a more suitable approach to developing agile organisations that are adaptable and flexible when confronted with 21st-century network complexity?'.

According to Li and Shi (2014), the method used to implement BPR has been described as not systematic, and the rationality and effectiveness of the method have been questioned in a few articles. Educational institutions who use BPR should consider the methodology of organisational (systematic) innovation to ensure that the challenges are resolved within the institution, not in just the part of the institution (Miskon, Bandara, and Fielt, 2017). IT has a significant impact on BPR by continually improving the outcome of business processes and empowering employees (Aregawi, 2014). BPR projects sometimes fail in organisations which are published owing to challenges such as operating in a silo and bureaucratic environment and operating in a linear method (Aregawi, 2014). Emes and Cole (2019) state that the recent study conducted for the association of project managers have indicated that some experienced project managers use systems thinking only for complex projects to deliver technology products successfully. Bradle and Kristoff (2017) further state that BPR is one of the management fads that has emerged from the IT industry. The results produced by the implemented BPR can be disappointing and disruptive to business.

2.7 Enterprise Architecture and BPR in IT projects at the university understudy

The organisation under study currently depends on Enterprise Architecture (EA) for purposes of understanding the challenges they have, which require improvement for any IT related projects for the organisation under study. EA is a tool used by more than 20 countries in the public sector to improve services and to ensure the holistic approach which aligns processes, strategies and IT resources (Dang and Pekkola 2016). According to Penttinen (2018), EA is the systematic approach used for the analysis of the organisation which implements the organisation's solutions. However, implementing EA is very challenging in organisations. Senge (1996) state that complete theory does not exist when attempting to resolve a problem; there is no inherent conclusion to any system. Senge (1996) further state that organisational challenges must be viewed in comprehensively and be dealt with more systematically.

According to Gomes (2015:525), Enterprise Architecture is a complete expression of the enterprise; a master plan which "acts as a collaborative force" between aspects of business planning such as goals, visions, strategies and governance principles; aspects of business operations such as business terms, organisation structures, processes and data; aspects of automation such as information systems and databases; and the enabling technological

infrastructure of business such as computers, operating systems and networks. Van Zijl and Van Belle (2014:405) cited TOGAF by stating that is "the purpose of enterprise architecture is to optimise across the enterprise the often fragmented legacy of processes (both manual and automated) into an integrated environment that is responsive to change and supportive of the delivery of the business strategy". Bakar, Kama and Harihodin (2016) posit that public organisations have challenges with implementing EA because there are various complexities and inflexibilities.

Kotusev (2016) argues that the projects which have been a success in the real-world had nothing to do with the EA frameworks and there is no specific evidence which can prove that EA frameworks are very effective. Kotusev (2016) further accentuates that EA is just a management fad which does not add any value to the organisation. EA is just an aimless description of architecture which results in organisations losing billions of dollars to consultants (Kotusev, 2019).

Bijata and Szafrański (2015) further indicate that EA uses frameworks such as TOGAF to conduct analysis and for connecting the EA strategy with the strategy of the organisation. Van Zijl and Van Belle (2014) highlight that business process architecture is one of four EA's four areas. Huysmans and Verelst (2013) further postulate that EA is effectively used in IT projects to provide guidelines which are systematic, and it assists with dealing with change, integration and complexity.

Cha et al. (2015) contend that the efforts of BPR and EA do not permit organisations to achieve the intended results entirely, and limited value has been achieved. EA and BPR are closely associated with using diagrams, and both tools for organisational development have been proven to be systemic approaches **(**Grigoriev and Kudryavtsev, 2013). According to Nam and Pardo (2011), EA and BPR are used to effectively implement innovation in the organisation while eliminating the traditional bureaucracy in the organisation. According to Kotusev (2019), EA has no business value, but over the years, it has been referred to as the "best practice" without any results for organisations. However, consultants continue to guide organisations to create the aimless architecture that results in organisations losing billions of dollars to consultants.

Magoulas, Hadzic, Saarikko and Pessi (2012) indicate that EA identifies interdependence within the various alignments of the organisation. Moreover, EA patterns are a consequence of forces of the organisation rather than rationality, and they can be softer aspects and hard aspects. According to Nam and Pardo (2011), EA signifies the interdependent group, which consists of multiple agencies which operate as a whole. EA considers the enterprise key strategies holistically rather than in silos with their related impacts pertaining to technology applications, business and application (Gomes, 2015). Larsson (2011) further aver that research conducted by scholars has indicated that in a large extent, EA has failed in the public sector because of so many factors such as non-alignment of business architecture and IT architecture.

According to Lemmetti and Pekkola (2012), EA is very useful in managing very complex environments in organisations, and it also combines IT, business, personnel and strategy of the organisation. EA has been overwhelmed with challenges especially during the implementation phase because EA is applied by the organisations as the IT project which sought to focus on IT than to also focus on business requirements (Dang and Pekkola, 2016). According to Larsson (2011), EA is one of the very effective approaches used in a public organisation to implement the aligned business processes while using IT projects by ensuring that both IT and business goals are achieved.

According to Penttinen and Isomäki (2010), EA supports the strategic goals of the organisations in the public sector by emphasising the collaboration and alignment such as the systems, processes to encourage working together with a whole in various organisational structures across the organisation. EA has to consider that multiple organisations have their complexities and IT projects are also complex, and events in the diverse organisation do not happen in a straight-line manner; there are always unexpected events (Larsson, 2011).

Larsson (2011) asserts that EA is a systematic approach for analysing, visualising, developing and governing the functions and structures of organisations. It describes how organisations businesses, information and systems function as a whole. Penttinen (2018) further posits that research and practice have shown the implementation of EA is challenging

and slow to advance, and EA does not cover all areas of organisations; it covers technology and organisational processes. Moreover, EA does not include the impact caused by the viewpoints of humans, and that result in EA programmes in the public sector failing (Penttinen, 2018). According to Wang and Elatlassi (2016), EA supports the organisations to achieve their goals, and it also complements multiple perspectives in a complex system. Wang and Elatlassi (2016) maintain that the application of systems thinking principles such as the soft system methodology in an organisation is crucial.

2.8 Systems thinking definition(s)

According to Peters (2014)

Systems thinking is defined as the whole that consists of parts, which are interconnected, and those parts interact together for a particular purpose; systems thinking acknowledges perceptions and holism (Peters, 2014).

Meadows, Sweeney and Mehers (2016)

Systems thinking is the term that epitomises the various methods that concentrate on the importance of interconnection or interrelatedness of elements rather than focusing on the parts individually. Systems thinking provides a useful framework in complex problem understanding and complex problem-solving. Systems thinking enables organisations to be proactive rather than being reactive to the crisis by thinking in an integrated way (Meadows, Sweeney and Mehers, 2016).

Sellers (2017) According to Sellers (2017: iv) ‘Systems thinking is examined by first contrasting it with traditional disciplined, reductionist, feed-forward, analytical thinking. Next, the scope and details of systems thinking are derived from the complex set of interrelated methods, paradigms, rules-of-thumb and perspectives of several published researchers.’

Bibri (2018)

Systems thinking advocates for understanding and examining the system with its subsystem in order to better understand the interconnectedness and interactions within the system as a whole (Bibri, 2018).

von Kutzschenbach, Schmid and Schoenenberger (2018)

According to von Kutzschenbach, Schmid, and Schoenenberger (2018), systems thinking is very crucial in enabling systematic and holistic view that focuses on an internal and external environment in the organisation(s) to permit competitive advantage.

According to Haines (2016)

Systems thinking is not issues, parts and events, boxes/ silos, single activities of change, defensiveness, inputs and resources.

According to Haines (2016)

System thinking approach is to lead planning and change in an organisation for the better in a strategic and holistic fashion. Systems thinking is a heavily researched methodology and vigorously macrosocial-scientific theory within the roots in the universal laws of living systems on earth and in ecology and biology.

Over 25 scientific disciplines such as electronics, architecture, complexity and chaos theory, project management, etc. leading thinkers and writers are moving in the direction of systems thinking. Systems theory is described as an actual process with some key elements. In the system process, there is a series of inputs to throughputs (or actions), results in outputs into the system's environment, a system also contains a feedback loop for monitoring and evaluating the system's input, throughput and output. Every living system also interacts with its environment, and everything system also openly interact with its environment.

2.8.1 Systems theory

According to Bhushan (2017), systems theory was advanced by the biologist Ludwig von Bertalanffy in the 1940s. The theory advocates a system that is an open purposive system. Von Bertalanffy was fascinated in understanding how the biological organisms work (Jackson, 2006) According to Bhushan (2017), systems thinking is the approach, which is trans-disciplinary, and it emerged in the 1940s or early 1950s.

According to Peters (2014), systems thinking has advanced in the 20 the century it has origins from various or different disciplines such as 'biology, anthropology, physics, psychology, and mathematics, management, and computer science". In the same vein, Jackson (2003) concurs that systems thinking is used in diverse disciples. Systems thinking is "the word system is derived from the Greek sunistánai, meaning to cause to stand together" (Peters, 2014:1). According to Harper (2018), systems thinking approach assesses the organisation as the open system that has the interconnection and interaction with other parts, the college is a system that is open with subsystems that interrelate with the environments which are internal and external.

Systems thinking is instrumental in discovering intended and unintended consequences, systems thinking to allow the presentation of the big picture in order to understand the processes and interconnection (von Kutzschenbach, Schmid and Schoenenberger, 2018). According to Monat and Gannon (2015), systems thinking highlights the fact that systems consist of inter-related components and focuses on the whole. Therefore, the relationships among the system's components are crucial in understanding the components themselves in order to solve problems. Systems thinking affords value and power and uses a collection of tools, such as a causal loop with feedback and delays, rich pictures and the ice bag model (Monat and Gannon 2015).

According to Arnold and Wade (2018), Barry Richmond is credited for inventing the word systems thinking in 1987, and he is a world-known leader in systems dynamics and systems thinking field. Systems thinking advocates understanding the problem from all angles (interrelatedness) to eliminate a partial or one-sided view of the problem (Jackson, 2006).

However, systems thinking does not have a standard definition or understanding. Nevertheless, it is prevalent today, since it has been applied in a variety of fields and disciplines for solving problems that are complex and unsolvable through conventional/reductionist methods. Furthermore, it is used in implementing change (Monat and Gannon, 2015). Problems cannot be solved in isolation because this can lead to more systemic problems. Therefore, systemic approaches must be used to solve problems (Murase, 2018). Faced with increasing complexity, change and diversity (Jackson, 2003), managers and leaders have inevitably sought the help of advisors, academics and consultants. Schaveling and Bryan (2018) assert that systems thinking is instrumental in solving ambiguous and complex problems.

System thinking gained a foothold from failure reductionism (a traditional scientific method for studying systems) and is used to address problems of complexity, change and diversity in complex systems (Checkland, 1999; Jackson, 2003), as well as being transdisciplinary in nature. According to Highsmith (2013), systems thinking acknowledges that simple solutions are destined to fail when pitched against complex problems or situations. Literature suggests that systems thinking deals with the interdependence, interrelatedness and interconnectedness of parts, systems and agents. Armson (2011) concurs that systems thinking focuses on unintended consequences, as well as consequences of a relationship's interactions, with the aim of ensuring that there is an effective and efficient intervention. According to Haine (2016), systems thinking enables leading change and is an effective and holistic approach. In the same vein, Jackson (2003) concurs that applied systems thinking was developed in the 1940s to respond to reductionism because it failed to respond to and manage complexity in the social and biological sciences.

The system-based approaches are very resourceful in complex situations, systems thinking approach equips the decision-maker with the ability to solve problems in the context of a full system. Moreover, the infusion of systems thinking in BPR does not attempt to replace the traditional thinking but to enhance it to resolve complex and chaotic challenges (Yurtseven and Buchanan, 2015). Bhushan (2017) posits that in the 1970s Peter Checkland introduced the soft systems methodology which replaced the hard systems methodology because the latter was not able to resolve complex challenges when organisation's complex

problems are human-centred and societal scenarios. Burge (2005) further asserts that soft systems methodology is very effective in helping people with different views from the messy, complex world to solve problems and resolve challenges sustainably.

Soft system methodology uses both sanctity and hard systems methodology (Bhushan, 2017). Traditional or hard systems methodology is scientific and fails in problems which are cluttered and complex. However, systems-based approach, such as the soft system methodology, solves the challenges in a full system (Yurtseven and Buchanan, 2015). According to Jackson (2003), management science is hard systems thinking or traditional systems thinking. In 1969, the research about soft system methodology began for an alternative to ill-structured problems.

2.8.2 Reductionism vs Holism

According to Ainscough, Wilson and Kenter (2018), the environment is a complex system which needs to be approached and better understood in a holistic manner to consider interactions between the system. However, reductionism is mostly used to understand the components individually instead of as a whole. Freddi and Salmon (2018) further state that reductionism is the principle of dissembling a problem into its pieces or parts. Reductionism is mainly used in technical science where parts are broken down while holism postulates that parts are interconnected or are interrelated they cannot exist without each other or as a whole (Freddi and Salmon,2018). In the same vein, Bhushan (2017) asserts that business processes or system must be viewed holistically and the way that is not linear in order to resolve complex challenges. "Complex systems cannot be understood by studying parts in isolation. The very essence of the system lies in the interaction between parts and the overall behaviour that emerges from the interactions. The system must be analysed as a whole" (Ottino, 2003:293).

A reductionist approach is a scientific methodology that is used to examine the system by breaking it down into separate parts or components (Fardet, 2017; Correll, Alexander, Albers, Sarikaya, and Gleicher, 2014). According to Correll, Alexander, Albers, Sarikaya, and Gleicher (2014: p2), 'Holism as a philosophy is a notion that the whole is greater than the sum of its parts. For evaluation, it is embodied by the belief that visualisations are best

evaluated as complete'. Holism advocates for not only examining the structure or a particular behaviour for problem-solving but, the holistic view always seeks to understand the situation and a problem in a worldview while considering that there is always interconnection between different elements and environments (Kang, Jia and Ju, 2016).

Business Process Management must consider the holistic view in order to study diverse aspects such as the organisational science, information science, computer science, and sociology (Cognini, Corradini, Gnesi, Polini, and Re, 2018). According to Chutri, Chisoro and Karodia (2014), it is very imperative that when BPR is implemented, it should incorporate the holistic approach in order to improve the organisation's speed, productivity, quality, solidity, customer focus and innovation. Kang et al., (2016) further indicate that reductionism is a traditional method used by scholars from the western-centric; it uses the linear way of solving problems.

The non-linear factors consider many parts in multiple layers in an open system, subsystems, innovation, and business processes is one of the factors considered in the holistic view (Bhushan, 2017). According to Jackson (2003), changes in any complex system have a significant impact on the long-term behaviour of the system that is called the butterfly effect; in the whole system, there are nonlinear relationships. Systems thinking can be used as an alternative to the methodologies, which are reductionist in order to provide the organisations with a sustainable solution (Moldavska and Welo, 2015).

Armson (2011) further posits that reductionist thinking has a privileged place in the western world and education where students are taught to understand a problem by breaking it down into smaller pieces. The holistic approach enables an understanding of the context. In the same vein, Jackson (2003) concurs that reductionism is the traditional scientific method that identifies and understands the parts and then understands the whole. However, reductionism is unable to cope with complex problems. According to Monat and Gannon (2015), systems thinking (holistic/ integrative) is contrasted with linear thinking (analytic/ separated).

2.8.3 Systems thinking for enhancement of BPR IT project(s)

Systems thinking has a tool called the feedback systems thinking that permits a holistic view in the complex organisational system (von Kutzschenbach, Schmid, and Schoenenberger, 2018). The feedback system approach is the approach that is created from the systems dynamics methodology; it was a concept that was developed in the 1950s by Jay W Forester (von Kutzschenbach et al., 2018).

Systems thinking approach is the backbone of enabling effective and efficient customer relationship management (CRM) by permitting management, control and assessment that is systematic (Trkman, Mertens, Viaene, and Gemmel, 2015). Business process projects focus is only on an organisation's single aspect of a unique operational process, single department as a result that causes failure because holism was not applied. Therefore, it is essential to use the holistic approach or principle in the scope documentation to eliminate isolated or single-mindedness on the specific feature (von Kutzschenbach et al., 2018).

Jackson (2003) further maintains that being systematic means that one understands problems from different perspectives and can resolve these problems from a variety of viewpoints and combining systematic approaches. To effectively address complex, chronic and social problems, systems thinking is more effective than the conventional way of thinking, as being unable to see the bigger picture translates into proposing traditional solutions that sometimes fail to solve the problems (Stroh, 2015). As stated by Checkland (1999) and Jackson (2003), systems thinking consists of hard systems and soft systems approaches. This is being discussed in more detail in the literature review of the actual study. The rationale for providing a summary review highlights the relevance of systems thinking to the study and shows how cognate it is to BPR IT projects. Checkland and Pouter (2006) posit that systems thinking employs a holistic view, and Jackson (2003) refers to this as creative holism. Systems thinking enables one to see the consequences of actions, as well as the connections that exist in any situation, and to understand better how systems unfold over time (Murray, 2016). It is useful when faced with messy and complex situations. BPR IT projects at universities are the backbone of their survival and sustainable competitive advantage.

Systems thinking approach should be used in a range of disciplines in order to be able to handle the complexity faced by the world (Arnold and Wade 2015). The professionally

trained individuals are trained to think linearly when resolving problems, and as a result, that causes limitations when problems are solved such as unintended consequences that were not identified because challenges are blinded by the traditional temporary solution (Sellers, 2017). Systems thinking provides the point of view, which is understandable in process philosophy (Keto, Palomaki and Jaakkola, 2018). Armson (2011) further postulates that holistic thinking advocates the understanding of an entity as a whole, together with its relationships or interconnections. In this regard, an entity can be an organisation, idea, person etc. Holistic thinking is the opposite of reductionism, which is scientific and seeks to understand the internal structures in the entity, by reducing them to component parts rather than understanding the bigger picture. Today's organisations are complex. It is crucial to understand the relationships between parts (Jackson, 2003).

Technology is always advancing, and it plays a very critical role in advancement. Therefore, there is an increase in interdependencies on their systems that have been present before (Arnold and Wade, 2015). According to Lu, Chang, Yan, and Lin (2016), universities are using IT in order to have the organisational reform and innovation in order to improve the education, e.g. Chinese Culture University ensures that IT is the fundamental part of the university strategy. Jafarzadeh-Kenarsari, Abouzari-Gazafroodi, and Zaersabet (2019) cited Balanko (2002) state that the education sector has changed drastically by introducing technology as a tool. As a result, digital learning has thrived over the years. The changes to business processes projects fail most of the time because they do not meet the desired outputs that result in financial loss, loss of competitive advantage and other factors (Rosenberg, 2016).

Emes and Cole (2019) indicate that systems thinking has many benefits when applied in complex projects.

The benefits are as follows:

- Deliver solutions to complex problems, which could not be resolved by the traditional approaches which applied decomposition in an attempt to solve problems.
- Drastically reduce any delays in the project.

- Enhance learning in the organisation on current projects and projects of the future.
- Better enhance the outcome of the projects.
- Support the organisation with identifying the correct project to address the challenges and also equip the organisation to execute the project effectively and efficiently.

Rosenberg (2016) argues that business process projects fail because of lack of interaction that is complex within the business process project, comprehension of complexities, projects are initiated and executed in a straightforward way and dynamics. Literature has quantified that 60% to 80% of the business processes change projects fail to get the projected goals by the organisation (Rosenberg, 2016 cited Al-Mashari et al., 2001; Berman et al., 2008; Koch and Hess, 2003; Trkman, 2010). According to Rosenberg (2016), the research which is actual states that business process change projects consider only the technical aspect of things, e.g. IT automation and they do not consider other more complex elements which are highlighted in scholarly work such as management, communication, interdepartmental cooperation, and user involvement is crucial for project success. According to Cognini, Corradini, Gnesi, Polini, and Re (2018), in order for organisations to reach their goals, objectives, they need to cope in the forever changing environment and complexities that arise. The organisation must have the business processes that are supported by IT infrastructure adequately. According to Khan, Butt, Mebrahtu, Shirvani, and Alam (2018), BPR has shown some big limitations and failures.

Leaders who are systems leaders are significant in an education system that is diverse, adaptive, and learning, in order for the educational system to be effective in the complex and very different system (Kuji-Shikatani, Gallagher, Franz, and Börner, 2015).

2.8.4 Systems thinking tools to be infused in BPR

According to Burge (2018), systems thinkers use tools to analyse specific situations, and they put systems principles into practice. Projects succeed because of the incorporating systems thinking in the project's traditional management approaches and measurements (Kasser, 2019). According to Arnold and Wade (2015), owing to international trade or open borders with different countries for purposes of economic development, that result in

economic feedback loops. As a result, there is always a ripple effect on other products. On the contrary, Emes and Cole (2019) assert that systems thinking can only be applied only in complex projects; simple projects do not have interconnectedness. There is a value proposition for organisations if systems thinking is used only in complex projects. According to Peters (2014:1), "Some see systems thinking as providing a powerful language to communicate and investigate complex issues, while others are confused by the sizable and amorphous body of theories, methods and tools involved". Nwabueze (2015) posits that BPR becomes very useful and highly successful if it is considering the interrelatedness and within the organisation such as the strategy, people and flexibility of the organisation, and effective leadership. Many modern complex projects these days have failed because of a systematic impact which can be identified immediately over a period of time (Emes and Cole, 2019).

According to Bhushan (2017), systems thinkers play a significant role in complexity by applying methodologies like systems dynamics (feedback loops) in order to resolve complexity. Systems dynamics is instrumental in consideration of the system dependencies in business processes by understanding other components or elements that allow sustainable improvement of complex challenges because systems dynamics enables improvement and understanding cross-functional business processes and bottlenecks (Bhushan, 2017). According to Burge (2018), systems thinking assesses situations as a system for better understanding and analysis. The conditions are better understood and resolved than applying the reductionist approach. Emes and Cole (2019) posit that there was a survey which took place in 2015, which highlighted the factors for project success was using systems thinking tools and principles in the across the project life cycle.

According to Marshall (2015), systems dynamics was established in the 1970s. It has been proven to be very useful in understanding another system's behaviour. According to Chan and Choi (1997), soft system methodology is very effective on BPR. There are significantly few organisations which implement BPR in a more holistic way through the approach enables the BPR to be implemented with success (Nwabueze, 2015). Emes and Cole (2019) state that a minimal number of projects managers apply systems thinking when managing projects even though they can benefit from using systems thinking in complex projects. Systems dynamics is the method that permits an understanding of feedback loops involving

delays, non-linear relationships, and systems dynamics future allows efficient business processes and policies (Bhushan, 2017). Bhaskar (2018) further posits it is estimated that roughly 70% of BPR projects failed because of the challenges with the methodology, which is unsustainable. According to Mays (2017), there are complexities in today's challenges and as a result, solving the problems holistically is very crucial for organisations. Solving the problems in silos or in isolation is not a sustainable way because the system is open with dynamic interactions. Systems dynamics is the tool that is used for understanding the dynamic behaviour of the system that is complex; a causal loop is used to represent the dynamics in the form of feedback, time delays, stocks and flows (Moldavska and Welo 2015; Aslani, Helo, and Naaranoja, 2014).

According to Bertolini, Bevilacqua, Ciarapica, and Postacchini (2015), when initiating and implementing the BPR projects, it is essential to understand the following As-Is Processes with the subprocesses and to process with the subprocesses. Bertolini et al. (2015:46) further state that "documenting the sequence of activities thus identified, in both causal and the temporal sense, including identifying" 1) causal relationships of process activities, 2) temporal relationship inputs and outputs in processes and 3) logical relationship.

According to Moldavska and Welo (2015) and Aslani, Helo, and Naaranoja (2014), systems dynamics is an enabler of understanding the behaviour of the organisation, and it is a very useful tool in assisting with making the organisational decisions. According to Mitra and Mishra (2016), systems dynamics method is the splinter of the theory of constraint. Fowler (2003:135) further accentuates that "managers need to develop and cultivate a capacity to perceive and analyse relationships between their organisations and the business environment as a complex, adaptive, dynamic system containing nonlinearities, inertia, delays, and networked feedback loops. Principles of, and linkages between, systems and control theory, complexity concepts, business process orientation and simulation are explored, through discourse, within this context". Senge (1996) further postulates that systems dynamic focuses on the causalities which trigger the patterns for change which are long-term in a very complex system.

According to Burge (2015), management in organisations attempted to use hard systems or traditional method to solve the organisational problems, and there was a discovery that management could not even adequately define problems to resolved and that created projects to collapse. Burge (2015) indicates that one of the reasons why there could be a failure in defining problems was that stakeholders do not have conflicting views on what the system is and the system problems. Burge (2018:2) further maintains that there are systems thinking tools which enable systems thinkers to "paint the big picture, capture and codify disparate viewpoints, unmask the hidden patterns, expose the natural and germane structure".

Burge (2015) articulates that Peter Checkland and Brian Wilson have developed soft systems methodology through action research; thus, soft systems methodology is more than just a process for resolving challenges. The tools which were developed are CATWOE, Conceptual Model, Rich Picture and Formal Systems Model. Burge (2019) further posits that in very unclear situations there is a need for a system thinking process to view the situation in a world view or big picture to better understand all the perspectives even from stakeholders. Chan and Choi (1997) assert that CATWOE is the tool used for understanding the root cause, and it is defined according to many views as per CATWOE. According to Jackson (2003:187), "A root decision should be well formulated to capture the essence of the relevant system and, to ensure that it is, should pay attention to the factors brought to mind by CATWOE (Customers, Actors, Transformation process, World view, Owners and Environmental constraints)".

CATWOE is a soft system thinking methodology tool used to illustrate the requirements from different spaces by understanding the perspective of a problem (Mayouf, Cox and Boyd, 2015). Jackson (2003) further states that with CATWOE, each system is analysed to define the root cause. According to Hagiwara and Saito (2016), CATWOE is used to analyse stakeholders, goals and issues. It assists in deriving a rich picture. CATWOE has six elements that are used to define the root cause in order to ensure that the problem is well understood and to explore other possibilities of the change is the root cause (Jackson, 2003: 193).

The six elements of CATWOE are defined as follows:

"C 'customers': the beneficiaries or victims of the transformation process";

"A 'actors': those who would undertake the transformation process";

"T 'transformation': the conversion of input to output";

"W 'world view': the world view that makes this transformation, meaningful";

"O 'owners': those who could stop the transformation";

"E 'environmental constraints': elements outside the system that are taken as given".

Von Kutzschenbach et al. (2018) argue for the importance of the systemic approach and holistic thinking for better service delivery for all stakeholders. The holistic view is very vital when understanding and resolving challenges. Therefore, using BPR and infuse systematic optimisation in processes is very important in order to reduce the risk of implementation failures and to provide sustainable solutions (Lin, Chen, and Ye, 2018; Vom Brocke et al, 2014). Moreover, Bibri (2018) concurs that organisation's problems are becoming more and more complex systems thinking is very important to consider when solving such problems by considering the factors such as the whole system and subsystems connection or interconnection and the new innovative ways to solve problems effectively. Burge (2018) further asserts that systems thinking powerful in management of organisational risks, problems and complexity in today's world.

2.9 Chapter summary

This chapter covered the theoretical framework of the study. The following areas were discussed in this chapter introduction, an overview of BPR, university as a complex system, Using BPR in higher education, IT as the enabler of BPR, BPR IT project(s) limitations in higher education, Systems thinking definition, Systems theory, Reductionism vs Holism, EA in BPR projects and infusing systems thinking in BPR IT projects. The following chapter presents the research methodology employed in this study.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter presents the research design and methodology of the study that the researcher has pursued. It entails the purpose of the study, objectives of the study, research questions, research philosophy, approach to the study, research design, the population of the study, sampling strategy, data collection method, data analysis, ethical consideration, and chapter summary.

Opoku, Ahmed and Akotia (2016) states that research methodology is a philosophy and a framework used in the process of enquiry. Taylor, Bogdan and De Vault (2015) also argue that the research methodology refers to how the research is conducted using which instruments, and it is the approach employed by the researcher to answer the research objectives and questions. According to Kumar (2019), research encourages the researcher to think logically, analytically and critically. The research methodology and the research design of the study frame the theoretical and philosophical position that justifies the research process in the study (King, Horrocks and Brooks, 2018).

Research is about generating answers to unanswered questions or creating that which does not currently exist (Goddard and Melville, 2004). The term "Re-", which is a prefix to the word research, means again (Henning, Van Rensburg and Smit, 2013). As one begins to search for information on any topic, research becomes a 'voyage of discovery' (Creswell, 2014) However, research is not just a process of gathering information (Goddard and Melville, 2004). Research evolves through inquisitiveness, which is the mother of all knowledge (Kumar, 2011). It is a systematic and methodological process of enquiry (Collis and Hussey, 2003; Ghauri and Gronhaug, 2002) and investigation in order to increase knowledge (Collis and Hussey, 2003).

3.2 Purpose of the study

The purpose of this exploratory qualitative case study was to investigate how systems thinking could be infused into the BPR of the university information and communication projects.

3.3 Research objectives

The study entailed four of the following objectives:

3.3.1 To establish the systemic impact of BPR on business processes and IT, and how is it managed at the institution under study.

3.3.2 To identify the strategies that are employed to understand the effects that BPR has on other sub-systems of the institution under study.

3.3.3 To investigate systems thinking approaches that can be used in BPR at the institution under the study in order to understand holism.

3.3.4 To identify the most suitable systems thinking the approach to recommend recommended for infusion in BPR for the institution under study.

3.4 Research questions

The study sought to answers the following research questions**:**

3.3.5 What systemic impact does BPR have on business processes and IT, and how is it managed at the institution understudy?

3.3.6 What strategies are employed to understand the effects that BPR has on other sub-systems of the institution understudy?

3.3.7 Which are systems thinking approaches can be used in BPR at the institution under study, in order to understand holism?

3.3.8 What would be the most suitable systems thinking approach to recommend for infusion in BPR for the institution understudy?

3.5 Research philosophy

Interpretivism, positivism and critical realism are the three philosophical paradigms. The researchers use them for purposes of research method guidance (Ryan, 2018). According to Higginbottom et al. (2016), critical realism is located in social science, and it is used to examine the world in multiple social perspectives or contexts; it is situated in social science.

In support of this view, Currie, Chiarella and Buckley (2015) define critical realism as using the social viewpoint by looking at the relationship between the social structure and people which can be influenced by social structures.

According to Ryan (2018), interpretivism maintains that knowledge and truth are subjective, and they are according to history, experiences of people and their understanding of those experiences. In support of this view, Packard (2017: 536) asserts that interpretivism is the philosophy which "sees the world through a distinct lens of intentionality rather than causality, of 'becoming' rather than 'being,' and relationships and interactions rather than social entities".

According to Alias and Hanapi (2016), positivism is defined as the philosophy which uses scientific methodology is focusing on objectives. Positivism is the opposite of interpretivism; positivism is related to the experiments and quantitative research (Ryan, 2018; Robson and McCartan, 2016). According to Goldkuhl (2012), qualitative research is mostly connected with interpretivism and positivism. This study followed interpretivism because this research is a cross-sectional qualitative case study.

3.6 Research approach

According to Newing (2010), research is classified as either qualitative or quantitative research, and quantitative approach produces numeric data, whereas qualitative produce non-numeric data like words or pictures. Du Plooy-Cilliers and Bezuidenhout (2014) indicate that there are three types of research approaches, that is, qualitative, quantitative and mixed researches method. Percy, Kostere and Kostere (2015:76) posit that qualitative method is used in the studies to report on "people's subjective opinions, attitudes, beliefs, or experiences of things in the outer world" such cannot be measured using statistics.

Qualitative research consists of numerous perspectives, namely, "philosophical and theoretical, various research designs which are interpretive, phenomenology, ethnography, grounded theory, narrative enquiry, arts-based research, qualitative action research and mixed methods" (Merriam and Grenier, 2019:16). According to Newing (2010),

quantitative research provides answers to questions focusing on cause and effect, or correlation between diverse variables.

According to Kumar (2019), the mixed-methods approach employs both qualitative and quantitative methods in one study. Some scholars distinguish mixed methods and multiple methods (Biesenbender and Héritier, 2014). In support of this view, Schoonenboom and Johnson (2017:108) describe mixed methods as the research method which can be defined as "the sibling of multi-methods research in which either solely multiple qualitative approaches or solely multiple quantitative approaches are combined". The mixed-method research is one of the research paradigms which positioned in both the traditional qualitative and quantitative research (Johnson and Onwuegbuzie, 2004).

According to Merriam and Grenier (2019), qualitative research is a sociohistorical context which is used to understand the way we live, and it is a narrative. Qualitative research looks at the situation as labelled from the individuals involved (Robson and McCartan, 2016). A qualitative approach was used in this study. It has been used to answer the main question that seeks to examine strategies of infusing systems thinking to BPR ICT projects. Qualitative research is a tool commonly used to understand our lives better (Merriam and Grenier, 2019). Robson and McCartan (2016) state that qualitative research is about the views of the eyes of people involved in the social world; there is slight or no use of statistical analysis. This study used a qualitative research design, which is an exploratory case study. The explanatory research attempts to clarify why and how there is a relationship between two aspects of a situation or phenomenon (Kumar, 2019).

According to Descombe (2002), exploratory research used a qualitative approach to investigate a phenomenon; hence this study employed the qualitative approach. As argued by Malhotra (2012), qualitative research provides a better understanding of the problem. In this instance, the researcher has been enabled to achieve the qualitative understanding of ways to infuse systems thinking into BPR IT projects at the public university in South Africa. Qualitative research allows the researcher to provide an elaborate interpretation of phenomena, and to crystallise the research problem (Miles, Huberman and Saldana, 2013). Furthermore, it can achieve a high quality of theory generation and development through

subsequent meticulousness in data analysis (Miles et al., 2013). Literature suggests that qualitative studies use open-ended questions and small samples.

3.7 Location of the study

The study was conducted in the main campus of the university under the study, which is in South Africa, Gauteng Province Pretoria. The one-on-one interviews were scheduled after the university granted the permissions to conduct a study. The interviews were scheduled in the main campus at the Information Communication and Technology (ICT) department on request by the participants. The offices were convenient for the participants as per their convenient time and location. The self-administered questionnaires were distributed via an email which contained the link that directed the participants to the Lime Survey software for completing the questionnaire. The participants completed the questionnaire at a convenient time and location.

3.8 Research design

Research design is a strategy for collecting information, analysing the information a study and the approach of communicating the findings (Kumar, 2019). Different research designs are used for various research project types. Research designs have a variety of research methods for collection and data analysis (Walliman, 2017).

3.9 Population

The population is the group of people with similar characters which are common, and the population provides the information for purposes of the research and based on their common characters (Wiid and Diggines, 2013). In support of this view, Du Plooy-Cilliers et al, (2014) state that population are all the characteristics the researcher has an interest in such as individuals, things, features, and units. The target population can be described as all elements or subjects that meet the criteria for inclusion in a study (Grove and Burns, 2013), or a group of objects that have the information that the researcher is looking for (Malhotra, 2012). The target population should translate the research problem into a precise statement in terms of who should be included in the sample (Malhotra, 2012). Furthermore, Kumar (2019) accentuates that population could be the people who are a group staying in the same area, a group of people with issues with our special, organisation employees, a community. There

is a population called accessible population, which refers to the specific population section that is targeted for the purposes of conducting a study (Du Plooy-Cilliers et al., 2014).

The population of this study was at the region of one hundred sixty-two from a South African public university ICT staff members who work on or have worked on the BPR ICT projects. The sample is extracted from the target population using non-probability purposive sampling. The sample is selected on the basis on that they are knowledge holders.

3.10 Sampling

According to Palinkas et al. (2015), qualitative research extensively uses purposive sampling to ensure that the relevant information related to the study is obtained from the sample. Creswell (1994) asserts that when conducting the research, which is qualitative purposive sampling represents the idea that the participants of the study are chosen purposefully.

The sampling strategy entails both probability and non-probability sampling. The sample is defined as part of the population, and the population does not consist of only people (Etikan, Musa and Alkassim, 2016). According to Du Plooy-Cilliers et al. (2014), with the non-probability sampling method, elements of the population do not have an equal opportunity to be part of the sample while the converse is true for probability sampling. Sampling is defined as the portion of the population which does not only mean the total number of people; it could be quantity of things which are an issue of the study (Etikan, Musa and Alkassim, 2016). According to Fowler (2013), the sample refers to the population's representative contained within the sample border.

According to Bless, Higson-Smith and Kagee (2006:98), sampling has numerous benefits for researchers, and they are listed as follows:

- Sampling has an influence on the factor which is time can be saved by the researcher because of gathering data by means of a sample.
- Sampling simplifies data collection and makes it practical because especially if the population size is large.
- Sampling is effective in the reduction of the population size.

- Time is saved drastically if the data are gathered using the sample.
- The researcher reduces the number of hours spent on the research by using sampling, the higher the hours spent on the research the higher the cost of conducting the study and the lower the hours spent on the research the lower the amount.

According to Malhotra (2012), in the case of probability sampling, all elements of the population have an equal chance of participating in the study. Given the fact that the study employs the qualitative approach, which uses a small sample to gather in-depth information, this study used non-probability sampling. Bell, Bryman and Harley (2018) assert that research samples are selected based on the relevance to this study, the researcher wanted to understand the details of the selected case study.

This study has employed the purposive sampling method. The participants of the study were chosen because they are knowledge holders with experience at different levels of BPR IT projects at the university. Moreover, the participants have assisted with shedding some light on the research questions from various perspectives of the knowledge holders.

The non-probability sampling, also known as non-random sampling, is applicable or influenced by the researcher's target population that meets practical criteria. It could be because of ease of access to people, geographical proximity, availability of people and whether people are willing to participate in the study (Etikan, Musa and Alkassim, 2016).

During the process of applying for ethics clearance and permission to conduct the study, the researcher had to group the participants into two groups to distinguish between the participants who participated in the questionnaire and the participants who participated in the interviews. Group 1 included nine potential participants to participate in a questionnaire. In contrast, Group 2 included seven potential participants who participated in the interviews. The participants for Group 1 and Group 2 are all based in the ICT department in the university under study. All the participants who participated in the study for questionnaires and interviews were asked the same 11 open-ended questions, which sought to respond to the research questions

3.11 Research method

According to King, Horrocks and Brooks (2018), research methods refer to the procedures or techniques used to collect and analyse the data. Du Plooy-Cilliers et al. (2014) further posit that exploratory studies employ qualitative methods such as personal interviews and focus group interviews. This study is a qualitative cases study which has used in-depth face-to-face interviews, questionnaires which were loaded on the LimeSurvey software and document analysis.

3.12 Data collection

According to Du Plooy-Cilliers, et al. (2014), data collection methods are used to obtain the data which is rich and depth form of data. In support of this view, Henning et al., (2013) articulate that data collection is effectively used for the purposes of acquiring data investigating and such phenomenon should apply two or three sources of information to ensure that the data are obtained incredibly. According to Bowen (2005), triangulation by means of various data collection methods in the study is very crucial to ensure that the study has credibility. According to Moser (2016), multiple data investigation methods are instrumental in supporting and triangulating the research evidence. Moreover, it is portraying the research evidence in a synergistic view. Romano (2018) further asserts that the multiple data collection methods are used because they are significant in ensuring better understanding while benefiting the researcher with obtaining data variety.

Data collection can be defined as the precise, systematic gathering of information relevant to specific research objectives or questions (Grove and Burns, 2013). In interpretive research, the researcher is the primary instrument for collecting and analysing the data, rather than an inanimate mechanism (Blanche, Durrheim and Painter, 2006; Creswell, 2014). According to Wiid and Diggines (2013), qualitative research depends upon detailed descriptions by respondents to gain insight into the problem. Hence, the study used both in-depth interviews and self-administered questionnaires, comprising open-ended questions to gather primary data. In order to obtain data variety during the process of investigating the phenomenon, Henning et al. (2013) posit that two or three sources of information should be used to obtain data. The researcher chose whom to interview and send questionnaires to. However, the secondary data was gathered through the literature review (academic, peer-

reviewed journal articles and books) and existing university documents. The researcher engaged with documents published by the university on BPR in IT projects in general as they contained explicit knowledge.

The researcher applied for ethics clearance in the institution under the study and permission to access the participants. The institution eventually granted the ethics clearance and permission to conduct the study after five months of initiating the application processes. The researcher could only proceed with collecting research data after the authorisation to conduct the study was granted by the university under study research office. The permission and ethics clearance was valid for a period of three years from the date issued. Data was collected between July and September 2019. This period was occasioned by the availability of participants for the interviews and the slow response rate to questionnaires by respondents. This study used multiple research tools to collect data, i.e. document reviews, semi-structured face to face interviews and the questionnaires which had 11 open-ended questions was distributed electronically using Lime Survey software. The questions for interviews and questionnaires were identical.

3.12.1 Interviews

According to Tong and Dew (2016), qualitative interviews assists the researcher to elicit the perspective of an individual using the questions for discussions which are open and in-depth According to Bell et al. (2018), interviews and focus groups are typically employed in the exploratory qualitative study. According to Bell, Bryman, and Harley (2018), data collection is described as very crucial for any research study. Questionnaires are one of the structured tools for effectively collection data. Du Plooy-Cilliers et al., (2014) further posit that semi-structured interviews apply the approach which is more inductive in nature. The semi-structured interviews for a qualitative study enabled the researcher to have a structure and ensure that the points which are critical are covered during the interview by planning in advance with the open-ended research questions to be asked to the participants to attain the objectives (Johnston and Johnston, 2018). Crowe, Inder and Porter (2015) postulate that the type of open-ended questions are used in the qualitative study because the questions do not anticipate any findings. Moreover, the research questions should not reflect the beliefs of the researcher related to the inquiry.

Interviews are one of the qualitative data collection methods. Moreover, in-depth interviews provide an opportunity for the interviewer to ask questions to elicit the views, opinions and beliefs of participants regarding a particular phenomenon in order to gain a deeper understanding of their stance (Creswell, 2014; Du Plooy-Cilliers et al., 2014). In-depth interviews are semi-structured to allow the researcher to probe (Du Plooy-Cilliers et al., 2014) in order to answer the substance of the research questions (Zikmund et al., 2013). The in-depth interviews aim to elicit tacit knowledge from participants, and, as stated by Henning, et al. (2013) to allow the researcher to achieve the same level of understanding and knowledge as participants. To obtain data variety during the process of investigating the phenomenon, Henning et al. (2013) posit that two or three sources of information should be used to obtain data.

The people selected to participate in the interviews for this study are chosen based on the research questions, that is a purposive approach to sampling (Crowe, Inder, and Porter, 2015). Silverman (2016) further accentuates that research is the tool used to offer peoples attribute to the experiences people have in the world. Interviews are a symbolic interaction used to understand other people's point of view. Interviews are the method used to collate and analyse data, and the open-ended questions have been compiled, and they were used to conduct interviews and survey (Du Plooy-Cilliers et al., 2014).

In order to collect data using interviews, the researcher applied for ethics clearance at the research office at the university under study, the ethical clearance application process, which was very lengthy. Ethical clearance application was approved after four months of initiation of the ethics clearance process, and soon after the ethics clearance was approved. The researcher proceeded to apply for permission to conduct the study. The method of applying for permission to conduct the study took one month, and the permission was granted by the university to conduct the study. The researcher spent five months processing the ethic clearance and permission application before she could collect any data.

The researcher was granted permission to collect data by means of interviews, document reviews and questionnaires. Soon after obtaining permission to conduct the study, the

researcher invited seven potential participants to participate in the semi-structured face-to-face interviews. The researcher used an email to invite seven potential participants. The email used to invite seven participants contained the introductory letter, consent form and ethics clearance to empower the participants with information about the study. The interview invite was sent out during the busy period at the university and their potential participants were assigned to urgent Annual Performance Plan (APP) projects.

Only one participant out of seven responded and accepted the interview invite-only after two weeks of sending the interviews to invite, and the interview was scheduled as per the three participants preferred convenient date, time and location. Upon acceptance of the interview invite, the interview was scheduled on outlook and a day prior to the interview, an outlook reminder was sent to the participant to confirm the interview. Another outlook reminder was sent out 15 minutes before the scheduled interview.

Owing to the lack of response rate from potential participants, the researcher sent out a reminder of the interview invites using an email. The email reminded the participants about the initial interview invite, which was sent out a month earlier by the researcher. Following the reminder which was sent out to potential participants, three other participants responded and accepted the invite and the interview were scheduled. In total, four out of seven participants responded and accepted the interview invites.

To ensure that the answers are related to the research questions and that there is a degree of systematisation in questioning and analysis (Marshall and Rossman, 2006). The researcher has compiled and used guiding questions for the interview process. The researcher also refrained from using any jargons to ensure that the level of understanding by the participants. The researcher was professional through the process of conducting the study, and during the face-to-face, interview professionalism continued. Most importantly, the participants were encouraged to express themselves freely, and they were re-assured about anonymity and confidentiality. The researcher collected the consent letters from all four participants on the day of scheduled interviews. According to Bell et al., (2018), the interviews were recorded and transcribed to ensure the correctness of data collected.

The four interviews were recorded, and prior to the interviews, a test was conducted on the recording devices to ensure that the voices are recorded. It is also important to note that during the interview, the researcher requested permission from the participants to voice record the interviews. Furthermore, the researcher listened to the participants attentively to understand their experiences and views related to the study. Importantly, the researcher is very familiar with the terminology used in BPR IT projects, but she ensured that she remained neutral in her interaction with participants. All the perspectives and experiences were listened to from all four participants.

After the interviews were conducted, they were transcribed by the researcher. The interviews took 40 minutes each, and the transcription of each interview took four days. The researcher had to listen to the voice recorders repeatedly to ensure that what was communicated by the participants is well documented, and the researcher also used the notes which were taken by the researcher during the interviews. Furthermore, the credibility of the data was enhanced through the recording of interviews. Moreover, data would be kept for a period of five years to allow it to be verified when necessary. The high level of confidentiality, privacy and anonymity of the participants was maintained by using pseudonyms where appropriate, and not using the title or occupation of the respondents.

3.12.2. Questionnaires

According to Crowe, Inder and Porter (2015), questionnaires are one of the tools used by the researcher for effective data gathering. McGuirk and O'Neill (2016) state that the questionnaire is the information gathering technique used by the researcher to determine the participant's opinions and attitudes. The questionnaire is a formal set of questions that are asked in order to obtain information from respondents (Malhotra, 2012). It is a common instrument in business research (Cooper, Seiford and Zhu, 2011), and an essential tool for data collection (Wiid and Diggines, 2013). A questionnaire is used for the standardisation of the data collection process and to ensure consistency and coherence for data analysis (Malhotra, 2012). The researcher developed the questionnaires which were used in the study, and the supervisor has scrutinised the questionnaire for relevance.

In order to increase the rate of response (Leedy and Ormrod, 2005), the researcher guaranteed the respondents' anonymity and encouraged participants to be as honest as possible. In addition, according to Du Plooy-Cilliers et al. (2014), fewer questions in a questionnaire yield a higher response rate. Furthermore, according to Zikmund et al. (2013), a questionnaire should be short in terms of design and appearance, while Malhotra (2012) suggests that it should be designed in a way that minimises the demands imposed on respondents. The questionnaire used for this study had at least a minimum of two questions relating to each research question. This is important because the questionnaire enables the researcher to collect relevant data to address the research questions (Malhotra, 2012).

A questionnaire was one of the tools used in this study to collect data. The researcher had to be granted ethics clearance and permission to collect data before any research question invite could be sent to participants. Shortly after obtaining permission to conduct the study, the researcher invited nine potential participants using an email to participate in the questionnaires. The body of an invite contained the introductory letter which contained information about the study. The introductory letter clearly indicated the terms and conditions of participating in the study should the participant grants consent to participate in the study. The questionnaire had only 11 open-ended questions, and the questions are the same questions which were used to conduct the interviews.

The questionnaires were loaded on Lime Survey software which could be accessed via a link sent which was contained in an email to nine potential participants. The potential participants could complete the questionnaire at any time and any location convenient to them because the questionnaire was loaded on the Lime Survey software. The researcher was keeping track of the response rate on Lime Survey software, subsequently one month of sending out the questionnaire the invite to potential participants. There were only two participants who completed all the 11 questionnaires, and one additional participant had started completing the questionnaire, but only one question was completed. After one month of sending the initial invite for questionnaires, the researcher sent a reminder using an email to the potential participants.

The researcher sent an invite using an email to the nine potential participants to participate in the study in the form of the questionnaire. An email which contained a link which directed the participant to the questionnaire which contained 11 open-ended questions, the questionnaire was loaded by the researcher on Lime Survey software. The 11 questionnaire open-ended questions sought to answer the research questions of the study. The researcher monitored the response rate, and only after two months, only six participants out of nine potential participants completed the questionnaires. The report in Chapter 4 documented about six out of nine participants who eventually responded to the questionnaires.

3.12.3. Documents analysis

Yu (2017) cited Corbin and Strauss (2008) by stating that document analysis is instrumental in assisting the researcher with providing the meaning, understanding and developing the experimental knowledge. The researcher engaged the documents published by the university on BPR in IT projects in general, as they may contain explicit knowledge. Qualitative studies use the approach or strategy that is called the triangulation. Data can be collected using the mixture of document analysis, interviews, observations etc. (Merriam and Grenier, 2019). According to Corbin and Strauss (2008), document analysis is used in qualitative research, to review the documents which can be electronic or a printed version using the method which is analytically based on the qualitative method and document analysis enables data interpretation and examination of knowledge. According to Bowen (2009) and Creswell (2014), document analysis encompasses of document review and evaluation by scanning, reading and interpretation documents. The researcher had to apply for ethics clearance and permission at the university under study, and both approvals were granted after five months of initiating the application processes. Shortly, after the researcher could be able to access the document related to the study on the university's intranet.

According to Bowen (2009:2), the documents can be in words and images, and the assessments of documents which is systematic are used as part of the research which can be in the form of "advertisements; agendas, attendance registers, and minutes of meetings; manuals; background papers; books and brochures; diaries and journals; and event programmes". This study intensively reviewed the university documents which were used as the secondary data to provide the rationale behind the of ICT BPR projects the following

three (3) documents were used: 1) the university's ODeL 2030 strategy document, 2) the university's ICT strategy document and 3) the university's Annual Performance Plan 2019.

3.13 Data analysis

Data presentation of this study illustrates the differences and similarities presented by the participants of the study and data were analysed by coding and grouping similar responses. According to Tong and Dew (2016), qualitative data analysis captures the depth and breadth of the collected data to ensure that trustworthiness, comprehensiveness and insights related to the research question. Bezuidenhout and Cronje (2014) further indicate that the researcher can derive numerous data meanings and interpretations from the data text. Further, data analysis allows the researcher to evaluate the hypothesis in detail (Collins, 2018). According to Bell, Bryman and Harley (2018), data analysis is also an interpretation of the secondary data such as artefact and qualitative research best uses themes from the various viewpoints.

Ghauri and Gronhaug (2002) define data analysis as the process of bringing order, structure and meaning to collected data. Interpretivism is known for inductive approaches that seek to collect data, analyse it and then formulate a theory based on the information and analysis (Du Plooy-Cilliers et al., 2014). Taylor, et al. (2015) concur with Miles, et al. (2014) that analysis of a qualitative data is a process of learning but conducting data analysis by reflecting, refining methods and making data be reusable. In support of this view Bell, et al. (2018) posit that data analysis consists of quite many fundamentals such as the interviews conducted for data collection are recorded and transcribed. The researcher transcribed the interviews without the software by listening to the recorders repeatedly, and also the researcher used the notes taken during the interview.

The questionnaires that were received via the Lime Survey software have been analysed individually, and themes were developed. According to Chigada (2014), the interpretive paradigm employs an inductive approach to developing theories and generalisations through observations. In this study, data analysis was used to identify data variables and themes. The researcher used the method of notes taking and observation during the interviews. The researcher also analysed the documents for effective and adequate analysis. According to Stuckey (2015), coding is for categorising data while ensuring that data are analysed, and

similarities are grouped together. The researcher ensured that during data coding grouping of the themes with similarities and differences took place after the transcription of the face-to-face voice-recorded interviews were completed.

The notes which were taken during the interviews were also used to ensure that the process of coding has validity as gathered from the participants. To ensure ethicality, the interviews were transcribed. After the transcription process, transcribed interviews were checked for accuracy. The researcher had to repeatedly listen to the voice-recorded interviews and read the documented text. Also, the notes taken during the interviews were very useful during the transcription process. All the four respondents were transcribed as respondents to ensure that there is anonymity during transcription of the interviews. The participants were referred to respondent one to four. The researcher took four days to transcribe each interview for this project.

According to Crowe, et al. (2015), reading the interview transcripts and crisscross themes and producing the codes. In the same vein, Bell, et al (2018) concur that coding is a process of giving the broken data into small components are then labelled by identifying the reappearance of sequence on the text that is coded, for determining the links with different codes. The interpretive paradigm employs an inductive approach to developing theories and generalisations through observations (Chigada, 2014). Data analysis was conducted utilizing data coding and using themes. Moreover, the researcher used a research diary for the analysis and themes, which included identifying consistent patterns in the self-administered questionnaire responses, documents and interviews summarising information obtained during the study. Thematical data analysis is the process, where during data collecting and post data collection, the researcher identifies the expressive by means of the change in voice tone, and emotions that leads the researcher to arrive at the themes (Bell, et al., 2018).

In support of the above views, Du Plooy-Cilliers et al. (2014:235) state that qualitative content analysis follows eight steps. These include data preparation, the definition of the coding to be analysed, development of the categories and coding scheme, assessment of coding consistency, coding of all text, testing of the coding system, interpretation of data by drawing the conclusions and lastly reporting the methods and findings. This study also followed the below qualitative analysis principles as offered by Tesch (1990: 95):

- The analysis is not the last phase in the research process; it is concurrent with data collection or cyclic.
- The analysis process is systematic and comprehensive but not rigid.
- Attending to data includes a reflective activity that results in a set of analytical notes that guide the process.
- Data are ‘segmented’, i.e., divided into relevant and meaningful ‘units’, yet the connection to the whole is maintained.
- The data segments are categorised according to an organising system that is predominantly derived from the data themselves.
- The main intellectual tool is comparison.
- Categories for sorting segments are tentative and preliminary in the beginning; they remain flexible.
- Manipulating qualitative data during analysis is an eclectic activity; there is no one ‘right’way.
- The result of the analysis is some type of higher-level synthesis.

Based on the process above followed by the researcher, concepts or themes emerged from the analysed data. Moreover, the repetition of text, themes were then identified in terms of similarities and differences. The researcher also compiled the transcription of the four interviews into one document, then the researcher read through the interviews several times, and the researcher added comments on the transcribed interview for purposes of data analysis. The researcher also noted the causal words from the respondents which were ‘since’, ‘because’, and ‘as a result’.

Given the paradigm location of the study, it used qualitative research methodology to gain an in-depth understanding of multiple realities in relation to ways of infusing systems thinking in BPR IT projects. Data analysis presents an opportunity for participants in shaping the themes that emerge from the process (Creswell, 2014). The inductive approach was used for primary data to generate theories, and the extant literature was reviewed to form the basis of the study.

3.14 Limitations of the study

The delimitation of this study is the public university in South Africa that offers education in distance mode of delivery. The study focused on systems thinking in BPR ICT projects. Moreover, this study was in nature cross-sectional and data have not been collected to the point of saturation owing to the time allocated to conduct a study as prescribed by the ethics clearance and permission. The study is a case study which followed the qualitative approach; automatically, the sample is smaller. According to Royadi, Susiana and Khumaida (2019:87), "Case studies are one type of qualitative research, where researchers explore the programs, events, processes, activities, of one or more people, time, activity and the researcher carries out detailed data collection using various procedures for collecting data and in a continuous-time".

3.15 Ethical considerations

The researcher had to follow various processes to ensure that all the ethical issues are complied with and approved. The researcher applied for gatekeeper's letter, and it was granted by the institution in which the study was conducted. The gatekeeper's letter from the institution under study is the prerequisite of applying for the ethics clearance with the University of Kwazulu-Natal (UKZN). The researcher is registered as a student with UKZN. The researcher applied for ethical clearance at the UKZN, and it was subsequently approved and granted to the researcher.

As soon as the researcher was granted the ethics clearance by UKZN, the researcher initiated the process of applying for ethics clearance with the research office of the institution under the study. The research ethics application process took five months. It was a lengthy process with the ethics clearance form, which had 28 pages in total. After five months of initiating the ethics clearance process, the researcher was granted the ethics clearance letter. The researcher had to proceed with the application for permission to conduct the study within the institution under study.

The institution only granted permission to access participants under the study to the researcher after the approval of the ethics clearance processes, the ethics clearance process

and permission application could not be done concurrently. The researcher was granted permission to conduct the study. The researcher could not conduct the study without the ethics clearance and permission to access the participants in the study for questionnaire, interviews and for documents access. The researcher had to ensure that all matters pertaining to ethics were adhered to such as confidentiality, privacy and anonymity for the participants. The researcher highlighted that the study is not associated with any risk which may be posed to participants. During the process of ethical clearance for the institution under the study, the researcher had to clearly state which research tools to be used to collect data, i.e. interviews, access to the institution document and questionnaires.

The researcher has complied with all the matters of ethicality and confidentiality as per the ethical clearances and permit application forms. More importantly, there were no foreseeable risks associated with the study before, during and after the study because the project did not constitute the sensitive topic and the participants are all adults, who are not deemed to be vulnerable. Furthermore, there were no foreseeable risks which harmed the participants or compromised the reputations of individuals and institutions. All participants were treated fairly and with respect. The institution under study has not been disclosed throughout the study.

The researcher had to ensure that the name of the institution under study is not disclosed and the participants' identity is not revealed. Confidentiality has been maintained throughout the study. The participants of questionnaires and interviews were also informed that they could stop participating in the study at any stage because participation in the study is voluntary. No occupation, job titles or and anything that could compromise the anonymity and confidentiality of participants or institution would be used in this report.

3.15.1 Measures for ensuring trustworthiness

According to Hadi and Closs (2016), a qualitative study has a proportion of strategies which are used to ensure that the study has trustworthiness, such as triangulation used in a qualitative study to decrease inherent bias by the researcher during the collection of data by increasing the data collection tool to at least two or more. Gunawan (2015) concur that triangulation is very important to ensure trustworthiness to reduce bias by the researcher and

a detailed transcription technique is crucial to ensure trustworthiness. Instead of examining the issues of validity and reliability that are used in quantitative studies, this qualitative study described the measures for ensuring trustworthiness.

Lincoln et al. (1985) stated that trustworthiness is developed through qualitative investigation. It includes credibility, transferability, dependability, conformability and authenticity. In terms of quality criteria established for post-positivist research, credibility is parallel to internal validity; transferability is parallel to generalisability; dependability is parallel to reliability; and confirmability is parallel to objectivity (Porritt, Gomersall and Lockwood, 2014; Zitomer and Goodwin, 2014*).* The criteria have become an expression of quality and serve as a means by which to validate the integrity, competence and legitimacy of the research process and findings (Zitomer and Goodwin, 2014*).* As stated by Polit and Beck (2008), trustworthiness is a term used in the evaluation of qualitative data using specific evaluation criteria.

Positivists frequently interrogate the trustworthiness of a qualitative study, possibly because their concepts of validity and reliability cannot be addressed in the same way in naturalistic work (Shenton, 2004), as they believe that qualitative research should be assessed for quality because it can be faulty (Porritt, et al., 2014). Qualitative researchers have, therefore, been tasked with justifying their research in order to counter allegations that it is undisciplined, theoretical, anecdotal, methodologically weak, and subjectively indulgent (Denzin, 2008).

Interviews, questionnaires and document analysis were used in this study for data collection. The researcher had a journal which she used to capture the notes related to the research to ensure self-description/reflexivity as part of warranting trustworthiness. The researcher listened to the recorded interviews together with the transcribed interviews repeatedly until she was satisfied to ensure what transcribed is accurate.

3.15.2 Credibility

Credibility denotes to the truthfulness of the study conducted by the researcher (Quiroga, 2017). Creswell and Miller (2000) further state that there is a consensus which is general,

which recommends that qualitative studies must generally demonstrate credibility. According to Lietz and Zayas (2010), credibility is the degree which the findings of the study epitomize the views of the participants of the study. Latvala, Vuokila-Oikkonen and Janhonen (2000) state that credibility in a qualitative study is strengthened by using more than one method when collecting data from multiple groups of informants, the method is named triangulation of data source. To ensure credibility, this study used multiple sources of data which was interviews, questionnaires and document analysis. According to Finlay (2002), a credible study does not necessarily require readers to agree with the conclusions of the study – rather, the readers need to see what the researcher saw, irrespective of the degree to which they agree. Polit and Beck (2008) define credibility as confidence in the truth of data.

Credibility implies that the researcher should take charge of the entire course of the research process, building trust by honouring confidentiality and not breaking any promise, and understanding the phenomena of interest from the participants' viewpoints. Does credibility attempt to answer the following question: How congruent are the findings with reality? (Shenton, 2004). According to Cooney (2011) and Finlay (2002), the credibility of the study contributes to the ability to identify with the research findings and their interpretation and to make reliable decisions based on them. As indicated above, this study has employed non-probability purposive sampling, wherein the participants were chosen because they are knowledge holders with experience at different levels.

This provided the opportunity for the participants to shed light on the research questions from various perspectives. In order to ensure the credibility of the study, one of the strategies that were used was to collect data using different tools, such as interviews, questionnaires and documents. The high level of confidentiality, privacy and anonymity of the participants was maintained by using pseudonyms where necessary, and not using the title or occupation of the respondents. Furthermore, the credibility of the data was enhanced through the recording of interviews, and by ensuring that the data are kept for a period of five years in order to allow it to be verified if and when necessary.

According to Mandal (2018), credibility necessitates that the participants recognised to participate in the study must have precise knowledge of the subject under the study. Brännström, Niederbach and Rödin (2018) further state that credibility in a qualitative study is about the information richness on each interview. Houghton, Casey, Shaw and Murphy (2013) assert that credibility touches on two important points which are conducting a study in the manner that is believable or ensuring that the findings of the study are believable while demonstrating credibility. Quiroga (2017) further postulates that there are generally three factors which affect the study's credibility, and they are respondents, reactivity and researcher bias.

This study selected the participants from the institution under the study who have worked on the ICT BPR projects because they have relevant knowledge. Moreover, when the researcher was conducting the study, she introduced herself as a researcher and not as a colleague to the participants. The interview guide was used to ask the participants the questions related to the study, and follow-up questions were asked where necessary and they were related to the study.

3.15.3 Dependability

According to Porritt et al. (2014), to ensure that there is dependability, it is recommended that the qualitative research procedure must have logic, sound, traceability and lastly must be documented evidently. In the same vein, Royadi, Susiana and Khumaida (2019) concur that qualitative research report must be in detail, clear and dependability or audit must be easy to test. Dependability refers to how trustworthy the study is, and the researcher used the research steps to ensure and to track the consistency in the study (Quiroga,2017). This study has been documented in detail to make sure that other researchers in future can use the study. The researcher has also ensured that the research steps were consistent throughout the study. The researcher has also kept a research journal documenting every work which has been done. Moreover, the research work journal has enabled the researcher to keep track of the tasks which occurred at different stages during the course of the study.

3.15.4. Conformability

Confirmability is linked to dependability; it is about data accuracy and data objectivity (Houghton, Casey, Shaw and Murphy, 2013). Shenton (2004) concurs that conformability is about the researcher proving that data was used to provide the findings of the study. According to Ary, Jacobs and Sorensen (2013), conformability in qualitative research suggests that the study is free of unfairness and bias in the procedures and interpretation of results and that the data collected and conclusions drawn can be established by other researchers examining the same situation.

In order to ensure confirmability, researchers have to indicate the steps they followed, in order to prove that the findings emerged from the data and not their own biases (Shenton, 2004). This study used the interviews, questionnaires and document analysis to collect the relevant and enough data that relates to the study for purposes of final report writing. More importantly, the researcher used the same research questions for the interview and for questionnaires, the researcher also asked the same question in different ways during the semi-structured interview to ensure the confirmability of the study.

3.15.4 Transferability

According to Quiroga (2017), transferability refers to how the study is convertible into another an alternative context. Transferability denotes how the findings of the study can be applied by other situations and groups (Lincoln and Guba, 1985). In the same vein, Houghton et al., (2013) concur that transferability is about the findings of the study if they can be relocated to another study which is similar in context with the study conducted. Transferability is parallel to generalisability (Zitomer and Goodwin, 2014). According to Porritt, et al. (2014), transferability in qualitative research is an area of disagreement among researchers because it refers to the generalisability of research results and corresponds to external validity in quantitative research. In order to enable transferability, the researcher provides necessary details of the circumstances of the fieldwork in order to enable the reader to decide whether the dominant situation is similar to another situation, and whether or not the findings can reasonably be applied to the other setting (Shenton, 2004). Salmond (2012) argues that it might be thought of like a matter of ‘fit’ between the situations being studied, and others to which one might be interested in applying the concepts and conclusions of that

study. Salmond (2012) maintains that transferability looks at the study fit with other people who might be interested in the study conclusions or concepts. Quiroga (2017) further asserts that the researcher should document the findings in detail to enable people who read the study to transfer the study to another context themselves where possible. Accordingly, the researcher wrote the research report for this study in detail while focusing on the concepts of systems thinking and business process ICT re-engineering projects.

3.15.5 Authenticity

To ensure that the study was authentic, the researcher has always treated the participants professionally with respect and fairly. Lincols and Guba (1989) identified diverse types of authenticity as criteria of fairness: ontological authenticity, educative authenticity, catalytic authenticity, and authenticity. The analysis and interpretation in this study included a faithful representation of the participants' viewpoints, thereby upholding the quality of qualitative research (Lyons et al., 2013). According to Lyons et al., (2013), authenticity is about representing the participants of the study correctly ensuring that their viewpoints are recorded accurately. In this report, the participants who participated in this study were cited in verbatim using pseudonyms with invited commas to ensure that their views and experiences are not misrepresented, and they are captured correctly. The researcher ensured that confidentiality is not compromised throughout the process of documenting the research report.

3.15.6 Delimitation and limitation of the study

The delimitation of the study is the public university in South Africa that offers the distance mode of tuition delivery. The study focused on the BPR of IT projects, as they determine the success or failure of the institution. Given that this is a case study, it focused on the university's BPR of IT projects, which takes place mainly on the university under the main study campus. The study is cross-sectional in nature and data were gathered at one point in time, which means that valuable trend analyses of the university's BPR of IT projects were included, which only a longitudinal study would be able to do.

The researcher has not collected the data up to the point of saturation because time is limited. This means the researcher could not exhaust the extant literature, given the timeframe, and may, therefore, miss some relevant publications. A longitudinal study could give better insight into how systems thinking approaches can be infused into a university's BPR projects over a more extended period.

The study looked at the infusion of systems thinking into BPR projects in the context of an IT project. Only the people who work or have worked on BPR projects are the key role players in the BPR projects at the university, were sampled.

The study has employed a qualitative approach, which presents limitations owing to the small sample size. This means that the study would not be representative of the total population; hence the findings cannot be generalised to the greater population (Nastasi and Schensul, 2005). The study used the purposive sampling technique, which limits the inclusion of a large number of participants. Literature suggests that this sampling technique also presents challenges for the researchers in terms of finding ways to convince the participants to take part in the study while guarding against compromising the credibility of the study. Another potential limitation is that not all participants may be available during the data collation phase.

3.16. Chapter summary

This chapter focused on the details of how the study was conducted to answer the research questions. The following was discussed the purpose of the study, objectives of the study, research questions, research philosophy, approach to the study, research design, the population of the study, sampling strategy, data collection method, data analysis and ethical consideration. The following chapter systematically presents the findings and analysis of the data of this study.

CHAPTER 4: PRESENTATION OF RESULTS AND DATA ANALYSIS

4.1 Introduction

In this chapter, the researcher analyses data and presents the findings for this qualitative case study. The study used research questions to guide the process of gathering data using interviews and questionnaires. In addition, the research questions were well phrased to ensure that the participants understood the questions so that they can easily express their views and perspectives. This chapter highlights the purpose of the study and presents the collected data in response to the research questions. Data presented herein in this chapter was collected from the participants through interviews, questionnaires, and it highlights the similarities and differences. Data is presented into two sections, section one depicts the interview data presentation, and section two depicted questionnaire data presentation in order to respond to the research questions while achieving the research objectives. Data analysis was guided by the qualitative analysis technique, as discussed in Chapter 3 of this study. Additionally, data were analysed by utilizing grouping and coding.

4.2 Purpose of the study

The purpose of the study was to investigate methods of infusing systems thinking with BPR IT projects at a public university in South Africa.

4.3 Objectives of the study

4.3.1. To establish the systemic impact of BPR on business processes and IT, and how is it managed at the institution under study.

4.3.2. To identify the strategies that are employed to understand the effects that BPR has on other sub-systems of the institution under study.

4.3.3. To investigate systems thinking approaches that can be used in BPR at the institution under the study in order to understand holism.

4.3.4. To identify the most suitable systems thinking approach to recommended for infusion in BPR for the institution under study.

4.4 Interviews data presentation

Data collected from participants during the semi-structured interviews are presented below using various themes as heading, the themes were identified during the analysis phase of the study.

4.4.1 Management of BPR projects at the university

According to Bradle and Kristoff (2017), BPR is one of the management fads that has emerged from the IT industry. The results produced by the implemented BPR can be disappointing and disruptive to business. Respondent 1 stated that "*the university does not currently have the formal process to manage business process re-engineering or any other IT project*". Emes and Cole (2019) state that there was a survey which took place in 2015, which highlighted the factors for project success was using systems thinking tools and principles in the across the project life cycle. Respondent one continued stating that *in* "*ICT department various project teams allocated per project does not apply any formal way to manage projects to my knowledge*". The respondent further reports that we have new senior management, and they are still in the process of introducing new ICT project management processes. Jackson (2003) asserts that the method to solve problems using quick fix-solutions are rarely effective when there is significant complexity, change and uncertainty. Universities have bought into many of the above management fads, as mentioned by Jackson (2003). Respondent 1 further stated that "*the projects are currently executed haphazardly, and the priority list is used to prioritize the projects, and various best practices are used to manage the impact of projects*". Pham (2017) argues that the complex adaptive systems are dynamic, open systems made up of individual agents that act independently, but whose actions are interconnected so that when one agent changes, it has the potential to influence other agents and create a ripple effect across the system. Participant 2 continued stating that "*at this stage, the university management is talking about tailoring Prince 2 for the management of projects. We just continue to work on projects without the formalized process*".

Participant 2 had a different view by stating that "*Managing and executing projects depend on what triggered the project to be initiated; there are many factors that can contribute to the initiation of a project it could be legislation, technology and business requirements*".

Nicholds and Mo (2015) accentuate that BPR projects are challenged with facing significant and constant changes in the environments. Moreover, business modelling methodologies need to be flexible in order to accommodate the forever-changing requirements of the BPR projects. Participant 3 stated that "*The project team normally customize our processes to suit our systems needs and we use the standard operating procedure to ensure that we have processes in place and acquire the system that will be best suited for our requirements*". Participant 3 further stated that "*At the moment the university does not pay attention to BPR ICT projects, we pay attention to business as usual*". According to Van Ackere, Larsen and Morecroft (1993), business re-engineering and systems thinking enabled organisational managers to scrutinise their business systems.

Participant 4 stated that "*we use the project management method and multiple compliances IT methodologies or approaches when we work on the IT projects*". Participant 4 continued saying that "*we don't have a strong well-established way of managing the BPR projects hence there have been dismal failures in the past big enterprise projects worth millions for replacement of the university legacy systems which has the direct impact of re-engineering of business processes*". However, AbdEllatif et al., (2018) contend that organisations are faced with many unexpected changes which occur in a swift pace, i.e. globalisation, technology change and customer requirements, that might fail BPR in organisations. In the same vein, Oswald, Köhler and Schmitt (2018) concur that it is essential to note that the projects which are implemented in this 21st century there must be initiatives and implementation of mastery of complexity in mind as the precondition in order to have a successful project.

The participant further indicates that "*the university is moving to the direction of using strategic partners because the management thinks that we don't have capabilities to replace systems or effectively implement the BPR projects because of the previous IT enterprise project failures*". This resonates with Rosenberg's (2016) assertion that business process projects fail because of lack of interaction that is complex within the business process project, comprehension of complexities, projects are initiated and executed in a straightforward way and dynamics are not taken into consideration. Participant 4 further

avers that "*I don't think it is a capability and a skills problem there are many factors which must be considered, this university is complex*".

According to Ruben (2018), the higher education sector is faced with many challenges, such as an increase in higher education demand, increases in university tuition fees, university-funding challenges. Becker et al. (2017) further affirm that the world has challenges such as moving away from the traditional method of teaching that is compelling higher education institutions to adapt by implementing technology and innovation. Lack of systems thinking knowledge in an organisation can expand the organisational problems instead of resolving them (Shangase, 2011).

According to Altbach, Reisberg and Rumbley (2009), higher education institutions are now responding to mass demand by moving towards providing distance education effectively while vastly improving the ICT components in order to provide better service. Senge and Scharmer (2008) state that this era has organisations which are faced by challenges, and organisations are faced with overwhelming challenges are being tackled in isolation, not in a systematic way.

4.4.2 Systems thinking in the University BPR projects

Participant 3 stated that "*systems thinking should be holistic but unfortunately if we still thinking of projects as operation in isolation as a result that becomes difficult for us to think systematically and effectively identify the challenges the university has and implement sustainable solutions on the BPR IT projects*". According to Leveson (2011: 25), "BPR thinking needs to be looked at in a holistic approach to re-engineering that involves business processes, technology and social system issues". AbdEllatif et al., (2018) state that BPR programmes have the design elements which are as follows purpose, output, input, process, people, technology, information, and environment.

Participant 1 stated that as a project team "*we sometimes use the IT systems impact and business process impact to analyse and identify any possible systematic impacts on projects*

within the university". IT is very important in initiating and executing BPR projects (Ahmadi and Abadi, 2016; Huang, Lee, Chiu, and Yen, 2015).

Sharma and Kumari (2016) have highlighted that the BPR projects necessitate IT awareness in order to understand the points of integration between IT systems and business processes efficiently. BPR still needs to be infused with systems thinking in order to ensure that there is a way to resolve complex and chaotic challenges. However, this does not mean that BPR traditional thinking is replaced (Yurtseven and Buchanan, 2015). Jackson (2003) further contends that BPR is reductionist in nature and cannot solve complex problems.

Respondent 4 conceded that "*we are dependent on the project office and the project managers for the management of projects with also the management of skills*". Traditional methods of solving challenges only assist with the maintenance of the status quo, and it does not create innovation that is able to deal with complexity and constant change (Srikanthan and Dalrymple, 2003). Participant 4 argued that "*we also use constant communication such as brief progress reporting meeting to report on the progress*". BPR projects need to understand the problems, but it is a very linear way of thinking for purposes of problem-solving (Vom Brocke et al., 2014). Sellers (2017) avers that systems thinking is very useful in dealing with complexity. However, the literature suggests that systems thinking has not permeated business livelihoods as it should be.

Participant 2 further postulated that "*in ICT BPR projects, all the components of the system are tested to ensure that all the components are in sync before implementation*". Yurtseven and Buchanan (2015) highlight that the existing traditional and scientific methods that are still used to resolve challenges should infuse a systems-based approach. Respondent 2 continued stating that "*the project managers manage the project tasks using the project plan; the project tasks are broken down into manageable tasks or activities allocated per time and resources*". Shays (1994) states that the tools which are used in BPR have limitations and that result in BPR projects not producing the desired results for organisations. On the contrary, Ahmadi and Abadi (2016) contend that redesigning the processes must not focus on only people, tasks, structures, and jobs, but also processes.

4.4.3 Strategies of infusing systems thinking in the university BPR projects

According to Burge (2018:2), systems thinking has useful tools which enable systems thinkers to "paint the big picture, capture and codify disparate viewpoints, unmask the hidden patterns, expose the natural and germane structure". Respondent 1 stated that "*the university currently uses strategies such as change management and enterprise architecture to understand subsystems caused by business process re-engineering projects within the university*". However, Shays (1994) asserts that if BPR is used to solve problems, it is essential to consider that every problem is part of the system and to recognise that the system has sub-systems and it is part of the more extensive system. Respondent 2 stated that "*the project charter is used to identify the impact the project will cause each business units and the risk register is used to track possible risks and manage risks if the risks arise*". Vom Brocke et al., (2014) accentuate that business process management must use a holistic methodology that incorporates, e.g. strategic, social, methodological, technical characteristics the focus should not be on only IT systems as enablers of the business processes. Respondent 4 stated that "*I would recommend the implementation of change management as a system thinking tool to ensure that the university community who use the business systems are aware of the changes which will be implemented by the ICT business process re-engineering projects*".

Respondent 3 stated that "*the enterprise architecture office has recently been established to collaborate with change management*". Jackson (2003) further argues that being systematic means that one understands problems from different perspectives and can resolve these problems from a variety of viewpoints and combining systematic approaches. Respondent 2 stated that "*we use the project management plan and the risk register to track any project risks*". Respondent 3 further contended that "*the enterprise architecture team conduct analysis to identify any impact on existing systems, and they also consider the entire university impact on any change to be implemented*". Gomes (2015:525) defines EA as "complete expression of the enterprise; a master plan which "acts as a collaborative force" between aspects of business planning such as goals, visions, strategies and governance principles; aspects of business operations such as business terms, organisation structures, processes and data; aspects of automation such as information systems and databases; and the enabling technological infrastructure of business such as computers, operating systems and networks". Arnold and Wade (2015) aver that systems thinking approach should be used

in a range of disciplines to be able to handle the complexity faced by the world. Sellers (2017) argues that the professionally trained individuals are trained to think traditionally when resolving problems and as a result, that causes limitations when problems are solved such as occurring unintended consequences that were not identified because challenges are blinded by the short-lived traditional solution.

Respondent 4 states that "*I think it is important that the components within the university system function dependently to one another and it breaks the issue of silo mentality when executing project in the university community*". Jackson (2003) emphasises that the challenge with BPR is that in nature, it is reductionist and cannot solve the complex problems. Three out of 4 interviewed participants stated that "*we normally identify and analyse the problem within the university. IT projects by breaking down the structure of the complex problem into small pieces for better understanding. Moreover, to understand the problems holistically*". According to Armson (2011), holistic thinking advocates the understanding of an entity, together with its relationships or interconnections. In this regard, an entity can be an organisation, idea, person etc. Armson (2011) argues that holistic thinking is the opposite of reductionism, which is scientific and seeks to understand the internal structures in the entity, by reducing them to component parts, rather than understanding the bigger picture.

4.4.4 Applying holism instead of reductionism in BPR projects

Respondent 2 further postulated that "*we use the project documentation such as the benefits management plan to ensure that we look at the projects holistically".* Respondent 2 continued stated that *we look at the problem holistically by understanding all the components which make the whole and consider the interdependence of all the parts of the problems identified and requirements*". However, Jackson (2003) asserts that organisations are very complex, and it is crucial to understand the relationships between parts. Mays (2017) further indicates that there are complexities in today's challenges and as a result solving the problems holistically is very crucial for organisations solving the problems in silos or isolation is not a sustainable way because the system is open with dynamic interactions.

Respondent 2 stated, "*that there are challenges in projects and they are well understood by breaking down the problems into small components using the project management tools*". Respondent 2 maintains that "*we sometimes use product breakdown to understand the project in detail and ensure that all the components are aligned*". According to Mays (2017), business challenges today have too many complexities. As a result, solving the problems holistically is very crucial for organisations because to solve the problems in silos or in isolation effectively is not a sustainable way because the system is open with dynamic interactions.

Respondent 4 stated that "*sometimes within the university, it is very challenging to understand the problems holistically which have to be addressed by the BPR IT projects*". Freddi and Salmon (2018) posit that reductionism is the principle of dissembling a problem into its pieces or parts. Respondent 1 stated that "*in this university's IT BPR projects we normally decompose the problems or challenges to be resolved to better analyse and understand the problem in detail and its effect on the university system*". Reductionism is mainly used in technical science where parts are broken down, holism states that parts are interconnected or are interrelated they cannot exist without each other or as a whole (Freddi and Salmon, 2018).

4.4.5 Traditional project management components on BPR projects

According to Emes and Cole (2019), the recent study conducted for the association of project managers has indicated that some experienced project managers use systems thinking only for complex projects to deliver technology products successfully. Respondent 4 accentuated that "*we rely on the project managers and project management principles for better management of projects and communication with the users of the system for awareness and prioritisation in our IT projects*". However, Sharma and Kumari (2016) and Shays (1994) state that the project for BPR has shown the trajectory of failure either before or after implementation, owing to today's complexities and other factors. Respondent 3 reported that "*project management ensures that we don't have a stand-alone component, every change or implemented system change has an impact on the other system and a process*". Respondent 3 asserted that "*the project management principles highlight the importance of stakeholders are engaged to analyse the problems and gather the business requirements for*

business process re-engineering projects". Aregawi (2014) has highlighted that BPR projects often fail in many organisations owing to challenges such as operating in silos, bureaucratic environment and operating in a linear method. Respondent 3 responded by stating that "*the university environment mostly uses projects as a strategy to achieve the goals set and the project structure does not accommodate the cross-functional structure ideally for the project to promote the project success. It is also important to promote collaborations and partnership with multiple stakeholders*".

Participant 4 indicated that "*sometimes it is a challenge to create the awareness of the ICT projects due to lack of communication and lack of taking ownership of the business change. We use meetings to eliminate working in silos and most importantly keeping track of how each project task is infused to create a whole*". Mays (2017) highlighted that today's world is complex, and it is full of challenges, and problems need to be resolved holistically. Organisations must learn to decide to stop solving the problems in silos or isolation.

4.4.6 Systems thinking and systems dynamics in BPR projects

Respondent 2 raised there is the possibility of using systems dynamics to resolve challenges in IT projects. He further stated that "*Systems dynamics could be used as an approach for better implementation of business process re-engineering at this university, to better understand the challenges holistically*". Respondent 1 also stated that "*I think, generally, there is a lack of understanding of what systems thinking is within this organisation; perhaps there should be an awareness campaign or maybe training on looking at challenges as a system*". Moreover, Bhushan (2017) posits that systems thinkers play a significant role in complexity by applying methodologies like systems dynamics (feedback loops) in order to resolve complexity. Respondent 3 and Respondent 4 stated that "*in projects, the work packages are broken down to work packages while enabling cross-functional teams to work collaboratively to deliver the results. In project management or programme management, there is a need for working together holistically*".

Bhushan (2017) further elaborates that systems dynamics is instrumental in considering the system dependencies in business processes by understanding other components or elements that allow sustainable improvement of complex challenges because systems dynamics

enables improvement and understanding cross-functional business processes and bottlenecks.

Respondent 2 asserts that "*It is important to apply the systems thinking to effectively apply everything that needs to be analyzed from the system and component perspective, to manage the projects as ICT better and implement the projects with success*". Respondent maintains that "*to enable better awareness and engagement of all stakeholders from various business units for an understanding of the business problems while solving the problems effectively*". Systems thinking is very crucial in enabling systematic and holistic view that focuses on an internal and external environment in the organisation(s) to permit competitive advantage (von Kutzschenbach, Schmid and Schoenenberger, 2018).

Harper (2018) states that systems thinking approach assesses the organization as the open system that has the interconnection and interaction with other parts, the college is a system that is open with subsystems that interrelate with the environments which are internal and external.

Respondent 2 postulates that "*the subsystems of the enterprise are aligned to the big picture of the organization. Awareness and training are important to the organisation employee for better use of systems thinking when solving challenges*". However, Bibri (2018) argues that systems thinking advocates for understanding and examining the system with its subsystem in order to better understand the interconnectedness and interactions within the system as a whole.

4.4.7 Stakeholder engagements

Respondent 1 reports that "*collaborations within the university community and constantly communicating with all the business units are very crucial for the BPR project success*". Respondent 1 maintains that "*it is very crucial to ensure that all the relevant stakeholders work together to identify the challenges and resolve those challenges within the projects when implementing business process re-engineering projects*". According to Burge (2015), one of the reasons why there could be a failure in defining problems was that stakeholders do not have conflicting views on what the system is and the system problems. Burge (2018:2)

further emphasises that there are systems thinking tools which enable systems thinkers to "paint the big picture, capture and codify disparate viewpoints, unmask the hidden patterns, expose the natural and germane structure".

Respondent 2 stated that "*Collaboration within the project team ensures that working in silos is resolved; thus problems will be resolved effectively and holistically*". Haines (2016) further posits that systems thinking is not issues, parts and events, boxes/ silos, single activities of change, defensiveness, inputs and resources. Respondent 1 contended that "*the challenge is that sometimes the problems are complex and can't be resolved easily because of the human-related issues; we have been using change management to resolve challenges*". Respondent 3 stated that "*engagement with all the stakeholders, especially the trade unions is very crucial for the success of the BPR projects*". Respondent 1 reiterates that "*It is also important to take into consideration the culture of the university and its resistance to introducing technology*".

According to Checkland and Pouter (2006), systems thinking is very useful in addressing the challenges faced by the world and views problematic situations from a holistic perspective, rather than working in silos. Respondent 1 opines that "*I think the university projects must invest more time in conducting a detailed investigation on customer(s) requirements and most importantly ensuring that the customer challenges are well understood; that can be done by engaging stakeholders, the university is very complex, and the which should be resolved by BPR projects must be well understood*". Respondent 2 highlights that the "*business requirements must be well understood to improve processes effectively and efficient by means of intensively engaging all the stakeholders of the university community*".

According to Kader and Dwolatzky (2016), literature has highlighted that there is a large number of project failure in various disciplines. There is less success of projects in organisation and BPR projects is one of the disciplines with the failure rate; there are multiple causes of project failure. Respond two avers that "*we use stakeholder identification and extensive stakeholder engagement from the project planning phase and initiation stage*

and some of the industry strategies for implementing ICT projects to ensure that the project is inclusive of everyone impacted by the project".

Respondent 3 contends that "*even though stakeholders are engaged there is a lack of knowledge within the university community. Stakeholder engagement does not guarantee project success. Stakeholders who have to lead the business units within the university do not understand their business units, and they struggle to articulate the challenges.* Respondent 3 postulates that "*stakeholders who are business units' owners within the university perceive that all their challenges must be resolved by the business process improvement IT projects without understanding what their challenges are*". According to Shangase (2011), the lack of systems thinking knowledge in an organisation can expand the organisational problems instead of resolving them.

Respondent 2 further highlights that "*stakeholder engagement is significant for project success and looking at it with the view that every stakeholder is part of the whole; every stakeholder has a significant role to play to address systemic challenges"*. Respondent 2 emphasises that *stakeholder engagement is a very critical tool for implementing business process re-engineering ICT projects*". Peters (2014:1) argues that "some see systems thinking as providing a powerful language to communicate and investigate complex issues, while others are confused by the sizable and amorphous body of theories, methods and tools involved".

Respondent 4 reports that "*stakeholder engagement and monitoring can assist the project team to identify interdependencies of tasks within the project using constant communication with all the impacted stakeholders*". Respondent 4 maintains that "*collaboration with all various business units is very crucial to promote the culture of cross-functional teams for better results in BPR projects*". Respondent 4 further emphasises that "*communication enables the project team to understand the problems better and it also enables awareness of the change which will be implemented in the form of the university BPR projects*".

4.4.8 Lessons learned on IT projects

Respondent 3 highlights that "*the university as a whole can benefit with the use of knowledge repository for IT projects which are already implemented, to track the challenges, achievements and better ways to implement BPR projects guided by the history and the lessons learned*". According to Hillon and Mele (2017), BPR projects have shown a trend of failures when project results are compared with the project objectives, and BPR projects have shown challenges by producing feedbacks, which are complex with uncertainties and reaction. Respondent 1 stated that "*lessons learned are very crucial for the project success because every environment is different, and it will help to use the university lessons learned documents to decrease the mistakes of implementing the project ineffectively*". Respondent 3 reiterates that "*there needs to be a change in the institution's culture and subculture, the institution's silo mentality creates challenges*". Respondent 3 further maintains that "*the structures or barriers should be broken down for better problem-solving*". According to Miskon et al. (2017), institutions of education who use BPR should consider the methodology of organisational (systematic) innovation in order to ensure that the challenges are resolved within the institution as a whole, not in just the part of the institution.

Respondent 2 and 4 concur that "*the university must share the lessons learned from projects which have failed and ensure that the soft skills such as change management for accumulating buy-in from various business units and for eliminating the mistakes acquired in projects*". According to Viaene, De Hertoghand Jolyon, (2011), the world best CIO's have recommended that IT must find paramount means to work collaboratively with business in order to realise enterprise value collectively.

Respondent 4 reports that "*reflecting on the previous projects and taking note of the lessons learned is very crucial for project success*". Respondent 2 reveals that "*in projects, we use stakeholder engagement for impact assessment to understand what will be affected by the project and whether the project is inclusive of all the possible challenges to be resolved to avoid omitting effective improvements while attempting to earn business benefits*". Luo et al. (1996) argue that organisations need to survive these turbulent environments and times where rapid adaptability is required. More importantly, the way of thinking must change, and organisations must move from mechanistic philosophy, stagnant system thinking, and

monocausal deduction to dynamic system thinking in order to adapt and do thinking within focusing on interactions within the functions with multidimensional deduction and dialectic philosophy in mind.

4.4.9 Resistance to BPR projects within the university

According to Ho (1996), BPR has many challenges, and one of them is employee resistance to BPR projects and that result in a significant failure rate. Respondent 1 stated that "*the major challenge in the university is resistance to change by the employees of the university whenever there is an attempt of implementing BPR projects*". Furthermore, Respondent 2 asserts that "*the university has resistance towards the IT BPR projects due to the culture of the university and resistance by the university community.* Respondent 4 stated that "*change management is one of the effective tools for acquiring buy-in on projects to eliminate the resistance to change by the university community*". AbdEllatif et al., 2018 maintain that owing to many factors which failed BPR, there is a need of looking for a holistic way of working on BPR projects while considering the environment, understanding of people, understanding of people and customer requirements for success.

4.4.10 Enterprise Architecture on BPR IT projects

Respondent 1 revealed that "*the university does not have an effective strategy which can be infused with ICT projects. However, maybe since the university has introduced consultants who work on EA there may be better project outcomes within a short turnaround time*". According to Penttinen (2018), EA is the systematic approach used for the analysis of the organisation which implements the organisation's solutions as a whole. However, applying EA is very challenging in organisations; there is little success in projects. Huysmans and Verelst (2013) indicate that EA is effectively used in IT projects to provide systematic guidelines, and it assists with dealing with change, integration and complexity.

Respondent 2 further buttresses that "*in my view, there should be enterprise architecture at an organization level to better understand the entire organization to me enterprise architecture is systems thinking*". Kotusev (2019) contends that EA is just an aimless

description of architecture which results in organisations losing billions of dollars to consultants.

Respondent 3 continued stating that "*in my view, enterprise architecture is systems thinking, right*". Respondent 3 further echoes that "*in an environment where there is lack of such competence you would find that there are duplications of systems and you find that there is uncoordinated work that is happening you would find out that even investments we invest on several systems that which talks to duplication again so in my view enterprise architecture is about the ICT landscape what systems do we have what functionality do we have and what it is that we do not have so that the requirements that we have from a business you then test them against the current system and see what system should be able to address what you need*". According to Bakar et al. (2016), public organisations have challenges with implementing EA because there are various complexities and inflexibilities.

Kotusev (2016) argues that projects which have been a success in the real-world had nothing to do with the EA frameworks, and there is no specific evidence which can prove that EA frameworks are instrumental. Respondent 3 further echoes that "*I think having our own EA unit at the university as one of the best to practise will be very useful for the university, other than relying on consultants for EA tools and skills*". Respondent 3 further argues that "*EA is the way to go in the sense that it will then inform every investment decision which should be taken by ICT*".

Respondent 3 avers that "*EA will assist the university to align ICT strategy, in terms of ICT structure perfectly and how are we then realise ICT strategy going forward*". However, Penttinen (2018) resonates that EA is a systematic approach for analysing, visualising, developing and governing the functions and structures of organisations. It describes how organisations businesses, information and systems function as a whole. Larsson (2011) asserts that EA has to consider various organisations have their complexities and IT projects are also complex, and events in the different organisation do not happen in a straight-line manner; there are always unexpected events.

4.5 Questionnaire data presentation

The questionnaire was sent digitally to nine potential participants, and only five participants completed the digital questionnaire. One participant completed only one question, and he or she has been excluded from this research report because she did not complete the full questionnaire. Three potential participants did not complete the questionnaire. The researcher applied for ethics and permission to distribute the qualitative questionnaire digitally using Lime Survey software. The nine questions were the same as the interview questions which sought to respond to the research question. This qualitative case study employed non-probability sampling to identify potential participants. The participants were selected because of the knowledge they have in the projects related to BPR ICT projects.

4.5.1 Management of BPR projects at the university

Two of the participants stated that "*the strategies we use on projects depending on the project, sometimes an agile methodology is used to solve complex problems*". One of the participants highlighted that "*Most improvement project stems from a requirement from the business community in the form of an error logged or alternative a project being logged*". AbdEllatif et al. (2018) further state that BPR automates that manual processes with more human intervention, and it also replaces that organisation's existing legacy systems.

Another participant stated, "*projects are managed by request logged by the university user of the business process, and if the request logged within ICT, an investigation by the business analyst is started, which in turn, based on the evidence of the investigation, will determine the business improvement effort required*". One of the participants concurred with the previous participant by stating that "*business process improvements projects are managed per user request. Users identify the need for change or improvement as a result of legislation changes, newly identified student need or an opportunity to any potential improvement*".

One of the participants stated that the "*BPR project introduces a change to the university even though the BPR projects are not initiated or implemented frequently. However, if there is a change in business processes, there is always a record of the change of the process improvement and scheduled to be re-visited in another two years*". Jackson (2006) cited Ackoff (1999) who described complexity as driven by the way in which problems are, and

problems do not present themselves individually they are related to each other or interconnected, and that is called “messes”.

Another participant argues that “*business process re-engineering is a very effective way of improving business processes for effectiveness and efficiency within the university, it is just that we don’t succeed well on BPR project due to the way the projects are managed*. *In BPR projects mapping of processes must be well documented especially the as-is processes to ensure the project success*”. According to Bertolini, et al. (2015), when initiating and implementing the BPR projects, it is essential to understand the current state of business processes which is the as-is processes with the subprocesses and to process with the subprocesses. One of the participants stated that “*operational process improvement is assigned for improvement when requested by business units to ICT*”. “Documenting the sequence of activities thus identified, in both causal and the temporal sense, including identifying” 1) causal relationships of process activities, 2) temporal relationship inputs and outputs in processes and 3) logical relationship (Bertolini et al., 2015:46).

Another participant stated that ICT Management approves strategic process improvement projects for implementation. The participant further noted that my role is to ensure that business processes are well documented, processes are improved effectively to ensure that business processes are effectively managed through the relevant university approval structures as per the IT governance. Jackson (2006) states that managers can respond effectively to chaos and complexities by using creative holism which enables learning and combining the multiple system methodologies to resolve organisational challenges.

Another participant further stated that *the Business Analyst is then assigned the logged request logged by the user for analysis and possible improvement and analysis of the current process is conducted, a to-be is designed, and the gap analysis is done. The business and technological capability assessment then follows this.”.* According to Jackson (2006: 649) “management fads also stifle creativity. They pander to the notion that there is one best solution in all circumstances. Sometimes, if this solution tackles only one of the aspects of an organisation relevant to effective performance, the result is to reinforce sub-

optimisation." According to Lu, Chang, Yan, and Lin (2016), re-engineering of business processes is one of the forms used to implement change in institutions.

One of the participants concurred with the two previous participants by stating that "*business process improvements are business requests driven the problem solver relies on the university business owners or process owners to identify and analyze the problem*".

One user indicated that "*IT business process reengineering projects at the university are sustainable solutions because when the business process university users have identified the business process for improvement they generally they have always to consider the existing technology systems if they can support the proposed new processes improvement*". Kasemsap (2020) concurs that BPR improves the performance of the organisation in the public sector, and it effectively supports the organisation in achieving the goals of the organisation. Another participant said: "*System that BPR is essential and it's a must be taken into consideration for the success of IT projects*". However, Jackson (2003) has a view which contends the participant's view by stating that BPR is one of the management feds that provide quick fixes and less sustainable solutions to complex problems. Innovations such as BPR have failed in higher education institutions (Srikanthan and Dalrymple, 2003), and isolated process relating to projects create unsustainable solutions with more problems emanating from factors such as political, economic, competition or governance (Vom Brocke et al., 2014).

Two of the participants reported that "*business process re-engineering places organisations at an advantage as they are able to respond to ever-changing customer needs, by re-designing their systems and process to suit customer needs. They are resulting in improved customer experience and more efficient and effective processes*". In support of the participants, Kasemsap (2020) highlights that BPR is the approach used by business to improve business processes across the organisation to enable effectiveness and efficiency in business processes. One other participant stated that *BPR IT projects at the university are beneficial and sustainable.* However, Arnold and Wade (2015) suggest that systems thinking the approach should be used in a range of disciplines in order to be able to handle the complexity faced by the world. Jackson (2003) argues that BPR solutions fail because they

decompose the whole into parts, thereby generating isolated or independent from the whole. Srikanthan and Dalrymple (2003) further state that traditional methods of solving challenges only assist with maintenance of the status quo, and it does not create innovation that is able to deal with complexity and constant change.

One of the participants stated that "*If the university can identify the possible areas for improvement by defining business processes and improving those identified processes, it can result in resolving problematic areas in the university, improved operation outputs and reduced operational costs*". Ahmadi and Abadi (2016) concur that BPR is central in enabling the business to agilely move towards implementing change(s) to adapt to challenges and complexities competently. Sellers (2017) argues that leaders of these organisations create more complexities by employing traditional reductionist methods in solving problems instead of creative holism.

4.5.2 Systems thinking in the University BPR projects

One of the participants stated that "*the possible impact of a system change to other subsystems is monitored by looking at the full business processes when doing a change on a system or a business process, and not only to a system or sub-process in question*".

One of the participants indicated that "*the possible impact of a system change to other subsystems is monitored "only when there is a need for improvement of one process which affects another process, the changes must happen to the main system that requires improvement and, on the subsystem, identified during analysis which will only need the improvement*". However, Srikanthan and Dalrymple (2003) state that traditional methods do not resolve challenges; they just only assist with maintenance of the status quo and create lack of innovation that is able to deal with complexity and constant change. Lin et al. (2018) argue that BPR creates bottlenecks in management and service as one process is improved without considering other business processes.

Another participant reveals that "*identifying the impact on subsystem caused by business process improvement is done collaboratively when a system change impacts other business*

processes. The participant further stated that "*the business process owners and system owners need to be engaged for a consensus and to evaluate the level of impact and plan for actions to control the impact*".

One of the participants asserted that "*the impact on subsystems when conducting improvement is identified "through conducting the Post-Implementation Reviews (PIR) with system users and ICT system owners. However, the PIR results are not always accurate due to the limited amount of time allocated to conduct the PIR*". The participant further stated that "*at times, the BA team is not always able to identify all impacts the change may have on other systems or business processes*".

One of the participants stated that "*the possible impact of subsystem caused by the improvement of one component in the system can be validated by analyzing and validating the business processes before any improvement to identify the possible impact*".

4.5.3 Resistance to BPR projects within the university

One of the participants stated that "*there are many challenges on IT BPR projects in the university, but I think the biggest one is that staff resist change due to fear of losing jobs*". Another participant said that "*the main challenge is the process for providing solutions to business takes too long, and that makes the IT project obsolete and not serve the purpose. The participant continued stating that the projects are time-consuming, and they do not provide immediate solutions to the business units at the university*". Several scholars such as Lin, Chen, and Ye (2018) and Vom Brocke et al., (2014) argue that the holistic view is vital for purposes of understanding and resolving challenges. Therefore, to use BPR and infuse systematic optimisation in processes is very significant in order to decrease the risk of implementation failures and to deliver sustainable solutions.

One participant said that "*some ICT projects start and end with no defined business processes and defining the current business process can shed light on what needs to be improved or catered for when designing the solution*". Bertolini et al., (2015) posit that when organisations initiate and implement the BPR projects, it is essential to understand the

following As-Is Processes with the linked subprocesses. On e respondent said: "*Business process analysis also provides the full picture of what needs to improve and what impact will that improvement have on other processes in the university. Moreover, if the project does not define the business processes, it stands a stand a greater chance to fail because it means that the is no understanding of how the university operates.*" Mapping the current state enables the business to investigate possible future sustainable solutions to enhance the performance of the organisation (To-Be) processes (Rinaldi, Montanari and Bottani 2015; Jamel, Saadian and Nurcan, 2018).

One of the participants echoed the sentiments of the previous participant by arguing that "*the challenges in IT project arise when there is no clear understanding of the business processes within the university, regarding what are our processes and which process impacts what for improvement*". In the same vein, Cha et al., (2015) concur that organisations have the knowledge which is very limited to BPR and that result in challenges in implementing BPR effectively and with success. The participant further argued that "*Actually, the challenge arises when processes are analysed the as-is and not thinking for the future when designing processes. The participant continued stating that the time constraints, as projects are given a short delivery time and rushing to deliver results that are not beneficial to the institution*". Rinaldi et al. (2015), Jamel, et al. (2018) buttress that BPR has very vital steps used for the analysis of the current state of the business processes and that step is the as-is analysis and mapping of the ongoing process.

One of the participants said that "*the challenge is that the university's ICT is very reactive to user needs. Most system changes or projects are initiated because of the response to changes in laws, policies and regulations, which often do not yield a return in investment efforts made. Insufficient information is given to create a business process*". Jackson (2003) asserts that problems present themselves individually but are related to one another, and simple solutions cannot cope with complexity, change and diversity.

Three of the participants stated that "*often complex IT challenges never get resolved because of the fact that they are complex and they are implemented in a complex environment*". The participants further stated that "*BPR IT projects have challenges which are caused by*

resistance for change by the university staff members or labour unions". Two respondents highlighted that the university had lost millions before on BPR IT projects which were going to replace the university's systems. One participant said that "*projects have been paused or canned by university leadership because of resistance and lack of progress in projects because of resistance*". Similarly, Highsmith (2013) concurs that systems thinking leaders do not pitch simple solutions to complex problems or situations, as they are not complex enough. Jackson (2003) also asserts that problems present themselves individually but are related to one another, and simple solutions cannot cope with complexity, change and diversity. Sellers (2017) argues that professionally trained individuals are trained to think traditionally when resolving problems. As a result, that causes limitations when problems are solved, such as occurring unintended consequences that were not identified because the short-lived traditional solution blinds challenges. Another participant stated that: "*changes in leadership and a never-ending cycle of starting projects and never finishing them; moreover, that creates resistance and uncertainty to the university community*".

4.5.4 Stakeholder engagements

One of the participants stated that "*discussions with the impacted business users resolve complex IT project problems*". Another participant said that "*the systems thinking approach I would recommend communication with all the stakeholders and especially the problematic ones*". However, Jackson (2003) has a different view from the participants by stating that managers are introduced to different management fads, such as BPR, customer relationship management, balanced scorecard, and continuous improvement.

Three participants stated, "*the BPR projects can perhaps be a success within the university if the stakeholders are engaged from the project conceptualization, to understand the challenges of the university better*". The participants further stated that "*stakeholder analysis and engagement is a very effective strategy for understanding and uncovering any current pain points, the role of a business analyst is important at this stage*".

One of the participants said that "*in my view, the BPR project team must ensure that all the stakeholders impacted directly or indirectly must have a clear understanding of the objectives for university's BPR projects*".

4.5.5 Strategies of infusing systems thinking in the university BPR projects

However, Valiris, and Glykas (1999) and Rosemann (2014) have a different view from the participant. They contend that BPR is reductionist; it presents certain limitations to systematic analysis. Moreover, by nature, BPR is unable to cope with and resolve complex challenges. One of the participants said: "*In my view, the university's business processes do not deliver quality work which enables value, the processes need re-engineering for efficient production. I would actually recommend that the university should embrace the university culture of defining the end to end business processes. The process of defining processes and improving on them should be ongoing*". However, Rosemann (2014) postulates that BPR needs to be applied in a cross-disciplinary and systemic approach to cope with change and complexity. One of the participants said: "*I would recommend that the university reflects on the previous BPR projects and conduct SWOT analysis to eliminate the challenges previously experienced on projects possibly*."

4.5.6 Applying holism instead of reductionism in BPR projects

Two participants reported that "*it is important always to consider that the whole system must function together; so, all other parts are important to deliver the final quality product within the university*". Rousseau (2018) concurs that it is crucial to understand the whole as a scientific foundation, rather than only understanding the parts as this provides knowledge of how the sub-systems interconnect. Another participant said: "*Decomposing parts of the system for holistic process improvements may not be a good idea. Moreover, all the parts of the whole system have a direct impact on one another. It is very crucial to consider all the parts of the system within the system to consider further the solution, which is a whole which considers all the parts*." Jackson (2003) defines a system as a complex whole, whose functions depend on its parts and the interactions between these parts.

4.5.7 Traditional project management component on BPR

Three participants shared the same sentiment by stating that the project team must include all specialist group and business users from the broader university community as per the project management principles for project success. Moreover, the visibility of the project

and its deliverables must be communicated to the organisation to avoid duplication of work efforts and promote collaboration in implementing one best solution for the university. According to Nicholds and Mo (2015), organisations are very complex nowadays, and the implementation of BPR projects without considering interrelatedness of internal factors results in BPR project failure.

4.5.8 Systems thinking and systems dynamics in BPR projects

One of the participants said: "*I don't know, it is difficult for me to say which system thinking approach will be best suitable for the university*". Senge (1990: 6) asserts that "learning organisations require a new view of leadership. He sees the traditional view of leaders as special people who set the direction, make key decisions and energise the troops as deriving from a deeply individualistic and non-systemic worldview".

Another participant said: "*Systems thinking approach which is best suitable should be involving and formulating project teams that consist of IT specialists and business users when designing, building and testing systems and validating the university's processes*". Jackson (2003) avers that organisations have constant failures owing to complexities and other factors. Management in organisations always opted for simple and easy solutions as a result that created failure because of the continuous failure organisations are now looking into using systems thinking of sustainable solutions.

One of the participants said: "*The complex IT challenges are resolved by using a divide a conquer method, a complex problem becomes simplified when subdivided.*" According to Rousseau (2018), it is crucial to understand the whole system as a scientific foundation, rather than only understanding the parts, as this provides knowledge of how the sub-systems interconnect. Checkland and Pouter (2006) also argue that systems thinking is very useful in addressing the challenges faced by the world and views problematic situations from a holistic perspective rather than working in silos.

One of the participants said: "*The university should promote working in silos on projects by implementing the enterprise systems which allows multiple functions in one or I can say*

implementing a collaboration software." Another participant argued *that* "*generally IT problems need to be broken down into small sections and prioritize them according to their impact to the environment", the participant continued stating that management involvement in solving IT problems is important for the survival of the university*". However, Bhushan (2017) concurs that business processes or system must be viewed in a holistic and the way that is not linear in order to resolve complex challenges. Freddi and Salmon (2018) further postulate that reductionism is mainly used in technical science where parts are broken down, holism states that parts are interconnected or are interrelated they cannot exist without each other or as a whole.

According to Mays (2017), institutions of education in higher learning are continuously searching of possible solutions by utilising information communication and technology to cope and, eliminate where possible, the competitive pressure to offer flexible and affordable learning opportunities. One participant said: "*the university uses one end to end technology system to provide all the services to the students from the application stage to the graduation stage. The system is outdated and built on old technology, which is not compatible with most modern technologies, thus making it difficult for the university to use multiple systems for student-related activities.* In this regard, Arundel et al. (2016) further state that it is essential for universities to be innovative, flexible and to adapt to the fast-changing environment easily. Moreover, IT and projects related to technology are very important for the university to survival.

Universities, like any other business, need to be innovative, flexible and adaptable (Arundel et al., 2016). Consequently, the university operates like any other entity; it relies on innovation and IT projects to deliver services and efficiently to the stakeholders.

Another participant said: "*collaboration can be promoted by establishing a team that will be responsible for planning, prioritizing and overseeing all ICT projects they are assigned to an individual and granting staff access to tools that will enable collaboration and a holistic view of project requests.*" Organisational management wants to use systems thinking, and they are aware that it is helpful, but there is a challenge that there is a lack of understanding of what systems thinking is (Jackson, 2003).

4.5.9 Lessons learned on IT projects

Three participants said: "*They suggest that the university reviews the previous business process re-engineering efforts by evaluating what went wrong and most importantly on the enterprise projects which did not yield the results.*" The participants further suggest that "*the lessons learnt record could be used by the university to assess the likelihood of success for BPR, it can further assist the BPR IT project team not to make the mistakes already committed.*" Rousseau (2018) argues that it is crucial to understand the whole as a scientific foundation, rather than only understanding the parts, as this provides knowledge of how the sub-systems interconnect.

Two other participants said: "*Based on the lessons learned on the participant of the previous project it is essential to allocate enough resources and time for executing the BPR projects with success and that it is crucial for the project team to only focus on BPR projects because they are complex.*"

4.5.10 Enterprise Architecture on BPR IT projects

Four participants shared the same sentiment by stating that *the university's enterprise architecture is useful in ensuring that ICT projects are supported, and different system from different disciplines work together as a single unity.* The participants further stated that *Enterprise Architecture (EA) already infuses system thinking because it deals with all layers of the business, from infrastructure, applications, Human Resources etc.* The sentiments resonate with Lemmetti and Pekkola's (2012) assertion that EA is useful in the management of the very complex environments in organisations and it also combines IT, business, personnel and strategy of the organisation. According to Larsson (2011), EA is one of the practical approaches used in public organisations to successfully implement business processes using IT projects while effectively achieving the organisational goals.

One of the participants said: "*The importance of highlighting that enterprise architecture is also a business functionality, it is not only the ICT functionality, but it is also the university-wide function as opposed to an ICT owned function*". The participant further unveiled that

"*EA involves business processes, information systems, infrastructure as well as the organizational structure, it is not only based on ICT, but the holistic business; systems thinking will enable the university to have solutions which are not IT-based but also business based for the university's sustainable solution*". In the same vein, Dang and Pekkola (2016) concur that EA has been overwhelmed with challenges which arise during the implementation phase of the EA programmes whereby the EA focuses on IT than to also focus on business requirements. Penttinen and Isomäki (2010) further state that EA supports the strategic goals of the organisations in the public sector by emphasising the collaboration and alignment such as the systems, processes to encourage working together with a whole in various organisational structures across the organisation. However, EA has to consider that multiple organisations have their complexities and IT projects are also complex and events in the different organisation do not happen in a straight-line manner, and there are always unexpected events (Larsson, 2011).

One of the participants said: "*The university effectively use an EA framework and its strategies to ensure that the university achieves its goals and ICT projects are implemented with success. EA is also used to understand the effects of BPR projects to the university subsystems.*" Lemmetti and Pekkola (2012) concur that EA is very efficient in the management of very complex environments within organisations, and it also combines IT, business, personnel and strategy of the organisation. However, Dang and Pekkola (2016) differ by stating that EA has been overwhelmed with challenges especially during the implementation phase because the organisation applies EA as the IT project which sought to focus on IT than to also focus on business requirements. Another participant posits that *"the problematic areas for business improvements are mostly identified per user request or based on the number of complaints received from users for a particular process or system*". According to Meadows, Sweeney and Mehers (2016), systems thinking provides an effective frame in complex problem understanding and complex problem-solving. Systems thinking needs to enable organisations to be proactive rather than being reactive to the crisis by thinking in an integrated way.

4.9.11 Document findings

Documents were also reviewed in this project to provide more information when responding to the research question. The documents were obtained from the university under study's intranet post the approval of ethics clearance and permission. The following documents were reviewed three documents they are: 1) the university's ODeL 2030 strategy document, 2) the university's ICT strategy document, and 3) the university's Annual Performance Plan 2019. The researcher intensively engaged the university documents to respond to the research questions. The documents did provide relevant information to respond to the research questions.

The three university documents obtained in the university intranet after the ethics and permission approval were reviewed by the researcher. The documents contained the information related to the study, and the information assisted the researcher to respond to the research questions.

The documents did indicate that ICT is very crucial in ensuring that there are student centricity and the university-wide integrated management system. One of the documents highlighted that the university must ensure that the ICT systems are cutting edge to support the university core business, enable high-quality service to the university community and all other university stakeholders and empower high performance with the support of technology.

According to Monat and Gannon (2015), Systems thinking does not have a standard definition or understanding. However, it is very popular today, since it has been applied in a variety of fields and disciplines for solving problems that are complex and unsolvable through conventional/reductionist methods. Additionally, it is used to implement change effectively.

The documents have highlighted that the university is focusing on the ICT infrastructure to ensure that ICT is an enabler of the university to achieve its objectives while providing the best service to the stakeholders such as students. Organisations are complex, and they are faced with unrests and uncertainties. However, some leaders use non-linear thinking when

resolving challenges and these leaders are systems thinkers (Shangase, 2011). The ICT department is also restructuring to ensure that the human capital employed by the ICT department in the university is currently positioned to deliver on the proposed university ICT projects effectively. According to Becker et al. (2017), universities are implementing technologies to meet the needs of an increasing number of students in institutions.

According to Darwin, Tetenbaum and Senge (2006), the traditional theory saw organisations as a closed system with boundaries; organisations were viewed as protected from the hostile environment. Organisational challenges cannot be resolved by linear methods or by leaders who rely on simple linear solutions to solve problems (Shangase, 2011).

The document stated that as part of the Annual Performance Plan for 2019 was to obtain the strategic partner(s) to investigate and replace the existing legacy systems. One of the documents highlighted that the students have to access services anywhere and 24 hours without experiencing challenges utilizing cutting edge technology. The researcher also noted that some of the annual performance goals were not achieved in 2018 were carried over to 2019 for implementation. Murase (2018) highlights that when attempting to resolve problems, they should not be solved in isolation, as this can lead to more systemic problems. Therefore, systemic approaches must be used to solve problems.

4.6 Chapter summary

This chapter presented data collected which was collected from participants in interviews, questionnaires and document analysis. The data gathered sought to respond to the research questions, and the data collected was also analysed, and the coding method was used to group similar responses and responses which are not similar. The following chapter presents the conclusions and recommendations based on the findings of this study.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the conclusion and a set of recommendations based on the findings. The study aimed to investigate ways of infusing systems thinking in BPR IT projects at a public university in South Africa. The study intensively reviewed the existing literature relating to BPR, systems thinking and other relevant disciplines. The study was situated in interpretivism paradigm, used a case study research, pursued a qualitative research approach, used questionnaires and in-depth interviews to collect primary data, and used university document and literature to gather the secondary data.

The study consists of five chapters. Chapter 1 presented the introduction and background to the study. Chapter 2 reviewed the existing literature in an attempt to respond to the research questions and problem statement. Chapter 3 mapped the methodology of the study and its research design. Chapter 4 presented the findings, analysis and interpretation of the study. Chapter 5 presents the conclusion and recommendations based on the research results and recommends future research.

5.2 Revisiting the research objectives of the study

The problem of this study was discussed in detail in Chapter 1 this study has addressed the research problem. The research objectives of this study were as follows:

5.2.1. To establish the systemic impact of BPR on business processes and IT, and how is it managed at the institution under study.

5.2.2. To identify the strategies that are employed to understand the effects that BPR has on other sub-systems of the institution under study.

5.2.3. To investigate systems thinking approaches that can be used in BPR at the institution under the study to understand holism.

5.2.4. To identify the most suitable systems thinking approach to recommend recommended for infusion in BPR for the institution under study.

5.3 Addressing the research questions

This qualitative case study sought to examine strategies of infusing systems thinking on BPR projects at a public university in South Africa. The findings of this study are not generalisable. The sample size was not representable of the population. It was not the intention of the researcher and the study to generalise the results. The study employed purposive sampling, which limits the size of the sample. The study adopted a qualitative approach. The study has responded to the research questions of this study.

Research question one: What systemic impact does BPR have on business processes and IT, and how is it managed for the institution understudy?

BPR is effectively implemented in the higher education sector for improving business process performance, innovation and for the introduction of IT (Kumari et al., 2015). According to Earl (1996), BPR has been used by organisational management in western regions to survive and cope with organisational challenges. According to Leveson (2011: 25), "BPR thinking needs to be looked at in a holistic approach to re-engineering that involves business processes, technology and social system issues". Jackson (2003) asserts that problems present themselves individually but are related to one another, and simple solutions cannot cope with complexity, change and diversity.

According to AbdEllatif et al., (2018), BPR projects have been highlighted to have a very high failure rate which is 70%. Their failure in BPR could be the result of only focusing on the process improvement without considering the environment and any other impact. Systems thinking is holistic, as it ensures that the parts of the organisation function together effectively to serve the needs of the whole system (Jackson, 2003). According to Orlikowski, et al. (2016), the re-engineering of a process or activity creates challenges, as one part of the process is improved, without considering the interconnectedness or interrelatedness with other parts of the system.

This research question has been responded to by the study. The participants who participated in the interviews and questionnaires have indicated that the university currently relies on traditional methods to manages the BPR IT projects. According to Sellers (2017), leaders of organisations create more complexities by employing traditional reductionist methods in

solving problems instead of creative holism. Yurtseven and Buchanan (2015) further accentuate that the existing conventional and scientific methods that are still used to resolve challenges should infuse a systems-based approach. The university under study's documents also revealed that the IT projects listed on the Annual Performance Plan (APP) targets for the university's ICT department are viewed as the vehicle to resolve challenges within the university for better service to the students and the university stakeholders. This has further been highlighted by the university strategy document stating that IT is an enabler of university operations.

The study revealed that the university's IT department relies on traditional methods such as Project Management, Enterprise Architecture (EA), Change Management and Stakeholder Engagement to manage and establish the systemic impact on the university's BPR IT projects. Respondent 1 and Respondent 4 on interviews indicated that there is no practical way of managing projects effectively within the university. All the respondents on interview ended up highlighting the traditional methods which are used for project management within the university. According to Jackson (2003), the approaches which are anti-systemic are quick fixes which are used by management in organisations, and they are prone to fail.

According to Vom Brocke et al. (2014), reductionism approach conducted in projects results in projects implementing the solutions which are not sustainable and it results in more problems caused by complex environment caused by political, economic, competition and governance issues. The innovation initiatives such as BPR has failed continuously in higher education institutions (Srikanthan and Dalrymple, 2003). In order to handle complexities faced by the world today, a system thinking approach should be used in various disciplines to effectively manage the complexities (Arnold and Wade, 2015).

The study showed that the university solely relies on traditional methods to resolve initiate and implement the BPR projects. In the view of the participants, the conventional methods were identified as effective tools to implement and initiate the BPR projects successfully. Regardless of the failure of projects over the years, owing to the limitation of traditional methods, Respondent 4 highlighted how the systematic impact of BPR projects is not well managed. This is because the university does not have a strong, well-established way of

managing BPR projects. Moreover, there have been dismal failures in the past big enterprise projects worth millions of rands for replacement of the university legacy systems, which has the direct impact of re-engineering of business processes. Knowledge of systems thinking and its ability to assist with looking at the challenges as a whole is crucial for the university to succeed in initiating, managing and implementing the BPR projects. BPR is the re-engineering of business processes or tasks for improvement of one part of the process, not the whole to consider the interconnectedness, interrelatedness and other parts of the entire system are not considered (Orlikowski et al., 2016).

Research question two: What strategies are employed to understand the effects that BPR has on other sub-systems of the institution understudy?

The study revealed that the participants for interviews and questionnaire continued referring to the traditional approaches as previously mentioned as effective strategies for understanding the effects of BPR projects on the university's subsystem. Regardless of its ineffectiveness in implementing sustainable solutions within the university, the participants highlighted some of the challenges within which were experienced during the BPR IT projects. However, the answer to the difficulties experienced was related to traditional methods.

Emes and Cole (2019) state that systems thinking has many benefits when applied on complex projects such as delivering the solutions to problems which are complex, which could not be resolved by the traditional approaches which decompose the parts in an attempt to solve problems. The participants have indicated that they break down the parts of the processes to analyse them for the understanding of other sub-systems effectively and that is a linear way of understanding the challenges. According to Leveson (2011), complexity compels organisations to rethink engineering by thinking holistically, rather than focusing on reductionism, which represents less effective, older approaches to doing things. Arnold and Wade (2015) postulate that there is constant growth in technology plays a very critical role in advancement. Therefore there is an increase in interdependencies on their systems that have been present previously.

According to Srikanthan and Dalrymple (2003), traditional methods do not thrive in resolving the challenges; they only contribute to maintaining the status quo. Moreover, they do not encourage innovation in complex and forever changing environments. Systems thinking advocates understanding the problem from all angles (interrelatedness) to eliminate a partial or one-sided view of the problem (Jackson, 2006). The participants have highlighted EA as one of the strategies which can be used to understand the university's sub-systems when implementing BPR effectively.

EA initiatives ensure that the organisation's strategies are analysed holistically rather than in silos with their related impacts on technology applications, business and application (Gomes, 2015). However, Larsson (2011) have that scholars have conducted some research studies which indicated that most of the times EA fails in the public sector because of so many factors such as non-alignment of business architecture and IT architecture. Traditional theory saw organisations as a closed system with boundaries; organisations were viewed as protected from the environment, which is hostile (Darwin, Tetenbaum and Senge, 2006).

Research objective three: Which systems thinking approaches can be used in BPR at the institution under study, in order to understand holism?

According to Harper (2018), systems thinking approach evaluates the organisation as the open system that has the interconnection and interaction with other parts. The college is a system that is open with subsystems that interrelate with the environments which are internal and external. Kang (2016) further asserts that holism supports examining the whole instead of the parts when attempting to resolve the problems. The holistic view always seeks to understand the situation and a problem in a worldview while considering that there is still interconnection between different elements and environments

The study also revealed that there is less knowledge about systems thinking in general within the participants. Some of the participants have indicated that there is less knowledge about systems thinking within the university. The BPR project team relies on traditional methods to resolve the challenges. Some participants have stated that it is crucial to understand the

systems as a whole even though they could not recommend the systems thinking approach owing to a lack of systems thinking knowledge.

According to Respondent 2, who participated in the interviews, systems dynamics as a system thinking approach can be used to understand the holism in BPR project initiation, management and implementation. According to Bhushan (2017), systems dynamics is useful in consideration of the system dependencies in business processes by understanding other components or elements that allow sustainable improvement of complex challenges because systems dynamics enables improvement and understanding cross-functional business processes and bottlenecks.

The study has also revealed that the lack of systems thinking knowledge has resulted in the BPR project team not being able to effectively identify the impact of improvement(s) on other parts of the whole system-in-focus and use linear thinking, as well as strange attractors. In addition, the responses of the participants demonstrated that within the university, there is a lack of knowledge related to the importance of interconnectedness, interrelatedness of parts in a system.

Research question four: What would be the most suitable systems thinking approach to recommend for infusion in BPR for the institution understudy?

The study established that the participants do not know about systems thinking. This was established through interviews and questionnaires with the participants. This study also revealed that the participants in interviews and questionnaires have an understanding that EA is a system thinking approach. However, EA is a traditional method approach. According to Kotusev (2019), EA does not add value to businesses. However, it continues to be raised as one of the practises, which are the best without any results, organisations continue to use consultants for EA initiatives while organisations lose billions of rands in such initiatives.

One of the participants in the questionnaires has indicated that they did not know which approach is suitable. This study has revealed that there is a lack of knowledge within the university's IT BPR project team on what systems thinking is. Respondent 2, who participated in the interviews, highlighted systems dynamics as a best suitable approach in BPR IT projects within the complex university. According to Pham (2017), complex adaptive systems are dynamic and open systems which are made up of individual agents that act independently. However, the actions of the different agents are interconnected. Pham (2017) further asserts that when one agent changes, it has the potential to influence other agents and create a ripple effect across the system.

5.4 Emerging issues from the study

According to Respondent 4, who responded through an interview, the university has had several failures of BPR IT projects, and omissions have resulted in the university losing millions owing to failed projects. The study has also revealed that the projects were BPR projects which have failed were identified as the legacy system replacements, which meant to replace the legacy system while re-engineering business processes within the university. The study also revealed that the participants have a view that the BPR projects fail because of resistance to change by the university community. The study has also exposed that the university is a very complex system, and there are many challenges which are emerging within the higher education sector.

5.5 Overall conclusion

The study concludes that within the university, the BPR projects are imitated and implemented without considering the holistic view of the system-in-focus. The linear way of initiating and implementing the project which focuses on sub-optimization, result in project failure and loss of millions of rands because of the failure of projects. The university projects should be initiated and implemented systematically and consider that every part of the system is interconnected and interrelated. The importance of noting that every part is interconnected and interrelated in the system is crucial for the university.

The traditional methods used in initiating and implementing the IT BPR projects such as project management, EA and stakeholder engagement would not be replaced by systems

thinking. However, systems thinking should be infused in the IT BPR projects to have a systemic view in problem-solving. The BPR IT projects should be initiated and implemented, looking at the university-wide for better impact analysis of the challenges. The BPR projects should also consider the impact of the internal and external factors such as Legal, Environmental, Political, and Economic to better infuse the systemic approach in the BPR projects.

5.6 Implications of this research

This study would enable the university community to see the need for incorporating systems thinking on the BPR project for the success of the project even though there is a lack of knowledge of what systems thinking is. The participants have acknowledged the importance of infusing systems thinking in complex projects for BPR project success.

There is a need for knowledge sharing sessions to improve better how BPR projects are initiated, managed and implemented within the university. As the study has revealed that only reductionism cannot resolve complex problems, change, unpredictability, and uncertainty.

The study has further revealed that the university's BPR IT projects initiation and implementation should not only rely on traditional methods for success because currently there is a dismal failure in projects for process re-engineering and legacy system replacement within the university. According to Hillon and Mele (2017), BPR projects have a higher failure rate. Therefore, organisations must look at other ways to deal with the complexities in this 21st century to respond to challenges, and the new strategies must be agile.

Systems thinking is very significant in organisations, especially when attempting to improve efficiency and effectiveness during the analysing business processes in large systems and systems thinking enables a crucial systematic non-linear and holistic method (Bhushan, 2017). "Complex systems cannot be understood by studying parts in isolation. The very essence of the system lies in the interaction between parts and the overall behaviour that emerges from the interactions. The system must be analysed as a whole" (Ottino, 2003:293).

The findings of this study promote creative holism to contribute to the body of knowledge, thus reducing challenges experienced when initiating and implementing business process re-engineering projects within the public university in South Africa.

5.7 Contribution to the research

This study has identified that there is a need for knowledge of systems thinking within the university to ensure that all the challenges that BPR IT projects attempt to resolve within the complex university system are adequately addressed. The study findings have the potential to assist the university to review how BPR IT projects are initiated, managed and implemented.

This study has added value in BPR IT projects to cope with complex and messy situations in the pursuit of process improvement. This study has also helped with ensuring that interrelatedness, interconnectedness and interdependency of parts of the university system as a system-in-focus, and that the sub-optimisation of one component may cripple other parts. This study would potentially change the way BPR is executed for project success.

5.8 Limitation of the study

This study was a qualitative case study with a small sample; this project was cross-sectional. This study used the sampling, which is purposive sampling technique. There is a smaller number of participants for this study. The project had an end date, and therefore the researcher could not collect the data up to the point of saturation. The researcher did not exhaust all the literature available related to the study owing to the timelines of the project; not all the available literature is included in this study. The study has been conducted for the specific period granted by the university under study as per the prescription by the ethics and permission. Not all potential participants of interviews and questionnaires participated in this study.

This study had some limitations experienced during the project, but the limitations did not hinder with the ensuring that the research objectives are attainable. The researcher did not

want to generalise the results, and that has been achieved. Moreover, the research questions were adequately answered.

5.9 Recommendations for future research

In Chapter 3, literature analysis indicated that incorporating systems thinking of problem analysis and solving is useful for sustainable solutions on BPR IT projects. The data collected in interviews, questionnaires and the university documents also showed it is vital to infuse systems thinking in BPR IT projects to initiate better and implement the BPR projects.

There should be future research of applying systems thinking in all other projects not only BPR IT project. The study should be conducted within the higher education sector. The proposed future research must have a larger sample size. The research method should be a mixed-method with a full set of the population other than IT people.

The study recommends that it is vital to infuse systems thinking in BPR IT projects within the university to complement the current traditional methods which are used in BPR projects. The study recommends that the conventional methods used by the university in BPR projects should not be disregarded but be infused with systems thinking for the university's BPR project success. Based on the findings in Chapter 4, there is a lack of systems thinking knowledge by the university employees who execute the BPR IT projects.

The study further recommends that there should be knowledge sharing sessions about infusing systems thinking within the university projects to resolve the complex problems effectively. Introducing systems thinking further enables the university community to see the problems as a whole and not in isolation. The university should consider the systemic impact of other parts of the university as a complex system, to also ensure that the BPR project's solutions do not improve one part of the system and further does not consider other interconnected and interrelated parts of the university as a system.

5.10 Summary of the chapter

This study has achieved its purpose to examine ways of infusing systems thinking in BPR IT projects at a public university in South Africa. The findings of the study have revealed that the university solely relies on traditional methods implement, initiate and manage the BPR IT projects for the complex university. This chapter revisited the objectives and questions of the study. The chapter also highlighted the emerging issues of the study, Implications of the research, contribution of the research, limitations of the study, the recommendation of the future research and overall conclusion of the study.

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APPENDIX A: UKZN ETHICAL CLEARANCE

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

14 March 2019

Mrs Noluthando Ursula Khanyile (216072396)
Graduate School of Business and Leadership
Westville Campus

Dear Mrs Khanyile,

Protocol Reference Number : HSS/1698/018M
New project title: Applying Systems Thinking in Business Process Re-engineering for Information Technology Projects: A case study of the University in South Africa

Approval Notification – Amendment Application

This letter serves to notify you that your application and request for an amendment received on 06 March 2019 has now been approved as follows:

- Change in Title

Any alterations to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form; Title of the Project, Location of the Study must be reviewed and approved through an 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 period of 3 years from the date of original issue. Thereafter Recertification must be applied for on an annual basis.

Best wishes for the successful completion of your research protocol.

Yours faithfu[redacted]

.....
Dr Rosemary Sibanda (Chair)

/ms

Cc Supervisor: Professor Theuns Pelser
cc Academic Leader Research: Professor M Hoque
cc School Administrator: Ms Zarina Bullyraj

Humanities & Social Sciences Research Ethics Committee
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