An Integrated Model for Information Technology Servitization Adoption in South African State-Owned Enterprises

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In fulfilment of the requirement for the degree of
Doctor of Philosophy in Information Systems

Faculty of Commerce, Law and Management

University of the Witwatersrand

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April 2021

THESIS ABSTRACT

Information Technology (IT) servitization manifests itself in multiple forms, including IT outsourcing, virtualization and cloud computing. It was inferred that various determinants influence South African State-Owned Enterprises (SOEs) to adopt IT servitization. Although the concept of IT servitization has been researched under various terms, the determinants, particularly in the context of South African SOEs, have not been adequately studied to date, resulting in large capital investments in IT servitization adoption but with limited value realised thereafter.

This thesis examines the determinants that influence the adoption of IT servitization. The study and thesis were motivated by the fact that these determinants were not well explained in order for SOEs to smoothly adopt IT servitization. Subsequently, the thesis develops an integrated theoretical and practical model for IT servitization adoption in the context of South African SOEs. Three theories were triangulated based on the study objectives to provide lenses for explaining the determinants. The lack of a single all-encompassing theory of innovation adoption influenced the triangulation decision. Technology, Organisation, and Environment (TOE) framework, Institutional theory, and Process virtualization theory are the triangulated theories.

In order to guide the actions and beliefs of the study, a positivistic philosophical orientation was followed with a quantitative deductive approach being adopted. The unit of analysis were individuals who have IT experience within South Africa's SOE environments. This decision was informed by the need to understand IT servitization adoption from the individual's point of view as opposed to the organisational point of view. Purposive sampling was the primary method for selecting respondents, which was supplemented by snowballing. A Web-based questionnaire was used to collect survey data from IT executives and practitioners. Structural Equation Modelling was used to validate the research model.

The theoretical and practical model for IT servitization adoption in the context of South African SOEs is thus the contribution of this thesis. This model indicates that, when technology allows for virtual interaction of participants in a professional setting (relationship readiness) as well as provide an automated process that uniquely and accurately verifies the identity of process participants (identification and control readiness), SOEs are enabled to adopt IT servitization. Moreover, when coercive and normative pressures are exerted, formally or informally, directly or indirectly, through regulatory bodies, trading partners, professional associations, and organisations on which SOEs rely, SOEs adopt IT servitization. Furthermore, the industry, or the business sector within which the SOE operates, has an influence on their adoption of IT servitization.

Keywords: Adoption, Cloud computing, IT servitization, Institutional theory, Outsourcing, South African SOEs, TOE framework, Process virtualization theory, Virtualization

DECLARATION

I, Palesa B. Chuene, hereby declare that the thesis titled “An Integrated Model for Information Technology Servitization Adoption in South African State-Owned Enterprises” is my own work and the literature that has been used to inform the study has been acknowledged accordingly. No part of the thesis has been previously submitted nor is it in the process of being submitted at another institution of higher learning.

Signed:

Date: 20/04/2021

ACKNOWLEDGEMENTS

Although the process of completing a doctorate can be a long, difficult, and lonely journey, I was able to cross the finish line thanks to the help of others. I would like to express my deepest gratitude to my supervisor Professor Ray Kekwaletswe. The guidance, time and support I have received from him throughout the entire process was nothing short of amazing, he kept it real. I could not have picked a better supervisor. Appreciation to Dr M Modiba, for his willingness to assist and his encouragement whenever I felt stuck. My fellow University of the Witwatersrand colleagues, I hope this academic journey we shared has been fruitful.

Nkhensi and Nhlamu, your mere existence changed my life. Throughout the process, you provided me with much-needed time and space to read, write, and to learn. Everything I do is meaningful because of you, and I love you. My family, friends, and spouse, thank you for always being a source of inspiration.

Mama and Papa, we made it! At my first graduation ceremony, I turned down your offer to buy me a black graduation gown and said I’m eyeing a red one. Here we are. Signed, sealed, delivered!

Lastly, to me. There has been no shortage of reasons to quit. There were many moments where I was not sure if I would complete this milestone, yet perseverance won. Completing a doctorate in the middle of a global pandemic is a feat, well done.

To God be the glory.

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CHAPTER 1

INTRODUCTION AND BACKGROUND

This thesis explains the adoption of IT Servitization in South African State-Owned Enterprises (SOEs). Triangulating Technology, Organisation and Environment framework, Institutional theory and Process Virtualization theory, this thesis converged the three lenses for cross verification to avoid getting a one-sided view or distortion, thus minimising possible prejudices resulting from using a single lens. As a result, this work contributes to the information systems field by explaining the determinants of IT servitization adoption through an integrated model.

The first chapter is organised as follows: First, it introduces the study by defining key terms in the thesis title to ensure that the reader has a common understanding. The next section provides background to the research problem, which seeks to examine determinants that influence IT servitization adoption in the context of South African SOEs. Following that, the problem formulation is presented. The gaps in knowledge are then discussed in order to situate this research within the context of existing literature, thereby making a case and motivating for the current study. The problem statement comes next, followed by the research purpose, goal, and objectives. Following that, primary and secondary research questions are presented. The study's contribution to practice, theory, method, and context is then presented. The delimitations and assumptions are then discussed, and finally, an overview of the thesis structure is provided.

The next section defines the key terms making up the research topic.

1.1. Defining Key Terms in the Research Topic

Before proceeding on to the study discussion, it is critical to define key terms from the thesis title. Key terms are briefly discussed below to facilitate mutual understanding of the research topic "*An Integrated Model for IT Servitization Adoption in South African State-Owned Enterprises*". The definition of key terms is necessary because the terms have been defined in a variety of ways in various studies. Thus, the terms are defined below.

1.1.1. Information Technology

Information technology (IT) is defined as a broad subject that encompasses all forms of technology that are used to create, store and distribute information in videos, voice, text, images and other formats (Hameed, 2007; Marais, 2009). According to Chowdhury (2000), the distribution of said information is primarily through computers, but also includes other communication media, peripherals, and devices that enable communication in various forms between people and information systems.

D'Orville (2000) expands the definition of IT in technical terms by stating that IT includes electronic networks, comprised of advanced hardware and software linked by multiple technical protocols. While defining it, Jimenez (2006) adds a security component by explaining that IT is concerned with the use of computers and related software for securely storing, protecting, converting, processing, transmitting, and retrieving information.

It should be noted that there are numerous definitions for the term IT. The current study, on the other hand, has adopted Jimenez (2006)'s definition, which defines IT as the use of computers and related software for networking, storage, and the use of related peripherals to securely create, process, transmit, store, and retrieve electronic data in all forms.

1.1.2. Servitization

Early literature by Vandermerwe and Rada (1988) introduced the concept of servitization, defining it as an activity in which value is added to an offering. The concept was first coined in the manufacturing industry in the 1980s. It was described as a transformation journey in which organisations develop the necessary capabilities for the provision of comprehensive solutions and services that add value to their standard products in order to create end-to-end value (Vandermerwe & Rada, 1988; Sultan, 2014).

Ahamed, Inohara, and Kamoshida (2013) highlight a critical shift and redesign in organisational business models across all industries brought about by servitization, positing it as an evolution of organisational skills and processes through innovation that allow for better creation of value to customers by shifting away from only providing product offerings but also providing product-service offerings to the customers. The term servitization was first used by Leo and Philippe (2001) as tertiarization, and then later by Rothenberg (2007) as servicizing. The term servitization was used in this study.

1.1.3. IT Servitization

Conger (2010) coined the term "Servitizing IT" in a publication to describe a trend in which organisations emphasise customer-oriented service in the delivery of IT solutions to businesses. Similar to the manufacturing industry, which pioneered the concept of servitization, the IT industry is undergoing a transformation in which organisations are no longer overly reliant on physical assets such as data centres, physical on-site storage, and servers for accessing high-end resources and applications. Access to the internet is the most important requirement in this day and age (Mahon, McPherson, Vaughan, Rowe, Pickett & Bielec, 2011). This process of transforming IT into a service is known as IT servitization. Conger (2010)'s definition was used in the current study.

1.1.4. Adoption

Adoption of an innovation is a process that results in the introduction and use of a new practice, process, or product by an organisation (Kimberly & Evanisko, 1981; Damanpour & Wischnevsky, 2006). The decision to fully utilise an innovation is also referred to as adoption (Rogers, 1983). The term "adoption" will be used throughout this study to refer to an organisation's use of a new practice, process, or product.

1.1.5. South African State-Owned Enterprises (SOEs)

The definition of what constitutes an SOE is a point of contention and an ongoing debate all over the world. In South Africa, SOEs are independent agencies that are partly or entirely owned by the government in order to achieve various socioeconomic objectives and to fulfil both commercial and developmental mandates as needed. Their main purpose is to carry out specific mandates guided by specific government Acts (Auditor General

South Africa, 2017). SOEs are also known as government agencies, state-owned enterprises, parastatals, state or public enterprises, and a variety of other descriptors.

Globally, the use of public authorities rather than privatisation has been adopted as a means of maintaining satisfactory public accountability while capitalising on private sector efficiencies (Ovens, 2013). According to the World Bank, among other things, commonly stated reasons for government ownership through SOEs are to increase citizens' access to public services while restricting absolute control of activities, both private and foreign, throughout the domestic economy, improve labour relations, and encourage economic development and industrialisation (The World Bank, 2006).

The Organisation for Economic Co-operation and Development (OECD) definition of SOE was used in this study. They define SOEs as enterprises that the government controls or fully owns, either outright or by a significant minority (OECD, 2005).

1.2. Background to the Research Problem

This section provides the background of the research problem as well as the location where the study was conducted, allowing the reader to gain an environmental understanding of the study.

1.2.1. Study Context and Location

Following the first ever democratic election in South Africa in 1994, the journey to transform government agencies into state-owned enterprises began. The transformation was implemented to promote the effective and efficient provision of basic services to citizens who previously had unequal access to public services due to apartheid laws that prevailed in the country for decades.

In today's democratic South Africa, SOEs remain important for economic development and are frequently defined by law in key sectors such as electricity, transportation, and telecommunications. However, the government allows competition in some sectors, such as telecommunications and air transportation (DPE, 2018). They contribute significantly to long-term economic development and growth, as well as overall country stability.

The Public Finance Management Act 1 of 1999 as amended by Act 29 of 1999 defines the national government business enterprise as an entity which:

- *"is a juristic person under the ownership control of the national executive;*
- *has been assigned financial and operational authority to carry on a business activity;*
- *as its principal business, provides goods or services in accordance with ordinary business principles; and*
- *is financed fully or substantially from sources other than the National Revenue Fund; or by way of a tax, levy or other statutory money."*

While conducting this study, in South Africa, the total number of SOEs published on 29 March 2018 by the National Treasury department was 277. The following institutions are classified: 9 constitutional institutions, 21 major public entities, 153 national public entities, 22 national government business enterprises, 56 provincial public entities, and 16 provincial government business enterprises. The study encompasses all SOEs. The reason for including them all was to ensure that responses were obtained from as many people as possible. Table 1.1 shows the number of SOEs classified by sphere.

Table 1.1: South African SOEs classified per sphere (National Treasury Department, 2018)

Number of institutions	**Classification**
9	Constitutional institutions
21	Major public entities
153	National public entities
22	National government business enterprises
56	Provincial public entities
16	Provincial government business enterprises

The Department of Public Enterprises has partial oversight or full responsibility for six major public entities, namely Alexkor, Denel, Eskom, SA Express Airways, SA Forestry Company and Transnet. South African Airways was transferred to Treasury in 2014 but was returned to the Department of Public Enterprises in August 2018 after only three and a half years.

Table 1.2: Number of employees in major public entities (State of the nation address, 2019)

Name of institution	Segment	Number of Employees
Transnet	Transport	56 718
Eskom	Energy	45 982
South African Airways	Airline	5 256
Denel	Defence	3 438
SAFCOL	Forestry	2 396
SA Express	Airline	711
Alexkor	Mining	331

The aforementioned major public entities are important to the South African economy and a key source of employment, employing approximately 115,000 people. The context population was informed by the understanding that SOEs are a significant part of key industries in South Africa that serve as inputs to other industries, as well as having a significant impact on long-term economic stability, development, and transformation. The number of employees in major public entities is represented in Table 1.2.

The choice of the SOE context was informed by the understanding that they are a significant part of key industries in South Africa that serve as inputs to other industries and are critical to the republic's economic growth.

1.2.2 Problem Formulation

IT departments' roles in organisations include, among other things, providing cost-effective, high-quality IT services in a way that promotes alignment with the organisation's strategy. With the introduction of IT servitization as an emerging strategic focus across the industry, it not only appears to enable the goal of business-IT alignment (Conger, 2010), but it is also expected to bring challenges in the technical, managerial, and economic aspects of various business domains in organisations (Ilk, 2012). With this understanding, this section examines the global and local challenges that enterprises in general, and state-owned South African enterprises in particular, face.

1.2.2.1. Disruption through Servitization in the Global Context

Traditional value propositions and ownership models have been disrupted on a global scale, from physical products (assets) to services (access). According to Garlo-Melkas (2017), manufacturing companies such as IBM Corporation, Boeing, Rolls Royce, and Philips used to be solely concerned with selling products and were not overly concerned with customer value add. The aforementioned companies have now redesigned their organisations and renewed their offerings, and they are now reaping the benefits of servitization.

Instead of continuing to sell only jet engines, Rolls Royce has changed their business model and is now primarily focused on selling lifecycle services using sensors and the Internet of Things. Similarly, Philips Healthcare has moved from selling physical MRI scanner machines to selling scans and is on the verge of selling diagnoses based on those scans. Servitization has been the driving force behind this shift, narrowing the gap between products and services by introducing a new concept in which value is added to products through services to improve the initial offering (Barrett & Davidson, 2008).

In general, Opresnik and Taisch (2015) observe that the prevalence of servitization as a business strategy is evident across industries. This has enabled organisations to maintain their competitive advantage in the face of increasing product commoditisation by focusing on service-led growth (Salonen, Saglam & Hacklin, 2017). IT has been the primary enabler and, in many cases, dependency in bringing about this change (Barrett & Davidson, 2008).

IBM Corporation is an example in the IT context. The corporation's business model has shifted from heavily focusing on hardware sales to dominating the computer industry through service-ware (non-hardware) and primary offerings becoming consulting, financing, training, and so on, and thus shifting their business model from only producing goods to now providing bundled offerings of goods and services.

Previously, ownership of physical assets such as data centres, storage, and servers were a significant determinant of access to high-end resources and applications in IT. However, this has changed. Access to the internet is the most important requirement in this day and age (Mahon, McPherson, Vaughan, Rowe, Pickett & Bielec, 2011). This demonstrates the evolution brought about by the servitization of IT.

1.2.2.2. Disruption through Servitization in the South African Context

Similar to enterprises globally discussed in the previous section, the said disruption is affecting South Africa. While this has been observed, it has become evident that in the South African context, research on servitization has formerly been in the service science field mainly. Studies such as Weeks (2010) researched overcoming the hurdles in implementing servitization strategy and later studies by Weeks and Du Plessis (2011) and Weeks and Benade (2014) further developed the business models and strategic frameworks for corporates.

While these studies are relevant to the South African context, they do not address IT servitization. Given the foregoing, to the knowledge of the researcher there is limited research that investigates the adoption thereof by South African SOEs. The motivation for investigating IT servitization adoption by South African SOEs is that, SOEs continue to be important for economic development and the introduction of IT servitization affects them as well.

1.2.2.3. IT Servitization Challenges Facing South African SOEs

Although the challenges faced by SOEs differ from those faced by the private sector, there are some similarities between them. They are accountable to their shareholders (the government) and are always on the lookout for new talent and skills, with operations and service offerings in local, national, and even global markets.

The importance of technology in the IT context of SOEs is evident, as is the interest in its servitization. For example, in the 2016/2017 annual report of South African Airways (SAA), IT was identified as an important business enabler across the organisation. This is due to technology driving operations and rapidly changing the way customers interact with airlines in the aviation industry. SAA has a significant need for secure IT solutions that are innovative, flexible, agile, cost effective, and competitive, allowing for benefits such as route profitability, automated airport operations, optimised fleet and crew utilisation, and facilitating product adoption by SAA customers.

Transnet's 2016/2017 annual report emphasised the importance of information technology. They reported that, as a transportation and logistics company, evolving IT capability beyond business enablement is critical for gaining a competitive advantage. Innovative digital technology such as 3D printing for rolling stock, aerial and underwater drones, and track and trace technology are some of the technologies being explored to enable an efficient operational landscape in order to create business value. Through collaboration, Transnet's IT service solutions enable digital innovations that will serve as potential future revenue streams and better customer service improvement, as well as enable the organisation to meet a market need at a competitive price.

The significance of IT has already been discussed; however, it should be acknowledged that there are several issues in South African SOEs brought about by IT. Large capital investments into IT as a result of communication costs and a lack of skills are but a few of the problems the South African SOEs are facing. There has been IT servitization initiatives were third party data centre hosting, as well as outsourcing of certain IT functions to the private sector have been implemented. These initiatives are done with the aim of taking advantage of private sector efficiencies while transforming South Africa’s economy. However, there have been some issues raised as a result of such initiatives. For most South African SOEs, the expected outcomes of such initiatives are inconsistent and as a result bring about inefficiencies and financial pressures for them.

As an example, according to reports, Eskom had R10 billion negative cash flow forecast for February 2018 in the first week but was subsequently rescued from debt defaulting when it was provided R5 billion rand bridging facility from the Public Investment Corporation (Business Report, 2018). Other South African SOEs are experiencing similar financial difficulties. His Excellency, Mr Cyril Ramaphosa, the current president of South Africa, stated while addressing the public through the state of the nation address in 2018, that an intervention to decisively stabilise and revitalise SOEs is required.

On the positive side, there have been cases such as the City of Johannesburg piloting a cloud-based customer application that allowed residents to directly report infrastructure faults such as potholes, broken traffic lights, and damaged manholes. Residents benefited from this application because it reduced fault resolution times from 32.4 days to less than a day. The success of this was evident in the residents' altered perceptions of access to service delivery and the enterprise's efficiency.

For this reason, given the important role that IT plays in South African SOEs and the relatively large allocated budget, it is critical to understand their IT service model choices and the factors that influence their adoption. Identifying and comprehending the determinants is the first step toward realising the adoption benefits; however, if they fail to consider the unique challenges that may influence the adoption, they may be unable to capitalise on the potential benefits. As a result, the study proposed that an investigation into the determinants that influence the adoption of IT servitization in South African SOEs be conducted.

1.2.2.4. Theoretical, Practical, Methodological and Contextual Knowledge Gaps

This subsection examines the existing literature and related works in order to identify their contributions and shortcomings, which serves as motivation for the current study.

There have been developments in the literature on servitization in the manufacturing, marketing, and operations disciplines, highlighting the need for this area of research to be better theorised (Vargo & Lusch, 2004, 2008). Barrett and Davidson (2008), on the other hand, observe that, in comparison to other disciplines, there has not been much contribution in the literature from the IS discipline to develop this growing area of research. Furthermore, Barrett and Davidson (2008) emphasise that, given the significant role that IT plays in servitization, it is surprising that the body of research in this area has not significantly contributed to the growing debate over the role of IT in servitization.

It is worth noting that a group of scholars (e.g., Chesbrough, 2005; Chesbrough & Spohrer, 2006; Spohrer & Maglio 2008) have been at the forefront of developing the "Service Science, Management, and Engineering (SSME)" area as a discipline in the sciences, with the goal of cultivating this area of research. Spohrer and Kwan (2009) go on to mention the rapid growth of the global service economy and reiterate that one of the main challenges for this research area is the integration of multi-disciplinary research areas into the creation of a single and all-encompassing service science.

While this study accepts the challenge of better theorising this emerging service science discipline while also agreeing that more research in the IT context is needed for servitization, Sultan (2014) notes that cloud computing is a new service model that has servitized the IT industry in an unprecedented disruptive manner from its preceding service models. Schneider and Sunyaev (2016), on the other hand, argue that cloud computing is, to some extent, just another form of IT outsourcing. Although these statements are diametrically opposed, they do indicate that literature in this area of research from the IS discipline has been as vibrant as in other disciplines, despite not being termed IT servitization.

There is currently limited literature on the overall concept of IT servitization adoption in the South African context, to the best of the current study's knowledge. Due to many forms that IT servitization has presented itself in the IS discipline, such as cloud computing, IT outsourcing and virtualization, contributions and short comings of previous South African studies are summarised by service model or IT servitization form. Following that, some prior studies that are somewhat related to the current study are discussed.

Cloud computing adoption related studies within the local SA context

This subsection examines the contributions and shortcomings of studies conducted on cloud computing adoption in various South African contexts:

Adendorff and Smuts (2019) conducted research on "Critical Success Factors for Cloud Computing Adoption in South Africa." The study combined literature and practical experiences through interpretive analysis of interviews with IT professionals involved in cloud solution implementation. Their research contributed by presenting critical success factors for cloud computing adoption in their respective South African organisations. One of the key findings in their study was the lack of ICT infrastructure development, resulting in low bandwidth and high latency in South Africa which has hampered the advancement of cloud adoption. The study's limitation is its narrow scope. Data collection was limited to organisations in one province in South Africa, namely Gauteng, and only collected from five organisations, two of which are large listed companies, one medium sized company, and two small enterprises, so results cannot be generalised.

Sithole (2019) conducted a study titled “Cloud computing adoption: challenges and opportunities for South African small, medium, and micro enterprises.” The TOE framework was used in the study to identify and discuss the opportunities and challenges influencing cloud computing adoption for South African Small, Medium, and Micro Enterprises. TOE is widely used as a framework in adoption studies, with findings indicating that cloud computing adoption opportunities included firm scope, relative advantage, competitive pressure, and technological readiness, while government support posed cloud computing adoption challenges. The researcher noted that because this study used a single lens, that is, the TOE framework, different industries may show different determinants. Furthermore, while the study produced a reasonable number of responses, more responses would have added more insights.

Scholtz, Govender, and Gomez (2016) conducted a study titled "Technical and Environmental Factors Affecting Adoption in the South African Public Sector." Their goal was to investigate the extent of environmental and technical factors that could deter public sector cloud computing adoption. The study discovered that data privacy and accessibility are concerning because cloud infrastructure may be in a different area while data may be kept away from where it is produced, making it difficult to ensure confidentiality, integrity, and availability. Adoption strategies for cloud computing implementations, usage guidelines, and regulatory requirements in organisations were also identified as major barriers to adoption. The limitation of their study was the small sample size of only 51 respondents.

The study “Cloud computing adoption for business development: A TOE perspective” by Abrahams, Ophoff, and Mwalemba (2015) investigated factors impacting cloud computing adoption for the financial services sector in South Africa through a TOE lens. According to the study, the two most important factors for cloud computing adoption are top management support and organisational compatibility. The final data set had 44 responses, which was insufficient for a quantitative study and thus did not represent the South African financial landscape.

Xi (2014) conducted a study titled “Readiness assessment of cloud-computing adoption within a provincial government of South Africa”. The study contributed to the field by developing a model based on findings from a literature review and empirical research into the area of cloud computing adoption readiness indicators in the context of a provincial government. The model's advantage is that academics, researchers, and practitioners can use it to assess an institution's readiness for cloud computing adoption. The research is limited by the fact that it is not supported by any information systems theory.

The study also only looked at non-technological factors that influence cloud computing adoption, leaving out the important technological component, which includes the availability of technical equipment and the expertise of the agencies that support them, as well as the government's willingness to fund cloud computing adoption programs.

Gillwald and Moyo (2014) contributed a policy paper titled "The Cloud Over Africa" by compiling a number of case studies that were originally submitted for a conference hosted by the United Nations in 2013. It demonstrated some of the advantages that small and medium-sized businesses and the public sector could gain from cloud computing. Their research examined and explained the cloud computing economy and how it fits into the ICT ecosystem, as well as evaluating cloud readiness and regulatory frameworks in a few

African countries. The study's shortcoming is that it is not underpinned by any information systems theory.

Trope (2014) investigated the organisation's adoption of cloud computing as a type of innovative information technology in the study entitled "Adoption of cloud computing by South African firms: an institutional theory and Diffusion of Innovation theory (DOI) perspective". The study explained the determinants and the extent of adoption in firms by employing Institutional theory together with DOI as lenses through which the study was viewed.

The development of a research model that facilitated an understanding of organisational cloud computing adoption and was tested in the South African context was the contribution to the field of study. It has practical implications for organisational IT decision-makers and IT service providers because the study can help them understand the impact of institutional pressures and system innovation factors on organisational decision-making. This is significant for organisations considering cloud computing adoption (Trope, 2014). The research's shortcoming is the small number of usable responses obtained, which prevents the results from being generalised or considered representative of all South African firms.

A study titled "The Potential of Cloud Computing as an Alternative Technology for Small, Medium Enterprises (SMEs) in South Africa" by Mohlameane and Ruxwana (2013) contributed to cloud computing discussions in the local context, examining the SMEs challenges around the adoption and usage of outdated on-premise ICT models and presenting cloud computing as a potential alternate solution. They used a multiple-case study design approach to study three SMEs in the insurance, financial, and engineering industries in South Africa's Gauteng province. According to the study, cloud computing is a cost-effective alternative ICT solution for SMEs that can play a strategic role in improving competitiveness. They did note, however, a reluctance on the part of SMEs to invest in ICT solutions due to the high cost, a lack of ICT skills, performance, downtime, and disaster recovery issues.

The study's main shortcoming is methodological. The purposive sampling which involved the selection of the units to be observed based on researcher's judgment could have been open to bias because the method is inherently subjective. Furthermore, the study had a limited scope because only three SMEs were studied.

Hinde and Van Belle’s (2012) study “Cloud computing in South African SMMEs: Risks and rewards for playing at altitude” sought to examine adoption levels of cloud computing within SMMEs in order to understand the determinants that influence the adoption process. TOE and the Technology Acceptance Model were used as complementary theoretical lenses.

Their findings confirmed that IT is pervasive in that specific business landscape, and with them typically lacking resources and underfunded, cloud computing provides a viable alternative for expanding their technology infrastructure with high-end information systems at a flexible and scalable rate. The study's shortcoming is that IT-centric businesses were the primary respondents, and the study's relatively small final sample size prevents generalisation of results to all South African SMMEs due to a lack of representation.

One of the similarities between studies on cloud computing adoption in South Africa has been the use of the TOE framework as the underpinning framework for the studies, sometimes alone but sometimes in conjunction with a complementary lens. Second, most studies are conducted at the organisational level rather than the individual level, leaving a gap for conducting that type of study to fill gaps in the literature.

The main limitation of the related studies reviewed is the relatively small number of responses obtained during data collection, which prevents the results from being generalised or considered representative of their contexts. Furthermore, some studies lacked an underpinning information systems theory, which according to Gregor (2002) is regarded as critical for understanding social context in IS studies.

Other context-related studies have been conducted in the past, but they have mostly focused on cloud computing adoption in the education sector. Researchers continue to pay close attention to this area (e.g., Le Roux, Evans & Bay, 2010; Muriithi & Kotze, 2012; van der Schyff & Krauss, 2014; Willett & Von Solms, 2014; Sabi, Uzoka, Langmia, Njeh & Tsuma, 2018).

IT outsourcing adoption related studies in the South African context

This subsection examines the contributions and shortcomings of South African IT outsourcing adoption studies:

Smuts, Kotzé, van der Merwe, and Loock (2015) contributed to Information Systems (IS) outsourcing discussions by sharing systematic literature review results on IS outsourcing opportunities and threats in their study “Threats and Opportunities for Information Systems Outsourcing.” Their research aimed to consolidate the knowledge as well as increase understanding of the benefits and drawbacks of IS outsourcing.

Their research discovered that poorly designed and implemented managed IS outsourcing contracts pose a significant risk to businesses. It was also noted that some failures in IS outsourcing are avoidable due to common threat knowledge and opportunities at play. The study also discovered that in order for the benefits of IS outsourcing to be realised, they must be not only designed but also articulated and agreed upon. The study's limitation is that it was a desk-based exercise, with a single source of data collection being a literature review. Additionally, despite the fact that the study was conducted by South African researchers, the local context did not come out strongly in this study.

The study “Critical Success Factors for Information Systems Outsourcing Management: A Software Development Lifecycle (SDLC) View” by Smuts, van der Merwe, Kotzé, and Loock (2010) sought to find success factors that are critical for IS outsourcing project management using SDLC as a reference. The factors were obtained through a survey from the South African corporate market based on project team members' and business stakeholders' experiences with large outsourcing contracts.

They noted that several organisations become frustrated when their attempts at IS outsourcing fail, but they also noted that certain failures are avoidable by understanding common drawbacks and critical success factors of IS outsourcing agreements. The low response rate of 38 % achieved by their study was a shortcoming. The fact that 66 % of participants were outsourcing firms and the remaining 34 % were customer firms prevents the results from being generalised or considered representative of all South African corporate firms.

Johnston, Abader, Brey, and Stander (2009) conducted a study titled “Understanding the outsourcing decision in South Africa with regard to ICT” in order to gain a better understanding of outsourcing in South Africa, specifically which business functions are outsourced and what influences those decisions. The study also looked into the factors that influence an organisation's decision to outsource its ICT functions. Their research made a contribution by exploring the literature and employing a variety of statistical tests and descriptive analysis methods to determine the state of the South African ICT outsourcing market.

The study discovered that cost is the most influential factor when organisations decide whether or not to outsource their ICT functions, regardless of firm size or type. Another important factor discovered was the availability of in-house skill or expertise, as well as focusing their efforts on the organisation's core-functions. The study's shortcoming is that it received a low response rate of 8.7 %. The researchers acknowledged that increasing the sample size could have improved data integrity and, as a result, their results.

Cachia and Kruger's (2007) study, "Guidelines for identifying risk vulnerabilities associated with ICT sourcing," sought to provide guidelines for identifying risk vulnerabilities from the perspective of a customer organisation, with the goal of examining the possibility of exposure from dealing with ICT suppliers. Their study looked at IT outsourcing practices in organisations that rely on technology. The extensive use of industry best practices for reference, as well as a review of literature from journals and commercial research, provided a solid foundation.

The methodological contribution stemmed from the application of a well-established grounded theory approach. The study's shortcoming is that, despite being conducted in the financial services industry with an organisation with well-established e-business channels in South Africa, information used to manage suppliers is considered confidential, so the level of detail contained in the organisation's internal documentation was minimal, and that information could have provided additional insights. Another shortcoming of this study is that, it is not underpinned by any information systems theory.

In conclusion, studies on IT outsourcing adoption in South Africa are limited and primarily conducted in the private sector, leaving public enterprises with a limited understanding of this phenomenon in both academic research and practice. The main limitation of the related studies reviewed is similar to the previous section. The sample sizes are small, which may have jeopardised the data integrity and, as a result, the results, preventing them from being generalised.

Virtualization adoption related studies within the South African context

This subsection examines the contributions and shortcomings of South African virtualization adoption studies:

The study “Exploring the roles of people, governance, and technology in organisational readiness for emerging technologies” by Ogunyemi and Johnston (2012) contributed to the body of knowledge on virtualization adoption by using the DOI lens, which provides insight into organisational adoption of innovations. They discovered that in South Africa, organisational readiness for their adoption of virtualization of servers, indicate that technology and people play prominent roles.

According to their study, inhibitors such as IT skills shortages, software and license costs, and other costs should be carefully considered by both the IT industry and adopting organisations. Another impediment mentioned in the study was the high cost of bandwidth and broadband connectivity. Due to cost considerations, market monopolies such as Telkom, the country's major fixed line telecom provider, continue to stymie the adoption of new technological innovations.

The study has theoretical implications in that it identifies organisational level determinants that facilitate or obstruct the adoption of emerging technological innovations. The study scope surveyed 83 South African organisations ranging from small to large across three metros using a quantitative approach that included both an online survey and a questionnaire, but only 8 % responded, presenting a limitation to this study.

Carroll, Kotzé, and Van Der Merwe (2011) investigated the critical subject of security in the virtualization area of research in their study titled “Securing virtual and cloud environments.” According to their research, in order to be competitive, organisations must be flexible and respond quickly to changes, while also continuously researching technological advances and innovations. While it is important to recognise the benefits of utilising innovations such as virtualization, it is also important to recognise that virtual IT systems are risk laden, and their inherent risks must be understood in order to ensure that adequate security measures are available.

Their study employed a literature review to assess the risks and benefits. They were identified and tested against data collected from 15 participants from various organisations in various industries. Their research discovered that by properly managing and governing security threats, virtualizing an environment, and using cloud computing, businesses and IT operations could undergo a transformation and reap numerous benefits.

They stated that the following controls should be considered for security threat mitigation: security administration, change control, network security, and logical access compliance. The study's shortcoming is that it does not provide a comprehensive risk and control framework that can be used to set standards for guidelines and control to holistically manage risks.

Carroll, Kotzé and Van Der Merwe (2010) study entitled “Going virtual: popular trend or real prospect for enterprise information systems”, contributed to the virtualization area of research by providing an overview of IT challenges in traditional physical setups and further exploring whether virtualization could provide a solution to these IT challenges. Their research discovered that the benefits of virtualization and its popularity stem from organisations' tiredness of dealing with IT challenges in traditional non-virtualized environments, where virtualization now provides a solution to these challenges.

The main challenge of traditional non-virtualized environments, according to their research, is an increase in the number of servers, which results in resource underutilization, administration issues and costs, data centre and other related hardware and software costs, as well as change management challenges and operational difficulties. The study's shortcoming is that it is not underpinned by any information systems theory.

To summarise, virtualization adoption studies in the local context provide useful information to both academics and practitioners, but they are limited in scope and are typically conducted by a small group of researchers. The main limitations of the reviewed studies are similar to those of cloud computing and IT outsourcing. Because of the small sample sizes, results cannot be generalised, and they are not supported by information systems theories. Except for the aforementioned studies, there has been little research in my research area to my knowledge.

Due to many forms that IT servitization has presented itself in the IS discipline, such as, IT outsourcing, cloud computing and virtualization, it is critical to consolidate knowledge about the overall concept of IT servitization in all of its forms to allow for better observation of this area of research. Overall, this suggests that there is a gap in the IS discipline for researchers to investigate, understand, and consolidate views in order to significantly contribute to the growing IT servitization debate, as Barrett and Davidson (2008) encourage researchers in this field to do.

Integrated Model for IT Servitization Knowledge Gap

South African SOEs continue to seek to servitize IT and significantly invest in technology sourcing techniques, as well as digital innovation and enablement, in order to meet the demands of the fourth industrial revolution. SOEs also make an effort to leverage strategic partnerships in order to ensure that agile and innovative services are consistently delivered through technology (Transnet, 2018).

However, it has been observed that over time, South African SOEs fail to realise the expected value of their investments. This is due to the organisation's inability to deal with disruptive innovation brought about by technology sourcing strategies (Transnet, 2018; Eskom 2018), resulting in a cycle of switching between IT service models, such as outsourcing IT services to external providers and then reverting to insourcing IT services after a certain period. As a result, legacy information systems renewal continues, resulting in insufficient support for business objectives.

The problem, according to this study, is caused by SOEs embarking on IS strategies to exploit benefits of new technological innovations and IT service models in the market, but doing so without first assessing their environment to understand the determinants and associated challenges they must circumvent that may influence the successful adoption of IT servitization.

Several SOEs have changed their IT service models and sourcing techniques, for example:

(1) Transnet transitioning from an outsourced data centre service in 2018 and build their own internal ICT capacity (Transnet, 2018).

(2) In 2017, SAA adopted private cloud storage in data centres, as well as the implementation of Office 365, Salesforce, and the Amadeus suite, as part of their digital innovation roadmap (SAA, 2017).

(3) Eskom's transition from T-Systems, which provided comprehensive ICT services until April 2018, to hybrid technologies that incorporate digital and cloud solutions (Eskom, 2018).

The preceding examples demonstrate SOEs' constant change in IT service models, as well as the need for an integrated theoretical and practical model that can be used to better analyse, provide knowledge, and understand IT servitization adoption in their context.

Theoretical Perspectives and Knowledge Gaps

There are currently few studies on IT servitization, both globally and locally, that have approached this area of study by triangulating Technology, Organisation and Environment framework, Institutional theory, and Process Virtualization theory, for convergence and cross verification, thereby reducing potential biases arising from the use of a single framework. The use of multiple theoretical lenses in the interpretation of the IT servitization adoption phenomenon is meant to assist the researcher in exploring, interpreting, explaining, and facilitating an understanding of the determinants influencing IT servitization adoption in South African SOEs.

To conclude the problem formulation, it is important to note that, in general, IT servitization is not a panacea for South African SOEs. However, it is a service model that has the potential to influence how business activities are carried out. Following the discussions about servitization in various fields and industries, there is a need for more research in the IS field and investigation into the emerging global trend toward IT servitization.

Better theorisation of this field of research and knowledge systematisation are also important for better observation and guidance of future research required to address knowledge gaps. As a result, a theoretical and practical integrated model that South African SOEs could use to understand the determinants of IT servitization adoption is proposed.

1.3. Problem Statement

Although the concept of IT servitization has been studied under various terms such as IT outsourcing, virtualization and cloud computing, the determinants of IT servitization adoption, especially in the context of local SOEs, have yet to be adequately explained, to date. This inadequate theoretical knowledge tends to result in large capital investments into IT servitization adoption but with limited value realised, owing to the lack of theoretically informed practical knowledge and vice versa. That is, significantly, IT servitization academic literature is yet to adequately explore and explain the determinants of IT servitization adoption and present an integrated model that could be applicable for use in South African SOEs. Its availability could provide South African SOEs with a guideline for pre-assessing and analysing their environment to understand whether the adoption determinants will positively or negatively affect their IT servitization adoption endeavour then pro-actively manage the negative aspects where necessary. Identifying the opportunities or benefits is however, the first step in the IT servitization adoption endeavour. However, failing to review the unique influences in the technological, organisational and external environment could adversely influence the SOE's ability to take advantage of the benefits.

Therefore, the golden thread winding throughout is the realisation that, an integrated model is important but not yet available. The model developed in this thesis may, therefore, provide the “know what” and the “know why” within the South African SOE context.

1.4. Research Purpose, Goal and Objectives

Derived from the problem statement, the purpose, goal and research objectives are as follows:

1.4.1. Purpose

The study purpose was to explore and explain the determinants which may influence IT servitization adoption, in the context of South African State-Owned Enterprises.

1.4.2. Goal

The goal of the study was to develop an integrated theoretical and practical model for IT servitization adoption, in the context of South African SOEs.

1.4.3. Objectives

In order to achieve the above goal, the study had the following objectives:

i. To explain the determinants which influence South African SOEs to adopt IT servitization.
ii. To determine if there is a positive or negative relationship between each determinant and IT servitization adoption.
iii. To identify if the determinants affect each other, and to subsequently determine the significance of the effect, thereof.
iv. To model the determinants influencing IT servitization in South African state-owned enterprises.

1.5. Research Questions

The study was guided by the following research questions:

1.5.1. Primary question

Why is IT servitization adopted, with difficulty, in South African State-Owned Enterprises?

1.5.2. Secondary questions

To answer the primary research question, the following secondary were formulated and ought to be studied to help drive the research.

i. What are the determinants which influence South African SOEs to adopt IT servitization?
ii. To what extent is there a positive or negative relationship between each determinant regarding IT servitization adoption?
iii. Which determinants are influential to each other, and what is that significance?
iv. In what ways could IT servitization be adopted in South African state-owned enterprises?

1.6. Delimitations and Assumptions

Conducting scholarly research can be both a humbling and an empowering experience. The realisation that you are critically limited in many ways as a researcher is a constant reality. The empowerment, on the other hand, comes from recognising the limitations that result from selecting the best possible options and then modifying accordingly (Simon, 2011). This section of the study goes over the study's delimitations and assumptions.

1.6.1. Delimitations

Delimitations, which are under the control of the researcher, define boundaries and limit scope (Simon, 2011). As a result, they assist the researcher in avoiding generalising the results to the entire population and making claims that their findings are always true for everyone, everywhere (Bryant, 2004). The delimitations of this study are informed and discussed as follows:

Choice of objectives

The study sought to explain why IT servitization is adopted but with difficulty, in the context of SOEs. The current study aimed to create an integrated theoretical and practical model for IT service adoption in the context of local SOEs. To achieve this goal, the study objectives (actual research activities) were deemed appropriate as to; a) explain the determinants that influence South African SOEs to adopt IT servitization; b) determine whether there is a positive or negative relationship between each determinant and IT servitization adoption; and c) identify whether the determinants affect each other, and determine the significance; then d) model the determinants influencing IT servitization in South African state-owned enterprises.

Chosen respondents

Individual experiences and perspectives were sought, rather than organisational perspectives, in the study. The delimitation of this study is the inclusion of only individuals and excluding organisations (this is because the study needed to explain IT servitization from the individual's point of view and outlook rather than that of an organisation). The study acknowledges that there may have been additional potential respondents (individuals) in or from other non-IT fields who could have provided relevant information that could be important for the study. The study, however, delimited the individuals who are in the IT field. As a result, only IT professionals were included in the study.

Methodological procedure

The current study took the positivist stance. As a result, the instrument only included closed-ended Likert scale responses rather than open-ended responses, which may have limited respondents who were willing to provide qualitative data to further explain the results. Furthermore, instead of a qualitative approach, this study used a quantitative research approach. The quantitative research method was used because the study aims to conduct an investigation, relying on data that can be measured to establish relationships and causation. Because the survey link was available online, the study limited potential respondents to those who had Internet access.

1.6.2. Assumptions

Assumptions are uncontrollable effects that would render the researcher's study ineffective if they disappeared (Simon, 2011). The problem under investigation could not exist in the absence of assumptions (Leedy & Ormrod, 2010). The study's assumptions are discussed further below.

The underlying assumption of this study is that IT servitization adoption will continue to be a critical strategic imperative for South African SOEs, validating the need for an integrated model for IT Servitization adoption in that context. This assumption is justified because the president of the republic, Cyril Matamela Ramaphosa, stated in his state of the nation address in 2018 that revitalisation of SOEs is necessary given the important role that they play in the economy. Furthermore, IT continues to be a driver of efficiencies in SOE business operations and has a relatively large budget because it is regarded as critical in driving the fourth industrial revolution.

The study also assumes that the individual participants are qualified to answer the survey questions and do so truthfully. This assumption may be correct because the survey is completely confidential and anonymous, since no participants' names or other identifying information is requested.

The researcher also assumes that the study will get to the bottom of the research problem. The assumption is valid because a pilot study was conducted to address apparent issues prior to distributing the main survey to the rest of the participants, allowing the researcher to answer the research questions.

1.7. Chapter summary

This chapter provided an overview of the research. The background to the research problem, as well as the study context and location, were also provided. The research problem and its formulation were also introduced in the chapter. The identification of knowledge gaps was presented in order to situate the current research within the context of existing literature. The research purpose, goal, and objectives, as well as the delimitations and study assumptions, were all discussed. Finally, a summary of the thesis structure is provided below.

1.8. Overview of the Thesis Structure

This thesis is divided into seven chapters, which are as follows:

Chapter one of the study explained key terms in the thesis title, then the research problem background, and finally the problem statement. Then came the research purpose, goal, and objectives, followed by primary and secondary research questions. Finally, delimitations and assumptions were discussed, and a summary of the chapter was provided.

Chapter two provides a survey of scholarship and theoretical perspectives on IT servitization and its various manifestations. A systematic literature review is followed by a discussion of the challenges and opportunities presented by various forms of IT servitization, as well as key determinants influencing adoption for each form. A summary follows at the conclusion of the chapter.

Chapter three introduces the three theoretical perspectives that underpin the study, namely the Technology, Organisation, and Environment framework, Institutional theory, and Process Virtualization Theory (PVT). The research model and hypotheses are then presented. The chapter concludes with an operationalisation of constructs and a summary.

Chapter four describes the research methodology, describing how the research is carried out practically in terms of the social inquiry's research design. The research process and data collection technique are discussed in detail. The chapter concludes with a data analysis strategy, method limitations, and ethical considerations.

Chapter five provides the data analysis emerging from the study. Both descriptive and inferential statistics are examined, as well as the instrument's dependability and validity testing. Following that, a structural equation model and an evaluation model for overall fit are run. The chapter concludes with a test of hypotheses and a summary.

Chapter six discusses the study's main results and presents the integrated model for IT servitization adoption. The results are compared to what has previously been observed in the field literature. A summary follows the conclusion of the chapter.

Chapter seven revisits the primary and secondary questions and objectives before assessing the research's relevance. The contributions of method, practice, theory, and context are then discussed, along with limitations and suggestions for future research. The chapter concludes with a research summary and conclusion.

CHAPTER 2

SURVEY OF SCHOLARSHIP AND THEORETICAL FOUNDATIONS

2.1. Introduction

The preceding chapter introduced this thesis by providing context for the research problem as well as the study context and location. The research problem, as well as the knowledge gaps that motivated the current study, were also discussed. The research purpose, goal, and objectives, as well as the study limitations, delimitations, and assumptions, were all provided.

This chapter is divided into five sections that cover the scholarship and theoretical foundations that informed the study. The servitization concept is discussed in the first section, where the evolution of the phenomenon and its varying degrees, as well as the adoption challenges, are explored. Second, a protocol for conducting a systematic literature review on the IT service models identified in the study, namely IT outsourcing, cloud computing, and virtualization. Third, there is literature on their adoption in various contexts, with a particular focus on the South African context. The fourth section discusses IT servitization opportunities and challenges, and the final section discusses key determinants influencing IT servitization adoption, which includes a holistic analysis of key determinants.

2.2. Section A: Servitization Overview and Concepts

Servitization is defined as a shift from solely trading in physical goods to trading in a combination of physical goods and services that ultimately delivers value. The servitization concept promotes a service-led strategy in which increased revenue and profits are realised, as well as opportunities to add onto products that typically have low mark-ups (Baines, Lightfoot, Benedettini & Kay, 2009).

Manufacturing companies benefit from the shift from traditional product offerings to a product/services mix. Better profitability, higher customer satisfaction, and consistent revenue streams are among the advantages (Mathieu, 2001; Oliva & Kallenberg, 2003; Vandermerwe & Rada, 1988). Brax and Visintin (2017) define servitization in manufacturing as a change in business model in which a manufacturing company intentionally incorporates service elements into its offering.

2.2.1. Servitization Evolution

Product-based organisations are gradually transitioning to service-based models (Cusumano, Kahl & Suarez, 2015). As a result, the interest in servitization and the research sphere has grown. The field continues to attract scholars and practitioners, and it generates a significant amount of research and practical discussions (Kowalkowski, Gebauer, Kamp & Parry, 2017). According to Vandermerwe and Rada (1988), the servitization process evolved from the initial point where organisations provided their offering based on either services or goods, to the later offering of bundling services and goods and self-service, knowledge, and support. To varying degrees, servitization entails re-structuring, re-configuration, and re-deployment of an organisation's resource base and capabilities (Baines et al., 2009).

Customer centricity is an important aspect of servitization strategies, in which end users are not only given products but also tailored solutions. In turn, the solutions provide outcomes that are tailored to the needs of the customer. This is done even if it means collaborating with other service providers to provide the customer with a comprehensive service solution (Miller, Hope, Eisenstat, Foote & Galbraith, 2002; Davies, 2004).

There are numerous organisations that have begun the process of servitization. For example, after suffering massive revenue losses and disappointments in the home computer market, IBM was able to survive by successfully transitioning from products to services. After selling its personal computer division to Lenovo, they changed their registration records at the New York Stock Exchange, transitioning from a goods company to a service company (Loving, 2011; Spohrer, 2017).

Rolls Royce was a pioneer in the aircraft industry, developing and trademarking power-by-the-hour contracts that provide insurance and maintenance to the majority of commercial airlines, corporate jet owners, and aircraft lessors in order to protect and accrue for engine maintenance. Under this service contract, a certain monetary value is paid to Rolls Royce for each hour the aircraft flies in exchange for the protection of any scheduled or unscheduled maintenance that may be required. Michelin's price per mile tyre model is also one of the industries that uses the servitization model (Kowalkowski et.al, 2017).

Similarly, Xerox pioneered the pay-per-use model in the documentation technology market, where clients pay for each copy produced by their machines. Their annuity-based model was later modified, and their focus shifted to bundling contracted services, supplying consumables, maintaining equipment, and generating recurring revenue through financing. Despite numerous successful servitizations in various industries, many organisations are struggling to achieve the expected profits and customer satisfaction (Kowalkowski et.al, 2017).

2.2.2. Servitization in Non-traditional Industries

There is a widespread misconception that servitization is limited to the manufacturing sector and related physical product-centric businesses, which is untrue. The service industry can benefit from servitization, just as other organisations can shift away from service provision-related constructs (Vandermerwe & Rada, 1988). According to Shah, Rust, Parasuraman, Staelin and Day (2006), organisations such as banks, for example, use automation and digitalisation to often retain a product oriented offering by maximising sales for pre-packaged products (financial) while maintaining a distance between themselves and their customers but may also have a product centric business logic.

Similarly, a company that sells consumer durables could use a service logic that focuses on processes in which their products provide customer value rather than solely on product (Grönroos, 2006). IT itself is becoming more servitized and commodity-like (Ilk, 2012; Sultan, 2014). The phenomenon of IT servitization will be discussed further in the section that follows.

2.2.3. Digital Servitization

Digitalisation refers to the increased use of digital technologies to connect organisations, people, groups, systems, products, and services (Hsu, 2007). It is an innovation that has provided manufacturers with numerous opportunities and the potential to significantly improve their performance and the service they provide to their customers (MIT Center for Digital Business & Capgemini Consulting, 2011). Service innovation may be aided by the use of digital methods for servitization in particular (Gago & Rubalcaba, 2007). According to Coreynen, Matthyssens, and Van Bockhaven (2017), manufacturers are now using digitalisation not only to advance their back-end or front-end processes and procedures, but also to transform their customer-facing operations to enable customer relations.

Digital disruption, along with electronic commerce (e-commerce), has altered power dynamics and organisational interdependence across multiple industries. In the music, transportation, and hospitality industries, new digital services such as Spotify, Uber, and Air BnB began as downstream retailers and now control consumer interaction with established competitive offerings, transforming owners of upstream resources into dependent suppliers (Vendrell-Herrero, Bustinza, Parry & Georgantzis, 2017).

According to Holmström and Partanen (2014), digital servitization is the provision of digital services that are integrated into a physical product. Brynjolfsson and McAfee (2011) identify both the positives and negatives of digital technologies, stating that while they are transforming employment relations and improving company productivity, they may also result in job losses. Digital technologies have also enabled product-based businesses to offer new product offerings that completely transform how they provide service and compete in the market (Porter & Heppelmann, 2014; Porter & Heppelmann, 2015).

The dematerialisation of physical goods combines the offerings in servitization and digitisation (Lerch & Gotsch, 2015). Emerging literature in digital servitization examines the role of digital technologies in goods-based companies that are servitizing (Vendrell-

Herrero & Wilson, 2016) as well as the drive brought about by digital technologies and how it aids servitization (Vendrell-Herrero et al., 2017).

There are three areas in which digital servitization differs from traditional servitization. To begin with, the peripheral costs of digital services are minimal (Rifkin, 2014). Second, traditional service offerings typically complement a goods offering (Cusumano, Kahl, and Suarez, 2015), whereas digital services frequently replace traditional physical goods (Greenstein, 2010). Third, digital technologies open up new opportunities for new offerings that can be carried out by new market participants (Christensen, 1997), most notably retailers and hardware and software developers (Vendrell-Herrero et al., 2017).

2.2.4. Servitization Adoption Challenges

Adoption of a servitization strategy frequently results in critical business and cultural challenges (Vandermerwe & Rada, 1988; Slack, 2005). The challenges can be divided into four categories: integrated goods, organisational transformation, strategy, and service design (Baines et al., 2009). Service design is the most difficult because designing a service differs significantly from designing a product because services are inherently ambiguous and difficult to describe (Slack, 2005).

Oliva and Kallenberg (2003) observe that, service design challenges may discourage organisations from expanding into the service dimension, particularly when considering industry competition outside the normal sphere and unexpected opponents such as their own suppliers, distributors, and even customers. The risk of taking over activities previously performed by customers can present new challenges, which must be considered during the service design process because the risk may outweigh the benefits of increased profit potential (Slack, 2005). Communication strategies should not be overlooked either. In the service provision design, the strategy should clearly define the value proposition to the customer (Mathieu, 2001).

According to Mathieu (2001), it is difficult to transform a traditional manufacturing company to the organisational strategy required to effect servitization. The service culture is diametrically opposed to the manufacturing culture. A mindset shift in the organisation is required to implement this service strategy and change development priorities to align with new trends for competitive advantage (Oliva & Kallenberg, 2003; Slack, 2005). Traditional practices will need to be adjusted, as will attitudes (Vandermerwe et al., 1989; Foote, Galbraith, Hope & Miller, 2001).

Baines et al. (2009) and Mathie (2001) also note that there is a high likelihood of resistance from areas within the organisation where there is a lack of understanding or fear of structural change when implementing these service strategy changes. As a result, when developing a service-focused setting, people with the appropriate skills for the service dimension are critical to the strategy's success.

2.2.5. Deservitization

Common perception holds that servitization shifts a company from a strictly goods enterprise to a service or solution enterprise while increasing integration with its customers (Mathieu, 2001; Oliva & Kallenberg, 2003; Penttinen & Palmer, 2007). However, evidence suggests that this simplistic view of servitization is partial and incorrect, and there is evidence that suggests the possibility of deservitization, in which organisations minimise the role of services in their strategy and operations, and in some cases completely abandon service offerings in favour of goods. Although research on deservitization is limited in comparison to research on servitization, there is evidence that some studies suggest that organisations shift away from product-service provision or abandon the service business entirely (Brashear, Gebauer, & Kowalkowski, 2012; Kowalkowski, Windahl, Kindström, & Gebauer, 2015).

Further research examines reverse servitization, in which organisations choose to begin with client-oriented service offerings that require client closeness and then introduce fewer intensive goods-oriented service offerings in the future (Cusumano, Kahl, & Suarez, 2015; Finne, Brax, & Holmström, 2013). An example of this shift occurred in the computer market in the early 1980s, when customers were less uncertain about technology. Later, there was growth with diffusion, and standards were established, motivating organisations to deservitize their offerings (Araujo & Spring, 2006).

As servitization and deservitization occur, and goods and services complement and replace one another, cheaper goods eventually replace customisation and other offerings

(Araujo & Spring, 2006). At an organisational level, deservitization and service reduction can be accomplished through divestment, liquidation, or sale (Kowalkowski et.al, 2017).

2.3. Section B: Systematic Literature Review of IT Servitization

The search strategy for IT service models was developed by first identifying relevant data sources, keywords, and timeframes for the articles to be reviewed. The literature was searched in six databases: Emerald, IEEE Xplore, ScienceDirect, SCOPUS, Springer Link, and Taylor & Francis. The databases were chosen with the goal of including mostly top-rated journals and conference papers in mind. Keywords used include “IT Outsourcing”, “Cloud Computing”, Virtualization, “IT Service Models” OR “IT Servitization” OR “IT Servitisation”.

The inclusion criteria for language was English, and the publication dates ranged from 2000 to 2020. Peer-reviewed journals, theses, conference proceedings, and book chapters were also included in the search. Grey literature and non-peer reviewed journals were excluded as article exclusion criteria. The multidisciplinary nature of the field of study influenced the decision to use multiple databases.

The literature search yielded 376 papers from the 6 databases. Only 51 of the 376 papers retrieved met the inclusion criteria. Because the six chosen databases yielded only a few articles, a Google scholar search for “IT Servitization” OR “IT Servitisation” was conducted to ensure the review was complete. The search yielded 29 papers, but only 7 met the inclusion criteria, bringing the total to 58. Following the cross-checking of references for IT Servitization articles, 5 more articles were added, bringing the total to 63.

The remaining articles were read to ensure relevance, and 28 were excluded because their descriptions of the IT service model concepts were similar and did not generate original perspectives on different forms of IT servitization. The analysis of the remaining 37 articles provides the theoretical foundation for the various forms of IT servitization. Figure 1 summarises literature review protocol.

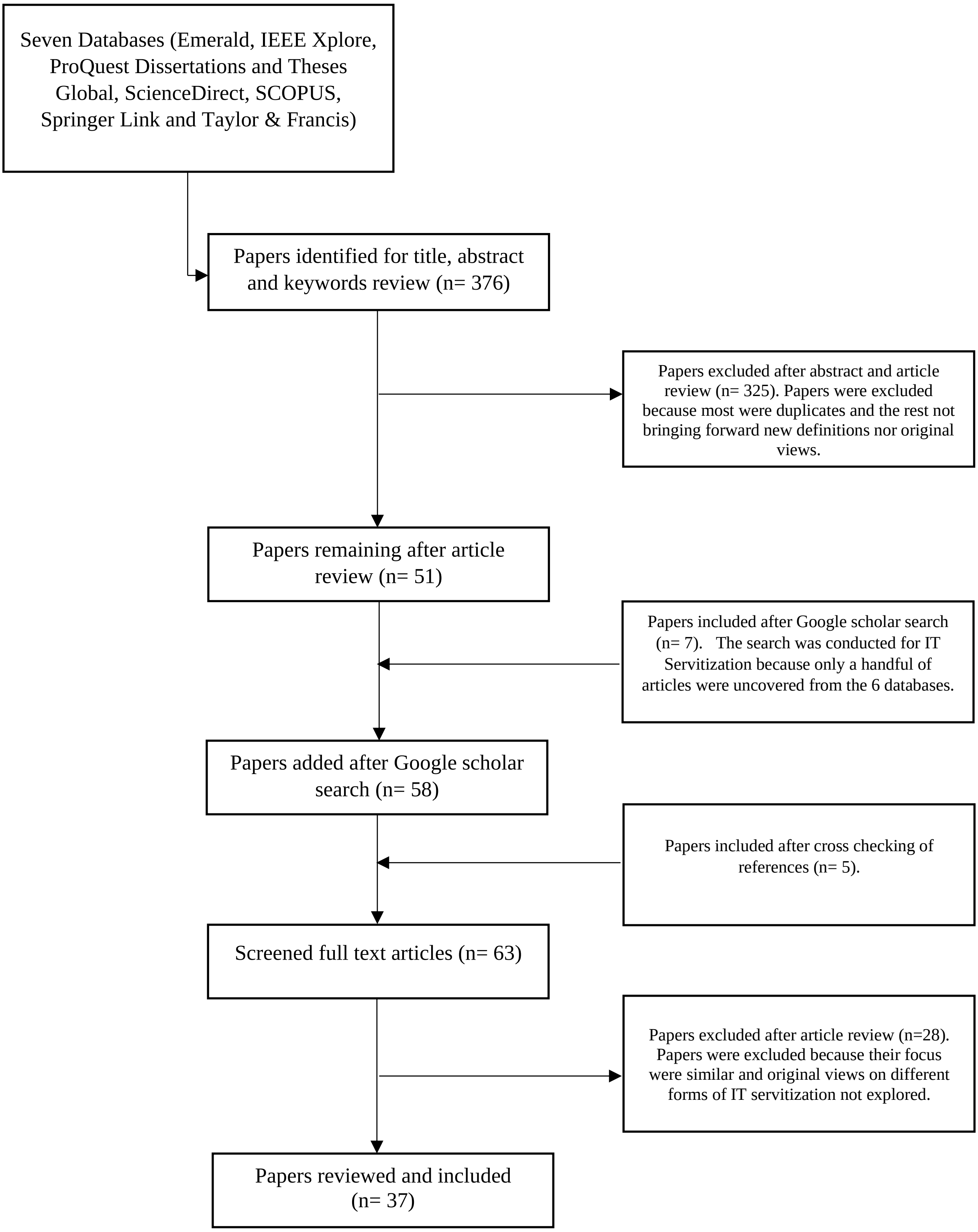

Figure 2.1: Systematic literature review protocol.

2.3.1. IT Service

The term service is defined as “an economic activity that does not result in ownership of a tangible asset” (Oxford English Dictionary, 2004). In the literature, IT service refers to a collection of IT-related services (Teubner & Remfert, 2017). According to Walter, Bohmann, and Krcmar (2007), the goal of IT services is to provide good information demand through planning, purchasing, and effective operation of IT applications and infrastructure. IT service is defined in a variety of contexts. In the IT service market context, IT service is referred to as a group of offerings that include IT skills development, IT consulting, IT service desks and software development offered as a service (Chen & Fu, 2007), whereas IT services are defined in the outsourcing and off-shoring business as offerings that are generally provided by outsourcing vendors in the IT area of specialisation (Dhar, 2012).

In addition to what has been stated above, the Information Technology Infrastructure Library (ITIL), a popular tool for managing organisational IT processes and procedures, defines IT service as a combination of people, processes, and technology provided by an IT service provider to customers that should be defined and agreed upon in a service level agreement (ITIL v3, 2007). Teubner and Remfert (2017) concisely summarise the ITIL definition, stating that IT service is comprised of technology, processes, and people, and that service levels should be clearly stipulated in an agreement. This study adopts Meister and Jetschni's (2012) definition of IT service as a clearly explainable service that is IT-based and is provided by a vendor at the customer's request.

2.3.2. IT Servitization Phenomenon

There have been indications over the last decade that we are living in an era driven by the service economy, and as such, IT service industries play a critical role in the overall globally evolving economy (Ilk, 2012; Kuo & Hsieh, 2008). It is not surprising that IT has been the driver and enabler of the aforementioned disruption by allowing goods and commodities that were traditionally delivered through physical mediums to become ubiquitous (Ilk, 2012).

As the history of the servitization phenomenon is traced, it is found that the concept of servitization was first introduced in the manufacturing industry in the 1980s by Vandermerwe and Rada in 1988. IT has been the primary driver of the servitization transition (Barrett & Davidson, 2008). The irony of IT itself becoming servitized and commodity is evident. It is exemplified by the use of computing offerings such as storage and platforms, which are mostly virtualized and no longer rely on hardware. In addition to changes affecting media content, hardware and software are increasingly virtualized and delivered as a service via the Internet (Ilk, 2012 & Sultan, 2014).

Having discussed the hardware and software change in offerings, the servitization transformation from goods-based IT functionalities to service-based ones has also infiltrated the IT services industry and provides great opportunities to modernise organisations' resources and become market-aware. As a result, it is expected that IT servitization will introduce managerial, economic, and technical challenges in a variety of business domains within organisations (Ilk, 2012).

There is a consideration that IT servitization has taken many forms in the IS discipline, such as IT outsourcing, cloud computing, and virtualization. To gain a better understanding of this phenomenon, it is necessary to discuss the concept of IT servitization in its various forms.

2.3.3. IT Outsourcing as a form of IT Servitization

IT outsourcing has been posited as the standard mode of operation (Cole, 2013), with an estimated 10% of organisations' IT budgets being outsourced in 2018 (Computer Economics, 2018). Outsourcing is the transfer of management of activities, assets, and/or people to a third-party service provider in order to achieve organisational goals (Cullen, Lacity & Willcocks, 2014).

Dhar, Gangurde and Sridar (2004) are specific in defining outsourcing in the IT context as a delegation act of shifting parts of, or the entire IT-related decision making, internal activities, business processes, and related services to a vendor with the goal of handing over and entrusting responsibility to them for developing, managing, and administrating the agreed-upon activities. IT outsourcing as a form is presented to help understand the IT servitization phenomenon discussed in the preceding section.

IT outsourcing literature dates back to the late 1980s, and one of the first articles to consider the concept was Outsourcing: Fad or Fantastic? by Wilder (1990). Since then, numerous studies have presented definitions of IT outsourcing, such as one by Simchi-Levi, Kaminsky, and Simchi-Levi (2004), which posits IT outsourcing as a process of obtaining services from an external organisation where the services were previously performed internally in the organisation. In the same year, Bhagwati, Panagariya, and Srinivasan (2004) support the definition and add the location and technology aspects, defining IT outsourcing as a process that involves off-premises or long-distance procurement of services from a vendor, primarily but not always via technology such as the Web and telephone.

Noting the contractual aspect, Goles and Chin (2005) go on to say that IT outsourcing occurs when the IT function or services are partially or completely subcontracted to an external vendor via legal agreements governed by a contract between the vendor and the organisation. Wu, Li, Chu and Sculli (2005) bring to the definition performance management, and simply describe it as a decision model for sustainable performance. Dhar and Balakrishnan (2006) broaden the definition and define IT outsourcing as an act of delegating internal activities and processes to an external organisation that has a significant contribution in the resources provision of part or all IT activities in accordance with the contract's agreed upon deliverable outputs and performance standards.

Dolgui and Proth (2013) conducted a previous study to clarify the differences between outsourcing, subcontracting, and offshoring. Subcontracting refers to the transfer of a portion of the work activities to an external organisation that possesses specialised resources and skills, allowing the tasks to be completed under better conditions than the contracting organisation. Only the service specification is altered by subcontracting. Offshoring, according to Murtha, Kenney, and Massini (2006), occurs when the vendor is located in a different country.

It is worth noting that outsourcing is not limited to specific business processes or capabilities such as IT, but can also include accounting services such as bookkeeping and investment advisory services (Yigitbasioglu, Mackenzie & Low, 2013).

IT outsourcing is still widely used as a business strategy, according to Martins, Oliveira, and Thomas (2015), and as a result, it receives a lot of attention in the literature. Earlier studies, such as Yao, Jiang, Young, and Talluri (2010) and Dolgui and Proth (2013), investigate sourcing techniques and the benefits of outsourcing, such as cost savings, quality, and flexibility. Weerakkody and Irani (2010) go over outsourcing models and how to develop outsourcing strategies.

Recent studies in this area of research include Dhillon, Syed, and de Sá-Soares (2017) investigating information security concerns in IT outsourcing, Gurung and Prater (2017) presenting cultural differences impact on IT outsourcing framework, and Gantman (2017) conducting a literature review on IT outsourcing in the public sector.

Further research, such as that conducted by Jeong, Kurnia, Samson, and Cullen (2018), provides consolidated views on psychological contracts in IT outsourcing through a systematic literature review. It is evident that IT outsourcing studies continue to generate interest and investigate new and unique areas, such as collaborative interfaces determinants in public-private IT outsourcing arrangements (Duhamel, Gutiérrez-Martnez, Picazo-Vela, and Luna-Reyes, 2018) and ethics and IP sharing in IT Outsourcing (Anand and Goyal, 2019), to name a few.

In conclusion, studies show that organisations and scholars alike continue to seek to understand this field of study, with discussions maturing to include ethical considerations. As a result, the IT outsourcing form of IT servitization continues to garner attention in the field of research, despite the fact that, to the best of the researcher's knowledge, limited studies have been conducted that investigate IT outsourcing in conjunction with IT servitization.

2.3.4. Cloud computing as a form of IT Servitization

Cloud computing is a relatively modern IT concept and although currently a shared accepted cloud computing definition does not exist, the definition provided by National Institute of Standards and Technology (NIST) describe it as a model that provides on-demand access to resources, through a network to multiple interconnected computing resources that are configurable such as storage, servers, networks, services and applications (Jansen & Grance, 2011). The term “cloud computing” derives from a graphical representation of the global interconnected network as a cloud. Technically, the cloud is used when in-depth technical details of the internet can be ignored (Ghilic-Micu, Stoica & Uscatu, 2014).

Scholars often compare cloud computing with its predecessor IT service models as noted by Son and Lee (2011) as a paradigm shift of IT service modelling and delivery. Sarkar and Kumar (2016) similarly note that, it can be considered as a more flexible form of IT outsourcing (Alpar and Polyviou, 2017) and often associated with infrastructure virtualization (Sarkar & Kumar, 2016). Alsouri, Katzenbeisser and Biedermann (2011) previously highlighted the cost factor by emphasising that, it is the next generation of services provided over the internet that allow cost effective outsourcing of applications, services and business processes.

Cloud computing offerings are commonly provided as a service. Xu (2012), actually suggests that in cloud computing every offering is provided as a service. There are three main cloud computing service offerings, in which services on-demand are typically provided as a service (aaS) via the Web to consumers using the cloud infrastructure (Mell & Grance, 2011). To elaborate, in general, cloud computing provisioning occurs at three levels: software (SaaS), platform (PaaS), and infrastructure (IaaS) (Xu, 2012).

As the concept of cloud computing evolves, Ghilic-Micu, Stoica and Uscatu (2014) identify additional four sub-models, namely: Storage (STaaS), DeskTop (DTaaS), Data Protection (DPaaS) and Business Process (BPaaS). With so many aaS models available to organisations, it is clear that cloud computing has the capability of making unlimited resources available, anytime, anywhere, and it is up to organisations to choose what is best for them from the variety of cloud solutions that are currently available (Flores, Narayana, Srirama & Paniagua, 2012).

There are four main cloud infrastructure deployment models, namely: community, public, hybrid, private and cloud (Subashini & Kavitha, 2011). The private cloud infrastructure model is used privately within an organisation and can be hosted on-premises or at the premises of a third-party provider. The most common deployment model is public cloud infrastructure. The public cloud infrastructure is primarily intended for use by the general public and has multiple tenants (Dillon & Chang, 2010; Marston, Li, Bandyopadhyay, Zhang & Ghalsasi, 2011).

Several target organisations use the community cloud infrastructure offering jointly because they have similar cloud requirements such as security, privacy, compliance, and performance. These communities frequently share a common goal and collaborate to achieve their objectives (Dillon & Chang, 2010; Schneider & Sunyaev, 2016).

Finally, there is the hybrid cloud. The hybrid model provides the above-mentioned cloud models. Organisations that use the hybrid cloud infrastructure model do so primarily to optimise resources and improve core competencies. Non-core business functions are moved to the public cloud, allowing core activities to be managed and controlled privately via the private cloud (Marston et al., 2011; Geczy, Izumi & Hasida, 2012).

According to Hsu, Ray, and Li-Hsieh (2014), cloud computing has significantly altered traditional IT delivery due to factors such as cost reduction, improved elasticity, and ubiquitous access. According to Galos and Sîrbu (2015), this has resulted in IT services becoming similar to any other utility, such as electricity and telephone, where resource costs are proportionate to usage. Sultan (2014) suggests succinctly that, while the concept of IT servitization via cloud computing is relatively novel and a departure from traditional models, it is evolving as an innovative business model for servitizing IT offerings.

2.3.5. Comparison of Cloud Computing and IT outsourcing

Studies by Riemer and Ahlemann (2001) and Currie and Seltsikas (2001), where they were studying service providers of applications, known as ASPs, note that they are usually called customization services vendors who provide software packages remotely as an outsourced service (Susarla, Barua & Whinston, 2003). This therefore bring forward the argument that there have been prior similar IT service models in the IT industry although the provision thereof by ASPs may have been somewhat different to the current forms. Scalable, hosted application software, and pay-per-use pricing models are mentioned by Currie and Seltsikas (2001) as important aspects for successful delivery of contracted services.

Several studies, including Israel and Raz (2013) and Teubner and Remfert (2017), agree that cloud computing is not a new concept, but rather a progression of concepts and a preferred method of outsourcing IT services in an efficient and cost-effective manner. In terms of the impact of cloud computing, Dhar (2012) claims that the cloud computing impact on IT outsourcing is clear and has resulted in a significant change in the way IT services are paid for and consumed. There have also been some discussions in the field suggesting that cloud computing is the end of outsourcing. This viewpoint is regarded as somewhat extreme. Nonetheless, cloud computing alters the traditional outsourcing model and its labour-dependent characteristics (Lioliou & Willcocks, 2019).

While similarities have been highlighted, there are also differences to be noted between IT outsourcing and cloud computing. To highlight one of the major differences, traditional outsourcing frequently has high-value contracts that provide custom IT offerings, whereas cloud computing offers generic offerings that are mostly acquired by specific divisions rather than through an organisation-wide contract (Schneider & Sunyaev, 2016). Table 2.1 summarises the differences between Cloud Computing and IT outsourcing in order to provide further context. The table provides a solid foundation for understanding these two IT service delivery models, as well as their similarities and differences.

Table 2.1: Evaluation of Cloud Computing and IT outsourcing (Schneider & Sunyaev, 2016)

	Cloud Computing	IT Outsourcing
Key Client	Key client is business department when dealing with software as a service Key client is IT division when dealing with infrastructure or platform as a service Self-service is predominant	Large outsourcing contracts with top management as main clients and high strategic relevance
Process of decision Making	Service provider choice tied to goods choice goods- based choice Online trial evaluations Duties moved from vendor to client	Request for information/request for proposal Service provider choice precedes the decision on outsourcing degree
Scope	Software is standardised or infrastructure made available by the cloud provider for an unspecified consumer in the market IT department becomes an integrator of services Customisation is limited	Custom-made services made for specific consumer May be inclusive of processes, people, software and hardware.
Governance Mode	Enables new scenarios of outsourcing and governance arrangements due to service model (as a service) variety and models for deployment (community, private, public, hybrid) Permits the administration of building blocks of IT, provided by vendors similar to when they are managed internally Most aspect of mode, ownership and degree are standard	Ownership configurations is for individual organisations, mode and degree
Proprietorship	Outsourced assets totally owned by the provider and its providers	It differs with form and extent of outsourcing which could be the following: Client total ownership Client partial ownership Provider total ownership
Mode	Single service providers/customers or multiple service providers/customers	Single service providers/customers or multiple service providers/customers
Degree	Partial outsourcing	Total/ Partial outsourcing
Contracting	Term is short Based on usage High levels of computerization and scale Cheaper initial costs	Term is long Based on period Independently negotiated Pricing dependant on metrics by business

	Minimal concession prospects, Uniform usage terms	Strategic and joint partnerships and relationships
External Environment	The marketplace is dispersed Unpredictable and undeveloped marketplace Indeterminate legal problems	Outsourcing environment is well established experienced providers that are many to choose from
Broad Network Access	Dependence on network connection Probable slowdowns, latency and unplanned failures no one has control of	Dependant on the outsourcing model
Resource Pooling	Virtualized applications that have multi-tenancy	None

According to the literature on business service outsourcing and offshoring, organisations are increasingly utilising professional services, particularly in the areas of security, digital conversion, automation, and governance. Willcocks, Lacity, and Sauer (2017) found IT outsourcing to be rapidly accelerating between 2016 and 2018, with further acceleration possible between 2018 and 2022. Having said that, they also highlight the recent growth of cloud computing and service automation as sourcing options that have surpassed traditional IT outsourcing.

On the market growth front, several case studies for offshore IT outsourcing show that profits reached US $100 billion in 2013 and that market growth averaged close to 12% per year between 2013 and 2018. Furthermore, traditional IT outsourcing is expected to lose 2.4% of its value from 2016 to 2022, whereas digital market, automation, and cloud computing offerings were valued at US $100 billion in 2016 and are expected to grow at a 21.7% compound annual rate between 2016 and 2022. (Willcocks, Lacity & Sauer 2017).

Snowden and Fersht (2016) predicted 2.2% annual growth from 2016 to 2020 as a result of processes and practices being outsourced, delivery end points being added, and new services being introduced. This suggests that, while IT outsourcing remains a viable option for IT sourcing, cloud computing as a form of IT servitization has grown in popularity and is likely to continue eating into the traditional IT outsourcing market.

2.3.6. Virtualization as a form of IT Servitization

It is difficult to define virtualization because there are numerous types of virtualization and a description that encompasses all of them is difficult to achieve (Nagesh, Kumar & Venkateswararao, 2017). Virtualization is the process of creating a virtual image or version of network resources, servers, storage devices, or operating systems for use on multiple devices at the same time (Malhotra, Agarwal & Jaiswal, 2014). Kiyanclar (2005) defines virtualization as a process of duplicating software architecture in such a way that it gives the software running on it the appearance of an actual separate device. Similarly, Nagesh, Kumar, and Vedula (2017) define virtualization as a model that divides a computing machine's available resources from a single environment into multiple environments, allowing for a plurality of methods such as partitioning, emulation, time sharing, and many others.

Virtualization aims to manage workloads by transforming traditional computing into a more cost-effective, efficient, and scalable architecture (Malhotra, Agarwal & Jaiswal, 2014). There are various types of virtualization, including server, storage, network, and application virtualization. Despite the fact that there are several types of virtualization, most people and organisations associate virtualization with server virtualization, even though IT has several virtualization types that are recognised and used by many people and organisations (Nagesh, Kumar & Venkateswararao, 2017). The various types of virtualization will be discussed next.

Server virtualization enables the creation of multiple virtual servers that are hosted by a single physical device. There are three layers involved in achieving server virtualization: physical (hardware), virtualization, and operating systems. A physical machine is partitioned, dividing a single physical server into multiple servers through partitioning, where each partition can independently become a system, whereas a hypervisor places software between the hardware and multiple operating systems while sharing a physical hardware (Malhotra, Agarwal & Jaiswal, 2014; Nagesh, Kumar & Venkateswararao, 2017).

Physical segmentation of the server occurs with hardware partitioning, in which it is broken down into physically independent small systems. These smaller systems have their own network resources, including CPUs, boot areas, operating systems, and memory. Virtualization layer partitioning enables virtual instances for unmodified operating systems to run completely separately inside the virtual device and is referred to as the guest operating system. The server is virtualized at the operating system (kernel) layer with operating system layer virtualization. The actual server and its operating system are virtualized into multiple, completely isolated partitions. From the perspective of the owner, each instance appears to be a real machine. The kernel is responsible for running a single operating system and providing performance to all instances (Malhotra, Agarwal & Jaiswal, 2014; Nagesh, Kumar & Venkateswararao, 2017).

Storage virtualization is not a new technology; it has been around for a long time. The implementation started with the use of a redundant array of independent disks (RAID). RAID enabled the logical combination of physical disks and the provision of those disks to the operating system as a virtual disk. Storage virtualization can combine physical storage from multiple disks and present it as a single pool of storage. Storage virtualization can be implemented without the need for server virtualization. It is advantageous, however, because it is based on logical unit (LUN) storage assignment and on-demand assignment. For example, if a LUN of 100 GB is created but only 10 GB is used, only 10 GB of real storage is assigned. Because it is assigned per use, there is a price benefit of reduced storage costs (Malhotra, Agarwal & Jaiswal, 2014; Nagesh, Kumar & Venkateswararao, 2017).

Network virtualization most used virtualizations are Virtual Private Network (VPN), Virtual IP (VIP) and Virtual Local Area Networks (VLAN). A virtual LAN (VLAN) is a method of creating independent networks by utilising a shared physical network. VLANs virtualize broadcasting areas and manage network communication between those segments. VLANs are a feature found in most network switches that allow the creation of multiple isolated virtual networks that separate and isolate each segment from the others. Creating VLANs is a safe and recommended method of isolating logical networks within a physical network (Nagesh, Kumar & Venkateswararao, 2017).

A virtual IP (VIP) address is one that is not tied to or associated with a specific network interface or computer, but is instead dynamically assigned to a device carrying network traffic at the time. Incoming network packets are sent to the VIP, that then redirects them to the host's real network interface. VIPs are typically used for solutions such as load balancing, where many systems share a back-end application and the VIP can receive and redirect traffic to the appropriate nodes (Nagesh, Kumar & Venkateswararao, 2017).

Virtual Private Network (VPN) is private network that uses communal network connectivity, such as the internet. VPNs are typically used to ensure confidentiality and secure communication over an unsecured network channel between two end points (Nagesh, Kumar & Venkateswararao, 2017).

According to Bose and Luo (2011), virtualization is a key driver and a modern technological means for organisations launching Green IT initiatives. Green IT is the cost-effective, energy-efficient use of IT resources, and it remains a critical future technology (Thatcher & Pingry, 2007). In terms of Green IT, virtualization can be defined as an energy-efficient technology found in data centres that is primarily used for cloud computing. Virtualization, whether applied to the server, desktop, application, network, or storage, aims to reduce energy consumption and associated costs by reducing the number of devices and physical data centre space and increasing resource utilisation efficiently (Kumar and Mieritz, 2007).

Although virtualization has existed as a form of technology since the 1960s, according to Kusnetzky (2014), the advent of cloud computing has brought additional attention to it by those in the IT industry where attention has been primarily lacking. This could explain why, when compared to the other three IT service models under consideration in the study, this type of IT servitization has received the least attention. The virtualization studies are mainly on the environmental aspect such as Green IT and Green computing (e.g., Kumar & Mieritz, 2007; Anwar, Ghaffar, Razzaq & Bibi, 2018) as opposed to IT service modelling studies (e.g., Bose & Luo, 2011; Nagesh, Kumar & Vedula, 2017).

2.3.7. Summary of Systematic Literature Review

To contribute to the literature in this area, the preceding section consolidated the various views and forms of IT servitization and demonstrated similarities and differences in these forms, demonstrating that the models borrow from each other's philosophies and continuously evolve to bring improved efficiencies and better management of on-demand services in the latter forms of IT servitization.

2.4. Section C: IT Servitization Adoption Studies in Different Contexts

The second section of this chapter examines previous research and literature on organisational adoption of IT outsourcing, cloud computing and virtualization, and ultimately IT servitization in general, while not overlooking the study context in order to facilitate understanding of this phenomenon.

2.4.1. IT Servitization Adoption the Global Enterprise perspective

IT's role in an organisation is to provide high-quality, cost-effective IT services that align with the organisation's strategy (Conger, 2010). As a result, servitizing the IT function has emerged as a critical area that contributes to the achievement of that goal. Given this assertion, Barrett and Davidson (2008) point out that, given the significant role that IT plays in servitization, it is surprising that the body of research in this area has not significantly contributed to the growing debate about the role of IT in servitization.

There are no comparable studies in IT servitization, such as the study by Hanafizadeh and Zare Ravasan (2018), which provides a comprehensive literature survey on IT outsourcing adoption. While their primary focus is on the banking industry, their extensive literature review includes insurance, stock trading, retail, transportation, airlines, communication, health care, agriculture, mining, energy, manufacturing, business services, hotels, education, construction, public administration, and media. As a result, even in 2020, there is still a lack of focus on studies into IT servitization and its adoption by organisations in various industries around the world.

2.4.2. IT Servitization Adoption in the South African context

There have been few studies on IT servitization in the local context, similar to the global enterprise perspective. There is a handful of researchers contributing to the broader servitization area of study such as Weeks and Benade (2009) studying the process of servitization at a small to medium sized South African manufacturing enterprise; Weeks (2010) studying the servitization challenges brought by skills and culture ; Weeks and Benade (2014) studying an institution's business model that required adaptation in order to implement the servitization strategy; Milanzi and Weeks (2014) study to improve the concept servitization understanding from a resilience incorporation viewpoints well as to gain an appreciation of the impact of resilience on a servitized organisation; and lastly, Weeks and Benade (2015) where a multi-disciplinary review of literature was done with an aim to develop a generic servitization framework which could become an information source and practitioners reference when trying to frame and execute a strategy on servitization and has been successfully utilised in South Africa at a manufacturer of security systems.

Although these are useful studies, they are not in the IT field and do not cover IT servitization. This therefore indicates the need for IT servitization research and understanding of its adoption in the local context. Given the foregoing, the researcher is aware of only a limited amount of prior research into IT servitization adoption in South Africa.

2.5. Section D: IT Servitization Opportunities and Challenges

The decision of whether an activity or process should be performed internally within an organisation or contracted out to a service provider remains critical for both practice and research (Lacity, Khan, Yan & Willcocks, 2010). This section considers the challenges and opportunities of IT servitization in its various forms in order to understand the challenges and opportunities. The decision to discuss the various forms rather than directly address the challenges and opportunities of IT servitization was influenced by the paucity of literature in this field of study. The researcher believes that this approach will aid in the development of literature in this area and will aid in the understanding and later consolidation of the various IT servitization forms.

2.5.1. IT Outsourcing Opportunities and Challenges

Over the last 30 years, businesses have increasingly shifted to IT outsourcing, relying on third-party service providers for traditional IT services, cloud computing resources, and automation tools (Lioliou & Willcocks, 2019). Corbett (2004) argues the importance of outsourcing in an organisation's strategy in earlier literature. According to the study, at least half of the IT budget in many organisations is allocated to outsourcing, despite the fact that previously, outsourced services were not always provisioned online (Motahari-Nezhad, Stephenson & Singhal, 2009).

Gonzalez, Gasco and Llopis (2005) suggest that, the rise of IT outsourcing is primarily due to globalisation. According to their research, organisations tend to locate their productive processes in foreign countries where highly trained computer staff is easily available at comparatively low salaries. Internet accessibility and acceptance are critical in the growth of IT outsourcing, particularly for application outsourcing, as the trend toward developing and accessing applications via the internet rather than installing them in a local environment grows. A decade later, Liu and Tyagi (2017) agree that cost is still a major factor, but they point out that the usual top three reasons are: overall cost reduction, converting fixed costs to variable costs, and access to specialised domain knowledge.

Before delving into the challenges and opportunities of IT outsourcing, it is critical to understand the IT outsourcing models and costing, as suggested by Overby (2017). According to Overby (2017), while the core service offering typically informs the appropriate IT service model for an organisation, the majority of outsourcing contracts are typically invoiced on a fixed price or time and materials basis. However, as outsourcing services have evolved, the most common way to bill outsourcing agreements is as follows:

Time and materials - In this model, the organisation compensates the vendor based on the amount of time and materials used to complete the task. This model is typically used when the specifications and scope are difficult to estimate or when needs are rapidly changing. This type of agreement has traditionally been used in long-term maintenance contracts and application development (Overby, 2017).

Unit/On-demand pricing - In this agreement, the service provider establishes a set rate for a service, and the organisation pays based on usage. An example of unit pricing is as follows: when outsourcing desktop maintenance, the organisation could pay an agreed fee based on the number of desktop units that require support and adjust accordingly as the number of units increases or decreases. The benefit of this unit pricing model is that it can deliver immediate productivity improvements and makes cost analysis for components and adjustments simple. For this pricing to be supported, precise demand figures and, most importantly, minimum transaction commitment volumes are required (Overby, 2017).

Fixed pricing- With this model, the pricing is fixed at the start of the contract. When the requirements, objectives, and scope are clear, and there is no variance due to any changes, the model tends to work well. Although fixed price payment for services may appear appealing to the organisation and may work well because it makes costs predictable, it can go wrong when market pricing falls later, as it frequently does, but the price remains the same, and the organisation loses out on the benefit of lower market prices. Fixed pricing is also difficult for service providers because it requires them to achieve service levels at a specific fixed price regardless of the complexity of the requirement or how many resources are required to deliver those services (Overby, 2017).

Variable pricing- The organisation pays same amount to the service provider's offered service at the low end, but adjustments in the amount are factored in when the service provider provides higher levels of service (Overby, 2017).

Cost-plus- With this model, the agreement is that the organisation pays the service provider for the actual costs incurred and the service provider adds a certain predetermined profit percentage. However, it should be noted that this type of pricing plan provides no flexibility as business needs, objectives, or technologies change. Furthermore, there is little to no incentive for a service provider to perform effectively and be innovative in their service provision (Overby, 2017).

Performance-based pricing- In this approach, the organisation provides financial incentives to the service provider in order to encourage them to meet the required standard of service performance. Penalties, on the other hand, are imposed for poor levels of service. This pricing model is typically used in conjunction with a standard pricing model, such as fixed price or time and materials. This pricing plan may be beneficial if the organisation is able to identify specific improvements and investments that the service provider could make in order to deliver a higher level of performance. Furthermore, the organisation must ensure that the product delivered adds tangible value because the service provider should not be compensated for providing basic services that should be performed anyway (Overby, 2017).

Gain-sharing- This model is based on the value delivered by the service provider's expertise beyond their typical contracted responsibilities. An automobile manufacturer, for example, may pay their service provider based on the number of cars produced. With gainsharing, both the organisation and the service provider have a common interest because both of their profits are at stake if one fails to meet their end of the bargain. On the plus side, when the service provider's performance is optimal and meets the organisation's objectives, each receives a percentage of profits (Overby, 2017).

Shared risk/reward- Both the organisation and the service provider fund the development of new goods, solutions, and services jointly, and the service provider receives a share of whatever the organisation derives as a reward for a set period of time. The service provider is encouraged to come up with business improvement ideas under this model, and the financial risk is shared by both parties. This model, however, necessitates a higher level of governance in order to be successfully implemented (Overby, 2017).

Now that the IT outsourcing pricing models and costing have been explained, discussed next is IT outsourcing opportunities and challenges.

IT Outsourcing Opportunities

Bachlechner, Thalmann, and Maier (2014) highlight the various benefits that IT outsourcing contracts typically provide, such as increased cost predictability and reduced costs, increased flexibility and scalability on demand, and other opportunities. An earlier study by Thompson (1991) discovered that the following opportunities are frequently cited as the benefits of outsourcing from the perspective of service providers: a) gaining a predictable technology budget by not tying budget to hardware and software but to actual requirements, which means organisations buy only what they need and eliminate wastage caused by excess capacity; b) cost savings for current and anticipated future expenditures incurred from purchasing or leasing new equipment; and c) access to experienced technical staff and other technical resources; d) company focuses on the core goods and services and not operational issues; e) having variable costs for the technology, which frees up capital that could be tied up in fixed costs and invested to core business activities; f) organisations sharing risk with the service providers in high cost, high risk areas such as application development. Considering that many years have passed since the study above, next, for discussion are the later studies on IT outsourcing opportunities.

Lower costs - One of the opportunities made possible by organisations outsourcing to service providers has been cited as the provision of services at a lower cost. This is primarily because of their specialisation, access to skilled resources, and economies of scale (Gilley, Greer & Rasheed 2004). When services are contracted to a service provider, there is also a reduced need to hire staff, little to no training or personnel development costs, and lower labour costs from sourcing from a global talent pool at a lower price. Reduced office space and hardware costs, as well as fixed monthly operating costs associated with IT outsourcing, are also advantages, particularly for organisations undergoing some form of business transformation (Patel, 2017).

Core business focus- According to Han and Mithas (2013), by outsourcing IT services such as application development and maintenance, organisations can focus on their main objectives and reallocate their IT resources and employees to more strategic activities, increasing the organisation's ability to achieve operational efficiencies and maximise profit.

Flexibility in the meeting the needs of services - Tan and Sia (2006) define four dimensions of flexibility in meeting the needs of services that benefit organisations: robustness, modifiability, new capability, and ease of exit. The ability to handle operational changes that exceed projected capacity on existing service delivery by both the organisation and the service provider is referred to as robustness. These changes could be caused by fluctuations in service volumes, variations in standard user requests, processing of urgent or special cases, and finally, exception handling. Modifiability refers to the ability to change attributes in existing services in order to address variation and change in business requirements, such as setting up a new configuration, changing processing workflow or business rules, updating reference data, or adding new reporting requirements.

The ability to add new services to address changes or shifts in business models, such as new governmental regulations, new technological innovations, functional advances, and process modernisations, is referred to as new capability. Finally, ease of exit refers to the ability to transfer services to other service providers or have them brought back in-house in response to the possibility of early termination of the agreement, service provider instability, or pricing disputes or disagreements. It should be noted that understanding all four flexibility dimensions is critical due to their differences in a variety of ways. The first three dimensions, robustness, modifiability, and new capability are usually within an existing outsourcing relationship, whereas ease of exit necessitates the establishment of a new relationship outside of the existing outsourcing contract (Tan & Sia, 2006).

Improved operational efficiencies - IT outsourcing can increase process operational efficiencies and free up resources, allowing resources to be reallocated to other processes or business objectives. Furthermore, organisations' complementary internal IT investments may make business processes more information-intensive and facilitate coordination with service providers, increasing the cost-saving effects of outsourcing (Han & Mithas, 2013).

Knowledge sharing is another efficiency that has been identified. Knowledge sharing is defined as any activity in which knowledge is transferred or disseminated from one person, group, or organisation to another, including both tacit and explicit knowledge (Lee, 2001). Because organisational knowledge can be acquired externally as well as internally, organisations can learn from their service providers and develop new competencies through strategic alliances through IT outsourcing (Simonin,1999). When both the organisation and the service provider share a common vision and goals for the partnership, as well as trust, they will make it possible for successful knowledge sharing to occur (Lee & Kim, 1999).

IT Outsourcing Challenges

Despite significant growth in IT outsourcing, this service model continues to face harsh criticism and a slew of challenges. Other researchers have gone so far as to identify risks and challenges associated with each advantage provided by IT outsourcing (Gonzalez, Gasco & Llopis, 2005). Earlier studies from the 1990s claimed that outsourcing has more drawbacks than advantages (Udo, 2000). (Lacity & Hirschheim, 1993; Hoffman & Vijayan, 1997; Nam, Rajagopalan, Rao, & Chaudhury, 1998) discussed the following potential disadvantages: a) a lack of chemistry between the vendor and the client; b) the frightening prospect of an organisation relying on a third-party provider for critical information; c) loss of a capability that could help the organisation succeed; d) loss of control over IT assets; e) a possible opportunism threat from service providers; f) loss of flexibility; g) loss of competitive advantage in information management; h) loss of IT expertise and corporate memory; i) decline in morale and performance of the remaining employees; j) long-term cost savings not being guaranteed. Now that the earlier studies have been investigated, subsequent studies are being presented to determine whether or not the challenges have evolved.

The loss of critical skills, moral and competences - Gonzalez, Gasco & Llopis (2005) contend that when a service is outsourced to a service provider, internal IT staff gradually loses understanding of the outsourced service. With new and innovative services offered to customers, a large portion of the new knowledge acquired remains with the provider and is rarely transferred to the organisation's internal IT staff. Furthermore, when only certain staff members are transferred from the organisation to the third party, it causes problems with motivation among those who remain in the organisation. Professionals who remain may feel offended because they believe they are not qualified to work for a specialised organisation such as an IT service provider. Working for a service provider can be either intimidating or stimulating, depending on the employee's perspective, with responses ranging from extremely negative to extremely positive (Hoogeveen, 2008).

On the other hand, those who are transferred from the organisation to third party IT service provider may encounter various changes in the new organisation that may include keeping their seniority or even the challenge to adapt to a new corporate culture (Gonzalez, Gasco & Llopis, 2005). According to Udo (2000), if the cost of morale issues outweighs the benefit of outsourcing, the organisation should abandon the outsourcing option for the sake of productivity and good will. It is important to note that people play a significant role in IT outsourcing arrangements. In addition to competencies, contractual agreements, and technical safeguards, service providers must ensure that their IT staff takes security and compliance seriously and that critical skills are not lost (Bachlechner, Thalmann & Maier, 2014).

Hidden costs- Many organisations underestimate the costs associated with identifying and evaluating suitable service providers, selecting and awarding to the finalist, and then negotiating and drafting the final contract. The other costs that are also underestimated are the cost of transitioning to the service provider, which can take months as the service provider familiarise themselves with the organisation processes and gets up to speed to have the knowledge that the internal IT department and IT staff possess and also, the costs related to provider service level agreement management which amongst other things relates to verifying that service providers is fulfilling their contractual obligations and negotiating any changes in contract that may be essential, and finally transition costs subsequent to outsourcing, meaning the insourcing switching costs of resuming IT activities internally or switching cost to another service provider (Gonzalez, Gasco & Llopis, 2005)

Although one of the motivations for IT outsourcing is to control IT costs, it is argued that the hidden costs derived from the dismissal or transfer of staff, software license transfers, and the like are also visible and are frequently ambiguous in the contract. For example, the contract may fail to define current and future IT requirements, employ ineffective staffing practices, and disadvantage the service provider by preventing them from obtaining good profit protection prices in contingency cases (Gonzalez, Gasco & Llopis, 2005).

The weakening of innovative and creative capacity - Although outsourcing typically results in cost savings and improved organisational performance, it almost never results in innovation. This concern has been frequently discussed, along with how creativity capacity could be revitalised, and innovation achieved (Willcocks, Oshri & Kotlarsky, 2018).

It should be noted, however, that there is a renewed emphasis on collaboration between organisations and service providers, as evidenced by a concept known as coopetition amongst service providers, which suggests how multiple service providers can be managed and encouraged to collaborate while competing with the goal of producing innovation and value for business for the contracting organisation (Lioliou & Willcocks, 2019).

Lack of managerial competence - The initial hype and fear brought by IT outsourcing is one of the challenges. This is introduced by managers representing organisations that place too much trust in the promises of service providers or, on the contrary, managers who are unconvinced about the value that outsourcing can provide. With this unresolved, if the organisation decides to proceed with outsourcing despite insufficient managerial competence, the outcome will be negative. If it is not recognised that outsourcing typically necessitates management skills that are appropriate for this arrangement as well as a different personality that is not the same as that required for managing insourced teams, this may lead to future difficulties. Neither the hype nor the fear approach produces the positive robustness required for leveraging on outsourcing (Lioliou & Willcocks, 2019).

In their research into outsourcing high performance, Lacity and Willcocks (2015) highlight that only 20% of outsourcing agreements achieved good performance as of 2015. In that 20%, management practices such as leadership collaboration between contracted service providers and organisations were discovered to be primarily focused on a) business and strategic benefits; b) strong transition change management and transformation capabilities ;c) a partnering approach; d) alignment of the retained organisation to business goals and their service provider; e) collaboration centric approach when resolving problems with the service provider; f) technology use as an enabler, domain expertise deployment, and analytics of business and finally, giving priority to innovation as well as providing incentives for it (Lacity & Willcocks, 2015).

IT Governance- Contractual agreements, specifically SLAs, are the primary means of documenting IT outsourcing agreements entered into by the various organisations involved. Compliance monitoring is critical, but it can be difficult for organisations if their service providers subcontract certain services to other service provider (Bachlechner, Thalmann & Maier, 2014). One of the main reasons IT outsourcing ventures between service providers and organisations fail, according to academia, is a lack of governance and management of the partnership between the organisations and providers (e.g., Lacity et al., 2010; Kern & Willcocks 2002). IT governance has mostly been fundamental but difficult in IT outsourcing (Lioliou & Willcocks, 2019). Previous research has discovered a link between poor outsourcing failures and governance inefficiency in IT outsourcing contracts (Equaterra, 2010; Mercer, 2010).

Lack of professionalisation - According to Lioliou and Willcocks (2019), even in 2018, the outsourcing industry was still far from mature and was still in the process of professionalising itself. Professionalisation provides several benefits, including codes of conduct, standards, a clear career path, and guidance on key roles required in the profession and what it takes to identify suitable candidates to fill those roles. Organisation-retained or insourced capabilities, on the other hand, have generally become more mature and task specific in recent years.

Security and confidentiality threat- Information security management is critical in IT outsourcing (Dhillon, Syed, & de Sá-Soares, 2017). In their study on outsourcing risk assessment, Kern, Willcocks, and Lacity (2002) identify security risks as one of the challenges that pose a risk to IT outsourcing. According to Khalfan (2004), the most serious concerns about outsourcing arrangements are internet security, data confidentiality, integrity, and availability.

Chang and Yeh (2006) make the important point that computer networks, regulations, and employees are also rated as the highest security threats to organisations, and they warn against solving information system security problems solely through technical means, as this may result in potential disasters for organisations.

Bachlechner, Thalmann, and Maier (2014) highlight the critical issue of data ownership, which requires special attention in the context of IT outsourcing. Keeping track of data becomes extremely difficult for organisations when service providers subcontract other service vendors. The physical location of data storage or processing is critical for organisations involved in IT outsourcing, particularly where regulatory differences in national legal obligations exist. It is also important to note the diversity of jurisdictions and laws. If a company and its service provider operate under different international laws and jurisdictions, it may result in information security issues, such as the inability to release data to the service provider's foreign workers (Dhillon, Syed, & de Sá-Soares, 2017).

Although these disadvantages can be avoided by partnering with the right service provider, it has been observed that a lack of experience in outsourcing contracts by organisations outsourcing their service continues to give rise to information asymmetry where service providers with experience negotiate with inexperienced organisations, which can favour service providers' position much better. As a result, before outsourcing, organisations must understand the nature of these contracts and make informed decisions to ensure that not only the organisation's interests are protected, but also the interests of their customers and employees are protected (Gonzalez, Gasco & Llopis, 2005).

According to Lioliou and Willcocks (2019), outsourcing management has been problematic for many organisations and will continue to be so. This is exacerbated by the unpredictability of business contexts in which technologies and services are constantly evolving and rapidly changing. There is evidence that only about 20% of outsourcing activities are of world-class quality, resulting in cost savings and improved services to the client's satisfaction (Lioliou & Willcocks, 2019). This suggests that there is still room for improvement in both theory and practice in understanding this IT outsourcing phenomenon. When comparing the later studies to the earlier studies, there is no significant difference in the challenges that organisations and service providers face when embarking on the IT outsourcing exploration.

In closing the subsection, Udo (2000) notes that it is unfortunate that IT outsourcing failures are not adequately admitted by organisations because no one would openly admit to being identified as a failure. Because of the scarcity of information about these failures, IT outsourcing decisions should be thoroughly scrutinized because they are critical to the survival of most organisations.

2.5.2. Cloud Computing Opportunities and Challenges

Avram (2014) offers a comprehensive enterprise perspective study of the benefits and challenges of cloud computing adoption. From an enterprise standpoint, the paper provides an analysis of the factors to be considered by an enterprise when making the decision to use cloud computing. According to El-Gazzar (2014), while cloud computing has received and continues to receive increasing interest from enterprises since its inception, Avram (2014) notes that there are two scenarios that represent enterprises that are not well informed in the area of cloud computing adoption. It should be noted that some businesses are adopting cloud computing because it is trendy in IT, whereas for others, the idea of storing sensitive data offsite is unthinkable.

In brief, before delving into the challenges and opportunities, it is critical to understand the critical characteristics that distinguish cloud computing from other computing technologies in order to conduct a more thorough analysis. Mell and Grance (2011) identify five key distinguishing features. First, there is on-demand self-service, in which the service consumer can automatically provision computing capabilities as needed with no service provider interaction or human interaction of any kind. Second, broad network access means that capabilities are available and accessible via standard mechanisms over the internet or network, facilitating and promoting accessibility by a variety of platforms such as mobile phones, laptops, and workstations.

Third, there is resource pooling. The provider's computing resources are pooled with resource pooling to serve multiple consumers whenever there is a demand. This multi-tenant model enables on-demand dynamic assignment of various physical and virtual resources to consumers. Fourth, quick elasticity. Capabilities can be provisioned and released elastically, and even automatically in some cases, allowing for rapid scaling outward and inward based on demand. Finally, there is measured service. Cloud systems can automatically optimise resource use by leveraging metering capability at a construct level appropriate to the type of service such as storage, processing, network bandwidth, and so on.

Following an explanation of the critical characteristics that distinguish cloud computing from other computing technologies, the benefits and challenges of adopting cloud computing are discussed.

Cloud Computing Opportunities

Cost - The main feature of cloud computing is that it provides all of the functionality of current IT services with lower upfront capital costs and savings on computing hardware investments, which has been a major limiting factor for many enterprises, preventing the deployment of a number of cutting-edge IT services (Staten, 2009). Furthermore, Garrison, Kim, and Wakefield (2012) highlight the opportunity to shift IT expenses associated with procurement, development, administration, and maintenance of in-house IT infrastructure to the cloud provider. Similarly, Avram (2014) observes that cloud computing lowers the barrier to entry for smaller businesses seeking to explore and benefit from compute-intensive business analytics that were previously only available to large enterprises with large IT budgets.

Location and device independence - Avram (2014) also notes the enormous opportunity offered and made possible by cloud computing to many third-world countries that were previously excluded from the IT revolution, where some cloud computing service providers are enablers of IT services in countries that would normally have a shortage of resources for such deployments as well as devices to access such services.

Scalability and agility - Cloud computing, according to Garrison, Kim, and Wakefield (2012), enables increased business agility. As more users join the system, the infrastructure's elasticity allows computing loads to be balanced and demand provisioned. Catering for capacity growth as well as on-demand access to available computational power that is typically large for relatively short periods of time, resulting in dynamic provisioning of resources, is also possible. This means that additional resources can be automatically provisioned when application load increases and released when load decreases, allowing for easy scaling up and down. Furthermore, because computing resources are managed by software, it is possible to deploy resources relatively quickly with minimal service provider interaction when new requirements arise (Avram, 2014).

Lower barriers to innovation - Cloud computing, as demonstrated by many promising start-ups, can lower IT barriers to innovation and enable the deployment of previously impossible modes of applications and services, such as mobile interactive applications that are environment, location, and context-aware (Avram, 2014).

Self-service deployment and immediate access - One of the most appealing aspects of cloud computing is self-service resource access. Self-service allows users to obtain services directly from a cloud service provider. Building a server and customising its software, configuring it, and deploying security policies are examples of such services

(Voorsluys, Broberg & Buyya, 2011). This is due to the expectation that cloud computing service users want instant, on-demand access to resources (Mell & Grance, 2011).

According to Armbrust et al. (2009), “cloud computing is an old idea whose time has finally come.” Cloud computing is becoming increasingly popular as an IT service model, and it provides numerous opportunities to businesses.

Cloud Computing Challenges

Despite the appealing opportunities for businesses, cloud computing poses significant technical, economic, regulatory, ethical, relational, and organisational challenges (Kuyoro, Ibikunle & Awodele, 2011; Garrison, Kim & Wakefield, 2012; El-Gazzar, 2014). These challenges are discussed next.

Security and privacy - Cloud security has been cited as the main barrier that prevents organisations from adopting cloud computing (Nkhoma, Dang & De Souza-Daw, 2013). Concerns about security are growing in tandem with the rise of cloud computing. The main areas of concern are data loss, sensitive data control loss, data leakage, a lack of security for stored kernels entrusted to cloud providers, and cyber-attacks. Without a doubt, organisations find it difficult to store data, run software, and use an external party's hard disk for their information (Kuyoro, Ibikunle & Awodele, 2011; El-Gazzar, 2014).

Data transmitted and stored in the cloud, particularly personal data, should be properly managed with appropriate controls in place (Haeberlen, 2010). Loss of control is still a concern because organisations that use cloud computing services lose control over their data and computational processing. As a result, loss of direct control can potentially become a problem if something goes wrong on the cloud provider's end (Timmermans, Stahl, Ikonen & Bozdag, 2010). As a result, this may result in what ethical literature refers to as a "problem of many hands," in which it is difficult to determine who caused the problem and nearly impossible for both the customer, i.e., the organisation, and the cloud provider to hold each other accountable for the issue if a disagreement arises, which may lead to undesirable outcomes (Haeberlen, 2010).

Mono/oligopoly and data lock-in - When only a few corporations control the use of resources, user autonomy may be jeopardised (Timmermans, 2010). Because economics of scale and network effects are two of the defining features of cloud computing, there may only be a few cloud computing providers who provide services to the entire world in the future (Grimes, 2009). According to Bartels, Bartoletti, and Rymer (2018), the cloud computing market currently exhibits the characteristics of an oligopoly. There are primarily three service providers that account for at least 70% of the market revenue. According to reports, Amazon Web Services (AWS) and Microsoft Azure captured 75% of all revenues in 2017, while Microsoft, Google, and Adobe had a market share of 90% for desktop applications (Bartels, Bartoletti & Rymer, 2018).

Timmermans et al. (2010) highlight the current risk of data lock-in caused by a lack of standardisation in data formats and service interfaces that could enable guaranteed data portability. A lack of it could result in complex migration from one provider to another, or even difficult migration of data and services back to the in-house IT environment, introducing service provision dependency on a specific cloud service provider. According to El-Gazzar (2014), the vendor lock-in risk represents a loss of governance within an organisation.

Trust - Khan and Malluhi (2009) define trust as a belief, having faith and confidence that something will reliably behave or deliver as expected and promised, and thus relying on them to care for your valuable assets. According to Khan and Malluhi (2009), cloud computing has introduced new challenges by introducing a different type of trust scenario in which the main concern for most enterprises is establishing trust in cloud computing providers. This is not necessarily because organisations do not trust the intentions of providers, but rather because they question the capabilities promised by this IT service model.

According to Garrison, Kim, and Wakefield (2012), a lack of trust by organisations in cloud computing providers indicates a heightened sense of suspicion, which may result in an ineffective exchange of information between the two parties, and when this occurs, it causes an organisation to reconsider and rethink its relationship with the cloud computing provider, as well as question their decisions on the deployment of cloud computing.

Costing and charging model- The appeal of cloud computing adoption to organisations is largely through savings as discussed in the studies by (e.g., Staten, 2009; Garrison, Kim & Wakefield, 2012 & Avram, 2014). However, the organisations must consider the trade-offs amongst computation and communication data lines. While cloud migration may result in cost savings due to reduced capital infrastructure, the cost of data transmission to and from the cloud, as well as the cost per unit of computational resource under the cloud pay per use model, may be significantly higher (Kuyoro, Ibikunle & Awodele, 2011). It is also important to note that there are performance risks as a result of moving massive amounts of data to the cloud computing provider infrastructure, which may take a long time and may necessitate the increase of bandwidth, which is costly (Garrison, Kim & Wakefield, 2012).

The other complexity is the charging model. The elastic resource pool where resources are dynamically increased when need and released when not is use has resulted in difficult cost analysis than normal fixed model for data centres. With the fixed model data centres, cost is calculated on a fixed basis and based on consumptions static computation use. The virtual machine instances that have replaced the traditional physical server as the unit of cost analysis have further complicated the charging model (Kuyoro, Ibikunle & Awodele, 2011).

Rigid IT infrastructure and relational capability- Organisations with rigid IT infrastructure and inflexibility in their approach to how infrastructure can be consumed, according to Garrison, Kim, and Wakefield (2012), are generally unable to fully adopt and implement the cloud computing strategy. Relational capability is also important, and it may be hampered by a strained relationship between the IT manager and the cloud service provider. The service provider should understand how cloud services benefit the client organisation and be motivated to deliver; similarly, the organisation should be confident that the cloud computing provider is interested in assisting them in leveraging their IT resources.

Equally important are IT managers who understand both business and IT, and thus understand how cloud computing can be exploited and integrated across business units. The deployment would be hampered if this information was not available (Garrison, Kim

& Wakefield, 2012). Garrison, Kim, and Wakefield (2012) even suggest that prior to implementing cloud computing, organisations should assess their capabilities (managerial and technical), as well as their ability to develop good relationships with cloud computing vendors, because if these are not in place, the understanding of the scope, duration, and implementation of cloud computing services between the organisation and the cloud computing vendor will be hampered.

Service Level Agreements (SLA) - Even though organisations that use cloud computing services have no control over the underlying computing resources, they still expect services to be available, reliable, and of high-performance quality. When core business functions are accessed via the cloud, they must still meet the required standards. In other words, getting assurances from cloud service providers about service delivery is critical. These are provided through service level agreements negotiated between the organisation and cloud service providers. The challenge in SLA management is defining SLA specifications to an appropriate level of granularity. There are frequently issues with trade-offs between expressiveness and complexity in order to cover consumer expectations (Kuyoro, Ibikunle & Awodele, 2011).

Availability and disaster recovery - Business continuity is critical, and every organisation must have a disaster recovery or business continuity plan that is affordable to the organisation while meeting the target recovery requirements based on the recovery point objectives (Alhazmi & Malaiya, 2013). The availability of cloud services is critical for organisations that use cloud computing for mission-critical applications and processes. Organisations should seek clarity on what happens to their data and operations when a disaster strikes, as well as the length of the recovery process (Prakash, 2011).

As Chaudhury (2019) points out, the risk of outages remains a challenge. To name a few outages, Salesforce experienced a service breach in May 2019 that resulted in regular users being granted advanced permissions. Similarly, Microsoft experienced a network connectivity outage for more than an hour in the same month, resulting in errors in Microsoft Azure affecting Office 365, Microsoft Teams, and other applications.

Regulatory compliance - The cloud computing model and architecture inherently have significant legal aspects that must be considered (Hourani & Abdallah, 2018). Regulatory and legal risks, such as data protection regulations and licensing issues, pose a risk to organisations considering cloud computing adoption (Garrison, Kim & Wakefield, 2012). The issue of physical location may raise significant jurisdictional issues in terms of protecting information's privacy and confidentiality in terms of where it can be processed and stored (Subashini & Kavitha, 2011)

Special regulations, policies, or rules may also apply to the handling of data flows across national and international borders and jurisdictions (Hourani & Abdallah, 2018). According to Subashini and Kavitha (2011), information in the cloud may have multiple legal locations with varying legal consequences, which adds complexity. Legal uncertainties also make assessing information privacy and confidentiality protection in the cloud difficult. Hourani and Abdallah (2018) also mention other legal issues, such as data portability, compliance, liability, data protection, and copyrights.

In the South African regulatory context, the government plays a critical role in creating structures, policies, and regulations that facilitate technological innovation, and the Protection of Public Information (POPI) Act (4/2013) is a good example of such regulation (Adendorff & Smuts, 2019). Previously, the lack of data protection prompted the passing of the (POPI) Act, which aims to align South Africa's data protection framework with international standards (Gillwald & Moyo, 2014).

South Africa’s (POPI) Act was scheduled to take effect from 1 April 2020, however, due to the coronavirus outbreak in the country, this was delayed (McKane, 2020). These are the aims of The Protection of Personal Information Act 4 of 2013.

- *“to promote the protection of personal information processed by public and private bodies;*
- *to introduce certain conditions so as to establish minimum requirements for the processing of personal information;*
- *to provide for the establishment of an Information Regulator to exercise certain powers and to perform certain duties and functions in terms of this Act and the Promotion of Access to Information Act, 2000;*
- *to provide for the issuing of codes of conduct;*

- *to provide for the rights of persons regarding unsolicited electronic communications and automated decision making;*
- *to regulate the flow of personal information across the borders of the Republic;*
- *and to provide for matters connected therewith.*"

In summary, the POPI Act encourages both public and private bodies to protect personal information that they process by introducing and establishing minimum requirements that must be met when businesses process personal information.

Inconsistent power supply - Another challenge in cloud computing adoption is inconsistent power supply, which is unique to the South African context (Gillwald and Moyo 2014). Eskom, South Africa's sole electricity supplier, has a rolling blackout policy that occasionally leaves many businesses without power. This poses a significant challenge to cloud adoption because data centres and network connections rely on continuous power supply to ensure data storage and access. (Gillwald & Moyo, 2014)

It is unsurprising that a discussion of the challenges and uncertainties associated with certain aspects of cloud computing may result in a number of challenges for organisations. As a result, understanding the opportunities and challenges may aid organisations in deciding whether or not to adopt cloud computing.

2.5.3. Virtualization Opportunities and Challenges

The amount of investment and implementation of virtualization by organisations is comparable to the amount of investment and implementation of internet connectivity within organisations at the end of the last decade. Virtualization debates continue to rage in the IT world. The assurance that the ever-increasing infrastructure inside data centres will be reduced is somewhat dampened by concerns such as ease of use and scalability. Virtualization technology has been recognised not only by IT experts, but also by executives and administrators (Nagesh, Kumar & Venkateswararao, 2017).

Nagesh, Kumar, and Venkateswararao (2017) go on to say that virtualization is presented as a ready-made solution that organisations do not need to think about. It is presented as a physical machine, with the advantage that virtualized hardware does not fail as easily as physical infrastructure. In some cases, people believe that having four virtual machines, for example, running on a single physical machine is the same as having multiple physical devices, which is not the case. Discussed next are virtualization opportunities and challenges.

Virtualization Opportunities

Virtualization has numerous positive and negative effects on the environment, as well as the business and IT arenas (Malhotra, Agarwal & Jaiswal, 2014). The benefits of virtualization are listed below.

Reduced energy consumption- Because of the reduced number of hardware machines, virtualization has the ability to reduce power consumption, making this technology eco-friendly and energy efficient (Malhotra, Agarwal & Jaiswal, 2014).

Redundancy- The repetition of data is referred to as redundancy. It is most commonly encountered when systems do not share a common storage and different memory storages are created; virtualization allows for this consolidation. Because of the large number of data centres, fault tolerance is very high, resulting in reduced redundancy (Malhotra, Agarwal & Jaiswal, 2014).

Hardware cost reduction- One of the cost-cutting, hardware-reduction models is virtualization. Organisations continue to benefit from resource sharing, aggregation, and dynamic resource allocation (Malhotra, Agarwal & Jaiswal, 2014).

In summary, as stated by Krishnatej et al. (2013), virtualization is reducing hardware costs, introducing redundancy benefits, and introducing energy-saving technology that is rapidly changing the way computing is done.

Virtualization Challenges

Mass data loss, infected application and data integrity - Virtualization poses significant risks in terms of data loss, infected applications, and data integrity. Critical issues have been identified as mass data loss, infected applications, and data integrity. a) In the case of mass data loss, if a disaster strikes a data centre, it may destroy the data stored or shut down servers. b) With infected applications, if a virus infects one file, it has the potential to infect the entire system. c) Concerning data integrity: Because data can be accessed from any location, data integrity can be jeopardised (Kuyoro, Ibikunle & Awodele, 2011).

Security- Virtual Machine technology is widely used and adopted in a wide range of industries. Critical workloads that were previously applied to isolated servers are now hosted on virtual machines, and security is the single most persistent issue raised. With a virtualization model in which all servers are consolidated and a single server running, for example, two critical virtual machines, the risk is magnified and allows not only the same attacks as in the traditional model, but also new cyber-attacks and vulnerabilities (Nagesh, Kumar & Venkateswararao, 2017).

2.6. Section E: Determinants influencing IT Servitization Adoption

Despite the enormous popularity of both the IT outsourcing and cloud computing phenomena, as well as, to a lesser extent, virtualization, and the fact that there are factors that determine successful adoption, it is surprising that there has been so little rigorous academic work done to holistically analyse the key determinants under the IT servitization umbrella. This section discusses the three in order to lay the groundwork for the subsequent chapters' collective analysis.

Similar to the previous section, this section considers the key determinants for IT servitization’s various forms in order to understand the determinations of IT servitization. Again, the decision to discuss the various forms rather than directly address the key determinants of IT servitization was motivated by a scarcity of literature in this field of study. The researcher believes that this approach will aid in the consolidation of literature in this area.

2.6.1. IT Outsourcing Adoption Determinants

Since the first major collaboration between Kodak Eastman and IBM in 1984, IT outsourcing has made significant progress (Jeong, Kurnia, Samson & Cullen, 2018).

While cost savings are cited as a major reason for outsourcing, they are not always the primary goal. Organisations primarily outsource so that they can focus on the core competencies that differentiate them and give them a true competitive advantage, and they pay other organisations to do the tasks that are not considered key success areas (Corbett, 2004). The following are some of the factors that may influence IT outsourcing adoption.

Quality relationship between the organisation and the service provider - In order for businesses to reap the essential benefits of IT outsourcing agreements, such as strategic, economic, and social benefits, the establishment and maintenance of a quality relationship between the organisation and the service provider is critical (Babar, Verner and Nguyen, 2007). According to empirical studies, Lacity, Khan, and Willcocks (2009) state that high-quality relationship quality between the organisation and the service provider significantly contributes to IT outsourcing success because it allows the organisation and the service provider to work closer together and toward achieving common goals associated with the outsourcing project.

Lower quality relationship levels, on the other hand, have been identified as a key cause of poor performance in IT outsourcing contracts, leading to contract failure, because poor engagement quality eventually leads to the breakdown of the organisation-service provider relationship (Babar, Verner and Nguyen, 2007). It is worth noting that, due to the subjectivity of quality relationships, there has been no agreement on what encompasses and determines them to date. Relationship quality is primarily determined by social factors that extend beyond formal and contractual agreements, making it difficult to assess and quantify (Lacity & Willcocks, 2012).

Cost savings - According to a study conducted by Lacity, Khan, and Yan (2017), cost savings are a major determinant of IT outsourcing decisions. Aside from cost, when an organisation has clear motivations driving sourcing decisions, such as the desire to improve IT and business process performance as well as the flexibility of existing services, it makes an even stronger case. The desire to gain access to the service provider's expertise, technical assets, and global markets have also been mentioned as determining factors. It should be noted, however, that before outsourcing, organisations must have clear expectations and an understanding of internal service costs, which must be equated to the cost once services are outsourced.

Organisational level uncertainty - In an empirical study, Leiblein and Miller (2003) discovered that demand uncertainty due to fluctuations tends to increase reliance on outsourcing. Similarly, Aubert, Houde, Patry, and Rivard (2012) back up the assertion, stating that organisations in sectors with a stable trend, whether downward or upward, are less likely to consider IT outsourcing than those in sectors where trends are difficult to predict and demands are difficult to anticipate. Organisations with fluctuating demands are more likely to outsource their fluctuating activities to service providers because volume fluctuations make outsourcing more appealing because an organisation is less likely to want to own excess assets.

Knowledge intensity of the organisation - When considering and assessing IT outsourcing, it is critical for an organisation to consider how closely related IT activities are to their core capabilities. Organisations in industries where information systems can provide a competitive advantage may lose innovative capacity if they relinquish control of their information systems and outsource them to a service provider (Aubert et al., 2012).

According to Udo (2000), if the services provided by IT are critical to an organisation's core operations, they should be classified as strategic services and thus important. As a result, relying on a third-party service provider to provide critical IT services that are critical to the business would be unwise. Thus, the idea is that an organisation should primarily outsource IT support services rather than those that are critical to operations.

According to Godin (2006), in this knowledge economy, organisations that are knowledge-based and heavily rely on information are more likely to keep their systems in-house and maintain them using internal IT skills. Aubert et al. (2012) also support the notion that organisations in knowledge-intensive sectors are more likely to use IT strategically than organisations in low-knowledge-intensity sectors.

Loss of control and security - It is hypothesised that whenever organisations feared losing control of their IT service or feared loss of security and intellectual property, it was discovered that they tended to choose keeping the function insourced; thus, loss of control and security is an important determinant for IT outsourcing (Lacity, Khan & Yan, 2017).

IT Governance and relational norms - Literature has repeatedly identified poor management and governance relationships between organisations and service providers as one of the primary causes of failed partnerships that do not produce expected results (e.g., Lacity et al., 2010; Kern & Willcocks, 2002). Kern and Willcocks (2002) observed that while researchers recognised relationships between organisations and service providers as a critical influencer of any outsourcing venture result. Only a few studies paid attention to it. The researchers stated that their understanding of relationships in IT outsourcing is insufficient and requested that more research be conducted.

Mutual trust relationships provide a solid foundation for the development of strong bonds between the service provider and the organisation (Lee and Kim, 2003). According to social literature, while contracts are important as a formal control mechanism in the governance between the service provider and the organisation, personal rules like trust and commitment can be used as contract substitutes. As a result, while formal IT governance is important, the relational aspect is equally important (Lioliou & Willcocks, 2019). Lacity, Khan, and Yan (2017) proposed in their most recent study that contractual governance and the length of relationships between the organisation and the vendor were important determinants of outsourcing outcomes.

Prior IT department performance and IT outsourcing experience - According to Lacity, Khan, and Yan (2017), CIOs should be aware that the past performance of the IT department will most likely influence the sourcing decision made by the organisation. Outsourcing is more likely for a low-performing IT department than for a high-performing one. The capabilities of the organisation also have an impact on the decision to outsource IT or not. Surprisingly, organisations with mature technical and methodological capabilities are more likely to outsource IT services. Another significant determinant discovered is that organisations with prior IT outsourcing experience and top management support frequently have better outcomes (Lacity, Khan & Yan, 2017).

Complexity - Complexity is defined by Aubert et al. (2012) as the degree to which the behavior of a specific process, task, or activity is frequently changing, difficult to predict, varied, and always new. In the context of outsourcing, complexity implies that activities cannot be easily described in detailed guiding principles, making governance difficult. Task complexity is also prone to unexpected problems, which can take time to resolve when they arise. As a result, complex tasks are more likely to be kept in-house and managed by internal IT personnel. Although complex tasks can be broken down and described, the difficulty in measuring them may prevent the parties involved from conducting a performance assessment, and as a result, a task or process cannot be outsourced in the absence of reliable measurement (Aubert et al., 2012).

2.6.2. Cloud Computing Adoption Determinants

It is evident that, in the recent years, cloud computing has progressed from a promising business concept to a rapidly expanding IT service model (Subashini & Kavitha, 2011). To successfully implement in an organisation, good planning, an understanding of risks, threats, vulnerabilities, and, most importantly, risk management countermeasures are required. Similarly, Bisong and Rahman (2011) and El-Gazzar (2014) agree that important factors for organisations to consider before adopting this IT service model include analysing internal and external factors as well as available countermeasures, as discussed below.

Internal factors, according to El-Gazzar (2014), are those that comprise the characteristics and capabilities of the organisation, which in turn affect its cloud computing adoption efforts, and they are listed next.

Willingness to invest - Willingness can be influenced by social pressures such as subjective norms, where managers can position cloud computing as a good thing to adopt, as well as the desire to elevate the organisation's status within its social system (Opitz, Langkau, Schmidt & Kolbe, 2012).

Top management - Top management's innovativeness and IT knowledge, competence, and capability of providing appropriate direction and a favourable climate for cloud computing adoption are invaluable. Their support in terms of budget, time, human, and IT resources is critical to cloud computing adoption. Their knowledge and understanding of cloud computing and its architecture, service models, organisational and strategic values, and aligning IT decisions with business strategies, as well as evaluating the readiness of existing IT infrastructure, IT knowledge, organisational culture, and human resource skills. Top management decisions on cloud computing adoption strategy, as well as cloud computing evaluation, integration, and implementation with the guidance of external regulatory and professional bodies, are equally important (El-Gazzar, 2014).

Firm size - Alshamaila, Papagiannidis and Stamati (2013), report that large organisations are more likely to perform a proof concept of cloud computing services first whereas, small and medium enterprises are more likely to be flexible in their adoption of cloud computing. A conceptual article stated that small and medium enterprises are more likely concerned about prices and less concerned about performance, while large organisations tend to balance costs against service reliability, security concerns and performance (Kushida, Murray & Zysman, 2011).

Organisational culture - According to El-Gazzar (2014), an adjustment in the way staff and management think is necessary. Organisations that are accustomed to having complete control over their on-premise data may find it difficult to embrace the alternative method of data control in which the cloud provider has complete control over the organisation's data. As a result, enterprises would need to ensure that cloud computing solutions adhere to internal corporate policies as well as external legal regulations and standards.

Employees' IT skills - Non-IT employees are thought to be a deciding factor in cloud computing adoption. Their knowledge of cloud computing is critical (El-Gazzar, 2014). Similarly, IT employees' skills would need to evolve in order for them to effectively use cloud solutions (Morgan & Conboy, 2013). Another important factor to consider when deciding whether to adopt cloud computing is the organisation's prior experience and familiarity with similar IT service models and technologies, such as virtualization (Alshamaila, Papagiannidis & Stamati, 2013).

El-Gazzar (2014) defines *external factors* as "outside factors from the social environment in which the organisation operates that influence its cloud computing adoption processes and endeavors". The following section will go over the external factors.

Government regulations - There is no consistency in international government regulations governing cloud computing. As a result, there is cause for concern because no widely agreed-upon data privacy policy exists among all governments in various countries. Some countries restrict organisations from storing data in cloud infrastructure unless it is within their national borders (Jensen, Schwenk, Bohli, Gruschka & Iacono, 2011; Kushida, Murray & Zysman, 2011).

IT industry standards institutes- IT industry standards institutes deal with the security and interoperability of cloud solutions in organisations (El-Gazzar, 2014). Although there is still much work to be done in order to develop standards. Some security standards, such as the Cloud Security Alliance's Security Guidance for Critical Areas of Focus in Cloud Computing, are available for managing cloud computing risks (Mcgeogh & Donnellan, 2013).

Cloud provider - Under regulations like the one mentioned above, cloud providers would be required to comply with government regulations and industrial standards in order to gain reputation and trustworthiness among their potential and current enterprise users, as well as be liable (Bhat, 2013). Furthermore, cloud provider demonstrations of successful business cases and models are more likely to increase cloud computing adoption rates and the attractiveness of the model for organisations seeking to adopt (Lin & Chen, 2012; Alshamaila & Papagiannidis, 2013).

Business partners - Perceived benefits by business partners have consistently emerged as an important factor in cloud computing adoption (Low, Chen & Wu, 2011; Lin & Chen, 2012). According to Cegielski, Jones-Farmer, Wu, and Hazen (2012), some business partners may even require an organisation to adopt cloud computing in order for them to continue providing support and collaboration. Also, competitors play an important role in providing incentives for organisations to adopt cloud computing for reasons such as increased market visibility, operational efficiency, and new market opportunities (Borgman, Bahli, Heier & Schewski, 2013; Espadanal & Oliveira, 2012).

Cloud service brokers or service integrators - El-Gazzar (2014) observes a scarcity of studies that investigate the critical role of cloud service brokers. The role of the cloud service broker is to achieve a predictable comprehensive service outcome for organisations that use the services of the cloud service provider. This is accomplished by forecasting, quantifying, and sustaining cloud service outcomes against expectations using service management standards. Early literature suggests that IT Infrastructure Library (ITIL) provided service management tools for cloud service brokers, though it was not mature enough at the time (Bellamy, 2013). Cloud computing, with its innovative IT service model, has the potential to add value to organisations, and the preceding section discussed the factors or determinants that organisations should be aware of if they are considering adopting cloud computing.

2.6.3. Virtualization Adoption Determinants

The empirical study by Liu, Sia, and Wei (2008) into the adoption of organisational virtualization in B2B firms discovered that institutional forces, pressures from associates and similar organisations, and advertising initiatives have an effect on increasing the organisation's intent to adopt virtualization. This is in addition to the savings that organisations hope to achieve by reducing hardware and becoming more energy-efficient, as discussed in the virtualization opportunities section.

2.7. Chapter summary

This chapter reviewed the scholarship in the servitization research area. It was observed that IT servitization literature is pervasive but somewhat ambiguous due to the various forms in which it manifests. This section consolidated the various perspectives and forms of IT servitization, as well as their adoption, in an effort to contribute to the literature in this area. Essentially, the surveyed scholarship was used to highlight contributions and identify gaps in current knowledge, thus justifying the research questions.

Although it is difficult to claim completeness for any review of literature, this chapter aimed to be as comprehensive as possible in the coverage of the literature in the criteria identified and to place this study within the context of existing literature to understand why this area of research is significant.

The next chapter discusses the three theoretical perspectives used as lenses to examine IT servitization adoption, as well as the rationale for the lenses chosen. The research model and associated hypotheses are also presented and discussed, followed by constructions that are operationalised in the same chapter.

CHAPTER 3

THEORETICAL FRAMEWORKS AND THE RESEARCH MODEL

3.1. Introduction

The previous chapter surveyed the scholarship in the field of study. The overview, concepts, and evolution of servitization were discussed, as well as the various forms it presents itself in the IS discipline. A systematic review protocol of existing literature was followed by a discussion of the opportunities, challenges, and key determinants influencing IT servitization adoption.

This chapter discusses the theoretical perspectives used as lenses for this study, namely the Technology, Organisation, and Environment (TOE) framework, Institutional theory, and Process Virtualization theory (PVT), as well as their limitations and justification. The integration of the Institutional theory to analyse institutional pressures in the environmental context and PVT to analyse the technological context are incorporated into the well-established theoretical lens of TOE framework to understand why IT servitization is adopted with difficulty in South African SOEs are also presented. This chapter also discusses the research model, its associated hypotheses, and construct operationalisation.

3.2. Theoretical Underpinnings of the Research Model

In IS studies, underpinning theories are frequently referred to as theories used for social context comprehension (Gregor, 2002). The goal of the underlying theories is to explain how and why things happen the way they do, and to incorporate both technical and social contexts of the phenomena under study. This has the following advantages: a) Helping with the unearthing of dependencies and relationships which exist in an environment among actors; b) Providing guidance for interpreting empirical data that has been gathered within a context over time; c) Creating awareness of social events, processes and activities that exist in the development, implementation and practice of IT and IS; d)

Reducing the gap of assumptions and predictive actions within a specific context (Mkhomazi& Iyamu, 2013).

Additionally, according to Mkhomazi and Iyamu (2013), although theories are important in IS research, it has never been easy to select a theory or combination of theories to underpin a study and this is attributed to factors such as, difficulty in understanding. The majority of theories used in the IS field originate from sociology discipline and this makes it difficult for IS researchers to understand their contexts and focus as was intended in their original discipline. Knowledge and familiarity - once some IS researchers have a good understanding of a theory, they tend to apply it to all of their research. Application - many IS researchers struggle with how to apply social-technical theories, and even experienced IS researchers who appear to understand certain theories struggle with application. Differentiation – some social theories have too many similarities in their focus areas and attention, which causes IS researchers to become confused.

With the aforementioned challenges in mind, how can one answer the critical question: what theory can be used to underpin the IS study? The decision is primarily influenced by the research objectives. Although there is no specific formula for selecting a theory or combination of theories, an understanding of various theories is necessary for the researcher to make an appropriate choice (Mkhomazi & Iyamu, 2013). Multiple theories were examined for this study, and useful theories were chosen based on the research objectives. The research objectives were examined first, followed by an examination of IS theories. The goal of this examining process was to determine which theories should best drive the study's goal and guide the researcher with the lenses through which the constructs were studied.

3.2.1. Theory Triangulation

Triangulation is the use of complementary theories, methods, data, or investigators in research to compensate for any bias or distortion caused by using a single method or theory. Triangulation was originally thought to be a validation instrument, but it is now thought to be a methodological technique that results in a more comprehensive and in-depth understanding of the research issue (Flick, 2002).

It should be noted that there is currently no single theory of innovation adoption, and it appears that the chances of a definitive one emerging are also remote, but researchers have been employing several theories to explain determinants in various contexts of IT adoption (Hameed, Counsell & Swift, 2012). Furthermore, researchers have argued that having a single theory that covers all forms of innovation is not possible because innovations are not the same. As a result, it is unlikely that a single theoretical explanation could provide an understanding of the adoption and diffusion of all types of innovations (Baker, 2012).

As a result of the foregoing, multiple lenses are required to comprehend the adoption of an innovation. Hence, theory triangulation is used to bring the three theoretical perspectives together in order to investigate, explain, and facilitate understanding of the factors that influence the adoption of IT servitization in South African SOEs.

In IS research there are many theories that are used (Wade & Hulland, 2004), but the current study will develop and triangulate on the Technology, Organisation, and Environment (TOE) framework developed by Tornatzky and Fleischer (1990), the Institutional theory developed by DiMaggio and Powell (2000), and the Process Virtualization theory developed by Overby (2008).

The chosen theories were primarily informed by research objectives and have empirical support in IS research, providing the researcher with a rigorous foundation for integrating multiple adoption perspectives. The justification for each theoretical lens choice is explained in greater detail in the following three sections, where each theory is discussed in depth.

3.3. Technology, Organisation and Environment (TOE) Framework

Tornatzky and Fleischer (1990) created the TOE framework to study organisational adoption of technological innovation. The framework's main goal is to identify technology, organisational, and environmental factors that influence IT innovation adoption in organisations (Clohessy, Acton & Rogers, 2019).

According to the TOE framework, there are three distinct environmental contexts that influence adoption decisions (Baker, 2012). The framework provides a useful analytics framework that could be used to study the adoption and integration of various types of IT innovations (Oliveira & Martins, 2010). TOE defines three broad categories that influence innovation adoption and implementation: technological, organisational, and environmental contexts (Tornatzky & Fleischer, 1990).

The technological context denotes characteristics of internal and external technologies that are already in use in the organisation, as well as those that are available but not currently in use. The term "organisational context" refers to factors such as firm size, organisational resources, top management structure and strategic behaviour, and communication (Baker, 2012).

The environmental context refers to the characteristics of the industry, the competitors of the organisation, and government regulation (Tornatzky & Fleischer, 1990; Low, Chen & Wu, 2011; Bose & Luo, 2011). The three contexts present both opportunities and constraints for the adoption of technological innovation (Tornatzky & Fleischer, 1990).

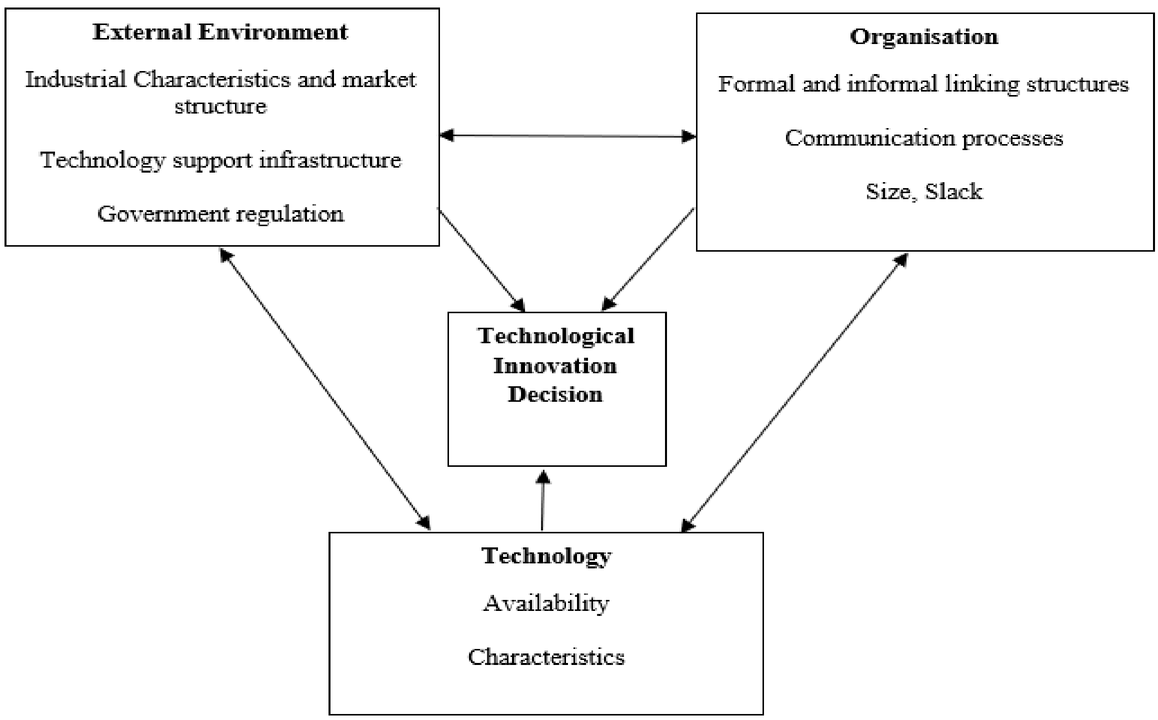

Figure 3.1: Technology, Organisation and Environment Framework (Tornatzky & Fleischer, 1990)

TOE framework has emerged as a useful theoretical framework for understanding IT adoption, according to Zhu, Kraemer, Xu, and Dedrick (2004). The framework has been frequently used to understand new innovation adoptions such as e-business using a case study of the Western Balkan Peninsula (Ilin, Ivetić & Simić, 2017), business intelligence system by understanding the determinants of business intelligence system adoption stages by SMEs (Puklavec, Oliveira & Popovič, 2018), blockchain adoption by examining Technological, organisational and environmental considerations (Clohessy, Acton & Rogers, 2019), interchange of electronic data by studying perception-based model for edi adoption in small businesses using a TOE framework (Kuan & Chau, 2001), electronic procurement where the determinants of e-procurement adoption in Chinese manufacturing enterprises were investigated (Li, 2008), and understanding Customer Relationship Management (CRM) adoption stages by empirical analysis building on the TOE framework (Cruz-Jesus, Pinheiro & Oliveira, 2019). This model's adaptability and effectiveness have been demonstrated by (e.g., Pan & Jang, 2008; Srivastava & Teo, 2010; Abrahams, Ophoff & Mwalemba, 2015).

3.3.1. Limitations of the TOE framework

One of the shortcomings identified by Dwivedi, Wade, and Schneberger (2011) is the absence of evolution, improvement, and change in the TOE framework since its inception. The other limitation of the TOE framework is highlighted by Aboelmaged (2014), Ismail and Ali (2013), Ven and Verelst (2011). They contend that the theory does not provide an actual set of factors influencing technology adoption, but rather provides taxonomies within the contexts in which the adoption process occurs. As a result, in the current study, additional lenses were used to identify constructs that influence technology adoption.

Another criticism is that the TOE framework assumes a proper match between an organisation's internal and external factors, which is not always the case during the adoption process (Arpaci, Yardimci, Ozkan & Turetken, 2012). The researcher was aware of these limitations, so in this study, additional two lenses were used to enhance TOE.

3.3.2. Justification for using TOE framework

Assessing the adoption determinants of innovations is an important organisational requirement for developing and keeping abreast of demands in the market and directions of where the technology world is heading. This study seeks to develop an integrated theoretical and practical model for IT servitization adoption in the context of South African SOEs and TOE framework has a solid base needed to drive and guide the study to examine the determinants that affect IT servitization adoption in SOEs. Recognising the significance of the three distinct contexts that influence innovation adoption in organisations, the framework served as a useful lens through which the determinants could be explored and explained.

According to Oliveira and Martins (2010), the TOE framework has a strong theoretical foundation and has consistently received practical support, implying that it has the potential to be applied to IS adoption studies. Dwivedi, Wade, and Schneberger (2011) add that as long as there is a need to understand adoption in organisations as a result of new technologies and innovations that are developed and continue to be introduced, and new adoption contexts can be identified, TOE will continue to have some significance. That is, as long as the TOE framework continues to provide information to those who require it, it will remain relevant. As a result, it was chosen for this study.

3.4. Institutional Theory

Institutional theory suggests that, the isomorphic pressures to which organisations are subject encourage them to adopt similar structures and practices, causing them to become similar or isomorphic (DiMaggio & Powell, 2000). In research, institutional theory has gained popularity for analysing the diffusion of organisational practices (e.g., Damanpour & Schneider, 2006; Trope, 2014; Sharma & Daniel, 2016; Awa, 2018).

DiMaggio and Powell (2000) explain that, the institutional environment can influence the development of formal structures in an organisation even more strongly than external market forces. The institutional environment legitimises innovation structures that advance technical efficiencies in early adopter organisations. When these innovations reach the point where they are finally legitimised, that is, when failure to adopt them is seen as illogical and careless, and they even become legal requirements. According to institutional theory, new and existing organisations will adopt those innovations even if there is little or no improvement in their technical efficiencies (Kung, Cegielski & Kung, 2013).

Coercive, mimetic, and normative pressures are identified as the three pressure forms by institutional theory (DiMaggio & Powell, 2000). Coercive pressures are those that put organisations under pressure to adopt similar structures and practices. According to Teo, Wei, and Benbasat (2003), coercion can be informal or formal. Cultural expectations in the society in which organisations operate, as well as other organisations on which they rely, exert this coercion.

Mimetic pressure is caused by uncertainty. When technological change is too rapid and the organisation's technological goals are not fully understood, organisations will imitate others. Because of the uncertainty in the environment, organisations that appear to be successful or legitimate are imitated (DiMaggio &Powell, 2000); Scott, 2007; Sharma & Daniel, 2016).

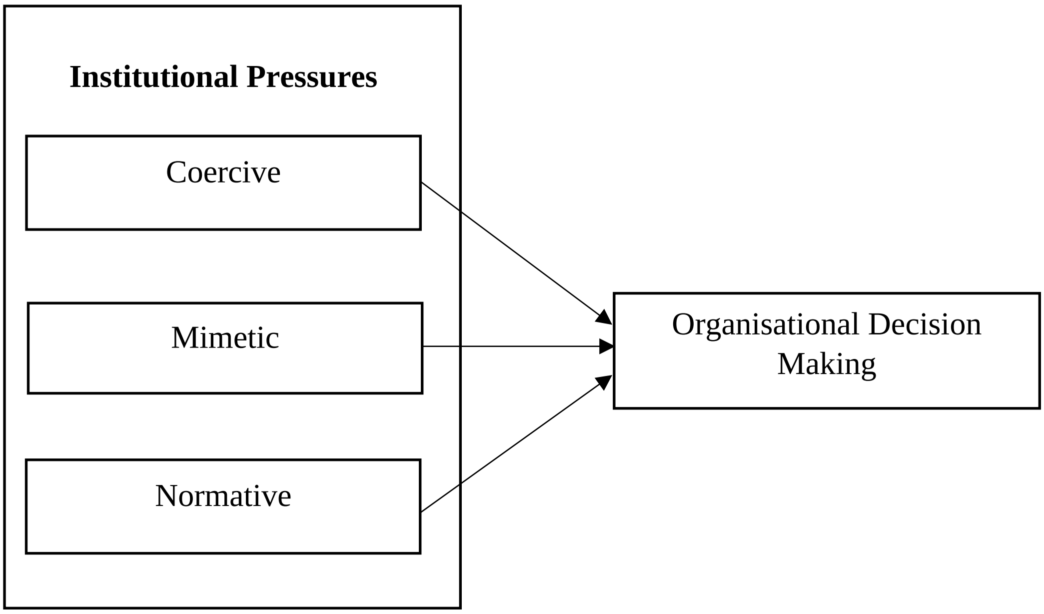

Figure 3.2: Institutional Theory (DiMaggio & Powell, 2000)

Normative pressures arise largely from professionalisation, when professionals in an occupation outline the methods and conditions of their work in their functional fields through professional networks, formal educational programs and training as well as trade associations (Nicholson & Sahay, 2009; Jeyaraj & Sabherwal, 2008; Currie, 2009). Normative pressures are also generated by the industry's standardization of job titles and roles, as well as the centralization of IT (Pearson & Keller, 2009).

Table 3.1 summarises the three pressures that arise from different institutions in the environment, which are at the heart of DiMaggio and Powell's (2000) institutional theory. The table is a good starting point for understanding these three pressures and their similarities and differences.

Table 3.1: Overview of DiMaggio and Powell's institutional pressures (Krell, Matook & Rohde, 2016).

	Coercive pressure	**Mimetic pressure**	**Normative pressure**
Origin of the Pressure	*Power differences:* Institutions in an enterprise's environment indirectly or directly request that the enterprise participate in certain actions. The organisations are influential enough to reward or sanction or the enterprise's actions.	*Uncertainty:* The enterprise has inadequat information to answer a problem. The enterprise sees that organisations in the environment have successful resolved similar difficulties.	*Promotion of norms:* Institutions in the firm's environment define and promote norms but do not directly sanction compliance or noncompliance.
Firm's actions in response to the pressure	Approximation of sanctions an rewards Approximation of the organisation's capability to loo out for compliance Approximation of the costs of compliance Approximation of how far compliance is desirable Initiation of actions required to achieve compliance	Observation of behaviours by other organisations in the environment Observation/approximation how successful the behaviou have been Estimation of how successful the behaviour cou be in the firm Mimicry of the behaviour that seems suitable for the firm	Estimation of positive and negative compliance consequences Estimation of the compliance costs Estimation of how far compliance is necessary Initiation of actions needed to attain compliance
Achieving legitimacy	Complying with the legal or interfirm request	Imitating a behaviour that is considered acceptable in the organisational environment	Identifying and complying with the norm
Examples	Enterprise conforming with legal regulations stipulated by governmental agencies	Enterprise implements an EF system based on observation that other enterprise successfully utilises their ER systems to improve time to market	Enterprise complying with norms defined by the Institution for Standardisation (ISO)

3.4.1. Limitations of the Institutional Theory

According to Currie (2009), using institutional theory in IS research introduces limitations or problems. First, the use of social theories such as institutional theory is occurring because the IS field is regarded as a new discipline with few theories of its own. This raises concerns because social theories are used by researchers to explain complex social, organisational, and technical issues. To address this limitation, institutional theory is combined with TOE, which is widely used in the field of information systems research, to study innovation adoption.

Second, institutional theory process studies typically investigate the cause and effect relationships between IT-related constructs such as intention, adoption, implementation, and assimilation without taking into account broader environmental factors (Currie, 2009). To avoid this theoretical and empirical oversight, the current study will include other environmental constructs incorporated from the TOE theory.

Currie (2009) further adds that, the use of institutional theory in IS research is sometimes presented in a fragmented manner, with variables selected and de-selected haphazardly. Similarly, institutional theory is used that way at times, and it can be difficult to see how theory concepts relate to the case study or narrative being told. To avoid fragmentation of constructs, all three institutional pressures will be examined in this study.

3.4.2. Justification for using Institutional Theory

Institutional theory has grown in popularity and power for explaining the actions of both individuals and collective actors, as well as organisational phenomena, in modern society (Cai & Mehari, 2015). In this study, the TOE framework was further enriched by using concepts and models from institutional theory, namely coercive, mimetic, and normative pressures, to examine industry characteristics, organisation's competitors, and government regulation within which South African SOEs operate, in order to holistically understand the environmental context. The impact of government directives, laws, and regulations on SOEs, as well as technology market forces, norms, and external parties that formally and informally influence SOEs to adopt IT servitization, were investigated.

In terms of previous use of the combination of these two lenses, there are numerous previous studies that combine TOE framework with the Institutional theory, such as (Gibbs and Kraemer, 2004, Li, 2008; Soares-Aguiar & Palma-Dos-Reis, 2008; Martins, Oliveira & Thomas, 2016; Tomás, Thomas & Oliveira, 2018), and as such, the choice to use institutional pressures from the institutional theory to enrich the environmental context of the TOE framework was justified because it covers the external factors comprehensively.

3.5. Process Virtualization Theory

Process virtualization has long piqued the interest of information security researchers (Overby, 2008; Dwivedi, Wade & Schneberger, 2011). Overby (2008) developed process virtualization theory (PVT) on the premise that certain processes are better suited to being carried out in virtual environments than others. The book shopping process, for example, has proven to be suitable for virtualization, whereas the food shopping process has not. That is, not all processes are equally virtualizable. PVT seeks to explain this variation and determine whether a process is more suitable for execution in a virtual environment, also known as process amenability (Overby, 2008).

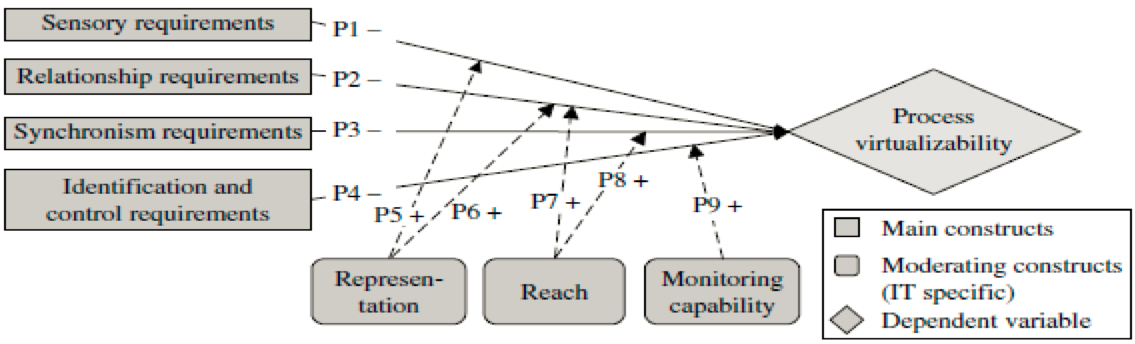

Figure 3.3: Process Virtualization Theory (Overby, 2008)

PVT proposes four major independent variables of the virtualization process. Sensory requirements, relationship requirements, synchronism requirements, and identification and control requirements are the variables. According to the theory, these four requirements have a negative relationship with process virtualizability, which means that if these four requirements are high, the process will be more difficult to virtualize than if they are low. Sensory requirements refer to the requirement of process participants to be able to enjoy a full sensory experience of the said process. Relationship requirements refer to the ability of process participants to interact with one another in either a social or professional context.

Synchronism requirements refer to the degree to which the process activities are required instantaneously with only a slight delay. Synchronism normally occurs freely in a physical process because participants are all in the same space and can thus interact with minimal delay, as opposed to virtual processes, which frequently take place where participants are not in the same place and thus introduce slowness into the process. Identification and control requirement is the degree to which other process participants must be identified and their behaviour must be controlled, as virtual processes are prone to identity spoofing issues because physical inspection of participants cannot be confirmed (Overby, 2008).

The theory also proposes three characteristics of IT virtualization mechanisms. The three moderating constructs are IT enabled and assist the four mentioned independent variables in positively influencing the process's virtualizability. Moderating factors include representation, reach, and monitoring capability. Representation refers to IT's ability to present information in order to simulate objects, environments, and people similar to those found in the physical world, where process participants interact. Reach refers to the IT capacity of allowing the interaction of process participants who are physically distant from one another at the same time and promoting the relationship between them across both space and time. Monitoring refers to IT's capacity to uniquely identify and authenticate process participants while also tracking activity (Overby, 2008, 2012).

Dwivedi, Wade, and Schneberger (2011) highlight the newness and breadth of PVT, which is applicable to multiple domains, and advise researchers to identify the process they are interested in, a suitable context, and a sample, before developing suitable constructs measurement and conducting a survey. PVT enables the researcher to tailor the items to their area of interest rather than having to apply the entire constructs set and relationships in order to use the theory for a specific research inquiry (Overby, 2008; Dwivedi, Wade & Schneberger, 2011). Furthermore, Overby (2008) asserts that PVT is not intended to determine whether a virtual process is better or worse than a physical process, or whether the inclusion of IT in a virtual process is good or bad.

Overall, the sensory, relationship, synchronism, and finally, identification and control requirements of PVT apply to process virtualization whether the process is IT based or not, but if the process is IT based, the moderating constructs facilitate integration into the virtual process. The use of representation, reach, and monitoring capability constructs is primarily intended to guide practitioners in determining whether IT can help satisfy the virtual process requirement (Overby, 2008).

It should be noted that process virtualizability is a critical variable in PVT. It is the dependent variable that describes the success of process virtualization and enables investigators to assess whether a process can be migrated from a physical to a virtual environment successfully. PVT suggest that if a process is successfully virtualized, it should thus be adopted over time and become an improved version of the original physical process. (Overby, 2008, 2012).

When applying the theory to a specific research question, PVT allows researchers to tailor the items to their area of interest rather than using the entire set of constructs and relationships (Overby, 2008; Dwivedi, Wade & Schneberger, 2011). The tailoring of the items to the current area of interest has been implemented in this study. The three IT specific moderating constructs were not studied in depth because IT servitization is none other than an IT based process. Second, because the study is not limited to a single virtualizable process, such as SaaS or electronic banking but to IT servitization in its many forms, therefore the need to incorporate the moderating constructs does not address any of the objectives.

3.5.1. Limitations of the Process Virtualization Theory

According to Balci (2014), the migration of processes from physical to virtual environments is a constant feature of the information age we live in, and it continues to provide significant advancements for organisations and individual users of technology. Despite this, there are still gaps and flaws in the theoretical lens, PVT. The limitations are that this research area is still relatively new, and rigorous study of the subject has only recently begun. Second, there is a scarcity of literature in this field. As a result, more empirical studies of PVT are not only necessary but also important for the development of this IS research area, but this is currently a limitation (Balci, Grgecic & Rosenkranz, 2013; Balci, 2014).

3.5.2. Justification for using Process Virtualization Theory

Overby (2008) established the foundation of PVT by introducing a model for process virtualization with the rationale that some processes are better suited to becoming virtualized than others (Overby, 2008, 2012). The rationale for IT servitization adoption in South African SOEs is investigated in this study. Recognising the importance of technology in the TOE framework, process virtualizability and its influence are investigated using the variables provided by this model to guide the current study by investigating the amenability of the IT servitization adoption process. The examination of technical and individual factors enabling or constraining a process's virtualizability was carried out through the lens of PVT.

Due to globalisation and the increased use of new innovations around the world, a growing number of processes and services are being virtualized (Balci, 2014). IT processes and services are no exception, which is why IT servitization has emerged. In this study, the technological context of TOE was augmented by introducing variables from PVT in order to holistically understand the technological context and not just examine availability and characteristics constructs from the original framework. Overby (2008) defines the variables as process characteristics, which include sensory requirements, relationship requirements, synchronism requirements, and identification and control requirements. These were used in order to investigate their influence on IT servitization adoption from an individual's perspective within an SOE.

The use of PVT has advanced into a mainstream research (Balci, 2014). In terms of previous use, PVT has been used in several studies including studies to understand why people reject or use virtual processes (Balci, Grgecic & Rosenkranz, 2013), adoption of SaaS (Tomás, Thomas & Oliveira, 2018), as well as understanding process digitisation in retail banking (Graupner & Maedche, 2015). The integration of the PVT constructs to the TOE technological context have been used in studies such as (Bose & Luo, 2011; Thomas, Costa & Oliveira, 2016; Tomás, Thomas & Oliveira, 2018). The aim of integrating the PVT into TOE in this study is not to criticise the TOE framework, but rather to provide a more integrated theoretical foundation provided by multiple perspectives.

3.6. Summary of the selected theoretical lenses

It is important to note that, while the three theoretical lenses are frequently used for studying adoption at the organisational level of analysis. Individuals are the unit of analysis in this case. This study used these commonly adoption theories as lenses because the individuals' views and experiences are premised and informed by the SOEs as the context. Table 3.2 below summarises the theoretical lenses used in this study.

Table 3.2: Summary of theoretical perspectives informing the research model.

IS Theory	Dependent Variable	Independent Variable	Short Description
Technology, Organisation & Environment (TOE)	A process by which an organisation recognises a need for, searches for, decides and adopts a technological innovation	Technological, Organisational and Environmental contexts	Includes available technologies of an organisation as well as the support structure Formal and informal linking structures Communication processes, size and slack of an organisation Industry characteristics, market structure and government regulation
Institutional Theory	A process by which organisation within a particular field or industry increasingly becoming similar as result of institutional isomorphism	Coercive pressures Mimetic pressures Normative pressures	External pressures that organisations are exposed to encourage them to adopt similar structures and practices and become similar
Process Virtualization Theory (PVT)	A process by which an organisation predicts whether a process is amenable to being executed in a virtual environment	Sensory requirements Relationship requirements Synchronism requirements Identification and control requirements	Process participants' ability to fully enjoy the process sensory experience Participants' ability to have an interaction with one another The extent to which process activities may speedily happen with minimal delay The ability to exert control and the extent to which the process requires participants' unique identification

3.7. Hypotheses and the Research Model

Adoption behaviour has received attention in IS research and has been investigated using a variety of IS theoretical foundations (Benlian, Hess & Buxmann, 2009). The integrative research model depicted in figure 3.4 is proposed in the study. Based on the studies discussed in the previous section, this study suggests that IT servitization adoption is a dependent variable.

The study incorporates the technological, organisational and environmental contexts from the well-established theoretical lens of TOE framework. The study integrates the Institutional theory to analyse institutional pressures in the environmental context and PVT to analyse the technological context. These factors, when considered together, are regarded as important determinants influencing the adoption of IT servitization.

The recent study by Tomás, Thomas, and Oliveira (2018) demonstrated the importance of combining the three theoretical perspectives for the study of IT adoption at the organisational level. According to the literature in the IS field, combining the TOE framework and Institutional theory provides depth to the TOE framework's environmental context (Oliveira & Martins, 2011; Martins, Oliveira & Thomas, 2016).

Similarly, combining the TOE framework and PVT provides more insight into the technological context by analysing the amenability of the technology process to being executed virtually (Bose & Luo, 2011; Thomas, Costa, & Oliveira, 2016; Tomás, Thomas, & Oliveira, 2018).

Combined, TOE framework, Institutional theory and PVT are adopted in this study to understand the key determinants that influence IT servitization adoption in South African SOEs. The research model (shown in Figure 3.4) is a function of technological contexts (sensory requirements, relationship requirements, synchronism requirements, identification and control requirements), organisational context (firm size and top management support) and environmental context (coercive, mimetic and normative pressures). The next section provides variables in the research model and hypotheses in detail.

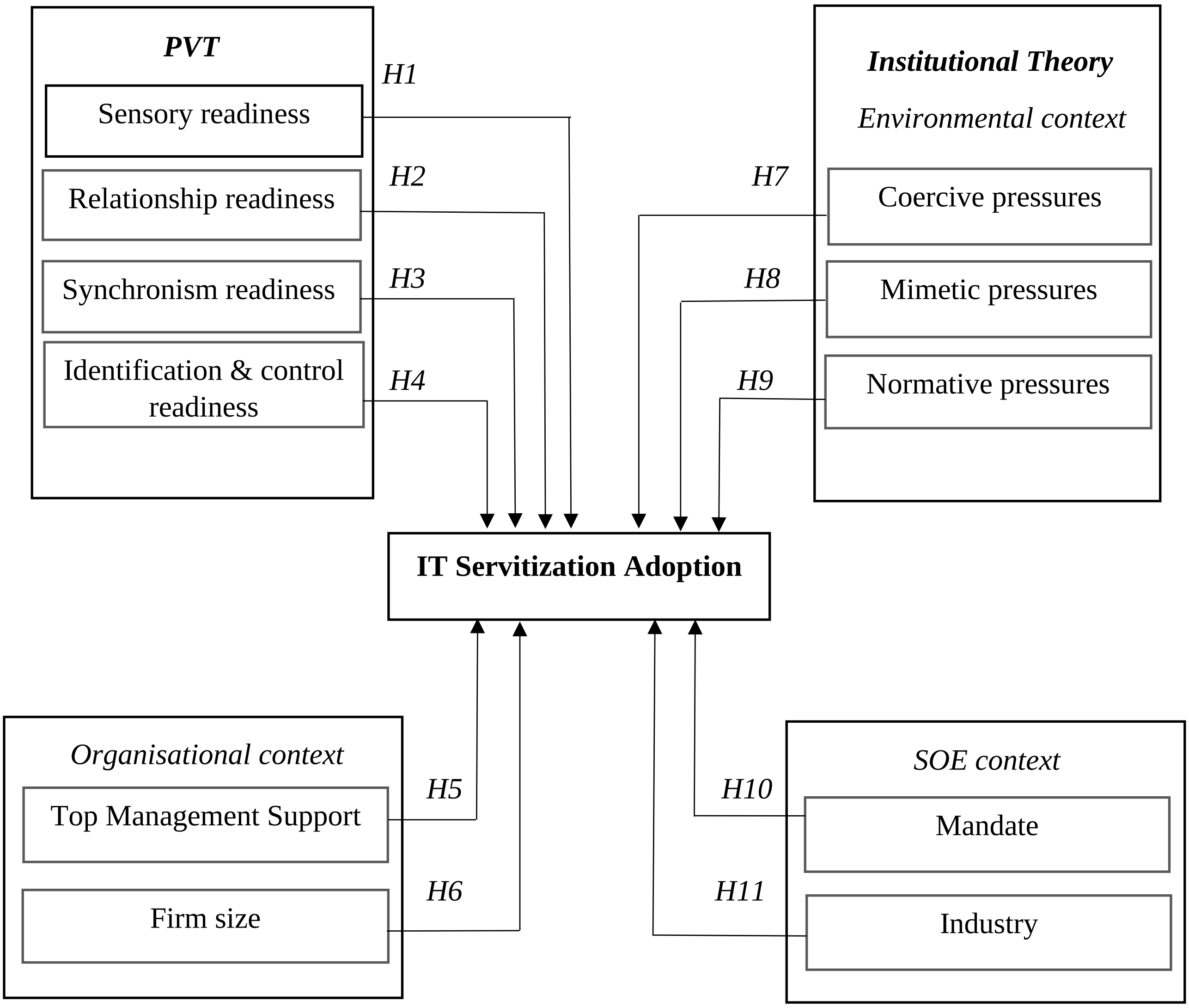

Figure 3.4: The Research model

3.8.1. The Technological Context

The availability of technologies in the organisation, such as IT infrastructure and IT professionals, defines the technological context (Zhu & Kraemer, 2005). The term "IT infrastructure" refers to the installed technologies, systems, and platforms that can be matched or replaced by a new technology (Oliveira, Thomas & Espadanal, 2014; Ngai, Cheng, Au & Lai, 2007).

Within the technological context, the first construct proposed to influence organisations to adopt IT servitization is sensory readiness. Sensory readiness is defined as the degree to which participants can enjoy a full sensory experience of the virtualized process that is comparable to the physical process (Overby, 2008, 2012). According to Srivastava, Vishnoi, and Srivastava (2016), the sensory requirement for a process should be minimal in order for it to be virtualized favourably. According to Overby (2008), the senses of sight and sound are now widely incorporated into IT virtual processes. As a result, virtualization of IT-enabled business methods provides sensory function variety to process participants. For example, organisations may host their electronic mail communication in the cloud, such as Microsoft Office 365, while still providing users with the same sensory experience as a locally hosted mailbox. Overby (2008) posit that by enabling participants to like the interaction experience of the process and the other process objects, the sensory readiness competence of the technological context has a positive influence on process virtualization (Overby, 2008) and thus IT servitization adoption. Therefore,

H1. *Sensory readiness positively influences the adoption of IT servitization.*

Relationship readiness is defined as the degree to which the need for professional interaction amongst process participants is enabled. This states the requirement for participants of the process to relate with each another in a professionally, e.g., through LinkedIn and connect participants with similar interests in order to build professional relationships with one another (Bose & Luo, 2011). It is possible to establish relationship requirements while conducting a virtual process; such interaction can result in knowledge acquisition, trust, and friendship development (Bose & Luo, 2011; Overby, 2008).

Thomas, Costa and Oliveira (2016) suggest that virtual settings allow operators to have interaction capabilities through modes such as instant messaging, email, video chat, and so on, and communicate using gestures and communicate emotions in the same way that physical interactions do (Bose & Luo, 2011; Hitch, Hortacsu & Ariely, 2010). According to Srivastava, Vishnoi and Srivastava (2016), for a process to be virtualized favourably, the relationship requirement should be minimal. By enabling process participation virtually regardless of location and time, the relationship readiness ability influences process virtualization positively (Bose and Luo, 2011; Overby, 2008) and thus IT servitization adoption. Therefore,

H2. *Relationship readiness positively influences the adoption of IT servitization.*

Synchronism readiness is defined as the degree to which the activities that make up a process must occur as quickly as possible with as little delay as possible (Bose & Luo, 2011). In the technological context, synchronous participation is also critical. According to Srivastava, Vishnoi and Srivastava (2016), for a process to be virtualized favourably, the synchronism requirement should be minimal. Physical processes are very synchronous in nature. This is because physical process participants interact with one another with little to no delay because they are all in the same physical space (Overby, 2008).

IT enabled process virtualization is also able to enable multiple participants, regardless of physical location to participate in a process synchronously. Existing technologies such as instant messaging which has features such characteristics as presence awareness, video conferencing, multi-party collaboration and event notification can facilitate live communication amongst participants and multi-way connection to a virtual process where participants can instantly communicate despite being in different locations (Thomas, Costa and Oliveira, 2016). Therefore, synchronism readiness of the technological context influences process virtualization positively (Overby, 2008) and thus IT servitization adoption. Therefore,

H3. *Synchronism readiness positively influences the adoption of IT servitization.*

Identification and control readiness is defined as the degree to which the process requires unique identification of process participants and provides the ability to exert control over participants and influence their behaviour (Overby, 2008). According to Srivastava, Vishnoi, and Srivastava (2016), the requirement for identification and control has a negative impact on virtual processes because it introduces threats such as hacking and identity spoofing, which may result in unauthorised access to a virtual process.

According to relationship development research, knowing the identity of the other party is critical when developing a relationship (Dombrowski, LeMasney, Ahia, Dickson, 2004). The virtualization of relationship development processes increases the possibility of people hiding their identities, which may make it difficult to identify the other process participants (Bose & Luo, 2011). When creating process relationships in a physical process for an organisational setting, the likelihood of participant anonymity is minimal.

While virtualization allows participants to conceal their identities, sophisticated advancements in identification administration technology, such as biometrics and password verification, allow process participants to be accurately identified. Furthermore, it is possible to track and monitor participants' virtual behaviour and actions, as well as analyse them in an automated and systematic manner (Bose & Luo, 2011). Thus, the identification and control readiness influences process virtualization positively (Overby, 2008) and thus IT servitization adoption. Therefore,

H4. *Identification and control readiness influence the adoption of IT servitization positively*.

3.8.2. The Organisational Context

The organisational context denotes the resources available to support the adoption of technological innovation (Lippert & Govindarajulu, 2006). Centralisation level, power and control distribution, information links, availability of slack resources, communication structure, firm size, and top management support all have an impact on the relationship between organisational structure and innovation adoption (Tornatzky & Fleischer, 1990; Lippert & Govindarajulu, 2006). Previous research for technology adoption, such as cloud computing, suggests that top management support and firm size are the most important factors (Low, Chen & Wu, 2011).

Top management support is critical for creating a supportive environment and allocating adequate resources for the adoption of new technologies (Lin & Lee, 2005; Wang, Wang & Yang, 2010). A successful adoption of a new technology is more likely to be accepted by employees and subsequently integrated into the business of an organisation if employees understand the benefits of its use and have the support of their superiors. Equally important, top management support may be required to ensure the commitment of resources and their incorporation into an organisational climate conducive to successful adoption (Ilin, Iveti, & Simi, 2017).

As technology becomes more complex, top management can provide a vision and commitment to foster an environment conducive to innovation (Lee & Kim, 2007) and create an atmosphere of idea sharing (McGowan & Madey, 1998). Previous research has found that there is a positive relationship between top management support and adoption of new technologies (Pan & Jang, 2008; Zhu et al., 2004). Literature identifies champion support at the level of top management who recognises the potential outcome (Meyer, 2000) is an important factor that positively influences technological innovation adoption (Grover, Cheon & Teng, 1996). This suggests that when top management recognise the benefits of IT servitization, there will be support to its adoption. Therefore,

H5. *Top management support positively influences the adoption of IT servitization.*

Rogers (2003) and Iacovou, Benbasat and Dexter (1995) indicated that larger firms are expected to facilitate technology innovation adoption because they have resource advantages due to available financial resources that better enable them and implement innovations; additionally, those with more employees, particularly those who receive frequent IT service requests, are expected to facilitate technology innovation adoption. Small businesses, on the other hand, are frequently unable to do so due to a lack of resources (Rowe, Truex & Huynh, 2012). In addition, earlier literature reports that large organisations tend to adopt more technology innovations due to their greater risk tolerance and flexibility (Pan & Jang, 2008; Zhu, Kraemer, Xu & Dedrick, 2004).

Furthermore, studies have revealed that firm size is one of the most important adoption determinants of technological innovation (Dholakia & Kshetri, 2004; Hong & Zhu, 2006; Pan & Jang, 2008). Consequently, firm size is a factor that is important which affects IT servitization adoption. Thus,

H6. *Firm size positively influences the adoption of IT servitization.*

3.8.3. The Environmental Context

The external environment refers to the external influences that affect the organisation. Although the decision to adopt a new technology should be guided by the organisation's vision and business requirements, institutional pressures can act as a catalyst (Ilin, Iveti,

& Simi, 2017). According to institutional theory, institutional environments play an important role in shaping social and organisational structures, behavioural focus, schemas, rules, norms, routines, and actions (Scott, 2001; Scott, 2007). As a result, the institutional environment can have a greater impact on the development of formal structures in an organisation than market pressures (Dimaggio & Powell, 2000).

According to institutional theory, organisational decisions are influenced not only by rational goals of efficiency, but also by external factors such as concerns for legitimacy and social and cultural factors. As a result of isomorphic and legitimacy pressures, organisations become more similar (Dimaggio & Powell, 2000).

Coercive pressures are formal or informal pressures applied to an organisation to adopt the same practices as external organisations on which they rely (DiMaggio & Powell, 2000; Teo, Wei & Benbasat, 2003). Coercive pressures can be exerted by regulatory bodies, government, professional networks, industry associations, and even multinational corporations and parent corporations on their subsidiaries (Harcourt, Lam, & Harcourt, 2005) that have the power to directly reward compliance or sanction non-compliance (DiMaggio & Powell, 2000).

Coercion may also be the result of a competitive necessity within an industry (Gular, Guillen, & MacPherson, 2002), as well as cultural expectations in the society in which organisations operate (DiMaggio & Powell, 2000). As a result, when an organisation is pressured to adopt technology innovation by regulatory bodies, professional networks, resource dominant organisations, or key organisations on which they rely, they are more likely to do so as well (DiMaggio & Powell, 2000). This implies that if an organisation is subjected to significant coercive pressures, the adoption of IT servitization will increase. Thus,

H7. *Coercive pressures positively influence the adoption of IT servitization.*

Mimetic pressures refer to an organisation's proclivity to imitate the actions of other successful and high-status organisations with a similar structure, even when no power relationships exist (Teo, Wei & Benbasat, 2003; Shi, Shambare, Wang, 2008). When organisations adopt innovations and practices by imitating competitors, pressures are felt

(Soares-Aguiar & Palma-Dos-Reis, 2008). When organisations face uncertainty and have ambiguous goals, mimicry occurs by reducing search costs by minimising and saving on experimentation costs (Shi, Shambare, & Wang, 2008) or avoiding first adopter risk (Teo, Wei & Benbasat, 2003). This implies that if an organisation is subjected to significant mimetic pressures, the adoption of IT servitization will increase. Therefore,

H8. *Mimetic pressures positively influence the adoption of IT servitization.*

Normative pressures refer to pressures originate from norms specified by institutions such as professional or industry associations where companies share information and rules (Teo, Wei & Benbasat, 2003; Krell, Matook & Rohde, 2016). Sharing these norms through relational channels strengthens them and increases their potential influence on organisational behaviour, despite the fact that institutions that exert normative pressure lack the authority to enforce compliance and sanction non-compliance (Powell & DiMaggio, 1991). The standardisation of job titles and roles in the industry, as well as the centralization of IT, also give rise to normative pressures (Pearson & Keller, 2009).

When trading partners are encouraged to conform to specific standards in order to allow for information sharing throughout the supply chain, normative pressures arise (Liu, Ke, Wei, Gu, & Chen, 2010), because organisations learn about innovations from industry adopters with whom they have direct or indirect relationships (Sherer, Meyerhoefer & Peng, 2016). This implies that if an organisation faces a high level of normative pressure, it will increase its use of IT servitization. Therefore,

H9. *Normative pressures positively influence the adoption of IT servitization*.

3.8.4. The SOE Context

SOEs are required by nature to generate, collect, store, and publish a large amount of data and information (Kalampokis, Tambouris & Tarabanis, 2011a, b). The regulatory requirement may lead to competitive necessity within an industry within which the organisation operate (DiMaggio & Powell, 2000). Altayar (2018) goes on to emphasise the importance of the regulatory environment and sanctioning activities on the institution and its mandate. Therefore, when an organisation is pressured to adopt technology innovation from regulatory bodies and professional networks within the industry they operate in, they are more likely to also follow suit (DiMaggio & Powell, 2000). This implies that if an SOE faces significant regulatory pressures as a result of the industry in which they are required to operate, the adoption of IT servitization will increase.

Consequently, SOE mandate and industry that it is delegated to service is a factor that is important which affects IT servitization adoption. Thus,

H10. *Organisation's mandate positively influences the adoption of IT servitization.*
H11. *Organisation's industry positively influences the adoption of IT servitization.*

3.8. Construct Operationalisation

The measurement items and constructs used in this study were adapted from previous studies that used validated and developed measurement items from the literature. A questionnaire-based survey is used to test our research model based on the three theoretical perspectives. To ensure content validity, items from existing studies that have already developed scales for testing were adapted and used for the variables, following the guidelines of Moore and Benbasat (1991) and Balci, Grgecic, and Rosenkranz (2013) to adjust the wording to the current study setting. The constructs of dependent and independent variables are discussed next.

Dependent Variable

Adoption

Adoption of an innovation is a process that results in the implementation and use of a new practice, process, or product for the adopting organisation (Kimberly & Evanisko, 1981; Damanpour & Wischnevsky, 2006). Rogers (1983) defines adoption as the decision to fully utilise the innovation. Adoption is defined in this study as the introduction and use of a new product, process, or practice in the adopting organisation.

IT servitization adoption is measured considering multiple forms of IT servitization, namely: IT outsourcing, virtualization and cloud computing. The total number of forms of IT servitization used or previously used by the respondent's SOE was accepted as an adoption measure. Respondents in the questionnaire answered questions about the three types of IT servitization presented. The eleven variables in the research model and hypotheses were used to measure the dependent variable. Table 4.9 presents how the dependent variable was operationalised supported by literature.

Table 4.9: Measure and operationalisation of the dependent variable.

Dependent Variable	Conceptual Definition	Operational Definition	Supporting Literature
Adoption of IT servitization	Whether the organisation uses or previously used technological innovation.	SOE use of any form of IT servitization, namely: IT outsourcing, virtualization and cloud computing	Choudrie & Dwivedi, 2005; Oliveira & Martins, 2011; Low, Chen & Wu, 2011; Tomás, Thomas & Oliveira, 2018

Independent Variables

Technological context: Sensory readiness operationalisation

Sensory readiness is conceptually defined as the requirements for process participants to be able to enjoy a full sensory experience of the said process (Overby, 2012). In order to operationalise the variable, items were adapted from previous study by Thomas, Costa and Oliveira (2016) have applied the following items for measuring sensory readiness variables. These items are adopted in this study to measure the influence of sensory readiness in the context of IT servitization adoption and they are represented with (Q2_1-5). The items below are measured through a five-point scale ranging between 1=strongly disagree and 5=strongly agree.

1. Q2_1: It is important for me to physically inspect products before purchasing them.
2. Q2_2: I like to see the products before purchasing them.
3. Q2_3: I like to touch the products before purchasing them.
4. Q2_4: I like to hear the products before purchasing them.
5. Q2_5: I like to smell the product before purchasing them.

Technological context: Relationship readiness operationalisation

The conceptual definition of relationship readiness by Overby (2012) explains it as a requirement by process participants to be able to interact with each other in either social or professional context. To operationalise the variable, previous study by Thomas, Costa and Oliveira (2016) have applied the following items for measuring relationship readiness variable. These items are adopted in this study to measure the influence of relationship readiness in the context of IT servitization adoption and they are represented with (Q3_-4). In the current study, all below items are measured through a five-point scale ranging between 1=strongly disagree and 5=strongly agree.

1. Q3_1: It is important for me to have a relationship with the seller when purchasing a product or service.
2. Q3_2: I consider my relationship with the seller when purchasing a product or service.
3. Q3_3: I would like to have a relationship with the seller when purchasing a product or service
4. Q3_4: My relationship with the seller when purchasing a product or service is not important.

Technological context: Synchronism readiness operationalisation

Synchronism readiness is conceptually defined as the degree to which the process activities need to occur instantaneously with minimal delay (Overby, 2012). For operationalising the variable Thomas, Costa and Oliveira (2016) in their study present the following items for measuring synchronism readiness variable. These items are applied in this study to measure the influence of synchronism readiness in the context of IT servitization adoption and they are represented with (Q4_1-4). In this study, all items below are measured through a five-point scale ranging between 1=strongly disagree and 5=strongly agree.

1. Q4_1: On the day that I place an order for a product or service, I like to take care of all purchasing-related activities.
2. Q4_2: I like to take care of all purchasing-related activities a week or more later after placing an order for a product or service.

3. Q4_3: After I purchase a product or service, I would like to get it on that day or the next.
4. Q4_4: Waiting for a week or more to receive a product or service after purchase is acceptable.

Technological context: Identification & control readiness operationalisation

The conceptual definition of identification & control readiness explains it as the requirement for identification of other process participants and the ability to control their behaviour as virtual processes are prone to identity spoofing problems because physically inspection of participants cannot be confirmed (Overby, 2012). In order to operationalise the variable, a study by Thomas, Costa and Oliveira (2016) present the following items for measuring the influence of identification and control readiness. These items are applied in this study to measure the identification and control readiness in the context of IT servitization adoption and they are represented with (Q5_1-4). In the current study, all items below are measured through a five-point scale ranging between 1=strongly disagree and 5=strongly agree.

1. Q5_1: Identification of people in a virtual process is important to me.
2. Q5_2: Being able to track and monitor others' behaviour and activities conducted in a virtual process is important to me.
3. Q5_3: I believe it is possible that people can hide their identities in processes that are virtual.
4. Q5_4: I believe that virtual process participants can be properly identified.

Organisational context: Top management support operationalisation

Top management support is conceptually referred to as the degree to which management in top structures support the innovation (Low, Chen & Wu, 2011). Lee and Kim, 2007 similarly points out that, as technology complexity increase, top management can provide a vision and commitment to create a supportive environment for innovation. In order to operationalise the variable, study by Bose and Luo (2011) present the following items for measuring top management support.

These items are adopted in this study to measure the influence of top management support in the context of IT servitization adoption and they are represented with (Q6_1-5). The items for this variable are measured through a five-point scale ranging between 1=strongly disagree and 5=strongly agree.

1. Q6_1: Top management sponsorship is a significant factor in successful adoption of IT servitization.
2. Q6_2: Top management support is a significant factor in successful adoption of IT servitization.
3. Q6_3: The implementation of initiatives to servitize IT require support from top management.
4. Q6_4: The acceptance of initiatives to servitize IT require support from top management.
5. Q6_5: Top management support can help overcome possible resistance in the adoption of IT Servitization.

Organisational context: Firm size operationalisation

Firm size is conceptually defined as the size of the organisation (Tornatzky & Fleischer, 1990; Guenther & Tamm, 2002). For operationalising the variable, the first item is adopted from a study by Zhu and Kraemer (2005) for firm size measurement, the other two are self-developed. This item is used in this study to measure the influence of firm size in the context of IT servitization adoption and it is represented with (Q7_1-3).

In South Africa, The National Small Business Act of 1996(Act No. 102 of 1996) defines what constitutes for small, medium and deem everything above that, large enterprises. A common definition for large enterprises includes any enterprises above the medium enterprise threshold. Meaning, in South African context, those that turnover above R 64 million annually and have more than 200 employees and have gross assets above R18 million excluding fixed property (Falkena, Abedian & Blottnitz, 2002). The definition was revised on 27 February 2019 and only has two indicators instead of three and number of employees revised from 200 to 250 for Medium enterprise threshold. Third indicator of Total Gross Asset value has been removed (Government Gazette, 2019).

1. Q7_1: The number of employees in an organisation should influence the decision to adopt IT servitization.
2. Q7_2: The number of employees who receive IT service should influence the decision to adopt IT servitization.
3. Q7_3: The frequency of IT service requests should influence the decision to adopt IT servitization.

Environmental context: Coercive pressures operationalisation

The conceptual definition of coercive pressures refers to both formal and informal pressures exerted onto organisations by cultural expectations in the society within which organisations operate as well as by other organisations on whom they are dependent that result in organisations getting pressure to adopt similar structures and practices (DiMaggio & Powell, 2000; Benbasat, 2003). In order to operationalise the variable (Sharma & Daniel, 2016; Liu, Wang & Zhao, 2018; Zeng, Chen, Xiao & Zhou, 2017) in their studies present the following items for measuring coercive pressures variable.

These items are adapted in this study to measure the influence of coercive pressures in the context of IT servitization adoption and they are represented with (Q8_1-4). In the current study, all items below are measured through a five-point scale ranging between 1=strongly disagree and 5=strongly agree.

1. Q8_1: Laws and regulations that have to be adhered to by an organisation should influence their IT service model.
2. Q8_2: Laws and regulations that have to be adhered to by an organisation should influence their IT service delivery.
3. Q8_3: Pressures from the government directives should influence the organisation’s decision to servitize IT.
4. Q8_4: External parties such as suppliers and customers should influence the organisation’s decision to servitize IT.

Environmental context: Mimetic pressures operationalisation

The conceptual definition of mimetic pressures explains that organisations will imitate others when technological sphere is changing too fast and the organisation's technology goals are not fully understood resulting in organisations that are seemingly successful or legitimate being imitated (DiMaggio & Powell, 2000; Scott, 2007; Sharma & Daniel, 2016). For the purpose of operationalising the variable (Sharma & Daniel, 2016; Liu, Wang & Zhao, 2018; Bananuka, Night, Ngoma & Muganga, 2019) in their studies designed the following items for measuring mimetic pressures variable.

These items are adopted in this study to measure the influence of mimetic pressures in the context of IT servitization adoption and they are represented with (Q9_1-4). In the current study, all items below are measured through a five-point scale ranging between 1=strongly disagree and 5=strongly agree.

1. Q9_1: Experienced vendors and consultants should provide advice on IT Servitization adoption.
2. Q9_2: The need to remain competitive and/or to stay ahead of industry peers should influence decision to servitize IT.
3. Q9_3: Industry leaders are always followed with regards to new IT trends or emerging technologies.
4. Q9_4: Environmental uncertainties and rapid change in the technology market forces IT servitization.

Environmental context: Normative pressures operationalisation

The conceptual definition of normative pressures defines this influence as a pressure that primarily stems from externally set norms arising from professionalisation and standardisation of job titles and roles in the industry and centralisation of IT (Nicholson & Sahay, 2009; Jeyaraj & Sabherwal, 2008; Currie, 2009; Pearson & Keller, 2009). Liu, Wang and Zhao (2018) add that universities, training institutions and professional bodies of associations play a significant role in defining, developing and promulgating normative rules. To operationalise the variable (Sharma & Daniel, 2016; Liu, Wang & Zhao, 2018;

Bananuka et al., 2019) in their studies used the following items for measuring normative pressures variable.

These items are adopted in this study to measure the influence of normative pressures in the context of IT servitization adoption and they are represented with (Q10_1-4). In this study, all items below are measured through a five-point scale ranging between 1=strongly disagree and 5=strongly agree.

1. Q10_1: Professional certifications should be considered when recruiting IT professionals.
2. Q10_2: IT professionals should have formal IT qualifications and/or IT certifications.
3. Q10_3: IT professionals should continuously be trained to remain current.
4. Q10_4: Professionalisation of the IT industry should regulate IT servitization (Professionalisation is when collective members of an occupation define the standards and methods of their work).

SOE context: Mandate operationalisation

Mandate is conceptually defined as the output responsibilities of the organisation or subsidiary (Cantwell & Mudambi, 2005). In order to operationalise the variable, the following items were adapted from studies by Kalampokis, Tambouris and Tarabanis (2011) and Altayar (2018) for mandate measurement. These items are adopted in this study to measure the influence of the organisational mandate in the context of IT servitization adoption and they are represented with (Q11_1-4). In the current study, all items are measured through a five-point scale ranging between 1=strongly disagree and 5=strongly agree.

1. Q11_1: In my view, the organisation's mandate requires creation and collection of high amounts of data.
2. Q11_2: In my view, the organisation's mandate requires maintenance and storage of high amount of data.
3. Q11_3: In my view, the organisation's mandate requires publication of relevant and on- demand information.

4. Q11_4: In my view, authority to sanction and the related sanctioning activities of the organisation should influence the adoption of IT servitization.

SOE context: Industry operationalisation

Industry is conceptually referred to as the sector of business within which the organisation operates (Yao, Lee & Lee, 2010). To operationalise the variable, the first two items were self-developed and the other two were adapted from DiMaggio and Powell (2000) for industry measurement. These items are adopted in this study to measure the influence of the industry within which the organisation operates to IT servitization adoption and they are represented with (Q12_1-4). In this study, all items below are measured through a five-point scale ranging between 1=strongly disagree and 5=strongly agree.

1. Q12_1: The kind of product and services offered by an organisation should dictate the adoption of IT servitization
2. Q12_2: The population the organisation caters to should dictate whether IT servitization is adopted or not.
3. Q12_3: The competition in the industry where the organisation operates should influence the need to servitize IT.
4. Q12_4: The industry laws and regulations where the organisation operates should influence the need to servitize IT.

IT Servitization operationalisation

IT servitization refers to an evolution of transforming IT into a service and organisations emphasising customer-oriented service in the delivery of IT solutions to businesses. This represents a shift from traditional ownership models in which physical assets such as data centres, storage, and servers were important determinants of access to high-end resources and applications to current models of on-demand access to services (Ilk, 2012; Sultan, 2014 & Conger, 2010). To operationalise the variable, the four items were self-developed. These items are used in this study to measure the exposure of IT professionals to the IT servitization practise and they are represented with (Q13_1-4). In this study, all items below are measured through a five-point scale ranging between 1=strongly disagree and 5=strongly agree.

1. Q13_1: I currently practise IT servitization on a regular basis.
2. Q13_2: In the past I practised IT servitization on a regular basis.
3. Q13_3: I currently practise IT servitization sometimes.
4. Q13_4: In the past I practised IT servitization sometimes.

There are a total forty-eight (48) questions used as measurement items for the variables or constructs above. Additional two demographic questions about the participant's job title and industry they are employed in were asked, bringing the total number of items to fifty (50).

3.9. Summary of the chapter

This chapter provided a review of the literature on the theoretical perspectives that were used as lenses for this study, namely the Technology, Organisation, and Environment (TOE) framework developed by Tornatzky and Fleischer (1990), Institutional theory developed by DiMaggio and Powell (2000), and Process Virtualization theory developed by Overby (2008). The limitations of the respective theories, as well as choice justification, were also discussed. This chapter also included the research model, its supporting hypotheses, and the operationalisation of constructs.

The next chapter discusses the research methodology, describing how the study was carried out in terms of the social inquiry's design. A discussion of the research process, paradigm, approach, design, and strategy used, as well as the technique used for data collection and study participants identified, is provided.

CHAPTER 4

RESEARCH METHODOLOGY

4.1. Introduction

This chapter discusses the research methodology followed and neatly unpacks the procedure using the research onion analogy. The research process, paradigms, and various research approaches, strategies, and designs used in IS research are covered. Aspects of research design are discussed in detail, as well as an overall methodology that aided the study in a systematic manner, to inform the development of an integrated theoretical and practical model for IT servitization adoption in this chosen context.

The research strategy is also discussed, which details the process that the study followed to explain why IT servitization is used in South African SOEs. Problems with the sampling frame not perfectly matching the population, i.e. IT professionals employed by South African SOEs are also discussed. Following that, the research instrument, data analysis strategy and design, time horizon, method limitations, and ethical considerations for the study are presented.

4.1.1. Research Process

The research onion analogy is used in research to explain the research methodology (Saunders, Lewis & Thornhill, 2012) and it will be used in this study. The application of the research onion framework suggests a method of proceeding from the onion's outer layer to its inner layer (see figure 4.1). Thus, when using the analogy, the research paradigm/philosophy is addressed first, followed by the subsequent layers. To understand the research onion analogy, the reader must peel the onion from the outside to the core, just like a real onion.

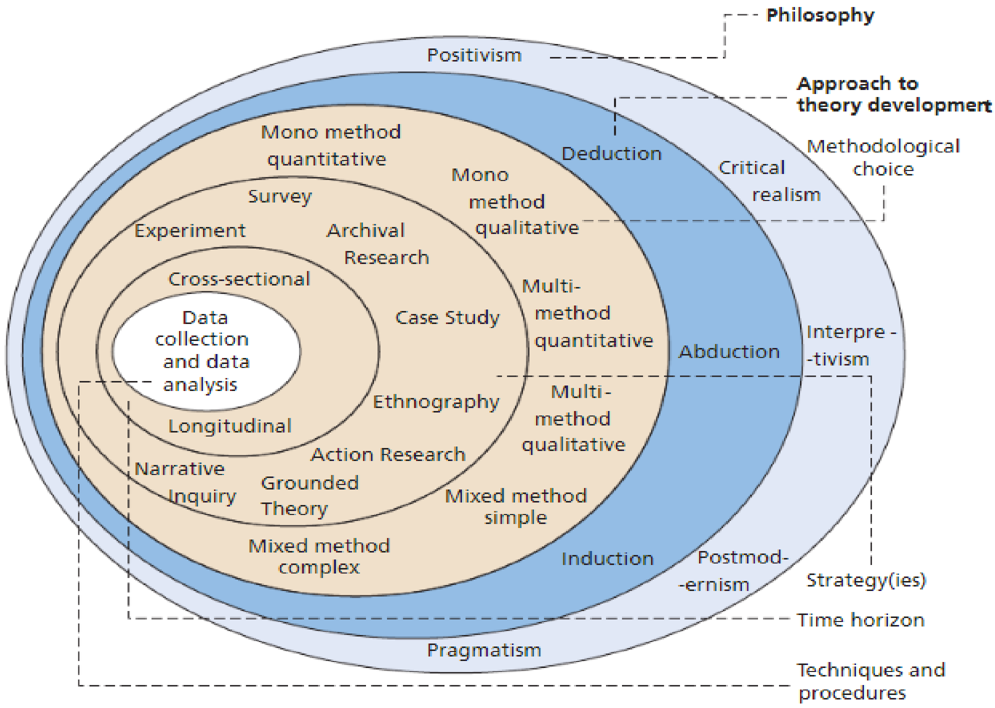

Figure 4.1: The Research onion (Saunders, Lewis, Thornhill & Bristow, 2019)

4.2. Research Paradigm

In research, researchers make a variety of assumptions and hold varying perspectives on how things work. This is evident in the various methods by which researchers conduct their research (Voce, 2004a). However, in research, there are specific rules and principles that can be followed to guide researchers' beliefs and actions while conducting research. These guiding principles are known as paradigms (Gephart, 1999). According to Bhattacharjee (2012), paradigms are implicit and thus difficult to recognise by researchers; therefore, identifying and considering them in social science research is critical.

Mackenzie and Knipe (2006) posit that, the choice of paradigm clarifies the motivation, expectation, and intent for the study; thus, without first selecting an appropriate paradigm, subsequent choices regarding literature, methodology, research methods, and design are invalid. Mackenzie and Knipe (2006) further add that, while some paradigms appear to lead a researcher to choose either qualitative or quantitative approaches, no paradigm prescribes or prohibits the use of either approach.

There are numerous research paradigms. Although there are many, positivism, interpretivism, and critical theory are the three most prevalent in IS studies (Voce, 2004a). Positivist studies are primarily objective, looking for correlations and links between variables (Voce, 2004b), whereas critical studies seek to uncover hidden interests, focusing on oppositions, conflicts, and revealing contradictions (Myers, 1997). Critical studies seek to eliminate the root causes of the status quo's alienating conditions and dominance (Bhattacharjee, 2012).

Interpretivist studies acknowledge that humans attach meaning to subjects and employ methods such as hermeneutics, ethnography, and participant observation. Interpretivists criticise both positivism and critical studies for applying a natural science lens to social science (Ngwenyama & Lee, 1997; Wahyuni, 2012). Although the literature suggests that positivist research tends to use quantitative approaches to data collection and interpretivist research tends to use qualitative methods, the paradigms are not mutually exclusive (Mackenzie & Knipe, 2006).

Table 4.1. Summary of research paradigms and fundamental beliefs in social sciences (adapted from Wahyuni, 2012 & Gephart, 1999)

Fundamental Beliefs	**Positivism**	**Interpretivism**	**Critical Realism**
***Ontology:* the position on the nature of reality**	External, objective and independent of social actors	Socially constructed, subjective, may change, multiple constructs	Objective and exist independently of human thoughts and beliefs or knowledge of their existence, but is interpreted through social conditioning
***Epistemology:* the view on what constitutes acceptable knowledge**	Only observable phenomena can provide credible data, facts Focus on causality and law-like generalisations, reducing phenomena to simplest elements	Subjective meanings and social phenomena. Focus upon the details of situation, the reality behind these details, subjective meanings and motivating actions	Only observable phenomena can provide credible data, facts Focus on explaining within a context or contexts
***Axiology:* the importance of values**	Value-free and etic	Value-bond and emic	Value-laden and etic

in a study and the stance of the researcher	Research is undertaken in a value-free way, the researcher is independent of the data and maintains an objective stance	Research is value bond, the researcher is part of what is being researched, cannot be separated and so will be subjective	Research is value laden; the researcher is biased by world views, cultural experiences and upbringing.
Research Methodology: the model behind the research process	Quantitative	Qualitative	Quantitative or Qualitative
Research Goal	The goal is to uncover truth and facts as quantitatively specified relations among variables Searches for contextual and organisational variables which cause organisational actions	The goal is to explain meanings, understand definitions of the situation, and examine how objective realities are made Searches for patterns of meaning	The goal is to uncover hidden interests; expose contractions; enable more informed consciousness; displace ideology with scientific insights Searches for disguised contradictions hidden by ideology
Data collection methods	Experiments, Quasi-experiments, Tests Scales	Interviews, Observations, Document reviews, Visual data analysis	May include tools from both positivist and interpretivist paradigms. e.g., Interviews, observations and testing and experiments
Assumptions	Assumes an objective world which science can "mirror" with privileged knowledge	Assumes an inter-subjective world which science can represent with concepts of factors; social construction of reality	Assumes a material world of structured contradictions and or exploitation which can be objectively known only by removing tacit ideological biases

Table 4.1 depicts the various philosophical beliefs and stances that drive social science research. For the purposes of this study, the epistemological stance is chosen, which is the belief that only obvious phenomena can provide reliable data and facts. The current study observes IT servitization adoption knowledge and obtains credible data and facts by surveying individuals with industry knowledge and understanding of the phenomenon. Section 4.5 goes into greater detail about the survey. As a result, the current study's

ontological stance is that reality is objective and independent of social actors. The identified potential participants, known as social actors, are thought to be sharing objective views and opinions rather than their subjective life experiences. In other words, the creation of IT servitization adoption knowledge is through objectivity.

The current study's philosophical orientation is thus positivistic, informed by the preceding epistemological and ontological stances. The positivistic orientation was chosen because the current study aimed to unearth truths and facts among variables specified in the preceding chapter in order to provide an objective reality on the determinants influencing the adoption of IT servitization in South African SOEs. The study's goal was to search for correlations and links between the dependent variable, i.e. IT servitization adoption, and the independent variables, which were the technological, organisational, environmental, and SOE contexts, so the positivist paradigm was appropriate.

4.3. Research Approach

The research approach identifies the mode of inquiry, which includes everything from assumptions to research strategy and data collection (Myers, 2007). According to Trochim (2006), the deductive reasoning process begins with the broader general context and ends with the narrow and specifics, whereas the inductive reasoning process moves from the narrow and specifics to the broader generalisations and theories. Deductive arguments are typically based on laws and rules, whereas inductive arguments are based on observations and experience (Trochim, 2006). Deduction, in essence, is the process of drawing conclusions about a phenomenon based on theoretical or logical explanations, whereas induction is the process of drawing conclusions based on facts or previously observed evidence (Bhattacherjee, 2012). Figure 4.2 depicts the model-building process and how inductive and deductive reasoning work together.

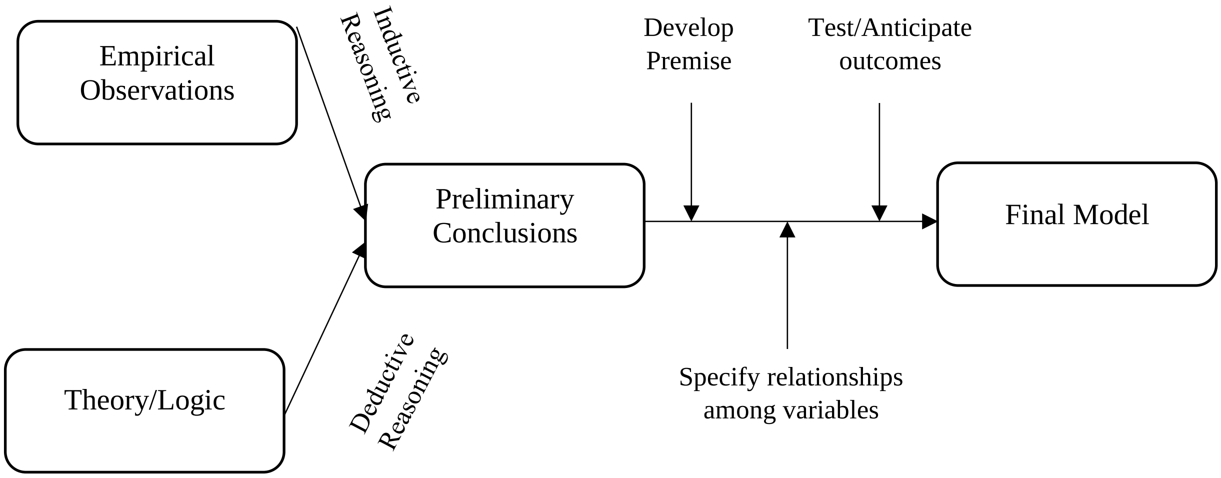

Figure 4.2: The model-building process (Bhattacherjee, 2012)

According to Flick, von Kardoff, and Steinke (2004), deduction proves that something must be the case logically, while induction demonstrates practical evidence that something is like that, and abduction merely assumes that something may be happening. Creswell and Plano Clark (2007), further suggest that, the intent of the research informs the approach, thereby adding that the typical aim in quantitative research is generally to deductively test theories while probing for evidence to either support or disprove the hypotheses, whereas the goal in qualitative researchers is usually to inductively identify themes by gathering information from individuals to which gives them an opportunity to create theories.

The following is a practical application of the deduction process: A researcher begins by developing a theory about a topic of interest, then narrows it down into more specific hypotheses that can be tested, and finally further narrows it when collecting data and performing observations to enable hypotheses testing with narrow and specific data that ultimately proves or disproves the theory. In contrast, the inductive process works in the opposite direction, with the researcher using participants' perspectives to develop broader generalisations and observations, then beginning to detect themes and patterns, then exploring tentative hypotheses, and finally developing theories (Trochim, 2006).

Deductive process

Theory → Hypothesis → Observation → Confirmation

Inductive process

Observation → Pattern → Tentative hypothesis → Theory

Figure 4.3: The deductive and inductive processes (Trochim, 2006)

According to Bhattacherjee (2012), it is critical for researchers to be able to navigate between inductive and deductive reasoning in order to benefit from post extensions or modifications to a given model, framework, theory, or construct that are beneficial for scientific research.

The deductive approach was used in this study because the study's goal was to deductively test theories while looking for evidence to either support or refute the hypotheses posited in the previous chapter of this study. The study began with a broader theory about why IT servitization is adopted with difficulty in South African SOEs and proposed some determinants thereof, then narrowed the adoption determinants down into more specific hypotheses that could be tested, and finally collected data to enable hypotheses testing with specific data, which finally supported some theories and disproved others.

4.3.1. Research Classification

Although there are numerous research approaches and classifications, the most common classifications, according to Wiley (2007), are qualitative and quantitative methods. Soiferman (2010) extends the approach to include the deductive and inductive reasoning processes, stating that the modes that are typically used are quantitative (tend to be deductive) and qualitative (tend to be inductive).

According to Mackenzie and Knipe (2006), research approaches have become more complex in design while remaining flexible in their application, resulting in mixed methods becoming more acceptable and common, allowing for the use of the most valuable features of both approaches. The mixed-methods research approach allows for the collection of both numerical data (e.g., on instruments and test scales) and text information (e.g., on interviews and observations) so that the final results contain both quantitative and qualitative information (Creswell, 2003).

Table 4.2. Characteristics of quantitative and qualitative research adapted from Anderson (2006) and Mackenzie and Knipe (2006)

Quantitative	**Qualitative**
Objective	Subjective
Researcher tends to remain objectively separated from the subject matter	Researcher tends to become subjectively immersed in the subject matter
Literature review must be done early in study	Literature review may be done as study progresses or afterwards
Facts are value-free and unbiased	Facts are value-laden and biased
Reduction, control, precision	Discovery, description, understanding, shared interpretation
Measurable	Interpretive
Report statistical analysis	Report rich narrative
Basic element of analysis is numbers	Basic element of analysis is words or ideas
Researcher uses tools, such as questionnaires or equipment to collect numerical data	Researcher is the data gathering instrument
Subjects	Participants
Context free	Context dependent

Hypothesis	Research questions
Establishes relationships, causation	Describes meaning, discovery
Researcher uses tools and instruments such as questionnaires or equipment to collect numerical data	Researcher is the data gathering instrument and uses communications and observation
Highly controlled setting: experimental setting (outcome-oriented)	Flexible approach: natural setting (process- oriented)
All aspects of the study are carefully designed before data is collected	The design emerges as the study unfolds
Researcher knows clearly in advance what he/she is looking for	Researcher may only know roughly in advance what he/she is looking for

In this current study, the quantitative research approach has been applied because the study seeks to conduct an inquiry, relying on measured data to establish relationships and causation as well as answer questions about the sample population, thereby exploring and explaining the determinants that influence the adoption of IT servitization in South African SOEs through the development of an integrated theoretical and practical model.

4.4. Research Strategy

Saunders, Lewis and Thornhill (2012) define research strategy as a plan which provides details of the process that the researcher intends to follow in order to solve the research problem under investigation. Experiment, archival research, case study, ethnography, action research, grounded theory, narrative inquiry, and survey are some of the strategies available (Saunders et al., 2019).

As a strategy, the current study employed a survey technique. Surveys, according to Fraenkel, Wallen, and Hyun (2011), are a method of gathering information from a pre-defined sample of respondents by asking questions with the goal of gaining insights on a topic of interest about a population. Previously, Pinsonneault and Kraemer (1993) explained that surveys, which are commonly used for political polls, marketing, and opinion polls, differ from survey research, which is conducted with the goal of expanding the scientific body of knowledge.

Zikmund (2003) emphasises that, a survey is a good research strategy, but it is only as good as the questions it asks. According to Bhattacherjee (2012), survey research has inherent strengths over other methods, but it also has weaknesses that must be considered. These strengths and weaknesses are summarised in Table 4.3.

Table 4.3. Survey Research Strengths and Weaknesses (Bhattacherjee, 2012)

Survey Research Strengths	**Survey Research Weaknesses**
Good for measuring a wide variation of unobservable data.	Non-response bias. Survey research has generally low response rates.
Suitable for virtually collecting data about a population that is too large to directly observe.	Sampling bias. This bias makes the respondent sample unrepresentative of the intended population and negatively impact the generalisability of claims drawn from the biased sample.
Respondents' ability to respond at their convenience.	Social desirability bias. The tendency among respondents to be untrue in order to portray themselves in a socially desirable manner hurts the validity of response obtained from survey research.
Large sample surveys are useful for detection of small effects even while analysing multiple variables.	Recall bias. Responses to survey questions are subject to respondent's motivation, memory and ability to respond.
Cost effective and economical in terms of researcher time and effort than most other methods.	Common method bias. This bias refers to the amount co-variance shared between independent and dependent variables that are measured at the same point in time.

The three primary characteristics of survey research are as follows: First and foremost, the goal is to quantitatively describe specific aspects of the study population. Second, information is typically gathered by asking structured and predefined questions to respondents, and their responses are then analysed as data. Third, while the information gathered is from a subset of the study population, also known as a sample, the sample size should be large enough to allow the statistical data gathered and the results to be generalised to the entire population (Pinsonneault & Kraemer, 1993).

Bhattacherjee (2012) states that, the survey research method is appropriate for explanatory, exploratory, or descriptive research, as well as individual studies where people are the unit of analysis. While this method is appropriate for individual studies, it should be noted that other units of analysis, such as groups and organisations, could also be studied using surveys, because a specific person from a unit is frequently chosen as a key informant or proxy. Because the current study's unit of analysis is individuals within

SOEs, the method was appropriate. The suitability of survey research methods for specific studies is discussed further below.

Exploratory research is best suited when the problem is in new areas of inquiry and has not yet been thoroughly studied and understood, as well as theory development for discovering relevant constructs during the formative stages (Bhattacherjee, 2012). Descriptive research, on the other hand, is best suited to a more in-depth comprehensive study that is not hypothesis driven but thoroughly examines all statements to ensure data saturation (Bogdan and Biklen, 2007). Finally, explanatory research is appropriate for studies that attempt to explain the subject matter, phenomena, problems, or behaviours being studied (Bhattacherjee, 2012).

The current study is in a new area of inquiry, so it is exploratory at first with a hypothetical idea, then explanatory by connecting ideas to understand the correlation between variables. As a result, both an exploratory and an explanatory survey research strategy was used. The goal of this research was to explore and explain the factors that influence the adoption of IT servitization in South African SOEs.

4.5. Research Design

The research design is an overall methodology that allows the researcher to conduct research in a systematic manner and provides a solid foundation for the research project (Darke, Shanks, & Broadbent, 1998). (Trochim, 2006). Quantitative design studies, according to Mackenzie and Knipe (2006) and Anderson (2006), use numbers and statistics to explain and analyse the relationship between variables. There are four main types of designs in quantitative research (Punch, 2013).

First, descriptive design research, in which the primary goal is to establish associations between variables, describe the situation or variable as it naturally occurs, and variables are typically measured once and do not require a hypothesis at the inception of the study (Hopkins, 2008; stlund, Kristofferzon, Häggström, & Wadensten, 2015).
Second, experimental or true experimental design research, the primary goal of which is to establish causality, or the cause and effect relationship between variables. In an experiment, subjects are randomly assigned to one of two groups (treatment or control),

they are measured before and after tests, and the independent variable is manipulated to see how it affects the dependent variable (Gribbons & Herman, 1997; Hopkins, 2008).

Third, there is research into quasi-experimental design. The design is similar to the experimental design in that the main goal is to establish causality, but the sample groups are not random. When random assignment is not practical or possible, this type of design research is used (Hopkins, 2008; Bhattacherjee, 2012).

Fourth, correlational design research where the main aim is to measure the strength and direction whether positive or negative of a relationship between two variables and discover their association using statistical analysis (Fraenkel, Wallen & Hyun, 2011).

The current study is quantitative and correlational in nature because it seeks to determine whether the dependent variable, i.e. adoption of IT servitization, and the rest of the independent variables are related and, if so, in what way.

4.5.1. Unit of analysis

Babbie (2004) explains that, there are four types of units of analysis in social science research: individuals (the primary unit of analysis in the majority of research studies), groups (two or more people who interact with each other and share similar characteristics), organisations (formally structured groups), and social artefacts (objects, products or behaviour of social being). Figure 4.4 depicts four types of unit of analysis.

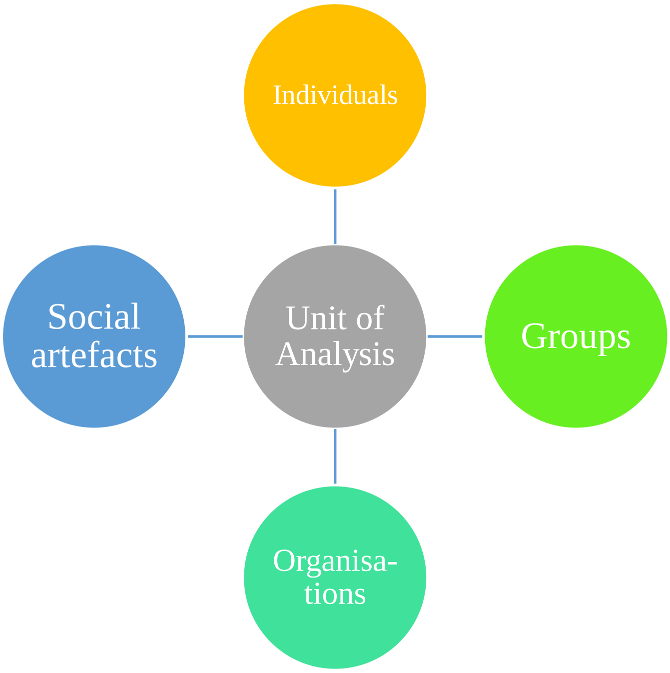

Figure 4.4: Unit of analysis categories (Babbie, 2004)

Kumar (2018) expands the definition to include technologies and countries, defining the unit of analysis as the person or object from which data is collected, i.e., individuals, groups of individuals, organisations of individuals, technologies, countries, and objects that are the subject of the investigation.

Individuals are the unit of analysis in this study. Despite the fact that two of the three theoretical lenses underpinning the study, TOE and Institutional theory (both of which are commonly used for organisational level studies), SOEs are not the unit of analysis for the study. Notwithstanding this, the two theories are applicable because individuals work within the SOEs organisational contexts. Individuals were chosen as the unit of analysis because the study sought to explore and explain the determinants of IT servitization adoption from the perspective of the individual rather than the perspective of the organisation.

4.5.2. Population

Bryman and Bell (2007), posit population as the universe from which the study's sample is drawn. Because of feasibility and cost constraints, it is rarely possible for the researcher to collect data from the entire population in order to answer the research questions (Bhattacherjee, 2012). The population for this study is IT practitioners and executives who are familiar with or work in the IT servitization environment. These individuals are knowledgeable about IT servitization in its many forms and/or have insights into the inner workings of information technology in the context of SOEs. IT practioners and executives include Chief Information Officers, IT directors, IT/IS managers, Business analysts, Project managers, IT architects, IT administrators, and other IT related specialists.

Individuals from the preceding professionals make up the study's population. The population is approximately 6 000 people. This figure is based on the assumption that each of the 277 SOEs has at least 22 individual IT professionals. According to Kumar (2018), because individuals' information and experiences frequently reveal important information, this category is the most commonly used in business research. Because the entire population is unable to participate, the sampling process is critical for selecting a representative sample from the population of interest for observation and analysis (Taherdoost, 2016).

4.5.3. Sampling

Choosing a sampling technique is critical because it entails making a series of decisions about how many respondents to include in a study, how they will be chosen, and the conditions under which this selection will take place (Onwuegbuzie & Collins, 2007). Figure 4.5 demonstrates how key sampling concepts are interrelated.

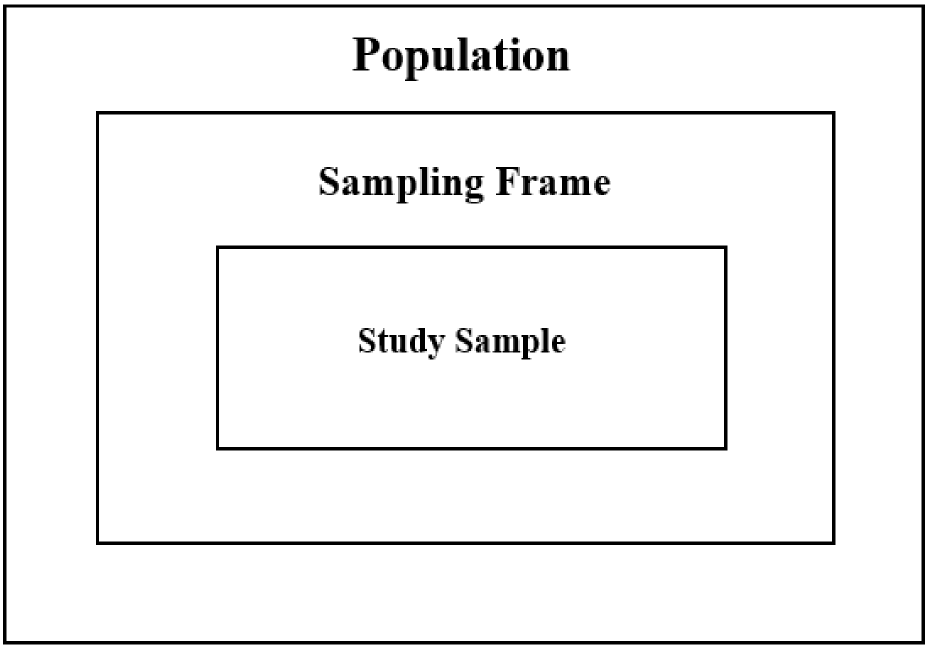

Figure 4.5: Key Sampling terms (Bhattacherjee, 2012; Trochim & Donnelly, 2001)

Alvi (2016) also emphasises the importance of the sample being representative of the population, stating that the better the representativeness of the sample, the higher the accuracy of the inferences, and thus the generalizability of the results. When the results of a sample are equally true or applicable to the entire target population, the results are considered generalisable (Alvi, 2016).

Sampling can be done in two ways: probability (random) sampling and non-probability sampling (Bhattacherjee, 2012). Probability sampling is a sampling technique in which every individual in a population has an equal (non-zero) chance of being chosen. Probability sampling is classified into several types, including simple random, systematic, stratified, cluster, matched pairs, and multi-stage sampling (Bhattacherjee, 2012; Taherdoost, 2016).

Non-probability sampling is a sampling technique in which a sample of respondents is chosen by the researcher at their discretion and subjective judgment, with the result that some population members have no chance of being chosen, resulting in zero probability. Non-probability sampling is classified into four types: convenience, quota, snowball, and purposive (also known as expert or judgemental) sampling (Bhattacherjee, 2012).

Due to the non-random selection, sampling bias may occur, making it impossible to generalise information back to the population (Bhattacherjee, 2012; Taherdoost, 2016). Figure 4.6 depicts the various sampling techniques.

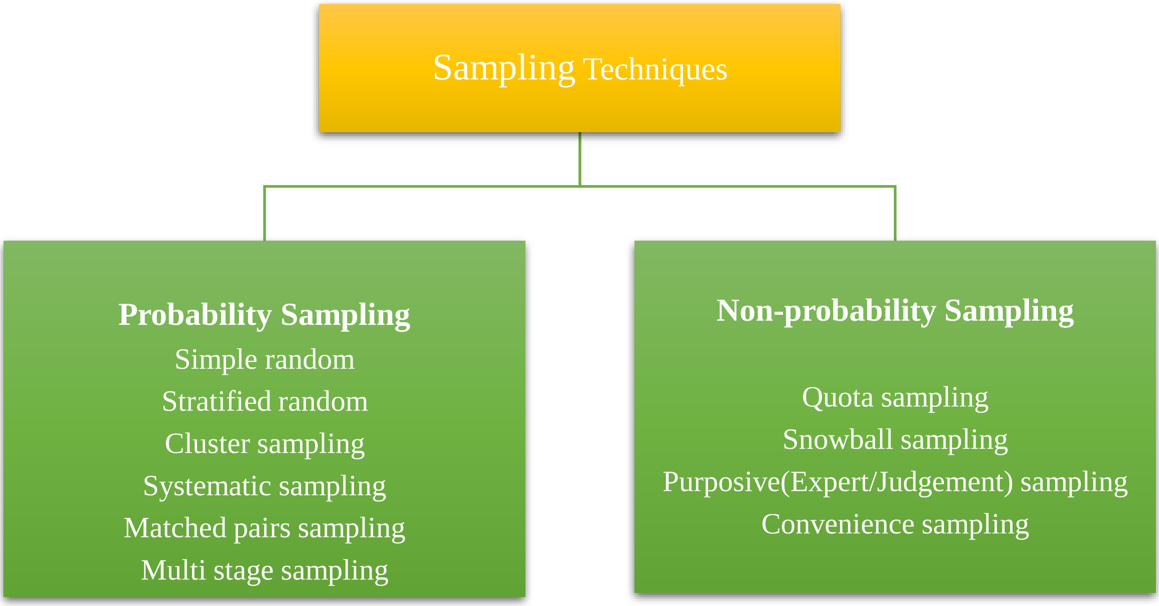

Figure 4.6: Types of sampling techniques (Bhattacherjee, 2012; Taherdoost, 2016)

The preceding section discussed probability and non-probability sampling. Table 4.4 then describes the characteristics of the various sampling techniques.

Table 4.4. Sampling techniques characteristics explained (Bhattacherjee, 2012; Taherdoost, 2016)

Technique	Characteristics Explained
PROBABILITY	
Simple Random Sampling	• Every case of the population has an equal chance of becoming part of the sample • Involves randomly selecting respondents from a sampling frame • A complete frame (a list of all units in the whole population) is needed • The simplest of all probability sampling techniques
Systematic Sampling	• The sampling frame is ordered according to some criteria and elements are selected at regular intervals through that ordered list • Involves a random start and then proceeds with the selection of every nth element • Every nth case after a random start is selected

Stratified Sampling	• Population is divided into strata (or subgroups) • Simple random sample is drawn within each subgroup
Cluster Sampling	• The whole population is divided into clusters or groups • Subsequently a random sample is taken from these clusters • All clusters are used in the final sample • Cluster sample will generally be higher than that of a simple random sample
NON-PROBABILITY	
Convenience Sampling	• Also called accidental or opportunity sampling • Selecting participants because they are readily and easily available • Tends to be a preferred sampling technique among students as it is inexpensive and an easy option • Scientific generalisability of observations is very limited
Quota Sampling	• The population is segmented into mutually exclusive subgroups (just as in stratified sampling) • Non-random set of observations is chosen from each subgroup to meet a predefined quota.
Snowball Sampling	• Researcher starts by identifying a few respondents that match the criteria for inclusion in their study, then ask them to recommend others they know who also meet the selection criteria • Also known as referral sampling • Uses a few cases to help encourage other cases to take part in the study • Most applicable in small populations that are difficult to access due to their closed nature, e.g., secret societies and inaccessible professions
Purposive (Judgement/ Expert) Sampling	• Respondents are chosen in a non-random manner based on their expertise on the phenomenon being studied • The respondents are chosen carefully based on researcher's knowledge and credibility to provide the best results for the research • Opinions from a sample of experts are more credible than a sample that includes both experts and non-experts • The results are still not generalisable to the overall population at large

Table 4.5. Strengths and weaknesses associated with each respective sampling technique (Malhotra & Birks, 2006)

Technique	Strengths	Weaknesses
PROBABILITY		
Simple Random Sampling	Easily understood, results projectable	Difficult to construct sampling frame, expensive, lower precision, no assurance of representativeness
Systematic Sampling	Can increase representativeness, easier to implement than simple random sampling Sampling frame not always necessary	Can decrease representativeness
Stratified Sampling	Includes all important subpopulation, precision	Difficult to select relevant stratification variables, not feasible to stratify on many variables, expensive
Cluster Sampling	Easy to implement, cost-effective	Imprecise, difficult to compute an interpret results
NON-PROBABILITY		
Convenience Sampling	Least expensive, least time consuming, most convenient	Selection bias, sample not representative, no recommended by descriptive or casual research
Quota Sampling	Sample can be controlled for certain characteristics	Selection bias, no assurance
Snowball Sampling	Can estimate rare characteristics	Time-consuming
Purposive (Judgement/ Expert) Sampling	Low-cost, convenient, not time consuming, ideal for exploratory research design	Does not allow generalization, subjective

Tashakkori and Teddlie (2003) state that quantitative studies typically employ probability sampling techniques, whereas qualitative research employs non-probability sampling techniques. They do, however, point out that no research tradition can claim a specific technique, and that any combination of sampling techniques could be used to answer the research question.

Purposive (judgement/expert) sampling was used as the primary method for selecting respondents for this study. Participants in this study were knowledgeable about IT servitization in its various forms, and had insights and a better understanding of the various issues and inner workings of their respective enterprises' IT departments. Chief Information Officers, IT Directors, IT/IS managers, Business analysts, Project managers, IT architects, IT administrators, and other IT related specialists comprised the sample.

Snowball sampling was used as a secondary complementary technique. According to Cooper and Schindler (2006), this technique is popular when researchers are having difficulty finding suitable participants. Snowball sampling, according to Atkinson and Flint (2001) and Cohen and Arieli (2011), can be used as an alternative or complementary sampling technique. It is used as an alternative technique when difficult circumstancing prevents the use of other techniques, as well as when random sampling is not possible. It is also used in conjunction with other sampling techniques to improve the quality and efficiency of research and to reduce sampling bias. This technique was effective in the current study because it made use of the referral networks of the participants who were initially identified.

Easterby-Smith, Thorpe and Lowe (2002), support the use of multiple sampling techniques. They claim that it provides additional perspectives on the issue under investigation. Purposive and snowball sampling techniques were thus used in this study. Because of the possibility of a lower response rate at some SOEs, the researcher asked participants to forward the survey to their colleagues who might not have been identified in the original study sample, mostly due to a lack of contact information.

It should be noted that when evaluating the study quality in quantitative research, generalisability to the general population is an important criterion (Kerlinger & Lee, 2000). Non-probability sampling techniques were used due to a lack of access to a list of the population being studied, as discussed in the sampling frame section. The researcher observes that non-probability sampling techniques are prone to sampling bias because they do not allow for the estimation of sampling errors (Bhattacherjee, 2012), and the information obtained from a sample is not generalisable to the entire population.

4.5.3.1. Sampling frame

A sampling frame is also known as a working population because it provides a list that can be worked with practically and operationally (Zikmund, 2003). It is the second step in the sampling process and consists of a list of the units that exist within the population. It is usually a list with contact information that represents a representative subset of the population from which the sample is drawn (Bhattacherjee, 2012). According to Pinsonneault and Kraemer (1993), the choice of respondents from the sampling frame influences the representativeness of the study sample.

Under ideal conditions, the sampling frame should exactly match the population, but South African SOEs' IT departments are constantly evolving. IT professionals are hired, and others leave, and it can take some time for all of the changes to be reflected in all of the relevant systems. Similarly, some SOEs are formed, while others are merged or dissolved, resulting in a sampling frame that does not perfectly match the population.

The total number of employees in the top seven major public entities at the time of the study was 114 832. (State of the nation address, 2019). However, a list of the overall employee population for the rest of the SOEs in various spheres was unavailable. As a result, the respective SOEs' IT departments' employee population list was also unavailable. Thus, while the population of interest has been identified as discussed in the previous section, the size of the population cannot be determined because the information is not publicly available.

Zikmund (2003) notes that, the availability of lists of population members is critical, but it is often unavailable to the researcher. That was the case in the current study because the population list of IT practitioners in SOEs was unavailable.

4.5.3.2. Study sample

The third and final step in the sampling procedure is to select a sample from a sampling frame (Bhattacherjee, 2012). The study sample is the actual units, i.e., individuals who will participate in the study and whose responses will be evaluated to allow conclusions about the population to be drawn, provided they are representative (Trochim & Donnelly, 2001). A sample, according to Ary (2010), is a subset of the population. That group provides the necessary information and as closely as possible represents the larger population.

It is impossible to select a sample that perfectly represents the population; however, determining the appropriate sample size for the study is critical (Van Zyl, 2013). Kotrlik and Higgins (2001) discuss the impact of inappropriate, inadequate, or excessive sample sizes on the quality and accuracy of research. Table 4.6 was used in this study to determine the minimum required sample size for the SOE IT practitioners' population size. The table shows sample sizes for continuous and categorical data with alpha levels of .10, .05, or .01. In the table, the margins of error are.03 for continuous data and .05 for categorical data.

Since a sampling frame comprising of a list of the units that exist within the SOEs IT practitioner population was unavailable. Table 4.6, along with the sampling error and non-response issues suggested by Van Zyl (2013), were used to guide the sample size calculation.

When there are inconsistencies and a characteristic is measured in some, but not all, of the units or people in the population of interest, this is referred to as sampling error (Lindner, Murphy & Briers, 2001). When deciding on a sample size, sampling error refers to a statistical error that occurs when researchers omit certain units and choose a sample that does not represent the entire population, and thus the results from the sample do not represent the results obtained from the entire population (Groves et al., 2011).

In order to reduce the sampling error, randomising sample selection and/or increasing the number of observations is necessary. Overall, the larger the sample, the lower the sampling error, and this approach was used in this study, i.e. choosing a larger sampler size. It is important to note, however, that even with a larger sample size, sampling error cannot be completely eliminated unless a census is conducted (Lindner, Murphy & Briers, 2001).

Another critical factor is the response rate. The number of respondents who agreed to participate in the study is referred to as the response rate. In reality, most researchers rarely achieve a response rate of 100% (Taherdoost, 2016). Bosnjak, Tuten and Wittman (2005) also note that, response rates for Web surveys are consistently lower than for other self-administered survey modes. Non-responses can be caused by a variety of factors, including inability to respond, refusal to respond, ineligibility to respond, a survey that did not reach all members of the sample, and so on (Taherdoost, 2016). To address common non-response issues, Salkind (1997) recommends increasing the sample size by 40% - 50% to account for uncooperative and non-responsive subjects.

Taking the preceding discussions into account, the population size of 6 000 on Table 4.6 was chosen. The size was determined based on the assumption that each of the 277 SOEs has at least 22 IT professionals in their IT department. As a result, the population is 6 094. The current study employs continuous data with margins of error of 0.03 and alpha of 0.5. As a result, the sample size is 119. Given the previous discussion about non-response, the sample size plus 50% (60) which equals 179 of the population, was chosen. It should also be noted that whether the sample size was 8 000 (29 IT professionals per SOE IT department) or 10 000 (36 IT practitioners per SOE IT department), the sample size would be the same, 179, with continuous data and margin errors of 0.03 and 0.5 alpha.

The standard alpha =.05 (5%) cut-off value was chosen because it is a commonly used cut-off value considered to reduce the possibility of a false positive known as Type I error. Type I error is the possibility of incorrectly rejecting the null hypothesis and thus incorrectly concluding that an observed difference did not occur by chance, or, to put it another way, the possibility of incorrectly concluding that there is a difference between two groups when the truth is that there is no difference (Bewick, Cheek & Ball, 2004). It should be noted, however, that because there is no hypothesis testing at this stage, this type of error is not completely applicable, but the method is used as a guide to determine the minimum required sample size for a given population.

The current study also noted the debate over the appropriate sample size. Fink (1995) warns that oversampling can increase survey costs and is often unnecessary. Van Zyl (2013) agrees with this assertion and raises the conundrum that a sample too small does not represent the overall population, but a sample too large is also an overkill that does not necessarily increase the precision of testing the questions and is simply self-defeating because it does not take advantage of the power of inference.

Table 4.6. Determining minimum returned sample size for a given population size for continuous and categorical data (Kotrlik & Higgins, 2001)

	Sample size					
	Continuous data (margin of error= .03)			Categorical data (margin of error= .05)		
Population size	alpha= .10 t= 1.65	alpha= .05 t= 1.96	alpha= .01 t= 2.58	p= .50 t= 1.65	p= .50 t= 1.96	p= .50 t= 2.58
100	46	55	68	74	80	87
200	59	75	102	116	132	154
300	65	85	123	143	169	207
400	69	92	137	162	196	250
500	72	96	147	176	218	286
600	73	100	155	187	235	316
700	75	102	161	196	249	341
800	76	104	166	203	260	363
900	76	105	170	209	270	382
1,000	77	106	173	213	278	399
1,500	79	110	183	230	306	461
2,000	83	112	189	239	323	499
4,000	83	119	198	254	351	570
6,000	83	119	209	259	362	598
8,000	83	119	209	262	367	613
10,000	83	119	209	264	370	623

Kotrlik & Higgins (2001) state that, when calculating sample size, the researcher should consider whether a continuous or categorical variable will play a primary role in data analysis. If the sample is continuous, continuous sample size formulas should be used; otherwise, categorical sample size formulas should be used. To address the ambiguity regarding continuous vs categorical variables and whether or not Likert scales should be classified as continuous variables, Norman (2010) and Sullivan and Artino (2013) state that Likert scales with five or more categories can often be classified as continuous without compromising the analysis for which they are intended to be used. Because the scale used in this study has five categories, the current study used a continuous data scale to determine the appropriate sample size from Table 4.5.

4.5.4. Data Collection

Data collection techniques, also known as research instruments, are simply devices or tools used to obtain information relevant to the researcher's project (Birmingham & Wilkinson, 2003). The techniques are discussed further below.

4.5.4.1. Questionnaire

A questionnaire is the heart of a survey because the results are heavily reliant on it because it serves as the script for the researcher's conversation with the respondents (Krosnick & Presser, 2010). Questionnaires, according to Zohrabi (2013), are one of the primary sources of data in research. A questionnaire, according to Malhotra (2006), is a formal set of questions used to elicit information from respondents. Similarly, Kumar (2011) defines a questionnaire as a fundamental research tool comprised of a formal set of questions. Malhotra (2006) further posits that, questionnaires are the main tool of collecting primary quantitative data.

Unstructured questionnaires, structured questionnaires, and a combination of the two are the three types of questionnaires (Zohrabi, 2013). Structured questionnaires typically have standardised questions and specify the words exactly in the same order for questions used in data collection, and they have a close relationship with the quantitative research approach (Cheung, 2014). Unstructured questionnaires, on the other hand, are typically made up of open-ended questions. Open questions allow respondents to express their opinions in their own words, and combination questionnaires are a hybrid of the two preceding types of questionnaires (Trueman, 2015).

Birmingham and Wilkinson (2003) advocated for the inclusion of a number of unstructured questions in the questionnaire to allow for a higher level of discovery; however, the current study opted for a structured questionnaire due to the quantitative nature of the study. The current study discovered that there are benefits and drawbacks to using a questionnaire. The benefits and drawbacks of the questionnaire are shown in Table 4.7.

Table 4.7. Advantages and disadvantages of questionnaires (Adapted from Jones, Murphy, Edwards & James, 2008; McPeake, Bateson & O'Neill, 2014)

Advantages of questionnaires	**Disadvantages of questionnaires**
Often can be quickly answered	Low response rates
Can be completed at respondent's convenient time	No guarantee that the individual will answer all questions
Data can be collected from geographically dispersed areas	No way of knowing if the right individual answered the questions
No interviewer bias – answers being influenced by the presence of interviewer	No opportunity to reword or further elaborate on the misunderstood questions
Inexpensive way to gather large data	Body language cannot be observed
Allows for anonymity	
Information is easily coded	
Responses can be analysed quickly	

Because individuals working for South African SOEs are geographically dispersed, a questionnaire (web-based) was chosen as the data collection research instrument. This method is also a low-cost way to collect the large amount of data required. Another reason for using a web-based questionnaire is that self-administered web-based questionnaires produce a higher response rate than paper-based questionnaires, according to De Leeuw, Hox, and Snijkers (1999). Bhattacherjee (2012) emphasises the advantages of an online or web survey. Some of the advantages are that they are inexpensive, simple to administer and modify, and results are recorded instantly.

Measurement scales

According to Yang (2011), there are four types of measurement scales used in research: nominal, ordinal, interval, and ratio. Nominal scales divide data into mutually exclusive categories with no data ranking, such as animal gender: male and female. Ordinal scales are used to categorise data that can be ranked but cannot be calculated arithmetically, such as learner evaluation values such as fail, pass, good, and excellent.

The interval scales can rank data and the unit differences can be calculated arithmetically, for example, degrees in temperature. It is important to note that zero in the interval scale does not mean nil or nothing. The ratio scales can rank data and the unit differences can be calculated arithmetically; it has the same properties as interval measurement. The difference is that ratio scales have a zero that is equivalent to arithmetic zero, which means nil or nothing, such as the number of children in a family (Yang, 2011). Yang (2011) further asserts that the ratio scale is the highest level, followed by interval, ordinal and nominal being the lowest level of measurement scales. In terms of including data information, the nominal scale is the least powerful. Table 4.8 shows various scales and their measurement characteristics.

Table 4.8. Types of scale and their measurement characteristics (Blumberg, Cooper and Schindler (2005)

Type of scale	Characteristics of Data	Basic Empirical Operation	Example
Nominal	Classified but no order	Determination of equality	Gender: Male/Female
Ordinal	Classified and order but no distance or unique origin	Determination of greater	Of lesser value. e.g., doneness of meat, rare, medium or well
Interval	Classified, order and distance but no unique origin	Determination of equality of intervals or differences	Temperature in degrees
Ratio	Classified, order, distance and unique origin	Determination of ratios	Ages in years

In addition to the four scales discussed above, Bhattacherjee (2012) adds four common scales for social science research: binary, semantic differential, Guttman, and Likert scales.

Bhattacherjee (2012) explains that, binary scales are nominal scales with binary items that have one of two possible values, such as yes or no, true or false, and so on. The semantic differential scales are composite or multi-item scales that ask respondents to express their opinions on a single statement by selecting different and opposing adjective pairs. The Guttman scale is a composite scale that employs multiple items, with the construct of interest arranged in increasing order of intensity from least to most intense (Bhattacherjee, 2012).

Likert scale statements are worded statements to which study participants are required to use a five or seven-point scale ranging from strongly disagree to strongly agree to determine their level of agreement or disagreement (Bhattacherjee, 2012). According to Wu and Leung (2017), Likert scales are widely used in social science research and are typically treated as an interval scale.

In this study, interval data was measured using a five-point Likert-type scale, with responses ranging from 1 to 5, with 1 being strongly disagree and 5 being strongly agree. According to Babakus and Mangold (1992), this scale increases response rate and quality while decreasing respondents' frustration levels and allowing for more granularity than binary scales.

4.5.5. Pilot Testing

Pilot testing, according to Bhattacherjee (2012), is an important part of the research process that is often overlooked. The pilot test was carried out to aid in the detection of potential problems and deficiencies in the research design, as well as to determine the validity of the instrument used in the current study. Thus, a pilot sample from a small subset of the population was chosen.

Biddix (2014) states that, finding a 100% accurate instrument is nearly impossible; however, the validity of the instrument chosen for a study should be nearly perfect. Bhattacherjee (2012) previously stated that measuring constructs in social science research is difficult, and as a result, using any scale that we prefer to measure social science constructs usually falls short. Therefore, the instrument and scales used to measure a variable are critical because they must accurately measure what they are supposed to measure because the conclusions drawn from the research are based on the information obtained from them (Fraenkel & Wallen, 2003).

The pilot study tested both face and content validity. Face validity refers to subjective judgment that evaluates the operationalisation of a construct to see if it appears to be a good translation (Trochim, 2006), but it is the weakest approach to demonstrating construct validity (Drost, 2011). Content validity, on the other hand, examines the operationalisation of a construct against the relevant content domain and frequently employs expert judges in the field to determine whether measures are fully representative of the content domain (Drost, 2011).

For this reason, the draft research instrument (questionnaire) was distributed to a few academics and IT professionals for review and feedback. Each of them examined the questionnaire individually, and their comments and feedback were used to improve the questionnaire accordingly. This was done to identify and correct the questionnaire's flaws, as well as to improve the instrument (Bailey, 2008). Some items were then changed to reduce ambiguity and ensure consistent comprehension. Furthermore, the current instrument's constructs and items were adapted from previously tested instruments from similar studies. The results of the pilot study provided preliminary evidence of the instrument's face and content validity. The main survey was conducted after the pilot testing was completed successfully.

4.5.6. The Main Survey

The main survey was carried out using eSurveyCreator, a Web-based application that allows participation regardless of time or location. The application was chosen because it is one of Wits University's recommended platforms, and it is free to use for registered research students. The application is simple to use, intuitive, and the link to the survey is easily shared. The application also stores the collected data in a single repository and provides simple survey results reporting. The main benefit of the eSurveyCreator application is that users remain anonymous, resulting in no breach of confidentiality.

The survey link was distributed via electronic mail (email) and social media platforms such as LinkedIn and WhatsApp to identified potential participants. The email addresses for the contacts were obtained from the publicly available Government Directory for State-Owned Enterprises. Where the addresses were out of date, a phone call was placed to the relevant SOE to obtain the current email address of the relevant individual. The individuals who were contacted were then asked to share the survey link with other relevant IT professionals. This snowballing technique, in conjunction with social media platforms such as LinkedIn and WhatsApp, enabled participants to reach a wider audience. This procedure was repeated until a sufficient number of participants were obtained. The survey was available on eSurveyCreator Website from 31 January 2020 to 31 May 2020.

The main survey link was initially distributed to 180 purposefully identified potential participants. Potential participants included IT executives and practitioners such as Chief Information Officers, IT Directors, IT/IS managers, Business analysts, Project managers, IT architects, IT administrators, and other IT related specialists who work within and/or are familiar with SOE information technology environments. Snowballing or referrals resulted in additional participation. When enough data was gathered, it was extracted from the survey tool and entered into SPSS for analysis and reporting.

4.6. Preparation of Data

When conducting research based on survey data collected anonymously through the internet there is always a concern regarding inattentive or thoughtless responses. As a result, data quality may be an issue (Meade & Craig, 2012). Data cleaning was part of the data preparation process for data collected via web survey. In terms of cleaning, all variables frequencies were run then based on those selected variables, the mean, median, mode, and standard deviation were determined. This allowed the researcher to perform data validation. Once completed, statistical calculations were carried out in order to analyse the data.

The total number of participants that partook the survey was 144. 110 participants fully completed the survey and their responses deemed appropriate for the study. There were 34 participants who only partially completed the survey (responded to less than half of the questions) and their responses were not used.

4.6.1. Data Coding

The collected data was transferred from eSurveyCreator, a web-based application, to MS Excel to allow for coding. After that, the codes were assigned to their respective responses. The coded data was then exported to SPSS for analysis. The allocations are shown in Table 4.9.

Table 4.9. The Codes

	Responses	**Allocated Code**	**Questions**
Likert scale: “Strongly Disagree” to “Strongly Agree”	Strongly Disagree Disagree Neutral Agree Strongly Agree	1 2 3 4 5	Questions 2-12
Job Title	Chief Information Officer Chief Technology Officer IT Director IT/IS Manager IT Administrator IT Architect Project Manager Business Analyst Other IT Specialist	1 2 3 4 5 6 7 8 9	Questions 13
Industry	Constitutional entity Major public entity National public entity National government business enterprise Provincial public entity Provincial government business enterprise Financial and Revenue Retail Educational ICT	1 2 3 4 5 6 7 8 9 10	Questions 14

4.7. Data Analysis Strategy

The current study used of both descriptive and inferential statistics for data analysis purposes with SPSS version 25 and AMOS version 25 statistical software packages.

4.7.1. Descriptive statistics

These describe the nature of the collected data and are used to summarise the characteristics of the study sample in order to organise data. These statistics are made up of quantitative measures that statistically describe, aggregate, and present the relevant constructs or construct associations (Bhattacherjee, 2012). The statistics include mean, median and mode to measure central tendency of a variable. They also measure dispersion of a frequency distribution through standard deviation and variance (Evans & Basu, 2010). Figure 4.7 depicts various statistical measures as well as their corresponding formulae.

Figure 4.7. Distribution measures and their respective formulae (Inani, 2016)

Moment number	Name	Measure of	Formula
1	Mean	Central tendency	$\bar{X} = \frac{\sum_{i=1}^{N} X_i}{N}$
2	Variance (Volatility)	Dispersion	$\sigma^2 = \frac{\sum_{i=1}^{N}(X_i - \bar{X})^2}{N}$
3	Skewness	Symmetry (Positive or Negative)	$Skew = \frac{1}{N}\sum_{i=1}^{N}\left[\frac{(X_i - \bar{X})}{\sigma}\right]^3$
4	Kurtosis	Shape (Tall or flat)	$Kurt = \frac{1}{N}\sum_{i=1}^{N}\left[\frac{(X_i - \bar{X})}{\sigma}\right]^4$

Where X is a random variable having N observations (i = 1,2,…,N).

Skewness and Kurtosis were used to measure frequency distribution and data normality in the current study. Skewness refers to distortion degree from the normal or symmetrical distribution bell curve. The normal distribution has a skew value of zero, implying that it is symmetric (Kim, 2013). As shown in Figure 4.8, there are two types of skewness: positive skew and negative skew.

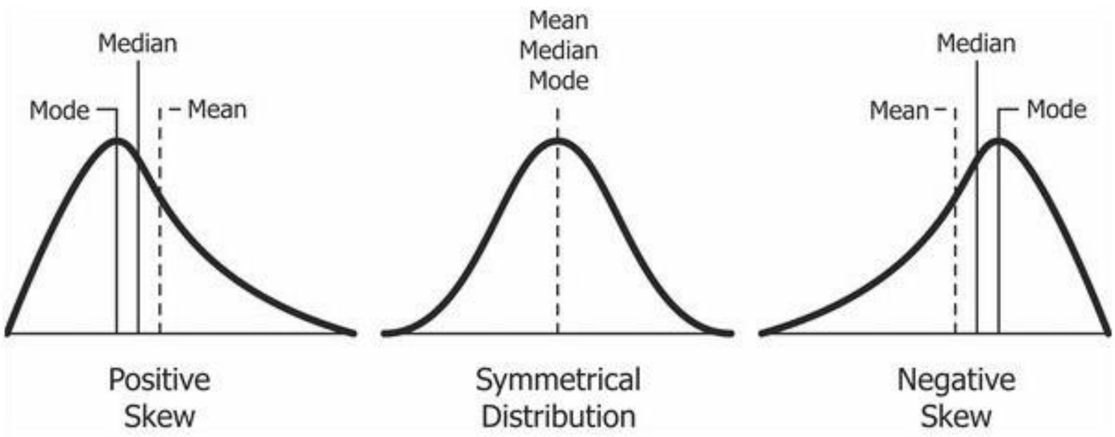

Figure 4.8: Positive and negative skewness (Jain, 2018)

Positive skew value occurs when the tail on the right side of the distribution is longer or fatter than the right side and the high number of values are lying towards the left of the mean (Kim, 2013). In other words, the mean and median will be greater than the mode (Jain, 2018). In contrast, negative skew value occurs when the tail of the left side of the distribution is longer or fatter than the tail on the right side and the high number of values are lying towards the left of the mean (Kim, 2013). As a result, the mean and median will be less than the mode (Jain, 2018).

The skewness of the data must be between -0.5 and 0.5 for it to be fairly symmetrical. If there is negative skewness with a range between -1 and -0.5 or positive skewness ranging between 0.5 and 1, then the data set is moderately skewed. Further to that, if there is negative skewness with a range less than -1 or positive skewness ranging greater than 1, then the data set is highly skewed (Jain, 2018). Next, Kurtosis is discussed.

Kurtosis refers to degree of flatness or peaked-ness of a given distribution relative to the normal distribution. It measures the fatness of tails in the distribution and indicates whether a frequency distribution is flat, normal or peaked shape (Ayadi, Cao, Lazrak & Wang, 2019). As shown in Figure 4.9, there are three degrees or types of distribution.

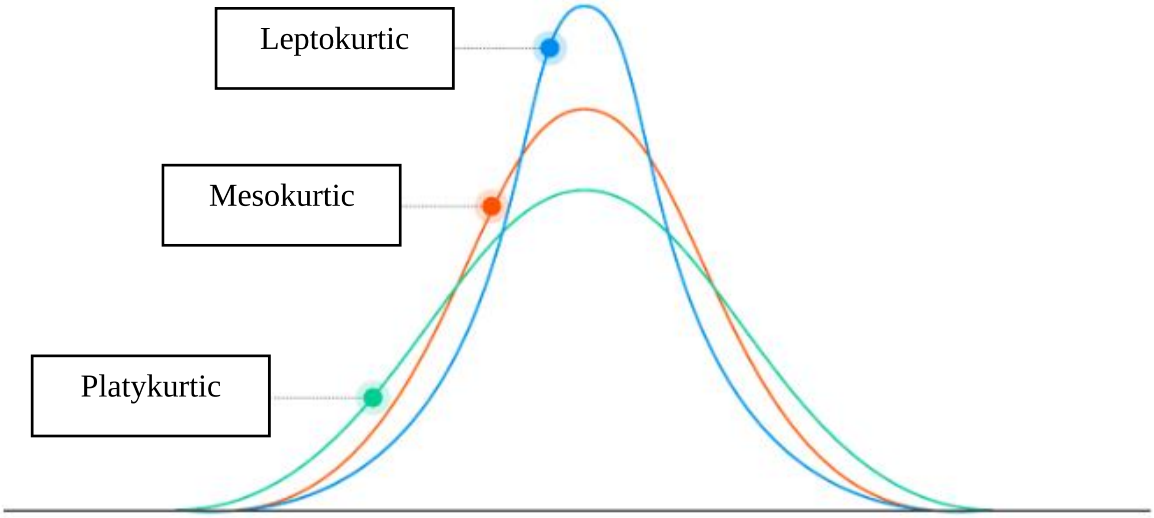

Figure 4.9: Types of Kurtosis (Jain, 2018)

The term “lepto” means thin or skinny. Leptokurtic distribution has a Kurtosis value which is > 3 meaning it has positive kurtosis. The curve is high and sharp which indicates an excess of outliers. In general, if a distribution is leptokurtic then the data set used is contaminated or comprises of extreme values. The outliers stretch the horizontal axis of the histogram graph, which makes the bulk of the data appear in a narrow, skinny or thin vertical range with a fatter tail (Cain, Zhang & Yuan, 2017; Jain, 2018).

Mesokurtic distribution has a Kurtosis value which is = 3. This statistic is similar to that of the normal distribution and indicate equal distribution of items around the central value. The extreme values of the distribution have a normal peak or the normal curve (Jain, 2018).

The term “platy” means broad. Platykurtic distribution has a Kurtosis value which < 3 meaning it has negative kurtosis. The peak is lower, flat and broader than Mesokurtic and the distribution has rather short tails and flat shoulder. This means less concentration of items near the centre and the data lacks outliers. This indicates that extreme values are less than that of the normal distribution (Cain, Zhang & Yuan, 2017; Jain, 2018).

The current study adopted the kurtosis value guidelines provided by Hair, Hult, Ringle and Sarstedt (2017). They posit that, the general guideline for kurtosis, is that if the value is greater than +1, then the distribution is too peaked. On the other hand, if the value is less than -1 then that indicates a distribution that is too flat. The distributions that have kurtosis exceeding these given guidelines are considered abnormal (Hair et al., 2017).

As suggested by Cain, Zhang and Yuan (2017), in order to understand normality, a measurement for it first needs to be defined. What is considered normal distribution was defined in the preceding section. For the current study the values for skewness and Kurtosis provided in preceding section were used as a guide for analysing data in the next chapter.

4.7.2. Inferential statistics

In contrast to descriptive statistics, inferential statistics draws conclusions from the population from which the sample was drawn and generalizes them to the entire population of interest (Allua & Thompson, 2009). Inferential statistics, according to Bhattacherjee (2012), are explicitly designed to test hypotheses. Many statistical procedures fall into this category, and the majority of them are supported by modern statistical software such as SPSS and SAS.

Inferential statistics are divided into two categories. Parametric statistics which are used for measuring interval or ratio level variables and includes t-test, Analysis of Variance (ANOVA), MANOVA, correlation (Pearson's r), canonical and regression. Non-parametric statistics, that are commonly used for measuring nominal or ordinal level variables and includes Chi-Square, Fisher's Exact, Mann-Whitney U, Kruskal-Wallis and Spearman Rho. Table 4.9 summarises commonly used parametric and non-parametric statistical techniques (Allua & Thompson, 2009).

Table 4.9. Commonly used parametric and non-parametric statistical techniques (Allua & Thompson, 2009)

Statistical Test	Independent Variable	Dependent Variable	Comments
Non- Parametric			
Chi-Square	Nominal	Nominal	Need > 5 expected subjects/cell
Fisher's Exact	Nominal	Nominal	
Mann-Whitney U	Dichotomous	Ordinal	
Kruskal-Wallis	Nominal	Ordinal	3 or more values for Independent Variable
Spearman Rho	Ordinal	Ordinal	
Parametric			
t-Test	Nominal	Interval/Ratio	
ANOVA	Nominal	Interval/Ratio	
MANOVA	Interval/Ratio	Interval/Ratio	Multiple Dependent Variables
Correlation (Pearson's r)	Interval/Ratio	Interval/Ratio	
Simple Regression	Interval/Ratio	Interval/Ratio	Single Dependent Variable
Multiple Regression	Interval/Ratio	Interval/Ratio	Multiple Dependent Variables
Canonical		Interval/Ratio	Multiple independent and dependant variables

To summarise, both parametric and non-parametric data analysis are founded on probability theory and the hypothesis testing procedure. The purpose of the study informs the choice of tests, which can be divided into three basic categories: evaluating differences, examining relationships, or making predictions (Allua & Thompson, 2009).

The current study aimed to firstly examine relationships between variables by explaining what determinants influence South African SOEs to adopt IT servitization, determine if there is a positive or negative relationship between each determinant and IT servitization adoption, identify if the determinants affect each other, and to subsequently determine the significance of the effect, thereof. Once the relationships were understood, the study then aimed to make predictions by providing a model for IT professionals to pre-assess and analyse an environment to understand if the IT servitization adoption determinants will positively or negatively their adoption attempt in order to pro-actively manage the determinants where necessary. Thus, a single statistical technique was insufficient to test and make inferences about the sample data hence multiple tests were deployed. The techniques used were Chi-Square, correlation (Pearson's r), ANOVA and regression. Since five-point Likert scales which measure interval data were used to measure variables, correlation (Pearson's r), ANOVA and regression were used in the process of hypothesis testing.

4.7.3. Reliability

This refers to the consistency that measures dependability of a construct (Fraenkel, Wallen & Hyun, 2011) as well as the measuring instrument consistency to provide a certain output when the same object is measured (Leedy & Omrod, 2005). Simply put, reliability is the consistency of a measurement over time and over a variety of conditions (Drost, 2011). If the research findings are consistently replicated, the findings are considered reliable. It should be noted, however, that reliability does not imply accuracy, but rather consistency. There are several methods for calculating reliability, including inter-rater, test-retest, split-half, and internal consistency reliability (Bhattacherjee, 2012).

The common method used for testing internal consistency in the behavioural sciences is Cronbach's alpha α or coefficient alpha (Drost, 2011). Therefore, the curent study will use the Cronbach's alpha which measures the degree of consistency between different items probing the same construct and producing the consistent results (Zohrabi, 2013; Bhattacherjee, 2012). According to Gliem and Gliem (2003) Cronbach's alpha is a technique to test reliability that requires only a single test administration to provide a unique estimate of the reliability with coefficient that normally ranges between 0 and 1. When the Cronbach's alpha coefficient is closer to 1, the greater the internal consistency of the items in the scale.

The following rules of thumb apply for the value of alpha: $\alpha > .9$ is Excellent, $\alpha > .8$ is good, $\alpha > .7$ is Acceptable, $\alpha > .6$ is questionable, $\alpha > .5$ is poor and $\alpha < .5$ is unacceptable (George & Mallery, 2003).

Cronbach's alpha is a coefficient to check reliability and not a test that is statistical. Gliem and Gliem (2003) further conclude that, Cronbach's alpha is the average value of the reliability coefficients that would be obtained for all possible combinations of items when split into two half-tests. Since this study will be using Likert scales, Gliem and Gliem (2003) note the importance of calculating and reporting Cronbach's alpha coefficient for internal consistency reliability for scales used. For this reason and also because a single test was administered to provide an estimate of reliability, Cronbach's alpha coefficient was deemed suitable for this study.

4.7.4. Validity

Validity seeks to understand if indeed the underlying construct intended to be measured has been measured and how the result of the research is truthful and trustworthy (Creswell, 2009). Bhattacherjee (2012) states that, there are two approaches to assess validity and they are, theoretical and empirical approaches and should ideally both be measured because they are critical in social science research to adequately ensure the validity of measures.

Construct validity - Theoretical assessment focuses on how well the idea of a theoretical construct is operationalised. It is called translational validity or representational validity and further consists of two subtypes, namely: face and content validity (Bhattacherjee, 2012).

- Face validity is a subjective judgment which assesses the operationalisation of a construct and see whether it seems like a good translation (Trochim, 2006) but the not necessarily the best approach to demonstrate construct validity (Drost, 2011).

- Content validity checks the operationalisation of a construct against the relevant content domain and often makes use of expert judges in the field to assess the measures and check whether they fully represent the content domain (Drost, 2011).

In the current study, items were adapted from the literature to ensure face and content validity, and pilot testing was used to check the instrument's validity and detect potential issues. The survey was given to a few academics and IT professionals to review and provide feedback on in order to assess the operationalisation of constructs against the relevant content domain. Next, criterion validity is discussed.

***Criterion validity* -** Empirical assessment focuses on how well a given measure relates to one or more external criterion, based on empirical observations. It is called criterion-related validity and consist of four sub-types, namely: convergent, discriminant, concurrent and predictive validity (Bhattacherjee, 2012).

- Convergent validity examines the degree to which the operationalisation of a construct converges on or is similar to other operationalisations that it is theoretically alike.

- Discriminant validity observes the degree to which the operationalisation of a construct diverges from or is not similar to other operationalisations that it theoretically different from (Trochim, 2006; Drost, 2011).

- Concurrent validity assesses how well a measure corresponds to other previously established concrete criterion that is presumed to occur simultaneously (Trochim, 2006; Bhattacherjee, 2012).

- Predictive validity assesses the operationalisation's ability to successfully predicts a future outcome that it should theoretically be able to predict (Trochim, 2006; Bhattacherjee, 2012).

In order to establish convergent and discriminant validity, a statistical technique called Principal Components Analysis (PCA) is applied to analyse evidence of unidimensional relationship and convergent validity by demonstrating that all the measured items for a single construct load onto a single component. Once the validity of the data elements is confirmed, further tests for the reliability of the data constructs is conducted by computing

Cronbach's alpha values for each construct using SPSS. The cut-off alpha value of .70 is used to establish whether the items demonstrated evidence of internal consistency.

External validity **-** focuses on how well a causal relationship from construct X to construct Y is generalisable and can be assumed valid for other cases and situations, and has been a valued standard for decades (Drost, 2011). Polit and Beck (2008) posit that external validity refers to the degree to which inferences from a study can be generalised to other people, task/stimulus, settings and times. Drost (2011) further add the importance of differentiating generalisations to well explained target populations from generalisations across populations. This study is based on literature derived from previous studies of a similar nature, and the instrument incorporates some questions asked in previous studies.

Internal validity **-** Assesses the validity of the research itself and about ensuring good controls when conducting a study. Internal validity questions whether the instrument measures what it aims to measure. Additionally, for the research to be considered internally valid it must isolate the effects of the variables used such that they can be measured separately (Drost, 2011). Some of the questions researchers consider are: given that there is a relationship between constructs, is the relationship a causal one? and are there any confounding factors in my study? Internal validity of a research design has several threats, these are: history, maturation, testing, instrumentation, selection, mortality, rivalry, regression, demoralisation, Hawthorne effect and diffusion of treatment and compensatory equalisation (Drost, 2011). In the current study regression was used for testing internal validity.

The previous two sections discussed reliability and validity, as well as how they were applied and ensured in this study. Both are significant. According to Van Zyl (2013), they are important as a primary defence against drawing incorrect or false conclusions. Next section discusses the measurement model for the study.

4.7.5. Measurement Model

Ahire and Devaraj (2001) posit that, measurement or assessment of a model can be obtained using these methods, namely: the exploratory factor analysis (EFA) method, confirmatory factor analysis method (CFA) and the hybrid method. The EFA and CFA methods are different but are both powerful statistical methods (Suhr, 2006). EFA does not extract factors founded on theory but on statistical results and previous information of the factor numbers or which variables go with which construct is not necessary. On the other hand, CFA deals with the relationship between variables and observed measures within a measurement model and it is driven by theory and hypothesis (Brown, 2006). The hybrid method is simply the combination of the two methods.

According to Al-Qeisi (2009), it is recommended that post the empirical testing of the EFA method then CFA method could be applied to make it a hybrid method and get the best of both, meaning start with EFA to explore then proceed with CFA for confirmation and for the other multiple advantages. Comparison between EFA and CFA methods are depicted on Table 4.10 and their characteristics discussed further below.

Table 4.10. Comparison between EFA and CFA (Adapted from Hu, 2016).

EFA	**CFA**
Descriptive/ Explorative procedure	Requires strong empirical or conceptual foundation
Input: Correlation matrix- All variables standardised	Input: variance-covariance matrix - Standardised and unstandardised solution
Factor selection based on eigenvalue procedures and model fit statistics	Pre-specification of number of factors pattern of factor loadings
Factor rotation to obtain simple structure	Simple structure is achieved by fixing indicator cross loadings to zero
Unique variances/ measurement error uncorrelated	Unique variances/ measurement error can be modelled
Lesser modelling flexibility than CFA	Greater modelling flexibility than EFA
Associated with theory development	Hypothesize beforehand the number of factors

The next section goes into great detail about the concepts and characteristics associated with EFA.

4.7.5.1. Exploratory factor analysis (EFA)

EFA is still one of the most commonly used quantitative methodology reporting techniques in social science research (Osborne, 2015). Beavers, Lounsbury, Richards, Huck, Skolits and Esquivel (2013) describe EFA as orderly rationalisation or simplification of interrelated measures. It is mainly used for determining the correct number of common factors required to explain relationships between variables being observed without imposing a pre-conceived structure on the results (Jomnonkwao & Ratanavaraha, 2016). EFA, as the name implies, is exploratory in nature and as such the investigator has no expectations of the number or nature of the variables and thus allowing them to explore and generate a model or theory or model from a large set of constructs (Williams, Onsman & Brown, 2010).

The following are the objectives of EFA: a) Reduction of the number of variables. b) Examination of the structure or relationship between variables. c) Detection and assessment of unidimensionality of a theoretical construct. d) Evaluation of scale, test or instrument construct validity. e) Development of parsimonious or simple analysis and interpretation. f) Addressing of multicollinearity where two or more variables are correlated. g) Primarily used to develop theoretical constructs and h) prove or disprove proposed theories (Williams, Onsman & Brown, 2010).

As suggested by Williams, Onsman and Brown (2010), EFA follows five-step protocol as depicted in Figure 4.10. EFA complex multivariate statistical approach involving numerous steps that are linear and sequential. The steps are described below and were followed for the current study.

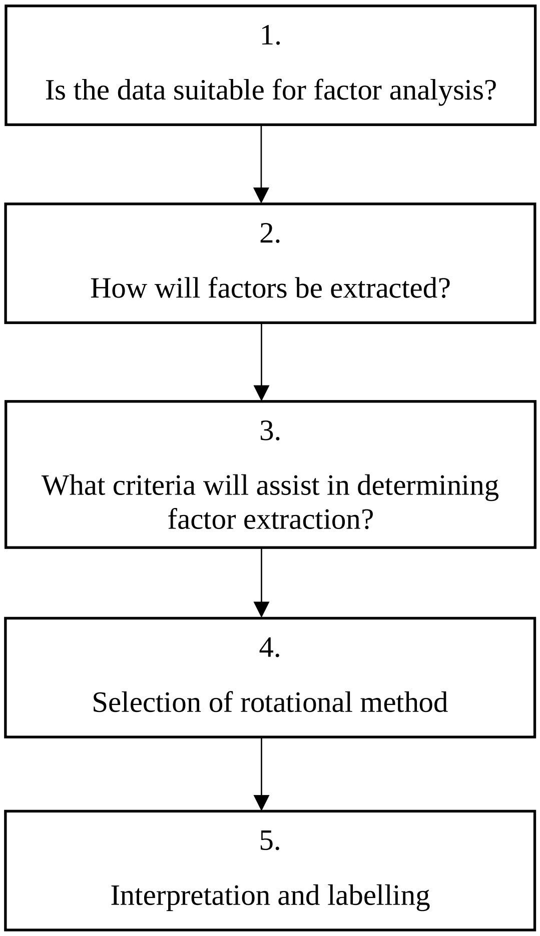

Figure 4.10: The 5-step EFA Protocol (Williams, Onsman & Brown, 2010)

First Step: Is the data suitable for factor analysis?

Williams, Onsman & Brown (2010) suggests that sample size, correlation matrix factorability, Kaiser-Meyer-Olkin Index and Bartlet's Test of Sphericity are appropriate to check data suitability for analysis of factors. Pearson and Mundform (2010) and Coughlin (2013), note the importance of noting the basic assumption of factor analysis. The assumption is that for a collection or group of variables being observed there are a set of underlying variables called factors that can explain the interrelationships among those variables. The factors are smaller than the variables being observed. Sample size, correlation matrix factorability, KMO test, communalities and Bartlett's test of sphericity concepts are explained further below. Factor analysis was basically used to reveal the hidden structure of a set of variables being analysed. The results are presented in Chapter 5 of this study.

Sample size

Sample size refers to the number of participants that are carefully chosen from the population and considered to be representative (Dhawan, 2010). Hair, Anderson, Tatham and Black (1998) suggest that, for a sample to be suitable it should have 100 or more participants. Pearson and Mundform (2010) go on to say that many models with high communalities, three or fewer factors and high p:m ratios, with sample sizes under 100 are most likely to achieve good agreement. The final study sample consisted of 110 participants, which was within the recommended parameters.

Correlation matrix factorability

Factorability refers to the assumption that there are a least some variables that have correlations with one another, allowing for identification of coherent factors to take place. In essence, correlation matrix factorability shows variable associations (Hair et al., 1998). The following guidelines are provided, ±0.3 equates to nominal, ±0.4 equates to substantial, and ±0.5 equates to very significant (Hair et al.,1998). Williams, Onsman and Brown (2010) suggest that, if correlations are less than 0.3, the researcher should reconsider whether factor analysis is the best statistical method for their study.

KMO Statistics

The KMO test of sampling adequacy measures the shared variance in the items (Beavers, Lounsbury, Richards & Huck, 2013). Glen (2016) explains this in simple terms and posits that, KMO test measures how your data is suited for factor analysis. When KMO is tested, it returns values ranging from 0 to 1, as shown in Table 4.11.

Table 4.11 Guidelines for Interpreting the Kaiser-Meyer-Olin Test (Kaiser, 1974)

KMO Value	**Degree of Common Variance**
0.90 to 1.00	Marvellous
0.80 to 0.89	Meritorious
0.70 to 0.79	Middling

0.60 to 0.69	Mediocre
0.50 to 0.59	Miserable
0.00 to 0.49	Unacceptable

The Kaiser criterion is said to be reliable when the averaged extracted communalities is at least more than 0.70 as Jolliffe recommends (Jolliffe, 1986). This criterion also suggests that all factors that are above the eigenvalue of 1 should be retained (Kaiser, 1960).

Communalities

According to Pearson and Mundform (2010) estimation of communalities and more importantly factor loadings is the major statistical problem for EFA. They add that for the results of a factor analysis are to be useful beyond a particular study and generalisable, then the estimated loadings must be good enough approximations of true population loadings. The communalities show the extent of correlation for a specific individual item against the rest of the other items (Gerber & Finn, 1999). When items have low communalities i.e. less than 0.3, Hosany, Ekinci and Uysal (2006) recommend that they should be eliminated.

Bartlett's Test of Sphericity

This test provides evidence that the observed correlation matrix (a matrix of Pearson correlations) differs statistically from a singular matrix thereby confirming that linear combinations exist. In simple terms, checks for redundancy between variables that could be grouped together with some factors (Beavers et al., 2013). For factor analysis to be suitable, the Bartlett's test of sphericity should be significant at $p < 0.05$ (Hair et al., 1998). This indicates that the construct correlation structure is good enough to allow for analysis factors. The results of the first step of the EFA Protocol indicate that data is appropriate and suitable for factor analysis and results are presented in Chapter 5 of this study.

Second Step: Factors extraction- How will factors be extracted?

Williams, Onsman and Brown (2010) posit that there are multiple ways to perform factor extraction. Tabachnick & Fidell (2007) and Thompson (2004) agree that commonly used extraction methods for EFA and CFA are Principal components analysis (PCA), Principal axis factoring (PAF), Maximum likelihood, unweighted least squares, Generalised least squares, Alpha factoring and Image factoring. PCA and PAF do however remain primary methods that are most used in academic literature (Tabachnick & Fidell, 2007; Thompson, 2004) and are discussed next.

Principal Axis Factoring (PAF)

PAF is one of the most widely used method in factor analysis and known for limiting the variance that is common among variables. In other words, it does not redistribute the unique variance to one variable (Ngure, Kihoro & Waititu, 2015). According to Stevens (2002), PAF and PCA are similar computationally. In PCA, the linear combination of variables results in components or factors that account for all of the variance in the original data and PAF analysis yields components or factors that account for the common variance in the original data (Stevens, 2002).

Principal Component Analysis (PCA)

PCA is a widely used method for factor extraction (Ngure, Kihoro & Waititu, 2015) and uses a correlation matrix as the matrix of association (Stevens, 2002). When researchers conduct an analysis, they focus on a reduced correlation matrix as the matrix of association. The results of this is a reduced correlation matrix that contains communality estimates on the main diagonal as opposed to ones (Stevens, 2002). This method was chosen for factor extraction because the aim was to identify correlations and associations in the data set.

Pett, Lackey and Sullivan (2003) suggest the use of PCA to establish preliminary observations in EFA. For this reason, the data was subjected to PCA using SPSS in the current study.

Third Step: Factor extraction criteria - What criteria will assist in determining factor extraction?

According to Yong and Pearce (2013), researchers need to strike a balance when number of factors to retain for analysis. If too many factors are extracted this may present undesirable error variance. On the other hand, if too few factors are extracted this might result in leaving out valuable common variance. Therefore, selecting which criterion is most suitable when deciding on the number of factors to extract for the study is important. The eigenvalues and scree plots are commonly used for determining how many factors should be retained (Yong & Pearce, 2013).

According to the Kaiser criterion, also called the Kaiser Guttman rule, all factors with eigenvalues that are greater than one should be retained. In order to apply this rule correctly, the researchers need to compute the eigenvalues for a correlation matrix to establish how many exceed one. Once done this number represents the number of components to be retained in an analysis (Coughlin, 2013).

Another criterion used was scree plots. According to this method, the factors are retained until the diminishing eigenvalues stop declining (Coughlin, 2013).

The results of the third step of the EFA Protocol identified eigenvalues and scree plots as the methods for determining factor extraction for the study and presented in the data analysis chapter.

Fourth Step: Selection of Rotational Method

Bryant and Yarnold (1995) define rotation as procedure where the components are rotated with an aim to achieve a simple structure. Rotation maximises high item loadings and minimises low item loadings, thus producing simplified, interpretable results (Brown, 2009). Primarily, there are two common rotation techniques. They are orthogonal rotation and oblique rotation. Orthogonal rotation methods assume that the factors being analysed are not correlated. On the other hand, oblique rotation methods assume that the factors being analysed correlated (Brown, 2009).

In published literature, orthogonal method is the commonly used rotation procedure (Coughlin, 2013). SPSS Version 25 used for statistical analysis offers five rotation methods: varimax, direct oblimin, quartimax, equamax and promax. Three are orthogonal (varimax, quartimax and equimax) and the remaining two are oblique (direct oblimin and promax). The current study used orthogonal(varimax) rotational method. The varimax orthogonal rotation algorithm was chosen because it yields simple structure for uncorrelated factors (Coughlin, 2013) and produces results that are easily interpretable (Costello & Osborne, 2005).

Since the goal of rotation is to seek a simple structure according to Brown (2009), Thurstone (1947) first proposed five criteria required for simple structure to be achieved. Firstly, for each variable there has to be at least one zero loading on some factor. Secondly, for each factor there should be at least as many zero loadings as there are factors. Thirdly, for each pair of factors there should be variables with significant loadings on one and zero loadings on the other. Fourthly, for each pair of factors there should be a large proportion of zero loadings on both factors. Lastly, for each pair of factors there should be only a few complex variables.

In order to understand Thurstone's five criteria, there is a few more concepts that need to be understood, they are: a) Zero loading- zero loadings includes any loading that fall between -.10 and +.10. b) Significant loading- when working with a sample size example 100 participants, loadings of .30 or higher can be considered significant. c) Complex variables- variables with loadings of .30 or higher on more than one factor. These guidelines were used achieve a simple structure in the current study as recommended by Brown (2009).

Fifth Step: Interpretation and labelling

The final step of the five-step EFA protocol involves examining the variables that are related to a factor then subsequently then labelling them (Williams, Onsman & Brown, 2010). The labelling of the factors is dependent on the researcher and highly subjective, but should be descriptive enough (Pett, Lackey & Sullivan, 2003; Henson & Roberts, 2006). The fifth and last step finds the factors that collectively describe most answers being analysed (Williams, Onsman & Brown, 2010). Chapter 5 discusses the interpretation. Next, CFA statistical technique is discussed.

4.7.5.2. Confirmatory factor analysis (CFA)

Al-Qeisi (2009) describes CFA as a statistical technique that is used to verify the factor structure of a set of observed variables and gives the researcher an ability to accept or reject the theory that is preconceived. Meaning it allows the researcher to test the hypothesis and ascertain if there is a relationship between the variables that are being observed together with their underlying constructs that are latent. With theory and research that is empirical, the pattern of the relationship is established, and the researcher is able test the hypothesis statistically (Al-Qeisi, 2009 & Suhr, 2006). CFA was applied for measurement model assessment and sketched using AMOS version 25 software.

Model Fit

There are several fit statistics that researchers use to assess their confirmatory factor analyses and structural equation models (Hooper, Coughlan & Mullen, 2008). Chi-square statistics were run for the current study for goodness of fit but was not the only model fit indicator because Hair et al. (2006) caution against the sole use of Chi-square statistics for assessing model specifications and posit that the statistics can be misleading. Thus, other goodness of fit measures were used to overcome problems associated with the sole use of chi-square. The goodness of fit indices generally have the following types: parsimony, absolute and incremental (Hair et al., 2006).

Parsimony fit measurements specifically provide information about model comparability among other models in the same category. It considers the model fit in relation to its complexity (Al-Qeisi, 2009). Included in this category are Parsimony Goodness-of-Fit Index- PGFI and the Parsimonious Normed Fit Index - PNFI (Hooper, Coughlan & Mullen, 2008). Hooper, Coughlan & Mullen (2008), assembled a list of the most popular fit statistics used and recommended cut-offs that indicate a good fit as shown on Table 4.12.

Absolute fit indices are directly measure of how well the model that is proposed is fitting the sample data or reproduces the observed data (McDonald & Ho, 2002). These indices provide the most basic indication of how well the proposed theory fits the data. Included in this category are Chi-Squared test, Root mean square error of approximation, Goodness of fit statistic, adjusted goodness of fit statistic, Root mean square residual - RMR and standardised root mean square residual -SRMR (Hooper, Coughlan & Mullen, 2008).

Incremental fit measures also known as comparative fit are a group of indices that do not utilise the chi-square in its raw form but compare them value to a baseline model. For these models the null hypothesis is that all variables are uncorrelated (McDonald and Ho, 2002). This model is also known to as null model and makes an assumption of uncorrelation for observed variables (Al-Qeisi, 2009 & Suhr, 2006). Included in this category are Normed fit index - NFI and Comparative fit index - CFI (Hooper, Coughlan & Mullen, 2008).

Table 4.12. Fit Indices commonly reported for CFA and SEM and their acceptable thresholds (Adapted from Hooper, Coughlan & Mullen, 2008; Cheung & Rensvold, 2002)

Measure	Name	Description	Acceptable Threshold levels
X^2	Chi-Square	Assess overall fit and the discrepancy between the sample and fitted covariance matrices. Sensitive to sample size. H0: The model fits perfectly.	p-value< 0.05
(A)GFI	(Adjusted) Goodness of Fit	GFI is the proportion of variance accounted for by the estimated population covariance. Analogous to R2.	GFI ≥ 0.90
		AGFI favours parsimony.	AGFI ≥0.95
(N)NFI TLI	(Non) Normed Fit Index	An NFI of .90, indicates the model of interest improves the fit by 90% relative to the null model. NNFI is preferable for smaller samples.	NFI ≥ 0.90
	Tucker Lewis index	Sometimes the NNFI is called the Tucker Lewis index (TLI)	NNFI ≥0.95
CFI	Comparative Fit Index Ordinal	A revised form of NFI. Not very sensitive to sample size. Compares the fit of a target model to the fit of an independent, or null, model.	CFI ≥0.95
RMSEA	Root Mean Square Error of Approximation	A parsimony-adjusted index. Values closer to 0 represent a good fit.	RMSEA < 0.08

(S)RMR	(Standardized) Root Mean Square Residual	The square-root of the difference between the residuals of the sample covariance matrix and the hypothesized model. If items vary in range (i.e. some items are 1-5, others 1-7) then RMR is hard to interpret, better to use SRMR	SRMR <0.08
AVE (CFA only)	Average Value Explained	The average of the R2S for items within a factor	AVE>.5

When coming to reporting indices, it is not necessary or realistic to include every index included in the statistical software because it is unnecessary and will burden both the reader and reviewer (Hooper, Coughlan & Mullen, 2008). The most commonly reported fit indices are the CFI, GFI, NFI and the NNFI (McDonald & Ho, 2002). In addition to the most commonly reported fit indices, the current study included TLI, RMSEA and PCFI. These indices have been chosen over other indices because according to Hooper, Coughlan and Mullen (2008) they have been found to be the most insensitive to sample size, misspecification of model and parameter estimates.

4.7.6. Model Building - Structural Equation Model

According to Hair et al. (2006), Structural Equation Modelling (SEM) performs theoretical model tests through mathematical models, statistical methods and computer algorithms. Hooper, Coughlan and Mullen (2008) further add that SEM has increasingly become one of the popular techniques for researchers across disciplines and increasingly the most preferred amongst social sciences for researchers.

SEM primarily has two model types, namely: a) Measurement model which characterises the theory and shows how measured variables interrelate for latent factors to representation. b) Structural model, also representative of the theory but also shows constructs relations (Al-Qeisi, 2009). The current study applied the SEM to test the hypothesis among model variables. Analysis of Moment Structure (AMOS) was also used to estimate model parameters. According to Bentler and Yaun (1999), model estimation shows the model fitness to the data collected by producing values which also shows the strength of theorised relationships among the variables in question.

SEM was deemed appropriate for this study due to the type of investigation carried out because it has provision for responding to questions that comprise multiple regression factor analysis carried out for a one dependent variable against a set of independent variables (Ullman, 2007).

4.8. Statistical significance

Sarantakos (2007) defines statistical significance as the probability that the result of a test has occurred by chance. Statistical significance testing has been in existence for nearly 300 years (Huberty, 1993) and has meaningfully contributed to the advancement of research in the social sciences. According to Vidgen and Yasseri (2016) publishing in a top journal often requires obtaining a p-value that indicates statistical significance. The level of significance determines the probability level (0.05 or 0.001) that is to be considered too low to warrant support of the null hypothesis. The test value is considered to be statistically significant if a p-value is smaller than 0.05 (Sarantakos, 2007). For this study a p-value smaller than 0.05 was considered to be of significance. The hypotheses that were stated in Chapter 3 will be tested in Chapter 5 and will be accepted or rejected in Chapter 6.

4.9. Time horizon

Blumberg, Cooper and Schindler (2005) define a cross-sectional study as one that is conducted only once and provides a snapshot of a specific time period. The study was a cross-sectional survey, which means that information was collected from a sample population at a single point in time and respondents were measured only once. Although cross-sectional studies capture information at a specific point in time, they are advantageous because they are less expensive to perform and take less time to conduct than longitudinal surveys (Cooper & Schindler, 2006). The longitudinal survey was not used because the study's goal is not to examine changes in data gathered over time.

4.10. Limitation of methods

The instrument used only includes closed-ended Likert scale responses, rather than additional open-ended responses, which may limit respondents who are more willing to provide additional information to further explain their responses and thereby enrich the survey. Furthermore, this study used a quantitative research methodology rather than a qualitative method to allow the researcher to be independent of the data and maintain an objective stance, allowing for the discovery of facts as quantitatively specified among variables and providing an objective reality on the determinants influencing IT servitization adoption in South African state-owned enterprises.

Finally, the exclusive use of the varimax rotation strategy is also noted as a limitation, despite the fact that it was chosen because it is by far the most preferred orthogonal rotation according to Osborne (2015) and was developed as an incremental improvement over prior algorithms quartimax and equamax.

4.11. Ethical considerations for the study

When issues of ethics are discussed, most people think of rules for distinguishing between right and wrong, such as the golden rule "Do unto others as you would have them do unto you", the Hippocratic Oath of professional conduct "First of all, do no harm", a religious belief like the Ten Commandments "Thou shalt not kill...", or a wise aphorisms like the sayings of Confucius (Resnik, 2011). The importance of ethical considerations in information systems as a field of academic research and business practice has long been recognised. This includes questions of what is considered right and wrong, good or bad. Information systems research also theoretically reflect on why certain rules may be considered moral or immoral (Stahl, Eden, Jirotka & Coeckelbergh, 2014). Raab (2020) observes that ethical concerns about privacy, as well as other human rights and social values, play a significant role in the development and application of IT innovations.

According to Zikmund (2003), researchers have disguised the purpose of their research on several occasions, creating a false impression about their study. Oates (2006) emphasises the importance of conducting research within legal and ethical boundaries. Olivier (2009) further explains that, ethics in research are observed by considering formal informed consent, the rights to privacy, procedures and avoidance of deception. Next, the general rules and key principles of research ethics are discussed.

The principle of informed consent - In both social and medical research, the obligation to inform and obtain consent from human subjects is critical (Homan, 2001). Participation in social science investigations is generally voluntary and takes place on the basis of full disclosure about the goals and methods of the specific piece of research, as well as any other additional information that may be required. Although the principle of informed consent may not always be practical in cases where comprehensive pre-information would distort research results, when faced with this challenge, an attempt must be made to use other possible modes of informed consent (Flick, von Kardoff & Steinke, 2004).

The principle of voluntary participation - When conducting an investigation, it is necessary to inform potential participants as fully as possible in advance so that they can make an informed decision about participating in the study. This should be done to eliminate the possibility that individuals, groups, or organisations may be misled about the identity and goals of the researchers who are observing the participants, especially when a study is being conducted over an extended period of time. In such covert cases, the principle of voluntary participation would be seriously violated, making it difficult to justify (Flick, von Kardoff & Steinke, 2004).

The principle of anonymity and damage avoidance- In research ethics, there is general agreement on the requirement not to inflict harm on research participants. Observed participants in the study or investigations shall not face any danger or disadvantage as a result of the research. All risks must be explained to the participants, and their anonymity must be maintained at all times (Flick, von Kardoff & Steinke, 2004).

For ethical reasons, the study was aware of the expected ethical behavior during the execution of the current research and conducted the study within ethical boundaries. Before completing the survey, participants in the study were asked to provide informed consent to participate in the study. Furthermore, the research was explained to them so that they understood what their participation entailed. Respondents were informed that their participation was entirely voluntary and that refusing to participate would result in no consequences, penalties, or loss of benefits. They were also be informed of their right to withdraw their participation at any anytime. To ensure anonymity and confidentiality, the instrument did not collect any personal information that could reveal the respondents' identities.

The study was carried out after receiving approval letter from the Ethics Committee of Wits University in Johannesburg. H19/08/04 is the clearance certificate protocol number (refer Appendix A).

4.12. Chapter summary

This study's research process was discussed. Also discussed were the research paradigm, approach, strategy, and design. The rest of the chapter discussed the data collection methods, analysis strategy, and factor analysis models, as well as the instruments used and their coding for the study's data preparation. Finally, statistical significance, method limitations, and study ethical considerations were discussed. The chapter on data analysis follows next.

CHAPTER 5

DATA ANALYSIS AND PRESENTING OF RESULTS

5.1. Introduction

The preceding chapter discussed the study's research methodology. This chapter analyses and presents the results of the data that was collected. The chapter starts with a discussion of data normality, including skewness and kurtosis, both of which are important for data cleaning. This is followed by descriptive statistics on demographics and constructs, including frequency distribution, central tendency, and construct dispersion. Following that, the inferential statistics are examined, as well as the reliability and validity testing of the instrument used in the current study. Factor analysis is performed first, followed by a structural equation model, and finally hypotheses testing.

5.2. Frequency distribution - Demographics

The frequency distribution of a variable refers to a summary of the frequency, occurrences or observations of single individual values or ranges of values for that particular variable (Bhattacherjee, 2012). Question 13 and 14 in Section E of the questionnaire were designed to collect demographic information. This was significant because it described the characteristics of the individuals who took part in this study. The questions sought to understand how different individuals responded to questions pertaining to the primary goal of this study.

5.2.1. Job Title

Question 13 aimed to determine the job title of the IT professional who completed the survey (see Appendix D). Participants selected one of nine job titles from a list of nine options. Chief Information Officer, Chief Technology Officer, IT director, IT/IS manager, IT administrator, IT architect, Project manager, Business analyst, and other IT specialists were among those chosen.

The results indicate that there was (1) Chief Information Officer, two (2) Chief Technology Officers, three (3) IT directors, nineteen (19) IT/IS managers, seven (7) IT administrators, three (3) IT architects, ten (10) Project managers, twelve (12) Business analysts and forty two (42) other IT specialists. Eleven (11) participants did not select any job title. Thus, the highest number of the respondents are other IT specialists, followed by IT/IS managers. Figure 5.1 and Table 5.1.1 depicts the spread of participants across different job titles.

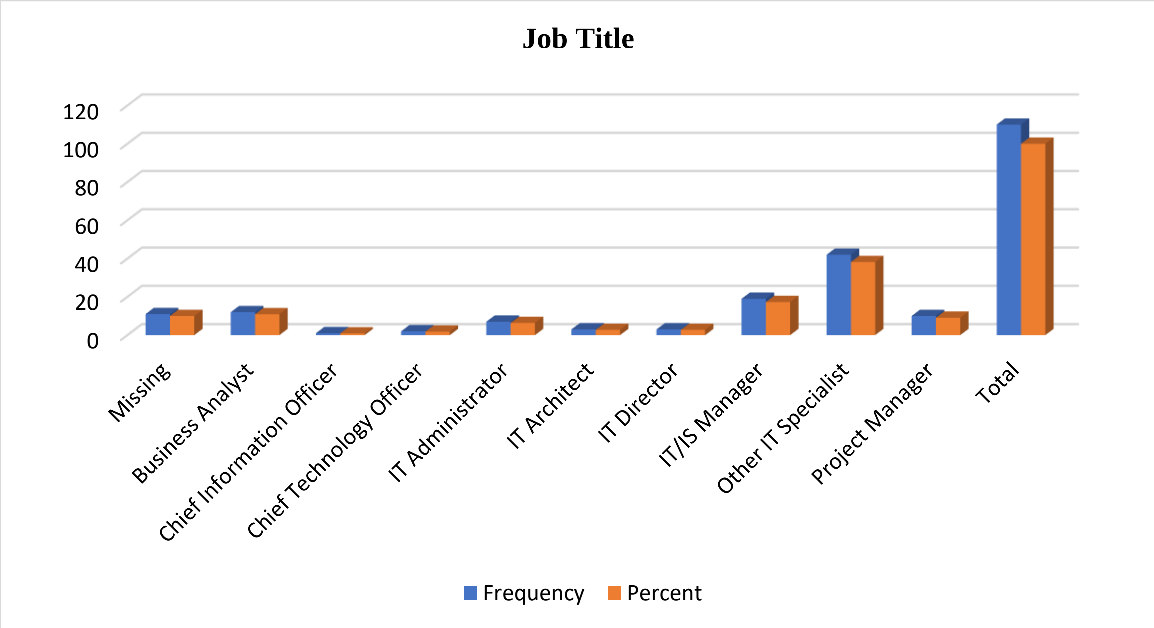

Figure 5.1 Job titles of participants

Q13 Job Title

	Frequency	Percent
Missing	11	10,0
Business Analyst	12	10,9
Chief Information Officer	1	,9
Chief Technology Officer	2	1,8
IT Administrator	7	6,4
IT Architect	3	2,7
IT Director	3	2,7
IT/IS Manager	19	17,3
Other IT Specialist	42	38,2
Project Manager	10	9,1
Total	110	100,0

Table 5.1.1 Job titles of participants

5.2.2. Industry

Question 14 aimed to determine the industry within which participants in South African SOE worked (see Appendix B). The results indicate that there were four (4) participants in the employ of constitutional entities, sixteen (16) in the educational industry, twenty three (23) in financial and revenue sector, twenty (20) in the ICT industry, ten (10) were in the major public entity, six (6) were in the national government business enterprise, six (6) were in the national public entity, five (5) were in the provincial government business enterprise, four (4) were in the provincial public entity and four (4) were in the retail industry. Twelve (12) participants had not selected any industry hence missing information. Thus, the highest number of the industries represented were ICT and financial and revenue sector. Figure 5.2 and Table 5.2.1 depicts the spread of industries within which participants are working.

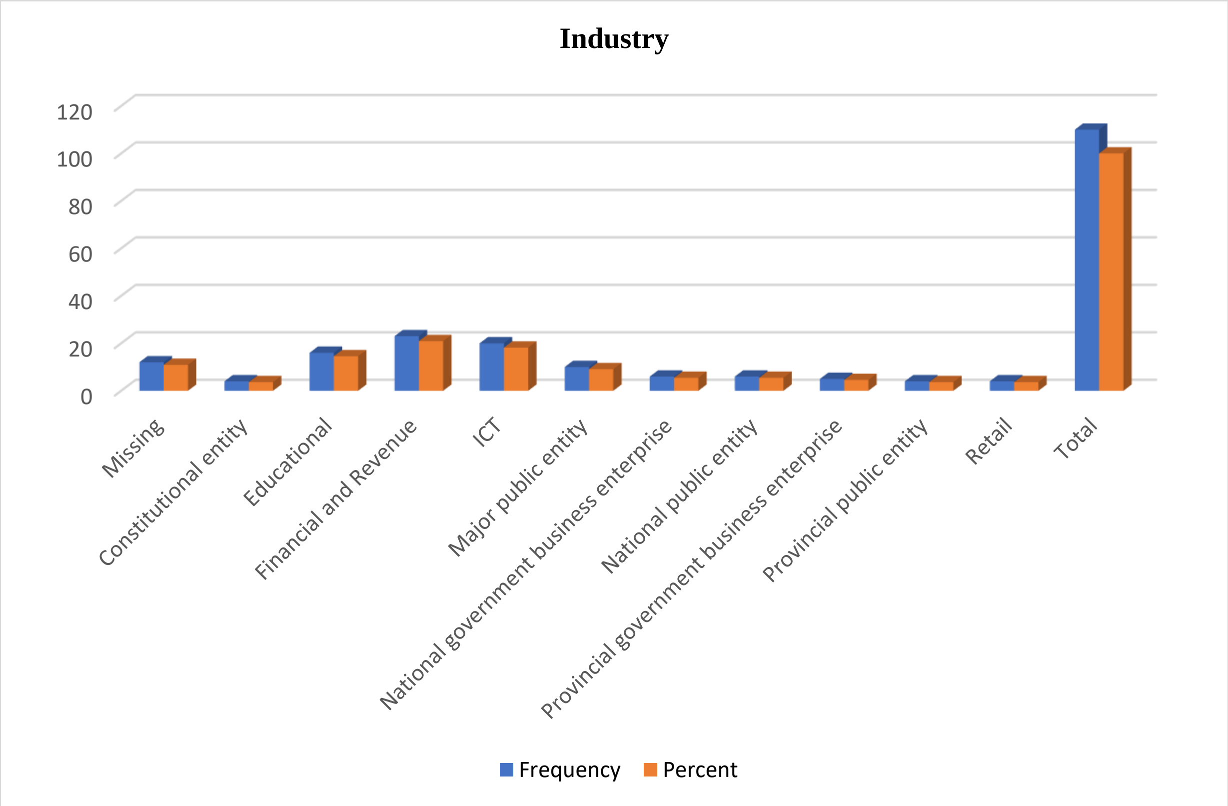

Figure 5.2 SOE Industry

Q14 Industry

	Frequency	Percent
Missing	12	10,9
Constitutional entity	4	3,6
Educational	16	14,5
Financial and Revenue	23	20,9
ICT	20	18,2
Major public entity	10	9,1
National government business enterprise	6	5,5
National public entity	6	5,5
Provincial government business enterprise	5	4,5
Provincial public entity	4	3,6
Retail	4	3,6
Total	110	100,0

Table 5.2.1 SOE Industry

5.3. Data normality and Frequency distribution - Constructs

The demographics of those who took part in the current study were described in section 5.2. This section describes the normality and frequency distribution of constructs in Questions 2–13, as well as the spread of responses with standard deviations greater than 0.03 for all items. First, data normality through skewness and kurtosis of the variables will be discussed. Skewness refers to distortion degree from the normal or symmetrical distribution bell curve (Kim, 2013), whereas kurtosis measures to degree of flatness or peaked-ness of a given distribution relative to the normal distribution (Ayadi et, al., 2019).

Second, the frequency tables will then be discussed. They depict the frequency distributions of participants' responses to the forty-eight (48) questions designed to address the primary objective of the study. All items for the questions below were scored on a five-point scale, with one indicating strongly disagree and five indicating strongly agree.

5.3.1. Sensory readiness

Sensory readiness construct measures the requirements for process participants to receive complete sensory experience of a process (Overby, 2012). Five items were adopted in this study to measure the influence of sensory readiness in the context of IT servitization adoption and they were represented with Q2_1-5.

Q2_1: Skewness and Kurtosis

Q2_1 is negatively skewed (range between -1 and -0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,774; -0,342; 3,91 and 1,088; respectively. The negative skewness and the negative kurtosis with platykurtic distribution indicate that there is less concentration of items near the centre, and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, participants generally strongly agree or agree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, on average it is important for participants to physically inspect products before purchasing them, as presented in the histogram figure 5.3.1 below.

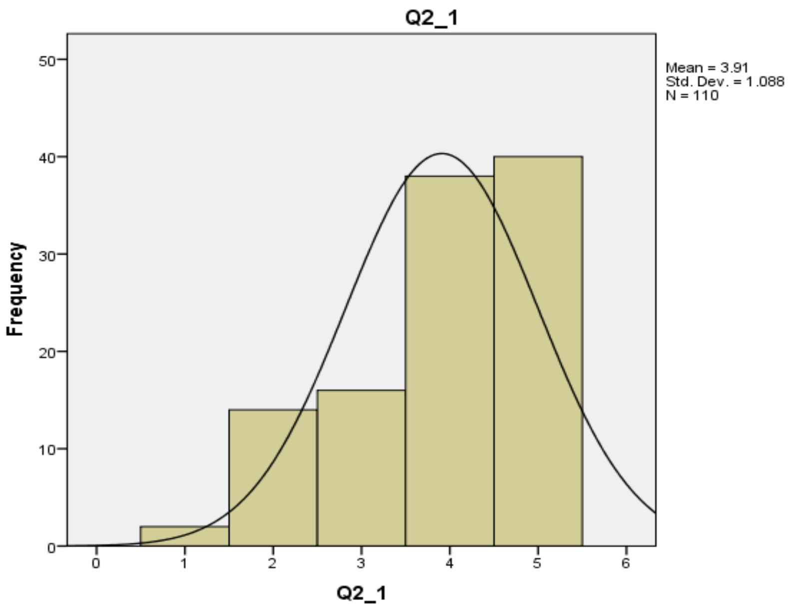

Figure 5.3.1: Q2_1 Skewness and Kurtosis

Q2_1: Frequency distribution

The frequency distribution for Q2_1: “It is important for me to physically inspect products before purchasing them”, recorded *strongly agree* response by most participants at 36,4%, closely followed by *agree* at 34,5%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	2	1,8	1,8	1,8
	2	14	12,7	12,7	14,5
	3	16	14,5	14,5	29,1
	4	38	34,5	34,5	63,6
	5	40	36,4	36,4	100,0
	Total	110	100,0	100,0	

Table 5.3.1: The frequency distribution

Q2_2: Skewness and Kurtosis

Q2_2 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,380; -1,114; 4,22 and 0,747 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, participants generally strongly agree or agree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this question and that indicates that, participants like to see the products before purchasing them, as presented in the histogram figure 5.3.2 below.

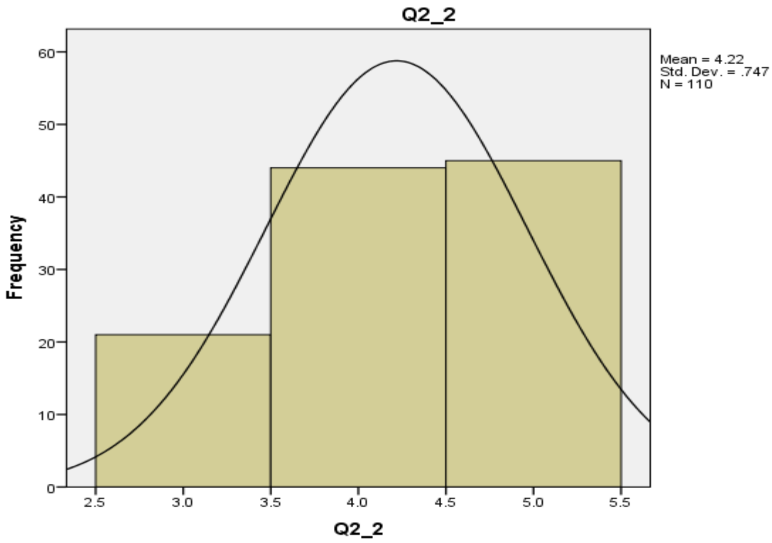

Figure 5.3.2: Q2_2 Skewness and Kurtosis

Q2_2: Frequency distribution

The frequency distribution for Q2_2: "I like to see the products before purchasing them", recorded *strongly agree* response by most participants at 40,9%, closely followed by *agree* at 40,0%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	21	19,1	19,1	19,1
	4	44	40,0	40,0	59,1
	5	45	40,9	40,9	100,0
	Total	110	100,0	100,0	

Table 5.3.2: The frequency distribution

Q2_3: Skewness and Kurtosis

Q2_3 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,202; -1,050; 3,39 and 1,189 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants were "neutral" for this item and that indicates that, some participants agree while others disagree that they like to touch the products before purchasing them, as presented in the histogram figure 5.3.3 below.

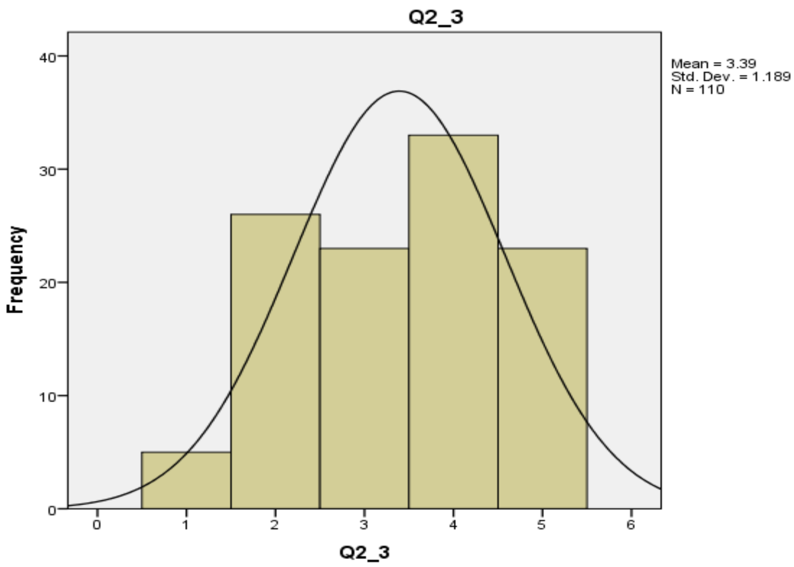

Figure 5.3.3: Q2_3 Skewness and Kurtosis

Q2_3: Frequency distribution

The frequency distribution for Q2_3: "I like to touch the products before purchasing them", recorded *agree* response by most participants at 30,0%, followed by *disagree* at 23,6%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	5	4,5	4,5	4,5
	2	26	23,6	23,6	28,2
	3	23	20,9	20,9	49,1
	4	33	30,0	30,0	79,1
	5	23	20,9	20,9	100,0
	Total	110	100,0	100,0	

Table 5.3.3: The frequency distribution

Q2_4: Skewness and Kurtosis

Q2_4 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are 0,169; -1,100; 3,35 and 1,028 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants were “neutral” for this item and that indicates that, some participants agree while others disagree that they like to hear the products before purchasing them, as presented in the histogram figure 5.3.4 below.

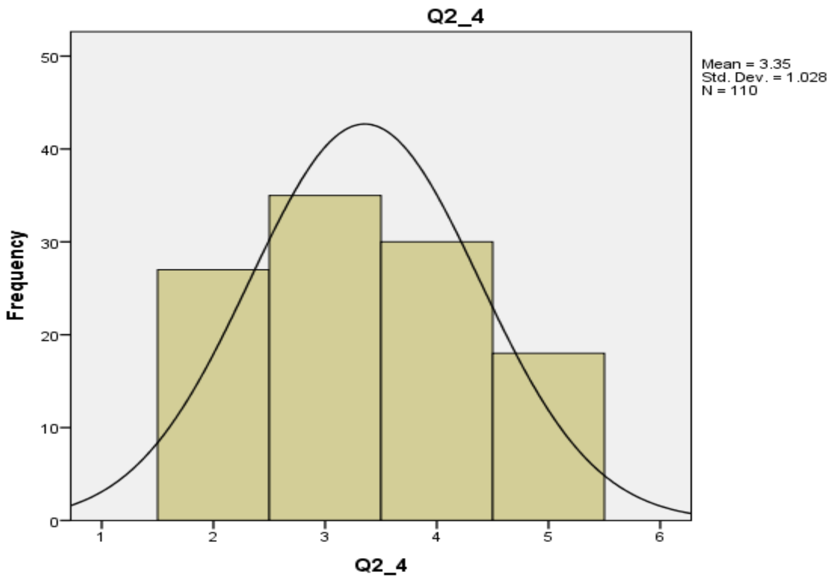

Figure 5.3.4: Q2_4 Skewness and Kurtosis

Q2_4: Frequency distribution

The frequency distribution for Q2_4: “I like to hear the products before purchasing them”, recorded *neutral* response by most participants at 31,8%, followed by *agree* at 27,3%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	2	27	24,5	24,5	24,5
	3	35	31,8	31,8	56,4
	4	30	27,3	27,3	83,6
	5	18	16,4	16,4	100,0
	Total	110	100,0	100,0	

Table 5.3.4: The frequency distribution

Q2_5: Skewness and Kurtosis

Q2_5 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,006; -1,106; 3,05 and 1,281 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants were “neutral” for this item and that indicates that, some participants agree while others disagree that they like to smell the products before purchasing them, as presented in the histogram figure 5.3.5 below.

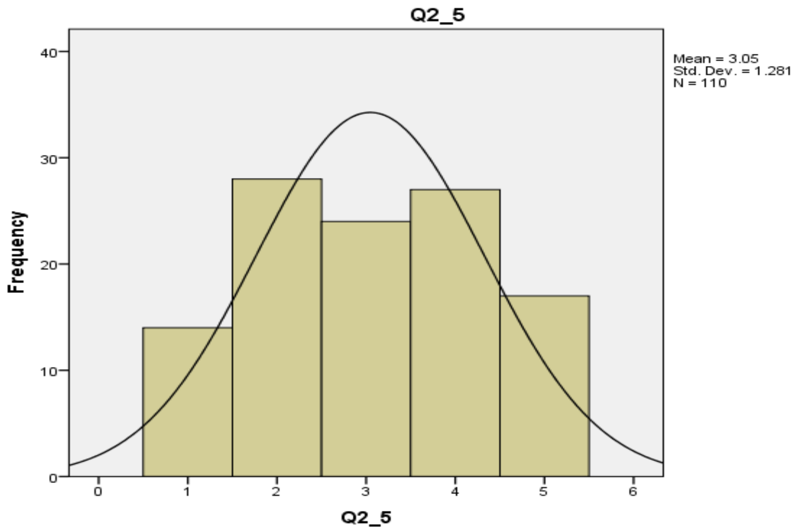

Figure 5.3.5: Q2_4 Skewness and Kurtosis

Q2_5: Frequency distribution

The frequency distribution for Q2_5: “I like to smell the product before purchasing them”, recorded *disagree* response by most participants at 25,5%, closely followed by *agree* at 24,5%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	14	12,7	12,7	12,7
	2	28	25,5	25,5	38,2
	3	24	21,8	21,8	60,0
	4	27	24,5	24,5	84,5
	5	17	15,5	15,5	100,0
	Total	110	100,0	100,0	

Table 5.3.5: The frequency distribution

Discussed next, is the relationship readiness construct.

5.3.2. Relationship readiness

Relationship readiness measures the requirement by process participants to be able to interact with each other in either social or professional context (Overby, 2012). Four items were adopted in this study to measure the influence of relationship readiness in the context of IT servitization adoption and they were represented with Q3_1-4.

Q3_1: Skewness and Kurtosis

Q3_1 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,318; -0,740; 3,32 and 1,203 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants were “neutral” for this item and that indicates that, some participants agree while others disagree that it is important for them to have a relationship with the seller when purchasing a product or service them, as presented in the histogram figure 5.3.6 below.

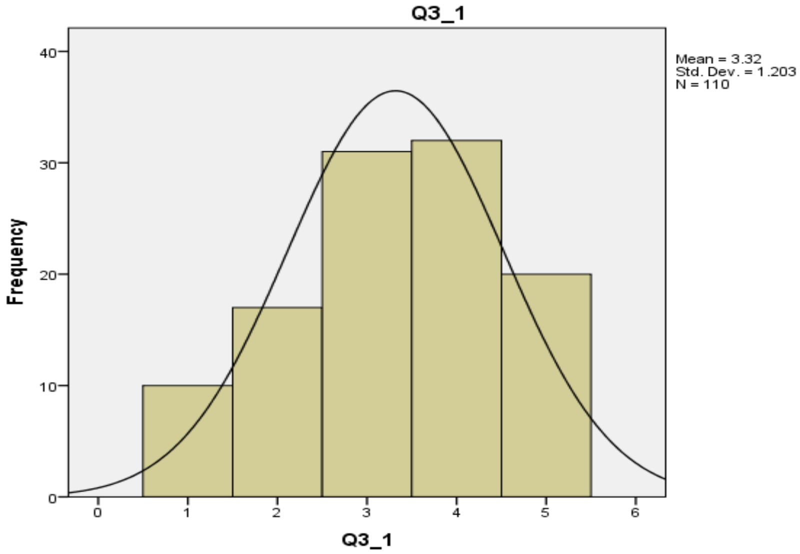

Figure 5.3.6: Q3_1 Skewness and Kurtosis

Q3_1: Frequency distribution

The frequency distribution for Q3_1: “It is important for me to have a relationship with the seller when purchasing a product or service”, recorded *agree* response by most participants at 29,1%, closely followed by *neutral* at 28,2%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	10	9,1	9,1	9,1
	2	17	15,5	15,5	24,5
	3	31	28,2	28,2	52,7
	4	32	29,1	29,1	81,8
	5	20	18,2	18,2	100,0
	Total	110	100,0	100,0	

Table 5.3.6: The frequency distribution

Q3_2: Skewness and Kurtosis

Q3_2 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,292; -0,875; 3,35 and 1,177 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants were "neutral" for this item and that indicates that, some participants agree while others disagree that they consider their relationship with the seller when purchasing a product or service, as presented in the histogram figure 5.3.7 below.

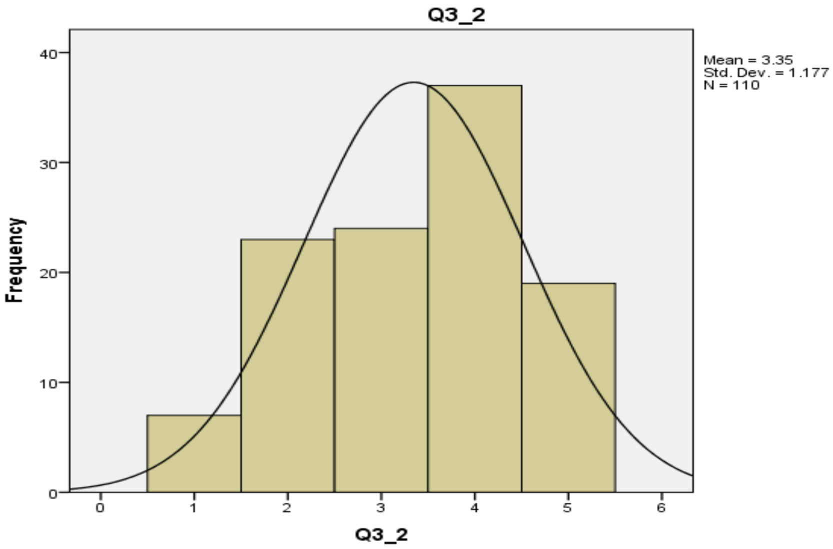

Figure 5.3.7: Q3_2 Skewness and Kurtosis

Q3_2: Frequency distribution

The frequency distribution for Q3_2: "I consider my relationship with the seller when purchasing a product or service", recorded *agree* response by most participants at 33,6%, closely followed by *neutral* at 21,8%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	7	6,4	6,4	6,4
	2	23	20,9	20,9	27,3
	3	24	21,8	21,8	49,1
	4	37	33,6	33,6	82,7
	5	19	17,3	17,3	100,0
	Total	110	100,0	100,0	

Table 5.3.7: The frequency distribution

Q3_3: Skewness and Kurtosis

Q3_3 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are 0,019; -0,866; 3,16 and 1,177 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants were "neutral" for this item and that indicates that, some participants agree while others disagree that they would like to have a relationship with the seller when purchasing a product or service, as presented in the histogram figure 5.3.8 below.

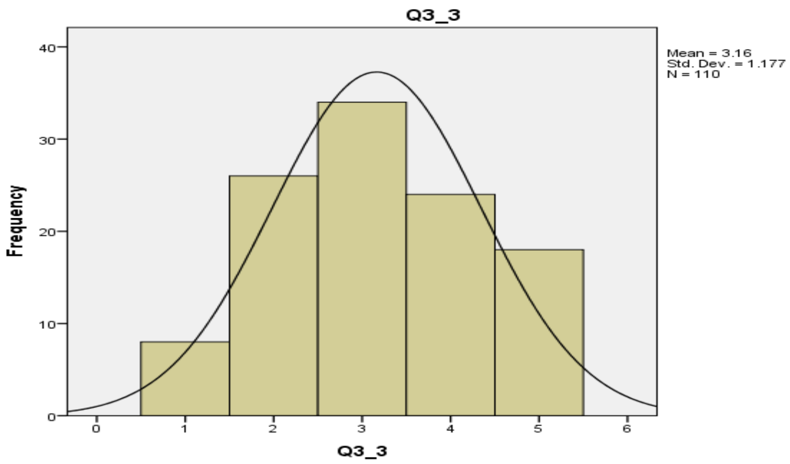

Figure 5.3.8: Q3_3 Skewness and Kurtosis

Q3_3: Frequency distribution

The frequency distribution for Q3_3: "I would like to have a relationship with the seller when purchasing a product or service", recorded *neutral* response by most participants at 30.9%, followed by *disagree* at 23.6%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	8	7,3	7,3	7,3
	2	26	23,6	23,6	30,9
	3	34	30,9	30,9	61,8
	4	24	21,8	21,8	83,6
	5	18	16,4	16,4	100,0
	Total	110	100,0	100,0	

Table 5.3.8: The frequency distribution

Q3_4: Skewness and Kurtosis

Q3_4 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,127; -1,057; 3,11 and 1,273 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants were "neutral" for this item and that indicates that, some participants agree while others disagree that their relationship with the seller when purchasing a product or service is not important, as presented in the histogram figure 5.3.9 below.

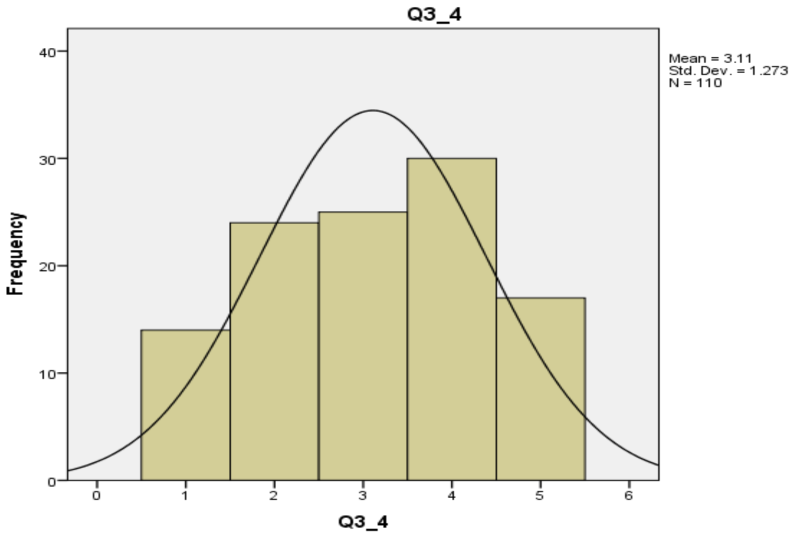

Figure 5.3.9: Q3_4 Skewness and Kurtosis

Q3_4: Frequency distribution

The frequency distribution for Q3_4: “My relationship with the seller when purchasing a product or service is not important”, recorded *agree* response by most participants at 27,3%, followed by *neutral* at 22,7%.

		Frequency	Percentage	Valid Percentage	Cumulative Percent
Valid	1	14	12,7	12,7	12,7
	2	24	21,8	21,8	34,5
	3	25	22,7	22,7	57,3
	4	30	27,3	27,3	84,5
	5	17	15,5	15,5	100,0
	Total	110	100,0	100,0	

Table 5.3.9: The frequency distribution

Discussed next, is the synchronism readiness construct.

5.3.3. Synchronism readiness

Synchronism readiness measures the degree to which the process activities need to occur instantaneously with minimal delay (Overby, 2012). Four items were applied in this study to measure the influence of synchronism readiness in the context of IT servitization adoption and they were represented with Q4_1-4.

Q4_1: Skewness and Kurtosis

Q4_1 is negatively skewed (range between -1 and -0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,702; 0,152; 3,94 and 0,849 respectively. The negative skewness and the positive kurtosis with leptokurtic distribution indicate that the data has an excess of outliers and comprises of extreme values. The data appears to be narrow and skinny with a fatter tail. The standard deviation shows that responses are spread-out for this item. The responses show that, participants strongly agree or agree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, on the day that they place an order for a product or service, they like to take care of all purchasing-related activities, as presented in the histogram figure 5.3.10 below.

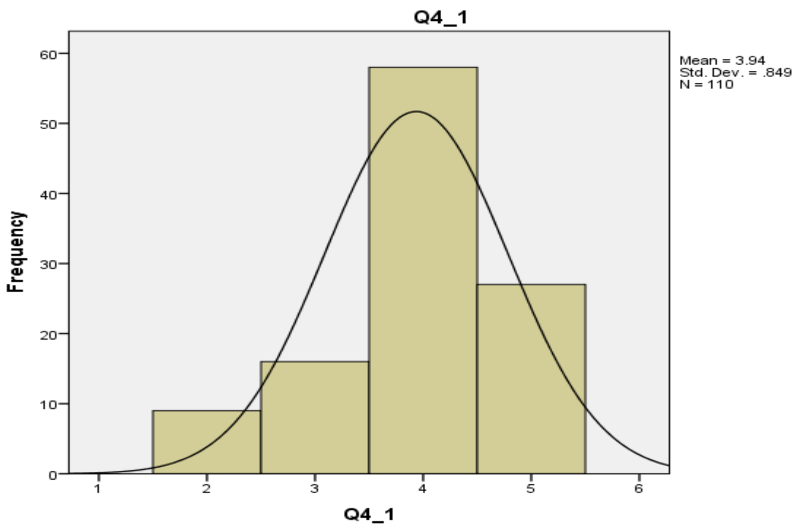

Figure 5.3.10: Q4_1 Skewness and Kurtosis

Q4_1: Frequency distribution

The frequency distribution for Q4_1: "On the day that I place an order for a product or service, I like to take care of all purchasing-related activities", recorded *agree* response by most participants at 52,7%, followed by *strongly agree* at 24,5%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	2	9	8,2	8,2	8,2
	3	16	14,5	14,5	22,7
	4	58	52,7	52,7	75,5
	5	27	24,5	24,5	100,0
	Total	110	100,0	100,0	

Table 5.3.10: The frequency distribution

Q4_2: Skewness and Kurtosis

Q4_2 is skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,010; -0,884; 3,08 and 1,134 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants were “neutral” for this item and that indicates that, some participants agree while others disagree that they like to take care of all purchasing-related activities a week or more later after placing an order for a product or service, as presented in the histogram figure 5.3.11 below.

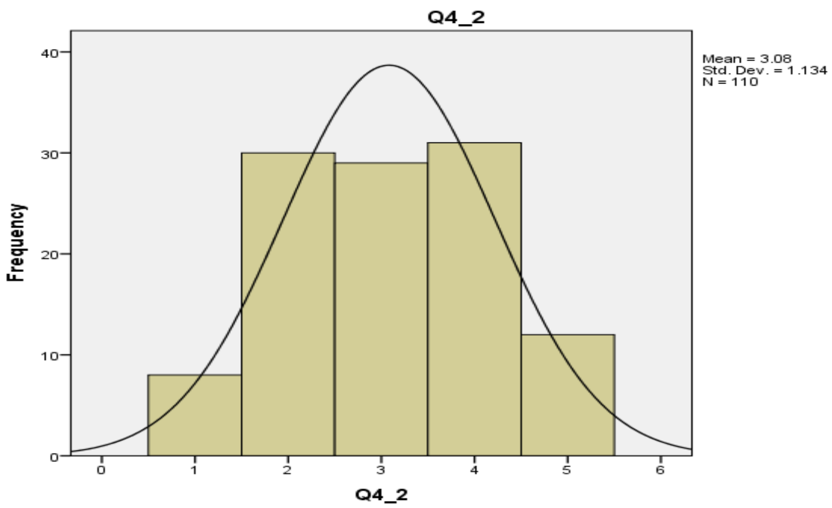

Figure 5.3.11: Q4_2 Skewness and Kurtosis

Q4_2: Frequency distribution

The frequency distribution for Q4_2: “I like to take care of all purchasing-related activities a week or more later after placing an order for a product or service”, recorded *agree* response by most participants at 28,2%, closely followed by *disagree* at 27,3%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	8	7,3	7,3	7,3
	2	30	27,3	27,3	34,5
	3	29	26,4	26,4	60,9
	4	31	28,2	28,2	89,1
	5	12	10,9	10,9	100,0
	Total	110	100,0	100,0	

Table 5.3.11: The frequency distribution

Q4_3: Skewness and Kurtosis

Q4_3 is negatively skewed (range between -1 and -0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,660; 0,251; 3,72 and 0,93 respectively. The negative skewness and the positive kurtosis with leptokurtic distribution indicate that the data has an excess of outliers and comprises of extreme values. The data appears to be narrow and skinny with a fatter tail. The standard deviation shows minimal response variations. The responses show that, participants generally agree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, after they purchase a product or service, they would like to get it on that day or the next, as presented in the histogram figure 5.3.12 below.

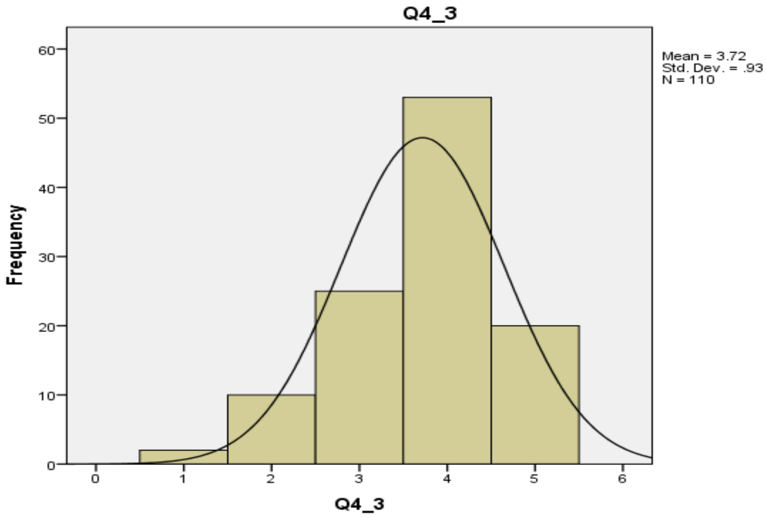

Figure 5.3.12: Q4_3 Skewness and Kurtosis

Q4_3: Frequency distribution

The frequency distribution for Q4_3: “After I purchase a product or service, I would like to get it on that day or the next”, recorded *agree* response by most participants at 48,2% followed by *neutral* at 22,7%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	2	1,8	1,8	1,8
	2	10	9,1	9,1	10,9
	3	25	22,7	22,7	33,6
	4	53	48,2	48,2	81,8
	5	20	18,2	18,2	100,0
	Total	110	100,0	100,0	

Table 5.3.12: The frequency distribution

Q4_4: Skewness and Kurtosis

Q4_4 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,082; -1,023; 2,94 and 1,244 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants were “neutral” for this item and that indicates that, some participants agree while others disagree that waiting for a week or more to receive a product or service after purchase is acceptable, as presented in the histogram figure 5.3.13 below.

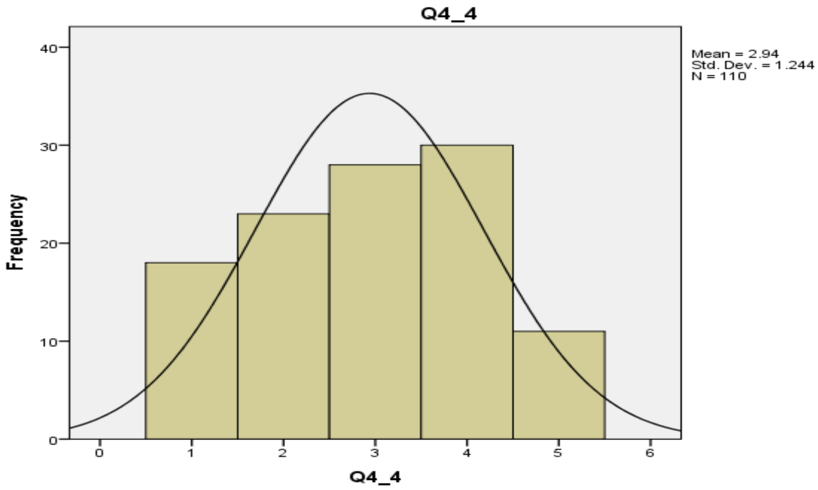

Figure 5.3.13: Q4_4 Skewness and Kurtosis

Q4_4: Frequency distribution

The frequency distribution for Q4_4: “Waiting for a week or more to receive a product or service after purchase is acceptable”, recorded *agree* response by most participants at 27,3%, followed by *neutral* at 25,5%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	18	16,4	16,4	16,4
	2	23	20,9	20,9	37,3
	3	28	25,5	25,5	62,7
	4	30	27,3	27,3	90,0
	5	11	10,0	10,0	100,0
	Total	110	100,0	100,0	

Table 5.3.13: The frequency distribution

Discussed next, is the identification and control readiness construct.

5.3.4. Identification and control readiness

Identification and control readiness construct measures the requirement for identification of other process participants and the ability to control their behaviour as virtual processes are prone to identity spoofing problems because physically inspection of participants cannot be confirmed (Overby, 2012). Four items were applied in this study to measure the influence of identification and control readiness in the context of IT servitization adoption and they were represented with Q5_1-4.

Q5_1: Skewness and Kurtosis

Q5_1 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,479; -0,757; 3,74 and 0,992 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, participants strongly agree or agree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, identification of people in a virtual process is important to them, as presented in the histogram figure 5.3.14 below.

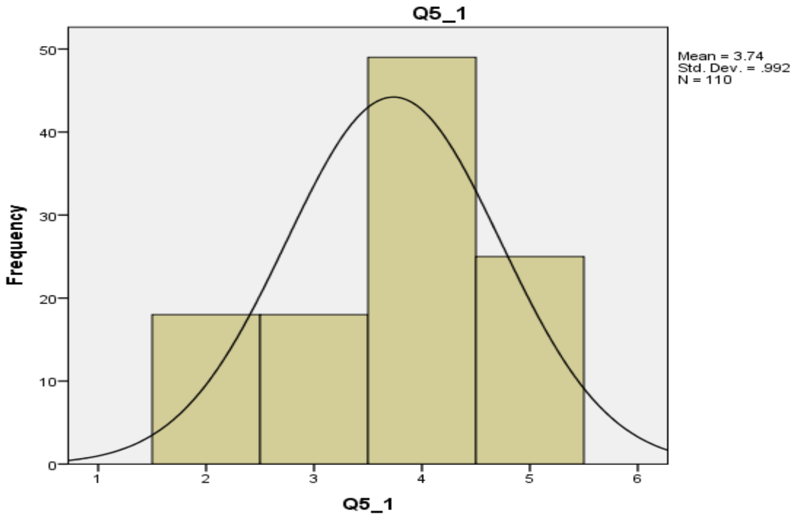

Figure 5.3.14: Q5_1 Skewness and Kurtosis

Q5_1: Frequency distribution

The frequency distribution for Q5_1: "Identification of people in a virtual process is important to me", recorded *agree* response by most participants at 44,5%, followed by *strongly agree* at 22,7%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	2	18	16,4	16,4	16,4
	3	18	16,4	16,4	32,7
	4	49	44,5	44,5	77,3
	5	25	22,7	22,7	100,0
	Total	110	100,0	100,0	

Table 5.3.14: The frequency distribution

Q5_2: Skewness and Kurtosis

Q5_ skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,354; -0,945; 3,64 and 1,011 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, being able to track and monitor others’ behaviour and activities conducted in a virtual process is important to them, as presented in the histogram figure 5.3.15 below.

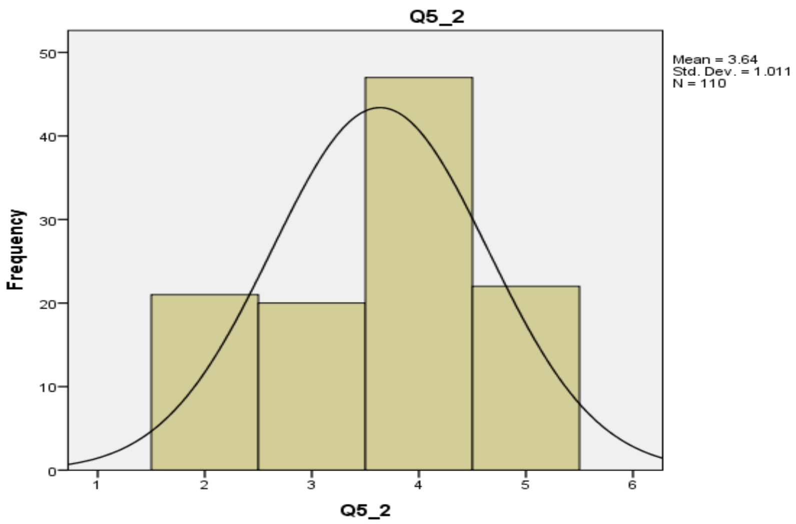

Figure 5.3.15: Q5_2 Skewness and Kurtosis

Q5_2: Frequency distribution

The frequency distribution for Q5_2: “Being able to track and monitor others’ behaviour and activities conducted in a virtual process is important to me”, recorded *agree* response by most participants at 42,7%, followed by *strongly agree* at 20,0%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	2	21	19,1	19,1	19,1
	3	20	18,2	18,2	37,3
	4	47	42,7	42,7	80,0
	5	22	20,0	20,0	100,0
	Total	110	100,0	100,0	

Table 5.3.15: The frequency distribution

Q5_3: Skewness and Kurtosis

Q5_3 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,087; -1,152; 4,05 and 0,74 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree while others neutral for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, they believe it is possible that people can hide their identities in processes that are virtual, as presented in the histogram figure 5.3.15 below.

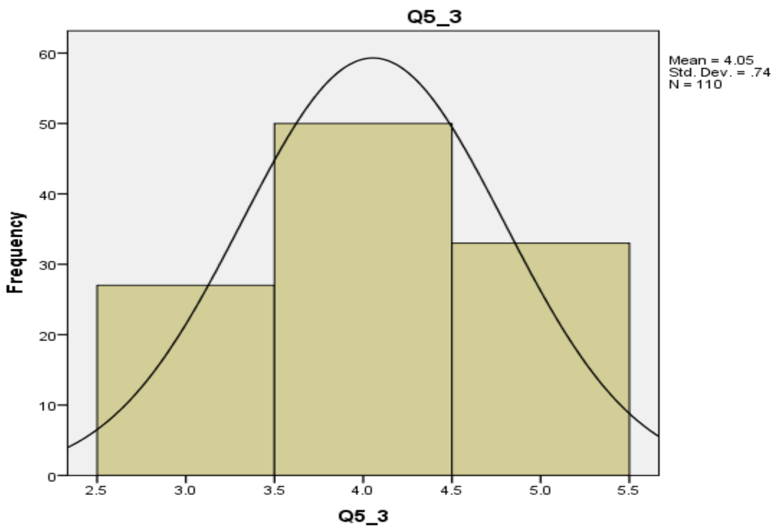

Figure 5.3.16: Q5_3 Skewness and Kurtosis

Q5_3: Frequency distribution

The frequency distribution for Q5_3: “I believe it is possible that people can hide their identities in processes that are virtual”, recorded *agree* response by most participants at 45,5%, followed by *strongly agree* at 30,0%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	27	24,5	24,5	24,5
	4	50	45,5	45,5	70,0
	5	33	30,0	30,0	100,0
	Total	110	100,0	100,0	

Table 5.3.16: The frequency distribution

Q5_4: Skewness and Kurtosis

Q5_4 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,342; -0,771; 3,68 and 0,957 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, they believe that virtual process participants can be properly identified, as presented in the histogram figure 5.3.17 below.

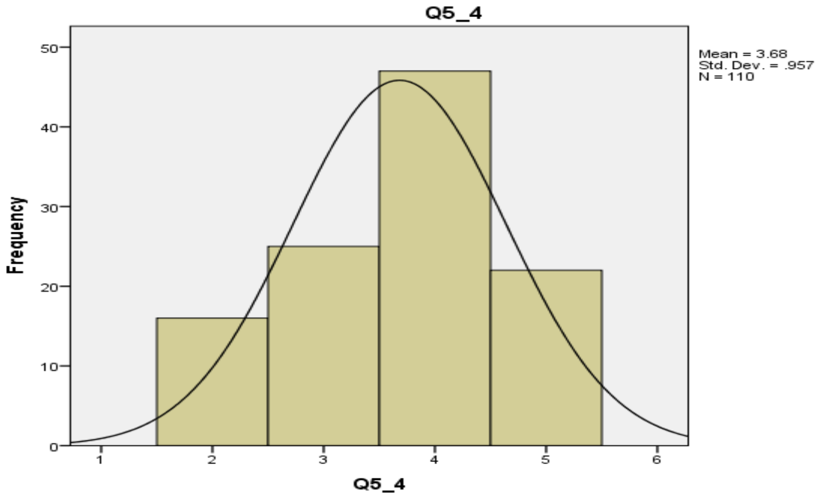

Figure 5.3.17: Q5_4 Skewness and Kurtosis

Q5_4: Frequency distribution

The frequency distribution for Q5_4: “I believe that virtual process participants can be properly identified”, recorded *agree* response by most participants at 42,7%, followed by *neutral* at 22,7%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	2	16	14,5	14,5	14,5
	3	25	22,7	22,7	37,3
	4	47	42,7	42,7	80,0
	5	22	20,0	20,0	100,0
	Total	110	100,0	100,0	

Table 5.3.17: The frequency distribution

Discussed next, is top management support construct.

5.3.5. Top management support

Top management support construct measures the degree to which management in top structures support the innovation (Low, Chen & Wu, 2011) and can provide a vision and commitment to create a supportive environment for innovation (Lee & Kim, 2007). Five items were applied in this study to measure the influence of top management support in the context of IT servitization adoption and they were represented with Q6_1-5.

Q6_1: Skewness and Kurtosis

Q6_1 is negatively skewed (range between -1 and -0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,509; -0,720; 4,34 and 0,667 respectively. The negative skewness and the negative kurtosis with platykurtic distribution indicate that there is less concentration of items near the centre, and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, participants strongly agree or agree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, they believe top management sponsorship is a factor that is significant in successful IT servitization adoption, as presented in the histogram figure 5.3.18 below.

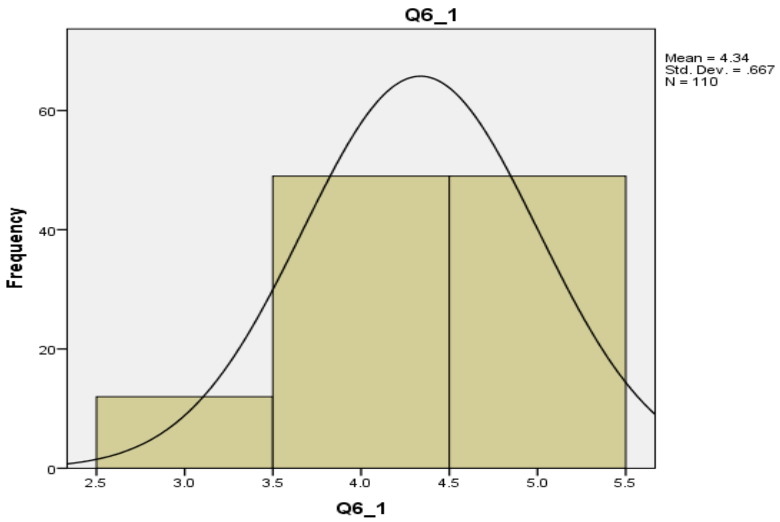

Figure 5.3.18: Q6_1 Skewness and Kurtosis

Q6_1: Frequency distribution

The frequency distribution for Q6_1: “Top management sponsorship is a significant factor in successful adoption of IT servitization”, recorded an equal number of *agree* responses by 44,5% participants together with *strongly agree* by the same Percentage.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	12	10,9	10,9	10,9
	4	49	44,5	44,5	55,5
	5	49	44,5	44,5	100,0
	Total	110	100,0	100,0	

Table 5.3.18: The frequency distribution

Q6_2: Skewness and Kurtosis

Q6_2 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,432; -0,725; 4,31 and 0,66 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree while others are neutral for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, they believe top management support is a factor that is significant in successful IT servitization adoption, as presented in the histogram figure 5.3.18 below.

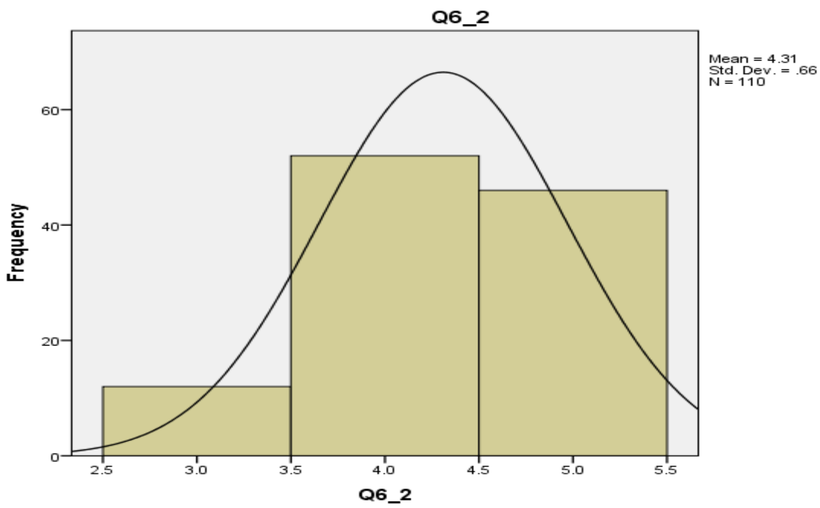

Figure 5.3.18: Q6_2 Skewness and Kurtosis

Q6_2: Frequency distribution

The frequency distribution for Q6_2: "Top management support is a significant factor in successful adoption of IT servitization", recorded *agree* response by most participants at 47,3%, followed by *strongly agree* at 41,8%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	12	10,9	10,9	10,9
	4	52	47,3	47,3	58,2
	5	46	41,8	41,8	100,0
	Total	110	100,0	100,0	

Table 5.3.19: The frequency distribution

Q6_3: Skewness and Kurtosis

Q6_3 is negatively skewed (range between -1 and -0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,612; -0,809; 4,35 and 0,71 respectively. The negative skewness and the negative kurtosis with platykurtic distribution indicate that there is less concentration of items near the centre, and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, participants generally strongly agree or agree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, they believe the implementation of initiatives to servitize IT require support from top management, as presented in the histogram figure 5.3.20 below.

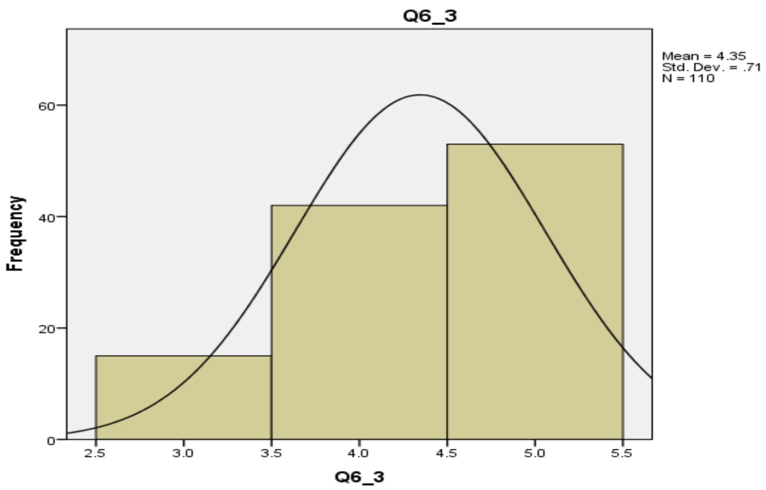

Figure 5.3.20: Q6_3 Skewness and Kurtosis

Q6_3: Frequency distribution

The frequency distribution for Q6_3: "The implementation of initiatives to servitize IT require support from top management", recorded *strongly agree* response by most participants at 48,2%, followed by *agree* at 38,2%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	15	13,6	13,6	13,6
	4	42	38,2	38,2	51,8
	5	53	48,2	48,2	100,0
	Total	110	100,0	100,0	

Table 5.3.20: The frequency distribution

Q6_4: Skewness and Kurtosis

Q6_4 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,495; -0,984; 4,28 and 0,731 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree while others neutral for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, they believe the acceptance of initiatives to servitize IT require support from top management, as presented in the histogram figure 5.3.20 below.

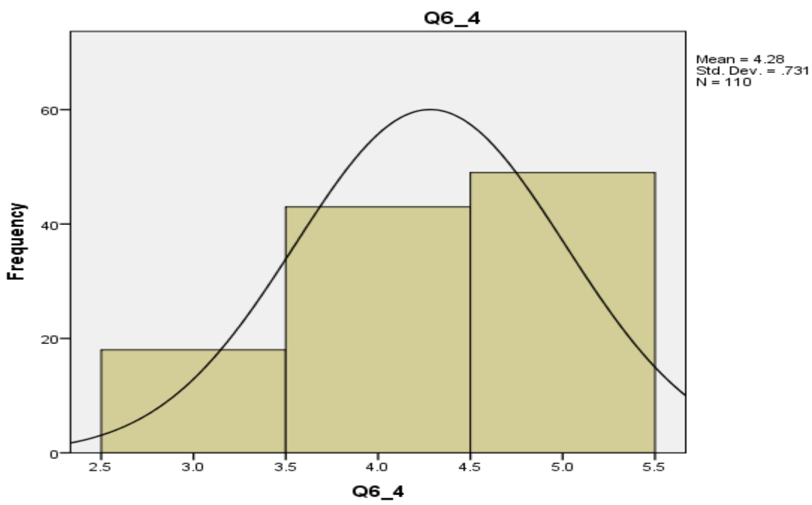

Figure 5.3.21: Q6_4 Skewness and Kurtosis

Q6_4: Frequency distribution

The frequency distribution for Q6_4: “The acceptance of initiatives to servitize IT require support from top management”, recorded *strongly agree* response by most participants at 44,5%, followed by *agree* at 39,1%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	18	16,4	16,4	16,4
	4	43	39,1	39,1	55,5
	5	49	44,5	44,5	100,0
	Total	110	100,0	100,0	

Table 5.3.21: The frequency distribution

Q6_5: Skewness and Kurtosis

Q6_5 is skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,434; -0,938; 4,26 and 0,713 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, they believe top management support can reduce probable resistance in IT servitization adoption, as presented in the histogram figure 5.3.20 below.

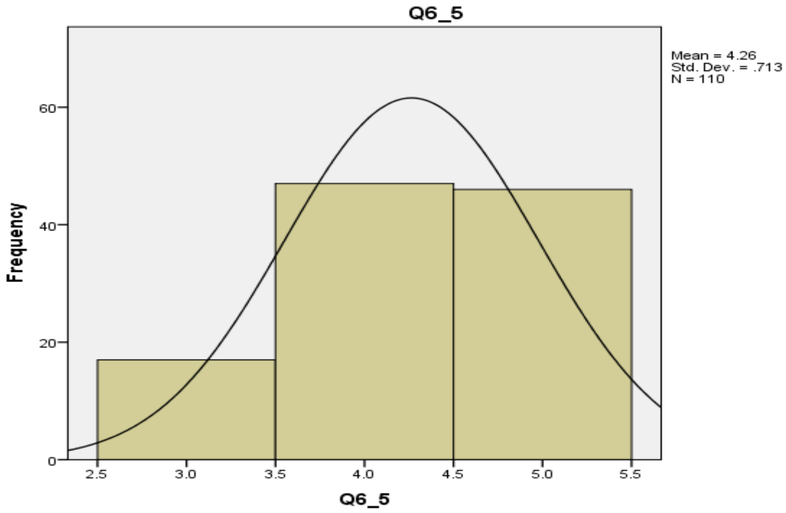

Figure 5.3.22: Q6_5 Skewness and Kurtosis

Q6_5: Frequency distribution

The frequency distribution for Q6_5: “Top management support can help overcome possible resistance in the adoption of IT servitization”, recorded *agree* response by most participants at 42,7% closely followed by *strongly agree* at 41,8%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	17	15,5	15,5	15,5
	4	47	42,7	42,7	58,2
	5	46	41,8	41,8	100,0
	Total	110	100,0	100,0	

Table 5.3.22: The frequency distribution

Discussed next, is the firm size construct.

5.3.6. Firm size

Firm size construct measures the influence of the size of the organisation (Tornatzky & Fleischer, 1990; Guenther & Tamm, 2002). Three items were applied in this study to measure the influence of firm size in the context of IT servitization adoption and they were represented with Q7_1-3.

Q7_1: Skewness and Kurtosis

Q7_1 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,286; -0,896; 3,36 and 1,163 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants were "neutral" for this item and that indicates that, some participants agree while others disagree that, the number of employees in an organisation should influence the IT servitization adoption decision , as presented in histogram figure 5.3.23 below.

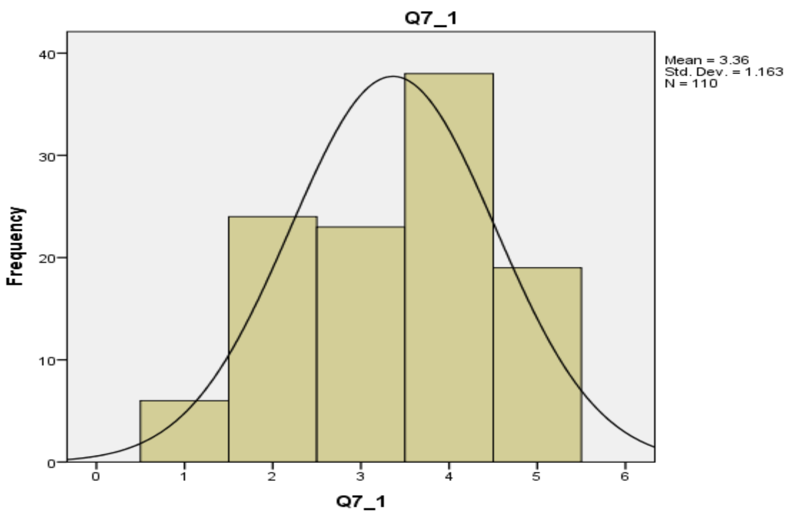

Figure 5.3.23: Q7_1 Skewness and Kurtosis

Q7_1: Frequency distribution

The frequency distribution for Q7_1: "The number of employees in an organisation should influence the decision to adopt IT servitization", recorded *agree* response by most participants at 43,5%, followed by *disagree* at 21,8%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	6	5,5	5,5	5,5
	2	24	21,8	21,8	27,3
	3	23	20,9	20,9	48,2
	4	38	34,5	34,5	82,7
	5	19	17,3	17,3	100,0
	Total	110	100,0	100,0	

Table 5.3.23: The frequency distribution

Q7_2: Skewness and Kurtosis

Q7_2 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,457; -0,823; 3,69 and 1,002 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, the number of employees who receive IT service should influence the IT servitization adoption decision, as presented in histogram figure 5.3.24 below.

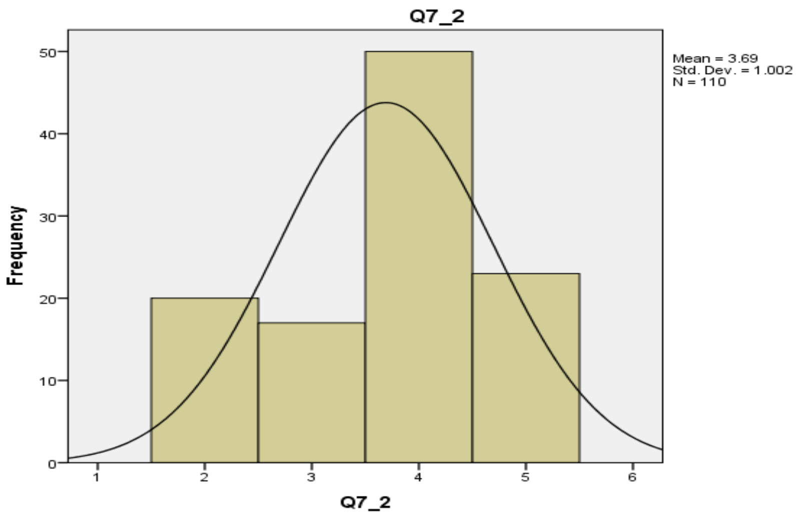

Figure 5.3.24: Q7_2 Skewness and Kurtosis

Q7_2: Frequency distribution

The frequency distribution for Q7_2: "The number of employees who receive IT service should influence the decision to adopt IT servitization", recorded *agree* response by most participants at 45,5%, followed by *strongly agree* at 20,9%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	2	20	18,2	18,2	18,2
	3	17	15,5	15,5	33,6
	4	50	45,5	45,5	79,1
	5	23	20,9	20,9	100,0
	Total	110	100,0	100,0	

Table 5.3.24: The frequency distribution

Q7_3: Skewness and Kurtosis

Q7_3 is skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,112; -1,076; 4,07 and 0,726 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, the frequency of IT service requests should influence the IT servitization adoption decision, as presented in histogram 5.3.25 below.

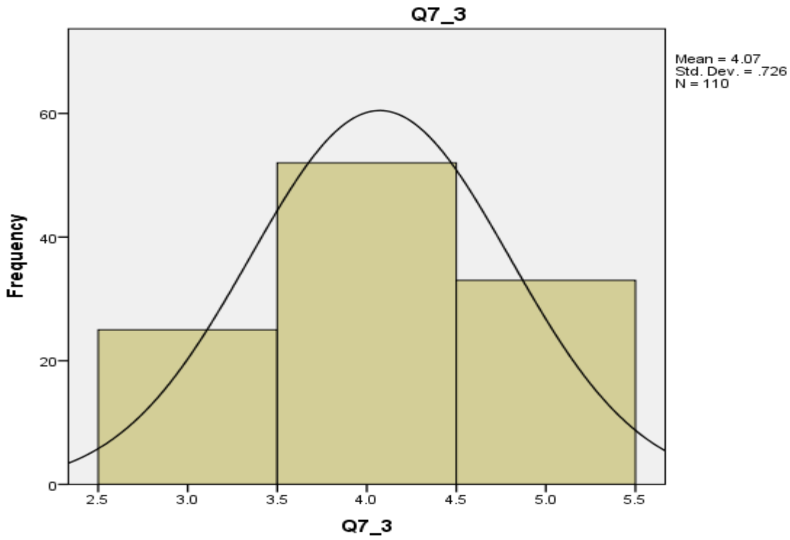

Figure 5.3.25: Q7_3 Skewness and Kurtosis

Q7_3: Frequency distribution

The frequency distribution for Q7_3: “The frequency of IT service requests should influence the decision to adopt IT servitization”, recorded *agree* response by most participants at 47,3%, followed by *strongly agree* at 30,0%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	25	22,7	22,7	22,7
	4	52	47,3	47,3	70,0
	5	33	30,0	30,0	100,0
	Total	110	100,0	100,0	

Table 5.3.25: The frequency distribution

Discussed next, is the coercive pressures construct.

5.3.7. Coercive pressures

Coercive pressures construct measures both formal and informal pressures exerted onto organisations by cultural expectations in the society within which organisations operate as well as by other organisations on whom they are dependent that result in organisations getting pressure to adopt similar structures and practices (DiMaggio & Powell, 2000; Benbasat, 2003). Four items were applied in this study to measure coercive pressures construct in the context of IT servitization adoption and they were represented with Q8_1-4.

Q8_1: Skewness and Kurtosis

Q8_1 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,201; -0,820; 4,15 and 0,68 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, laws and regulations that have to be adhered to by an organisation should influence their IT service model, as presented in the histogram figure 5.3.26 below.

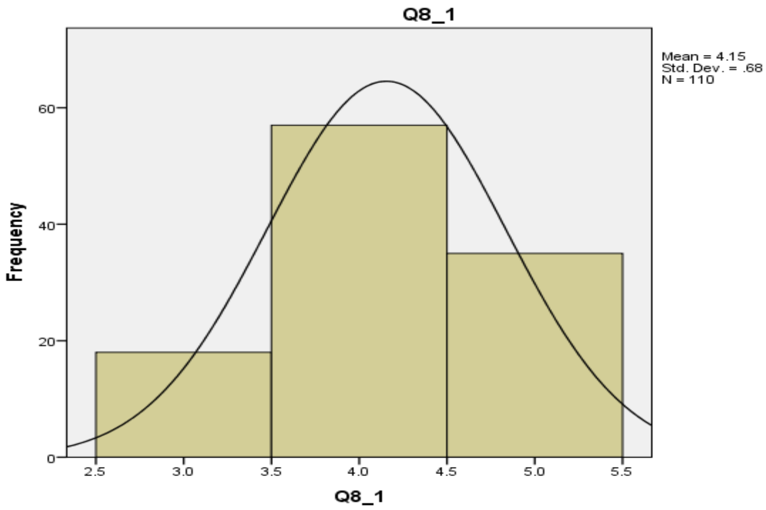

Figure 5.3.26: Q8_1 Skewness and Kurtosis

Q8_1: Frequency distribution

The frequency distribution for Q8_1: "Laws and regulations that have to be adhered to by an organisation should influence their IT service model", recorded *agree* response by most participants at 51,8%, followed by *strongly agree* at 31,8%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	18	16,4	16,4	16,4
	4	57	51,8	51,8	68,2
	5	35	31,8	31,8	100,0
	Total	110	100,0	100,0	

Table 5.3.26: The frequency distribution

Q8_2: Skewness and Kurtosis

Q8_2 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,129; -0,580; 4,14 and 0,642 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, laws and regulations that have to be adhered to by an organisation should influence their IT service delivery, as presented in the histogram figure 5.3.27 below.

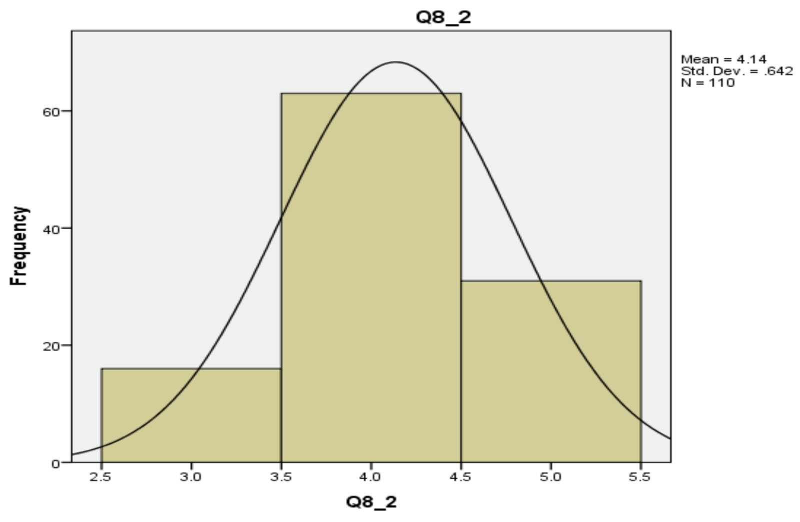

Figure 5.3.27: Q8_2 Skewness and Kurtosis

Q8_2: Frequency distribution

The frequency distribution for Q8_2: “Laws and regulations that have to be adhered to by an organisation should influence their IT service delivery”, recorded *agree* response by most participants at 57,3%, followed by *strongly agree* at 28,2%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	16	14,5	14,5	14,5
	4	63	57,3	57,3	71,8
	5	31	28,2	28,2	100,0
	Total	110	100,0	100,0	

Table 5.3.27: The frequency distribution

Q8_3: Skewness and Kurtosis

Q8_3 is skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,270; -1,010; 3,65 and 1,018 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, pressures from the government directives should influence the organisation’s decision to servitize IT, as presented in the histogram figure 5.3.28 below.

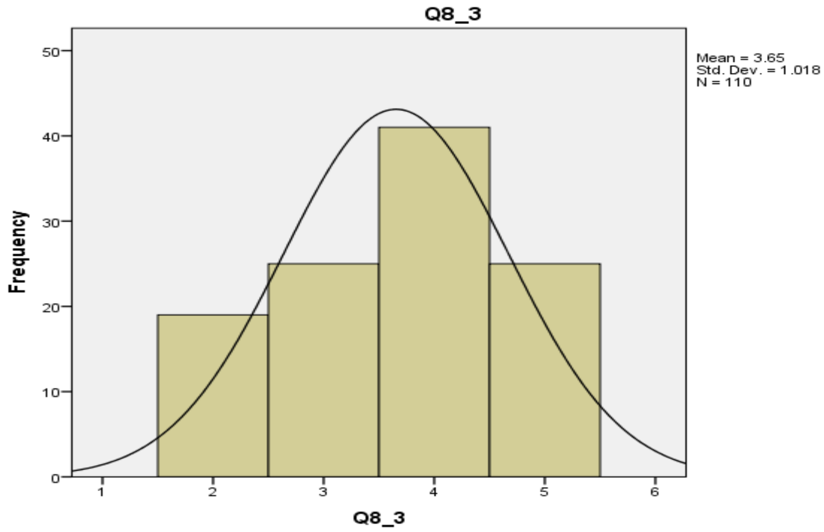

Figure 5.3.28: Q8_3 Skewness and Kurtosis

Q8_3: Frequency distribution

The frequency distribution for Q8_3: "Pressures from the government directives should influence the organisation's decision to servitize IT", recorded *agree* response by most participants at 37,3%, followed by both *strongly agree* and *neutral* at 22,7%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	2	19	17,3	17,3	17,3
	3	25	22,7	22,7	40,0
	4	41	37,3	37,3	77,3
	5	25	22,7	22,7	100,0
	Total	110	100,0	100,0	

Table 5.3.28: The frequency distribution

Q8_4: Skewness and Kurtosis

Q8_4 is negatively skewed (range between -1 and -0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,727; -0,278; 3,76 and 1,116 respectively. The negative skewness and the negative kurtosis with platykurtic distribution indicate that there is less concentration of items near the centre, and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, participants generally strongly agree or agree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, external parties such as suppliers and customers should influence the organisation's decision to servitize IT, as presented in the histogram figure 5.3.29 below.

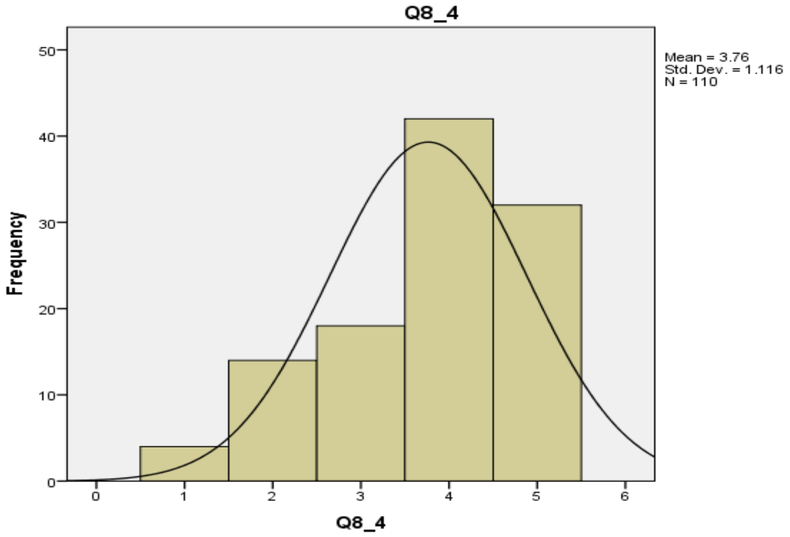

Figure 5.3.29: Q8_4 Skewness and Kurtosis

Q8_4: Frequency distribution

The frequency distribution for Q8_4: "External parties such as suppliers and customers should influence the organisation's decision to servitize IT", recorded *agree* response by most participants at 38,2%, followed by *strongly agree* at 29,1%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	4	3,6	3,6	3,6
	2	14	12,7	12,7	16,4
	3	18	16,4	16,4	32,7
	4	42	38,2	38,2	70,9
	5	32	29,1	29,1	100,0
	Total	110	100,0	100,0	

Table 5.3.29: The frequency distribution

Discussed next, is the mimetic pressures construct.

5.3.8. Mimetic pressures

Mimetic pressures construct measures the degree to which organisations imitate others when there is rapid change in technology market and organisations that are seemingly successful or legitimate being imitated (DiMaggio & Powell, 2000; Scott, 2007; Sharma & Daniel, 2016). Four items were applied in this study to measure mimetic pressures construct in the context of IT servitization adoption and they were represented with Q9_1-4.

Q9_1: Skewness and Kurtosis

Q9_1 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,128; -1,103; 4,08 and 0,731 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, experienced vendors and consultants should provide advice on IT servitization adoption, as presented in the histogram figure 5.3.30 below.

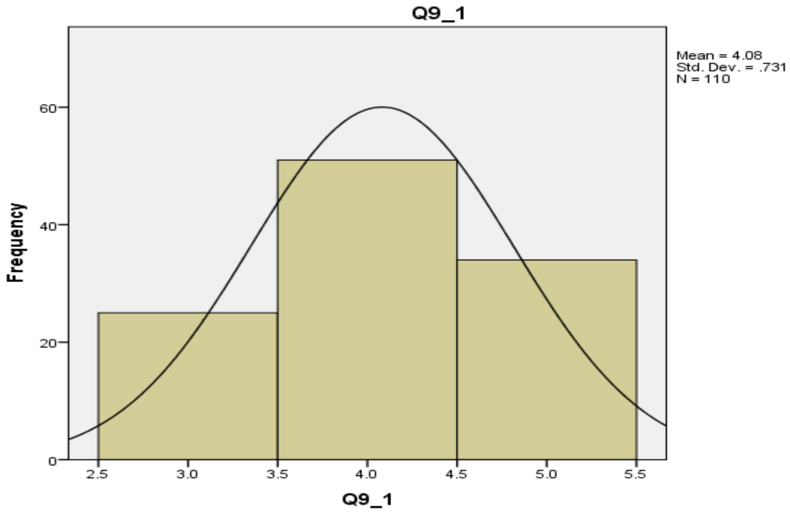

Figure 5.3.30: Q9_1 Skewness and Kurtosis

Q9_1: Frequency distribution

The frequency distribution for Q9_1: "Experienced vendors and consultants should provide advice on IT servitization adoption", recorded *agree* response by most participants at 46,9%, followed by *strongly agree* at 30,9%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	25	22,7	22,7	22,7
	4	51	46,4	46,4	69,1
	5	34	30,9	30,9	100,0
	Total	110	100,0	100,0	

Table 5.3.30: The frequency distribution

Q9_2: Skewness and Kurtosis

Q9_2 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,240; -1,027; 4,15 and 0,719 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, the need to remain competitive and/or to stay ahead of industry peers should influence decision to servitize IT, as presented in the histogram figure 5.3.31 below.

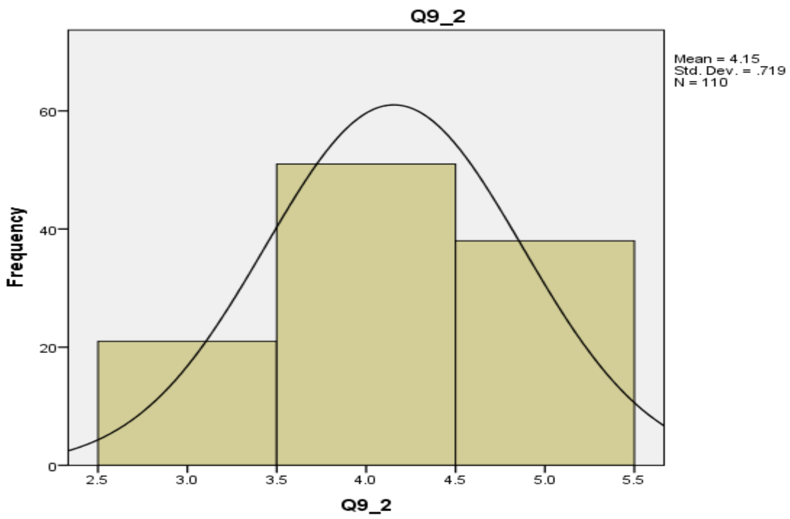

Figure 5.3.31: Q9_2 Skewness and Kurtosis

Q9_2: Frequency distribution

The frequency distribution for Q9_2: “The need to remain competitive and/or to stay ahead of industry peers should influence decision to servitize IT”, recorded *agree* response by most participants at 46,4%, followed by *strongly agree* at 34,5%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	21	19,1	19,1	19,1
	4	51	46,4	46,4	65,5
	5	38	34,5	34,5	100,0
	Total	110	100,0	100,0	

Table 5.3.31: The frequency distribution

Q9_3: Skewness and Kurtosis

Q9_3 is skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,112; -0,700; 4,1 and 0,663 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, industry leaders are always followed with regards to new IT trends or emerging technologies, as presented in the histogram figure 5.3.32 below.

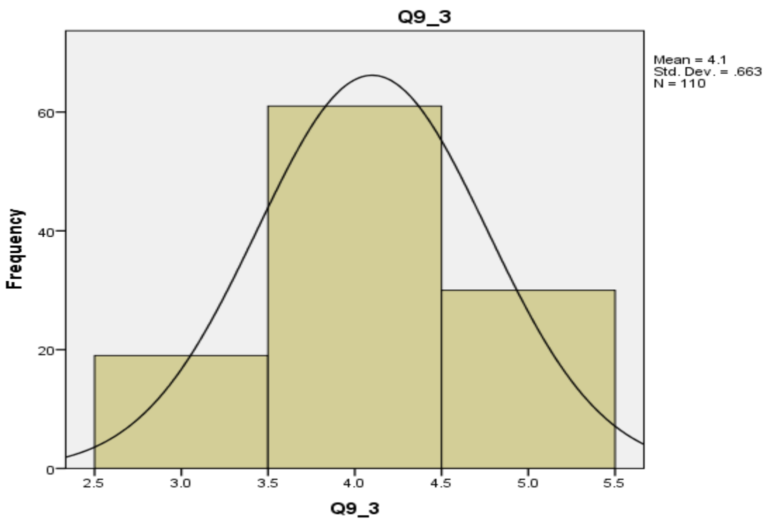

Figure 5.3.32: Q9_3 Skewness and Kurtosis

Q9_3: Frequency distribution

The frequency distribution for Q9_3: “Industry leaders are always followed with regards to new IT trends or emerging technologies”, recorded *agree* response by most participants at 55,5%, followed by *strongly agree* at 27,3%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	19	17,3	17,3	17,3
	4	61	55,5	55,5	72,7
	5	30	27,3	27,3	100,0
	Total	110	100,0	100,0	

Table 5.3.32: The frequency distribution

Q9_4: Skewness and Kurtosis

Q9_4 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,133; -0,993; 4,09 and 0,711 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, environmental uncertainties and rapid change in the technology market forces IT servitization, as presented in the histogram figure 5.3.33 below.

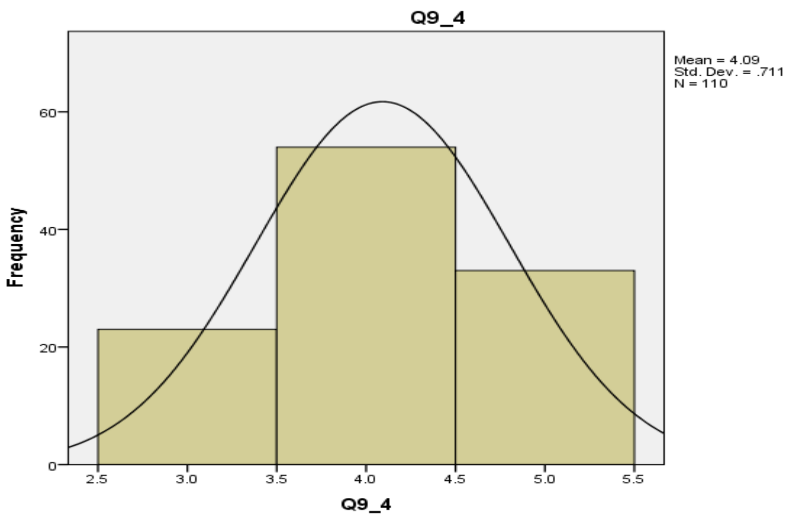

Figure 5.3.33: Q9_4 Skewness and Kurtosis

Q9_4: Frequency distribution

The frequency distribution for Q9_4: “Environmental uncertainties and rapid change in the technology market forces IT servitization”, recorded *agree* response by most participants at 49,1%, followed by *strongly agree* at 30,0%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	23	20,9	20,9	20,9
	4	54	49,1	49,1	70,0
	5	33	30,0	30,0	100,0
	Total	110	100,0	100,0	

Table 5.3.33: The frequency distribution

Discussed next, is the normative pressures construct.

5.3.9. Normative pressures

Normative pressures construct measures the influence of pressure that primarily stems from externally set norms arising from professionalisation and standardisation of job titles and roles in the industry and centralisation of IT (Nicholson & Sahay, 2009; Jeyaraj & Sabherwal, 2008; Currie, 2009; Pearson & Keller, 2009). Four items were applied in this study to measure the influence of normative pressures in the context of IT servitization adoption and they were represented with Q10_1-4.

Q10_1: Skewness and Kurtosis

Q10_1 is negatively skewed (range between -1 and -0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,976; 0,460; 4,01 and 1,063 respectively. The negative skewness and the positive kurtosis with leptokurtic distribution indicate that the data has an excess of outliers and comprises of extreme values. The data appears to be narrow and skinny with a fatter tail. The standard deviation shows that responses are spread-out. The responses show that, some participants agree while others neutral for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, professional certifications should be considered when recruiting IT professionals, as presented in the histogram figure 5.3.34 below.

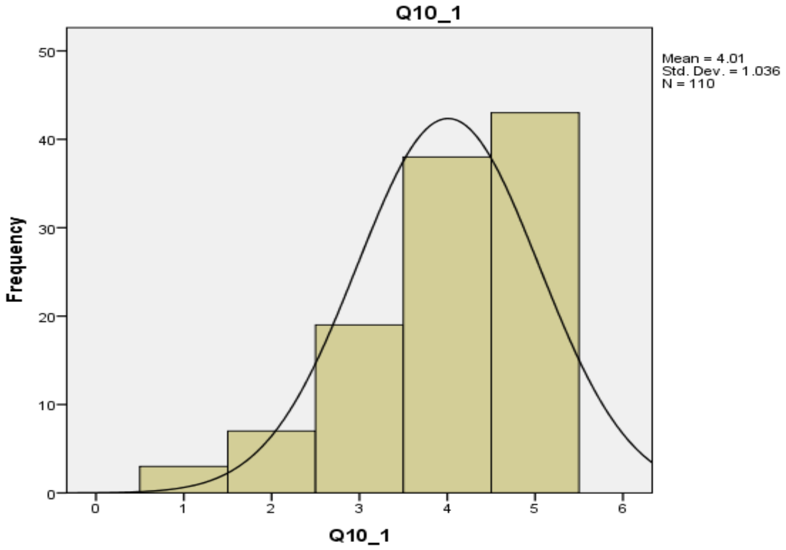

Figure 5.3.34: Q10_1 Skewness and Kurtosis

Q10_1: Frequency distribution

The frequency distribution for Q10_1: “Professional certifications should be considered when recruiting IT professionals”, recorded *strongly agree* response by most participants at 39,1%, followed by *agree* at 34,5%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1	3	2,7	2,7	2,7
	2	7	6,4	6,4	9,1
	3	19	17,3	17,3	26,4
	4	38	34,5	34,5	60,9
	5	43	39,1	39,1	100,0
	Total	110	100,0	100,0	

Table 5.3.34: The frequency distribution

Q10_2: Skewness and Kurtosis

Q10_2 is skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,398; -1,336; 4,21 and 0,802 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, IT professionals should have formal IT qualifications and/or IT certifications, as presented in the histogram figure 5.3.35 below.

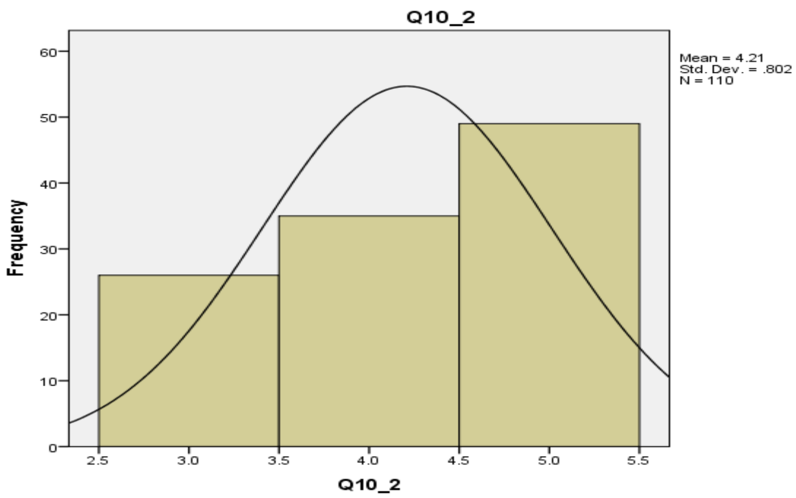

Figure 5.3.35: Q10_2 Skewness and Kurtosis

Q10_2: Frequency distribution

The frequency distribution for Q10_2: "IT professionals should have formal IT qualifications and/or IT certifications", recorded *strongly agree* response by most participants at 44,5%, followed by *agree* at 31,8%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	26	23,6	23,6	23,6
	4	35	31,8	31,8	55,5
	5	49	44,5	44,5	100,0
	Total	110	100,0	100,0	

Table 5.3.35: The frequency distribution

Q10_3: Skewness and Kurtosis

Q10_3 is highly negatively skewed (range less than -1). The skewness, kurtosis, mean and standard deviation for this item are -1,221; 0,540; 4,64 and 0,802 respectively. The negative skewness and the positive kurtosis with leptokurtic distribution indicate that the data has an excess of outliers and comprises of extreme values. The data appears to be narrow and skinny with a fatter tail. The standard deviation shows minimal response variations. The responses show that, participants generally strongly agree or agree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “strongly agree” for this item and that indicates that, IT professionals should continuously be trained to remain current, as presented in the histogram figure 5.3.36 below.

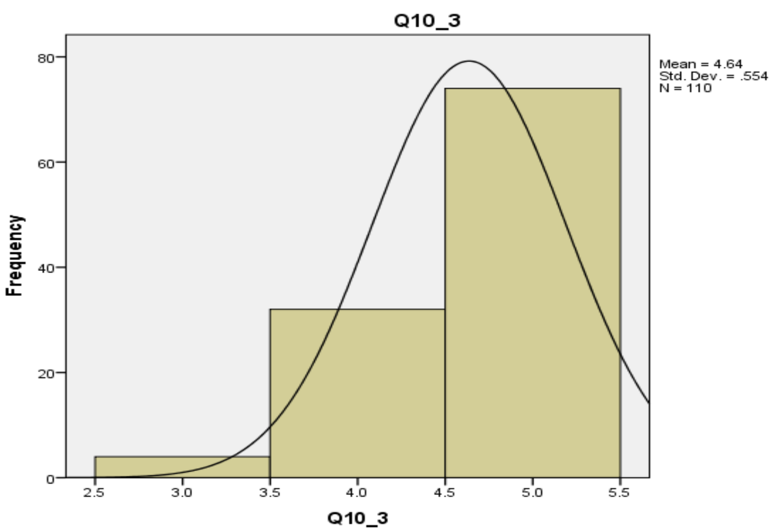

Figure 5.3.36: Q10_3 Skewness and Kurtosis

Q10_3: Frequency distribution

The frequency distribution for Q10_3: “IT professionals should continuously be trained to remain current”, recorded *strongly agree* response by most participants at 67.3%, followed by *agree* at 29,1%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	4	3,6	3,6	3,6
	4	32	29,1	29,1	32,7
	5	74	67,3	67,3	100,0
	Total	110	100,0	100,0	

Table 5.3.36: The frequency distribution

Q10_4: Skewness and Kurtosis

Q10_4 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,209; -1,300; 4,12; 0,775 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that there is less concentration of items near the centre and heavy abnormal distribution of data. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, professionalisation of the IT industry should regulate IT servitization, as presented in the histogram figure 5.3.37 below.

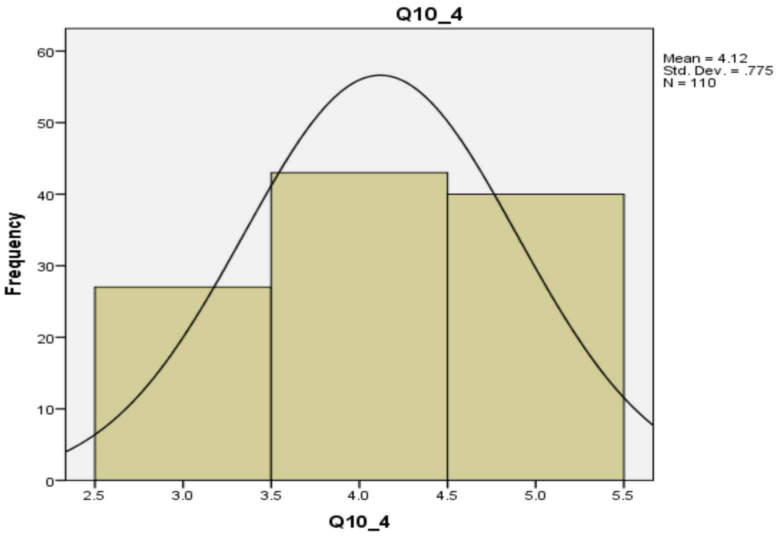

Figure 5.3.37: Q10_4 Skewness and Kurtosis

Q10_4: Frequency distribution

The frequency distribution for Q10_4: "Professionalisation of the IT industry should regulate IT servitization", recorded *agree* response by most participants at 39,1%, followed by *strongly agree* at 36,4%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	27	24,5	24,5	24,5
	4	43	39,1	39,1	63,6
	5	40	36,4	36,4	100,0
	Total	110	100,0	100,0	

Table 5.3.37: The frequency distribution

Discussed next, is the mandate construct.

5.3.10. Mandate

Mandate construct measures the influence of output responsibilities of the organisation or subsidiary (Cantwell & Mudambi, 2005). Four items were applied in this study to measure the influence of the organisational mandate in the context of IT servitization adoption and they were represented with Q11_1-4.

Q11_1: Skewness and Kurtosis

Q11_1 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,184; -1,071; 4,12 and 0,726 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that there is less concentration of items near the centre and heavy abnormal distribution of data. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, participants are of the view that the organisation's mandate requires creation and collection of high amounts of data, as presented in the histogram figure 5.3.38 below.

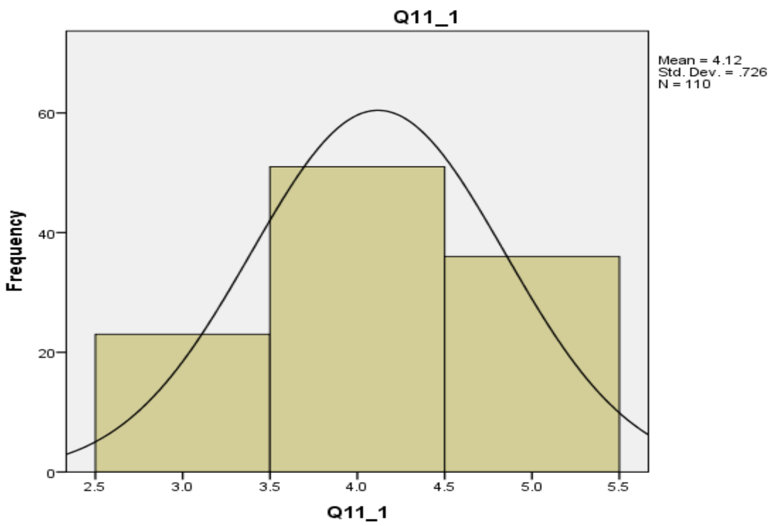

Figure 5.3.38: Q11_1 Skewness and Kurtosis

Q11_1: Frequency distribution

The frequency distribution for Q11_1: "In my view, the organisation's mandate requires creation and collection of high amounts of data", recorded *agree* response by most participants at 46,4%, followed by *strongly agree* at 32,7%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	23	20,9	20,9	20,9
	4	51	46,4	46,4	67,3
	5	36	32,7	32,7	100,0
	Total	110	100,0	100,0	

Table 5.3.38: The frequency distribution

Q11_2: Skewness and Kurtosis

Q11_2 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,174; -1,112; 4,11 and 0,734 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, participants are of the view that the organisation’s mandate requires maintenance and storage of high amount of data, as presented in the histogram figure 5.3.39 below.

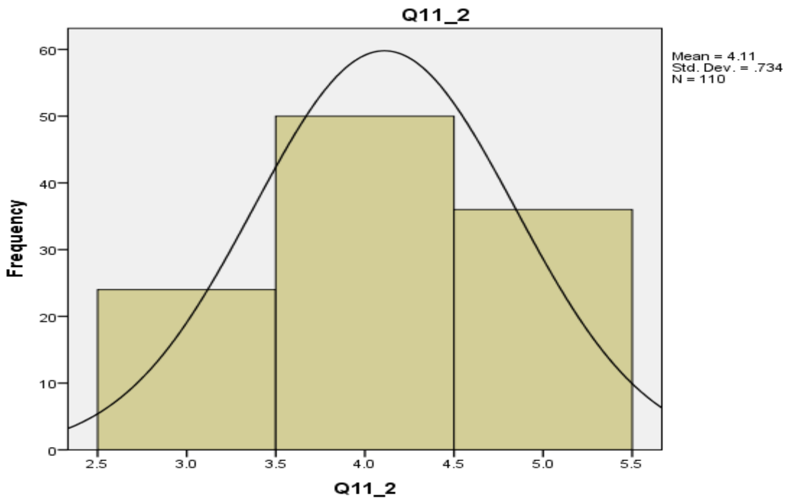

Figure 5.3.39: Q11_2 Skewness and Kurtosis

Q11_2: Frequency distribution

The frequency distribution for Q11_2: “In my view, the organisation’s mandate requires maintenance and storage of high amount of data”, recorded *agree* response by most participants at 45,5%, followed by *strongly agree* at 32,7%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	24	21,8	21,8	21,8
	4	50	45,5	45,5	67,3
	5	36	32,7	32,7	100,0
	Total	110	100,0	100,0	

Table 5.3.39: The frequency distribution

Q11_3: Skewness and Kurtosis

Q11_3 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,041; -1,061; 4,03 and 0,723 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicates that, there is less concentration of items near the centre and heavy abnormal distribution of data that is too flat, has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, participants are of the view that, the organisation’s mandate requires publication of relevant and on-demand information, as presented in the histogram figure 5.3.40 below.

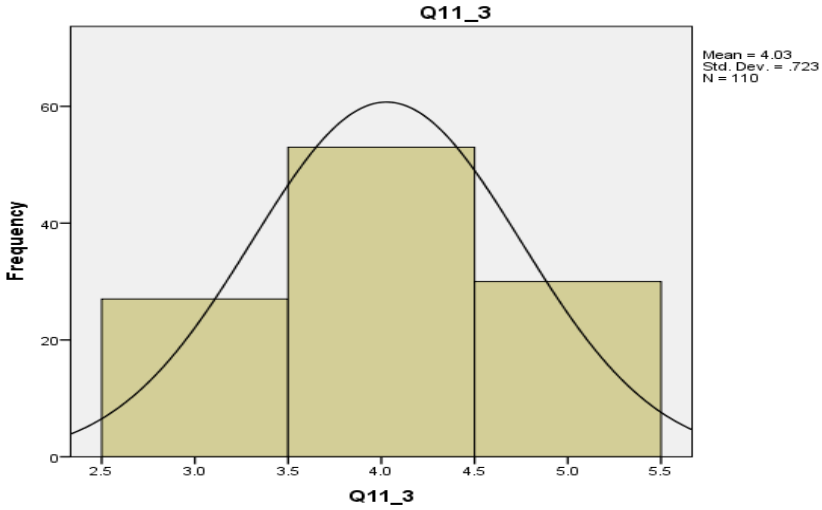

Figure 5.3.40: Q11_3 Skewness and Kurtosis

Q11_3: Frequency distribution

The frequency distribution for Q11_3: “In my view, the organisation’s mandate requires publication of relevant and on-demand information”, recorded *agree* response by most participants at 48,2%, followed by *strongly agree* at 27,3%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	27	24,5	24,5	24,5
	4	53	48,2	48,2	72,7
	5	30	27,3	27,3	100,0
	Total	110	100,0	100,0	

Table 5.3.40: The frequency distribution

Q11_4: Skewness and Kurtosis

Q11_4 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,345; -0,671; 3,81 and 0,914 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, participants are of the view that, authority to sanction and the related sanctioning activities of the organisation should influence the adoption of IT servitization, as presented in the histogram figure 5.3.41 below.

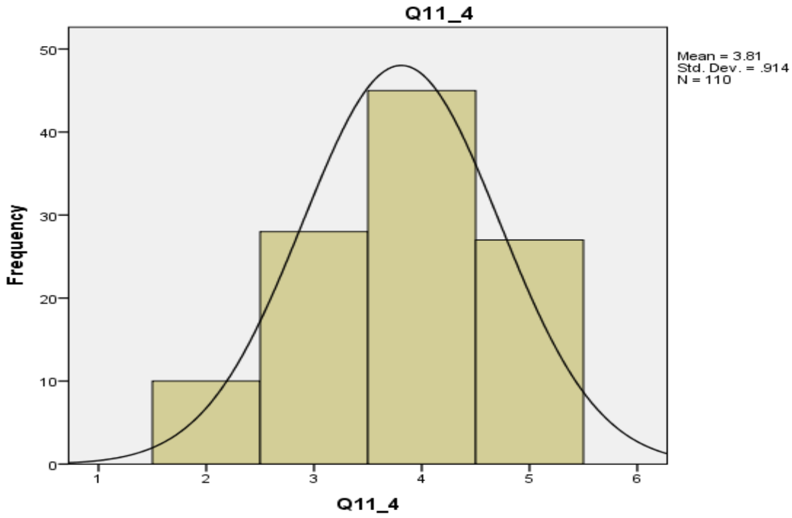

Figure 5.3.41 Q11_4 Skewness and Kurtosis

Q11_4: Frequency distribution

The frequency distribution for Q11_4: "In my view, authority to sanction and the related sanctioning activities of the organisation should influence the adoption of IT servitization", recorded *agree* response by most participants at 40,9%, followed by *neutral* at 25,5%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	2	10	9,1	9,1	9,1
	3	28	25,5	25,5	34,5
	4	45	40,9	40,9	75,5
	5	27	24,5	24,5	100,0
	Total	110	100,0	100,0	

Table 5.3.41: The frequency distribution

Discussed next, is the industry construct.

5.3.11. Industry

Industry construct measures the influence resulting from the sector of business within which the organisation operates (Yao, Lee & Lee, 2010). Four items were applied in this study to measure the influence of the industry within which the organisation operates to IT servitization adoption and they are represented with Q12_1-4.

Q12_1: Skewness and Kurtosis

Q12_1 is highly negatively skewed (range less than -1). The skewness, kurtosis, mean and standard deviation for this item are -1,258; -0,425; 3,76 and 0,427 respectively. The negative skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows minimal response variations. The responses show that, some participants are neutral while others agree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, participants are of the view that, the kind of product and services offered by an organisation should dictate the adoption of IT servitization, as presented in the histogram figure 5.3.42 below.

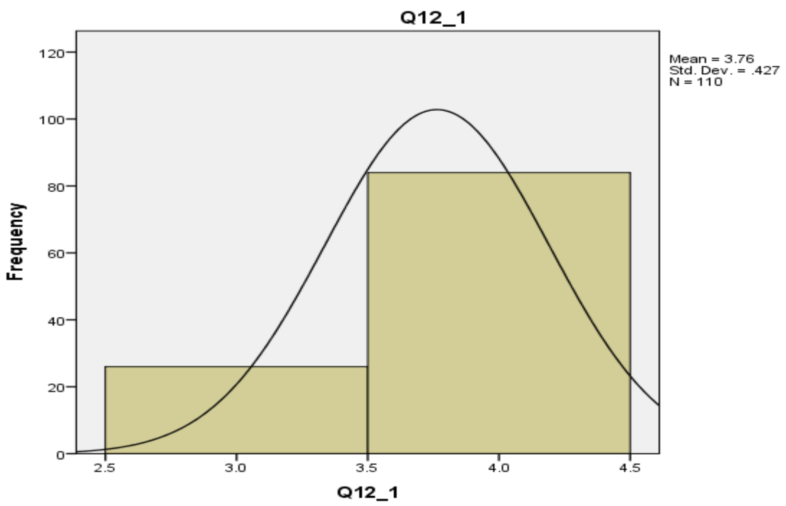

Figure 5.3.42 Q12_1 Skewness and Kurtosis

Q12_1: Frequency distribution

The frequency distribution for Q12_1: "The kind of product and services offered by an organisation should dictate the adoption of IT servitization", recorded *agree* response by most participants at 76,4%, followed by *neutral* at 23,6%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	26	23,6	23,6	23,6
	4	84	76,4	76,4	100,0
	Total	110	100,0	100,0	

Table 5.3.42: The frequency distribution

Q12_2: Skewness and Kurtosis

Q12_2 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,483; -0,710; 3,72 and 0,978 respectively. The standard deviation shows that responses are spread-out. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, participants are of the view that, the population the organisation caters to should dictate whether IT servitization is adopted or not, as presented in the histogram figure 5.3.43 below.

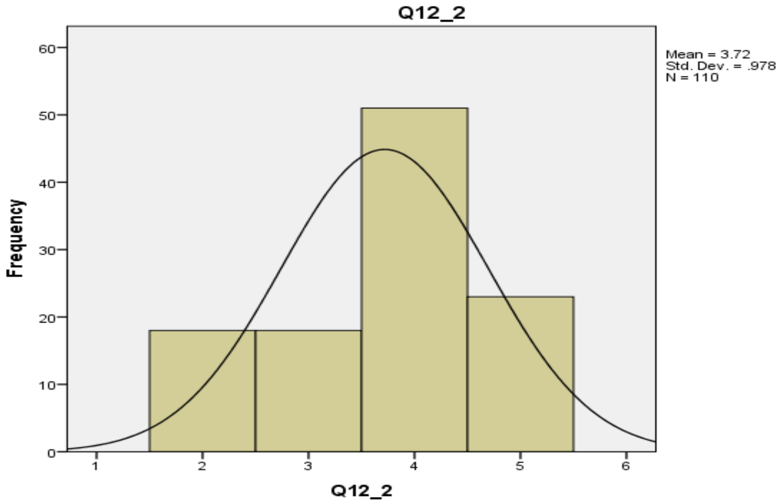

Figure 5.3.43 Q12_2 Skewness and Kurtosis

Q12_2: Frequency distribution

The frequency distribution for Q12_2: "The population the organisation caters to should dictate whether IT servitization is adopted or not", recorded *agree* response by most participants at 46,4%, followed by *strongly agree* at 20,9%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	2	18	16,4	16,4	16,4
	3	18	16,4	16,4	32,7
	4	51	46,4	46,4	79,1
	5	23	20,9	20,9	100,0
	Total	110	100,0	100,0	

Table 5.3.43: The frequency distribution

Q12_3: Skewness and Kurtosis

Q12_3 is highly negatively skewed (range less than -1). The skewness, kurtosis, mean and standard deviation for this item are -1,384; -0,087; 3,78 and 0,415 respectively. The negative skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows minimal response variations. The responses show that, some participants are neutral while others agree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, participants are of the view that, the competition in the industry where the organisation operates should influence the need to servitize IT, as presented in the histogram figure 5.3.44 below.

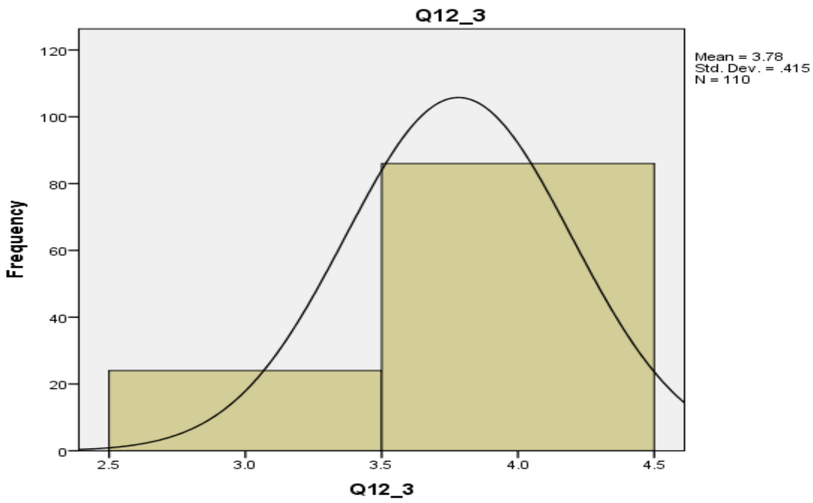

Figure 5.3.44 Q12_3 Skewness and Kurtosis

Q12_3: Frequency distribution

The frequency distribution for Q12_3: "The competition in the industry where the organisation operates should influence the need to servitize IT", recorded *agree* response by most participants at 78,2%, followed by *neutral* at 21,8%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	24	21,8	21,8	21,8
	4	86	78,2	78,2	100,0
	Total	110	100,0	100,0	

Table 5.3.44: The frequency distribution

Q12_4: Skewness and Kurtosis

Q12_4 is negatively skewed (range between -1 and -0.5). The mean, standard deviation, skewness and kurtosis for this item are -0,574; -0,181; 3,86 and 0,872 respectively. The negative skewness and the negative kurtosis with platykurtic distribution indicate that there is less concentration of items near the centre, and the data has few outliers with short tails and flat shoulders. The standard deviation shows that responses are spread-out. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered "agree" for this item and that indicates that, participants are of the view that, the industry laws and regulations where the organisation operates should influence the need to servitize IT, as presented in the histogram figure 5.3.45 below.

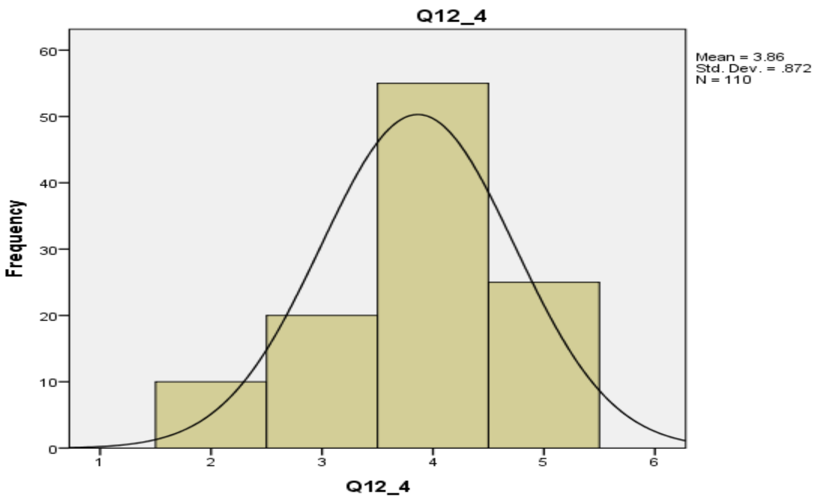

Figure 5.3.45 Q12_4 Skewness and Kurtosis

Q12_4: Frequency distribution

The frequency distribution for Q12_4: "The industry laws and regulations where the organisation operates should influence the need to servitize IT", recorded *agree* response by most participants at 50,0%, followed by *strongly agree* at 22,7%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	2	10	9,1	9,1	9,1
	3	20	18,2	18,2	27,3
	4	55	50,0	50,0	77,3
	5	25	22,7	22,7	100,0
	Total	110	100,0	100,0	

Table 5.3.45: The frequency distribution

Discussed next, is the IT servitization construct.

5.3.12. IT servitization

IT servitization construct measures the exposure of IT professionals to the phenomenon where organisations evolve to making IT a service and emphasising customer-oriented service in the delivery of IT solutions to business (Ilk, 2012; Sultan, 2014 & Conger, 2010). Four items were applied in this study to measure the exposure of IT professionals to the IT servitization practise and they are represented with Q13_1-4.

Q13_1: Skewness and Kurtosis

Q13_1 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,055; -0,234; 3,83 and 0,539 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows minimal response variations. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, participants currently practise IT servitization on a regular basis, as presented in the histogram figure 5.3.46 below.

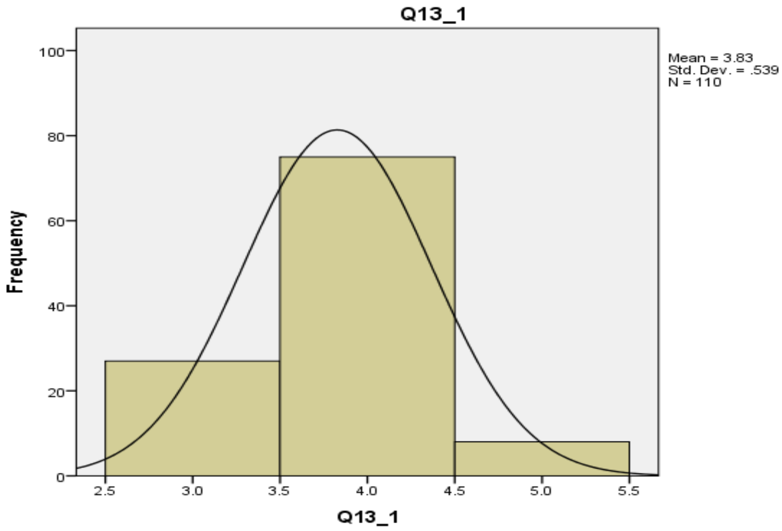

Figure 5.3.46 Q13_1 Skewness and Kurtosis

Q13_1: Frequency distribution

The frequency distribution for Q13_1: "I currently practise IT servitization on a regular basis", recorded *agree* response by most participants at 68,2%, followed by *neutral* at 24,5%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	27	24,5	24,5	24,5
	4	75	68,2	68,2	92,7
	5	8	7,3	7,3	100,0
	Total	110	100,0	100,0	

Table 5.3.46: The frequency distribution

Q13_2: Skewness and Kurtosis

Q13_2 is highly negatively skewed (range less than -1). The skewness, kurtosis, mean and standard deviation for this item are -1,199; -0,572; 4,71 and 0,456 respectively. The negative skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows minimal response variations. The responses show that, some participants are neutral while others agree for this item as per the Likert scale.

Thus, the mean shows that the majority of participants answered “strongly agree” for this item and that indicates that, participants have practised IT servitization in the past regularly, as presented in the histogram figure 5.3.47 below.

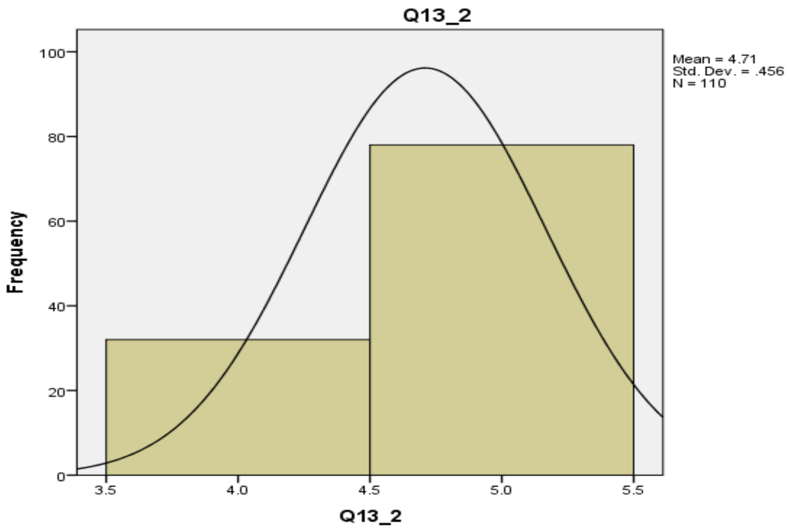

Figure 5.3.47 Q13_2 Skewness and Kurtosis

Q13_2: Frequency distribution

The frequency distribution for Q13_2: “In the past I practised IT servitization on a regular basis”, recorded *strongly agree* response by most participants at 75,5%, followed by *agree* at 24,5%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	4	27	24,5	24,5	24,5
	5	83	75,5	75,5	100,0
	Total	110	100,0	100,0	

Table 5.3.47: The frequency distribution

Q13_3: Skewness and Kurtosis

Q13_3 is skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are 0,044; -0,397; 2,87 and 0,592 respectively. The standard deviation shows minimal response variations. The symmetrical skewness and the negative kurtosis with platykurtic distribution indicate that extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants were "neutral" for this item and that indicates that, some participants agree while others disagree that they currently practise IT servitization sometimes, as presented in the histogram figure 5.3.48 below.

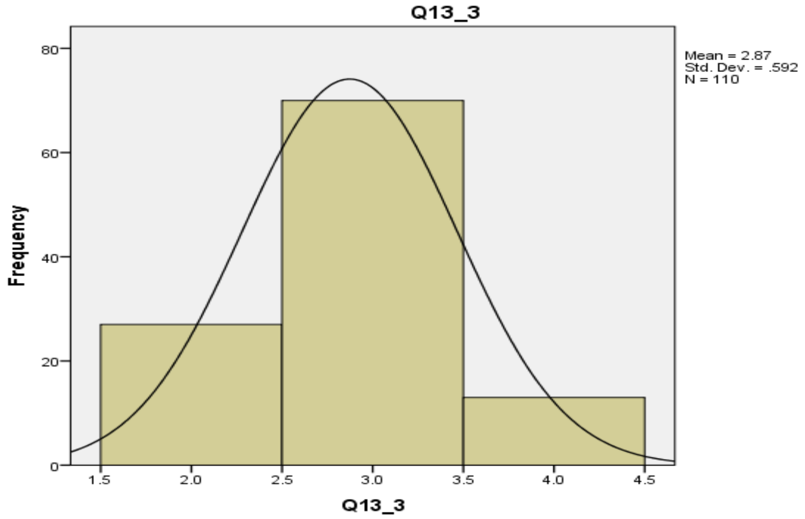

Figure 5.3.48 Q13_3 Skewness and Kurtosis

Q13_3: Frequency distribution

The frequency distribution for Q13_3: "I currently practise IT servitization sometimes", recorded *neutral* response by most participants at 68,2%, followed by *disagree* at 24,5%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	2	27	24,5	24,5	24,5
	3	75	68,2	68,2	92,7
	4	8	7,3	7,3	100,0
	Total	110	100,0	100,0	

Table 5.3.48: The frequency distribution

Q13_4: Skewness and Kurtosis

Q13_4 skewness is fairly symmetrical (range between -0.5 and 0.5). The skewness, kurtosis, mean and standard deviation for this item are -0,020; -0,684; 3,81 and 0,533 respectively. The symmetrical skewness and the negative kurtosis with platykurtic distribution means extreme values are less than that of the normal distribution and the data has few outliers with short tails and flat shoulders. The standard deviation shows minimal response variations. The responses show that, some participants agree or neutral while others disagree for this item as per the Likert scale.

In summary, the mean shows that on average participants answered “agree” for this item and that indicates that, participants have in the past sometimes practised IT servitization, as presented in the histogram figure 5.3.49 below.

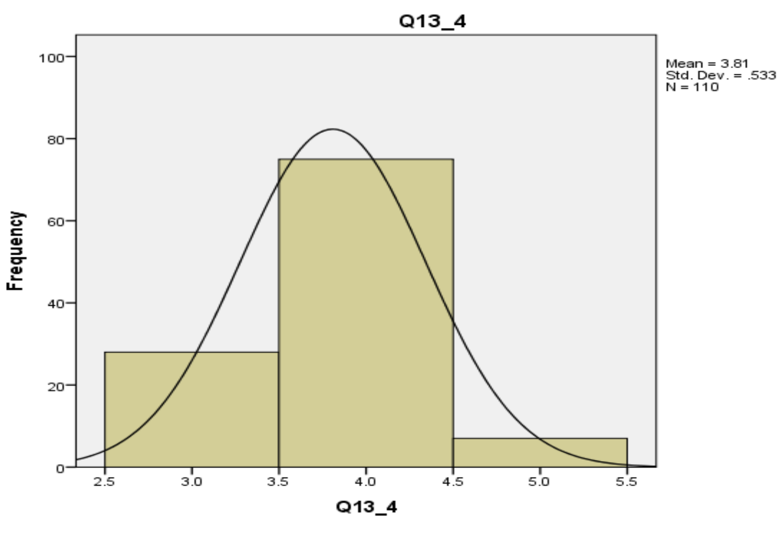

Figure 5.3.48 Q13_4 Skewness and Kurtosis

Q13_4: Frequency distribution

The frequency distribution for Q13_4: “In the past I practised IT servitization sometimes”, recorded *agree* response by most participants at 68,2%, followed by *disagree* at 25,5%.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	3	28	25,5	25,5	25,5
	4	75	68,2	68,2	93,6
	5	7	6,4	6,4	100,0
	Total	110	100,0	100,0	

Table 5.3.49: The frequency distribution

This concludes the section for constructs frequency distribution. Discussed in the next section is the descriptive statistics for the constructs.

5.4. Central tendency and Dispersion - Constructs

This section discusses the descriptive statistics and reveal the central tendency and identifies outliers for the constructs through; a) Minimum which indicates the smallest data value; b) Maximum which is the highest data value; c) Arithmetic mean or simply mean, which according to Bhattacherjee (2012) calculates the average of all values in a sample. Finally, standard deviation which reveals dispersion and corrects for outliers through the use of a formula that calculates how spread-out each value is from the mean (Evans & Basu, 2010; Tustin et al., 2005). Table 5.4 shows the minimum, maximum, mean and standard deviation of the constructs.

Descriptive Statistics- Central tendency and dispersion statistics of constructs

Constructs	N	Minimum	Maximum	Mean	Std. Deviation
Sensory readiness	110	1,75	5,00	3,50	0,82569
Relationship readiness	110	1,00	5,00	3,28	1,11688
Synchronism readiness	110	2,25	5,00	3,42	0,48262
Identification & control readiness	110	2,25	5,00	3,78	0,65957
Top management support	110	3,00	5,00	4,31	0,58273
Firm Size	110	2,00	5,00	3,71	0,83515
Coercive pressures	110	2,67	5,00	3,98	0,65562
Mimetic pressures	110	3,00	5,00	4,11	0,55589
Normative pressures	110	3,00	5,00	4,16	0,67085
Mandate	110	2,75	5,00	4,02	0,65076
Industry	110	2,00	5,00	3,79	0,78513
IT servitization	110	3,00	4,67	3,80	0,49317
Valid N (listwise)	110				

Table 5.4 Central tendency and dispersion statistics of constructs

Sensory readiness: There is a total number (N) of 110 valid observations for this construct with a standard deviation of 0,82569. The standard deviation shows that responses are spread-out for this construct. The minimum, maximum and mean for this construct are 1,75; 5,00 and 3,50 respectively. The minimum value is slightly low but acceptable considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered “agree” for sensory readiness construct questions; which measure the requirement for process participants to be able to enjoy a full sensory experience of a process (Overby, 2012). Thus, sensory readiness is generally regarded as an influencer in the context of IT servitization adoption.

Relationship readiness: There is a total number (N) of 110 valid observations for this construct with 1,11688 standard deviation. This shows that responses are spread-out for this construct. The minimum, maximum and mean for this construct are 1,00; 5,00 and 3,28 respectively. The minimum value is slightly low but acceptable considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered “neutral” meaning they neither agree nor disagree on relationship readiness construct; which measures the requirement by process participants to be able to interact with each other in either social or professional context (Overby, 2012). Thus, relationship readiness may or may not be regarded an influencer in the context of IT servitization adoption.

Synchronism readiness: There is a total number (N) of 110 valid observations for this construct with 0,48262 standard deviation. This shows that there is less spread of responses for this construct. The minimum, maximum and mean for this construct are 2,25; 5,00 and 3,42 respectively. The minimum value is within limits and acceptable considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered “neutral” meaning they neither agree nor disagree on synchronism readiness construct; which measures the degree to which the process activities need to occur instantaneously with minimal delay (Overby, 2012). Thus, synchronism readiness may or may not be regarded an influencer in the context of IT servitization adoption.

Identification & control readiness: There is a total number (N) of 110 valid observations for this construct with 0,65957 standard deviation. This shows that responses are spread-out for this construct. The minimum, maximum and mean for this construct are 2,25; 5,00 and 3,78 respectively. The minimum value is within limits considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered “agree” for identification and control readiness construct questions; which measure the requirement for identification of other process participants and the ability to control their behaviour as virtual processes are prone to identity spoofing problems because physically inspection of participants cannot be confirmed (Overby, 2012). Thus, identification and control readiness is generally regarded as an influencer in IT servitization adoption.

Top management support: There is a total number (N) of 110 valid observations for this construct with 0,58273 standard deviation. This shows that there is less spread of responses to this construct. The minimum, maximum and mean for this construct are 3,00; 5,00 and 4,31 respectively. The minimum value is within limits considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered "agree" for top management support construct questions; which measures the degree to which management in top structures support the innovation (Low, Chen & Wu, 2011) and can provide a vision and commitment to create a supportive environment for innovation (Lee & Kim, 2007). Thus, top management support is generally regarded as an influencer in the context of IT servitization adoption.

Firm size: There is a total number (N) of 110 valid observations for this construct with 0,83515 standard deviation. This shows that responses are spread-out for this construct. The minimum, maximum and mean for this construct are 2,00; 5,00 and 3,71 respectively. The minimum value is within limits considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered "agree" for firm size construct questions; which measures the influence of firm size (Tornatzky & Fleischer, 1990; Guenther & Tamm, 2002). Thus, firm size is generally regarded as an influencer in the context of IT servitization adoption.

Coercive pressures: There is a total number (N) of 110 valid observations for this construct with 0,65562 standard deviation. This shows that responses are spread-out for this construct. The minimum, maximum and mean for this construct are 2,67; 5,00 and 3,98 respectively. The minimum value is within limits considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered "agree" for coercive pressures construct questions; which measures both formal and informal pressures exerted onto organisations by cultural expectations in the society within which organisations operate as well as by other organisations on whom they are dependent that result in organisations getting pressure to adopt similar structures and practices (DiMaggio & Powell, 2000; Benbasat, 2003). Thus, coercive pressures are generally regarded as an influencer in the context of IT servitization adoption.

Mimetic pressures: There is a total number (N) of 110 valid observations for this construct with 0,55589 standard deviation. This shows that there is less spread of responses to this construct. The minimum, maximum and mean for this construct are 3,00; 5,00 and 4,11 respectively. The minimum value is within limits considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered “agree” for mimetic pressures construct questions; which measures the degree to which organisations imitate others when there is rapid change in technology market and organisations that are seemingly successful or legitimate being imitated (DiMaggio & Powell, 2000; Scott, 2007; Sharma & Daniel, 2016). Thus, mimetic pressures are generally regarded as an influencer in the context of IT servitization adoption.

Normative pressures: There is a total number (N) of 110 valid observations for this construct with 0,67085 standard deviation. This shows that responses are spread-out for this construct. The minimum, maximum and mean for this construct are 3,00; 5,00 and 4,16 respectively. The minimum value is within limits considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered “agree” for normative pressures construct questions; which measures the influence of pressure that primarily stems from externally set norms arising from professionalisation and standardisation of job titles and roles in the industry and centralisation of IT (Nicholson & Sahay, 2009; Jeyaraj & Sabherwal, 2008; Currie, 2009; Pearson & Keller, 2009). Thus, normative pressures are generally regarded as an influencer in the context of IT servitization adoption.

Mandate: There is a total number (N) of 110 valid observations for this construct with 0,65076 standard deviation. This shows that responses are spread-out for this construct. The minimum, maximum and mean for this construct are 2,75; 5,00 and 4,02 respectively.

The minimum value is within limits considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered “agree” for mandate construct questions; which measures the influence of output responsibilities of the organisation or subsidiary (Cantwell & Mudambi, 2005). Thus, mandate is generally regarded as an influencer in the context of IT servitization adoption.

Industry: There is a total number (N) of 110 valid observations for this construct with 0,78513 standard deviation. This shows that responses are spread-out for this construct. The minimum, maximum and mean for this construct are 2,00; 5,00 and 3,79 respectively. The minimum value is within limits considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered “agree” for industry construct questions; which measures the influence resulting from the sector of business within which the organisation operates (Yao, Lee & Lee, 2010). Thus, industry is generally regarded as an influencer in the context of IT servitization adoption.

IT servitization: There is a total number (N) of 110 valid observations for this construct with 0,49317 standard deviation. This shows that there is less spread of responses to this construct. The minimum, maximum and mean for this construct are 3,00; 4,67 and 3,80 respectively. The minimum value is within limits considering the mean. The maximum is also within limits and there were no extreme values.

The mean indicates that the majority of participants answered “agree” for IT servitization construct questions; which measures the exposure of IT professionals to the phenomenon where organisations evolve to making IT a service and emphasising customer-oriented service in the delivery of IT solutions to business (Ilk, 2012; Sultan, 2014 & Conger, 2010). Thus, that the majority of IT professionals in the sample have been exposed to IT servitization practise either in the present or in the past.

This concludes the central tendency and dispersion statistics discussion of constructs. Next, the internal consistency of the constructs is analysed.

5.5. Reliability analysis - Constructs

The internal consistency of the constructs is discussed next. Cronbach's alpha is the common method preferred for testing internal consistency in the behavioural sciences (Drost, 2011). This technique tests reliability and requires only a single test administration to provide a unique estimate of the reliability with coefficient that normally ranges between 0 and 1. According to Gliem and Gliem (2003) when the Cronbach's alpha coefficient is closer to 1, the greater the internal consistency of the items in the scale but if alpha coefficient is equals to or smaller than 0.6 then internal consistency is not satisfactory (Malhotra, 2004).

The current study adopts DeVellis (1991) criteria for assessing Cronbach's alpha results $\alpha > 0.8$ reliability is interpreted as good, α between 0.8 and 0.6 reliability is interpreted as acceptable, $\alpha < 0.6$ reliability is interpreted as unacceptable.

5.5.1. Reliability of Sensory readiness

This construct has four items. Item Q2_1 has excess of outliers and extreme values and indicated possible contamination therefore removed as discussed in data normality section 5.3.1. On average, Cronbach's alpha for this construct is 0,763. The individual item values are between 0,622 and 0,779 and are therefore adequate to be analysed further because they are above 0,6. While item Q2_1 has Cronbach's alpha of 0,779, higher than the overall one, removing it will only result in an insignificant adjustment of this construct's Cronbach's alpha.

Table 5.6.1: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,763	4

Thus, there was no need to increase the overall Cronbach's alpha through deletion of any item. The overall Cronbach's alpha reliability statistics are also indicated in table 5.6.1. In addition, the scale mean, variance and total correlation for the four items and

Cronbach's alpha, resulting from deletion of any item are shown below in table 5.6.2 below.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Sensory readiness	Q2_2	9,79	8,552	0,412	0,779
	Q2_3	10,62	5,559	0,701	0,622
	Q2_4	10,65	6,357	0,674	0,648
	Q2_5	10,96	6,017	0,517	0,745

Table 5.6.2: Item-Total Statistics

5.5.2. Reliability of Relationship readiness

This construct consists of three items. Item Q3_4 has excess of outliers and extreme values and indicated possible contamination therefore removed as discussed in data normality section 5.3.2. On average, Cronbach's alpha for this construct is 0,936. The individual item values are between 0,895 and 0,925 and are therefore adequate to be analysed further because they are above 0,6. No item had a Cronbach's alpha that is higher than the overall one for this construct.

Table 5.6.3: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,936	3

Thus, there was no need to increase the overall Cronbach's alpha through deletion of any item. The overall Cronbach's alpha reliability statistics are also indicated in table 5.6.3. In addition, the scale mean, variance and total correlation for the three items and Cronbach's alpha, resulting from deletion of any item are shown below in table 5.6.4.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Relationship readiness	Q3_1	6,51	5,151	0,847	0,925
	Q3_2	6,48	5,169	0,874	0,904
	Q3_3	6,66	5,124	0,885	0,895

Table 5.6.4: Item-Total Statistics

5.5.3. Reliability of Synchronism readiness

This construct has three items. Item Q4_3 has excess of outliers and extreme values and indicated possible contamination therefore removed as discussed in data normality section 5.3.3. On average, Cronbach's alpha for this construct is 0,205 and unacceptable to be analysed further. The individual item values are between 0,045 and 0,235 and also unacceptable to be analysed further because the values are less than the threshold.

Table 5.6.5: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,205	3

Thus, there was no need to increase the overall Cronbach's alpha through deletion of any item. The overall Cronbach's alpha reliability statistics are also indicated in table 5.6.5. In addition, the scale mean, variance and total correlation for the three items and Cronbach's alpha, resulting from deletion of any item are shown below in table 5.6.6.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Synchronism readiness	Q4_1	6,02	2,899	0,172	0,045
	Q4_2	6,87	2,497	0,093	0,184
	Q4_4	7,02	2,275	0,079	0,235

Table 5.6.6: Item-Total Statistics

5.5.4. Reliability of Identification & control readiness

This construct has four items. These items Cronbach's alpha is between 0,555 and 0,642. On average, Cronbach's alpha for this construct is 0,668 and are therefore adequate to be analysed further because it is above 0,6.While items Q5_1 and Q5_2 value is below 0,6; Su and Yang (2010) suggest that the items with a Cronbach's alpha higher than 0,5 should be considered for analysis. Therefore, because Q5_1 and Q5_2 have values of 0,555 and 0,588 respectively, they were analysed further. No item had a Cronbach's alpha that is higher than the overall one for this construct.

Table 5.6.7: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,668	4

Thus, there was no need to increase the overall Cronbach's alpha through deletion of any item. The overall Cronbach's alpha reliability statistics are also indicated in table 5.6.7. In addition, the scale mean, variance and total correlation for the four items and Cronbach's alpha, resulting from deletion of any item are shown below in table 5.6.8.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Identification & control readiness	Q5_1	11,37	4,089	0,470	0,588
	Q5_2	11,47	3,885	0,515	0,555
	Q5_3	11,05	4,951	0,444	0,614
	Q5_4	11,43	4,467	0,390	0,642

Table 5.6.8: Item-Total Statistics

5.5.5. Reliability of Top management support

The number of items for this construct is five. On average, Cronbach's alpha for this construct is 0,893. The individual item values are between 0,855 and 0,882 and are therefore adequate to be analysed further because they are above 0,6. No item had a Cronbach’s alpha that is higher than the overall one for this construct.

Table 5.6.9: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,893	5

Thus, there was no need to increase the overall Cronbach’s alpha through deletion of any item. The overall Cronbach’s alpha reliability statistics are also indicated in table 5.6.9. In addition, the scale mean, variance and total correlation for the five items and Cronbach’s alpha resulting from deletion of any item are shown below in table 5.6.10.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Top management support	Q6_1	17,20	5,739	0,721	0,873
	Q6_2	17,23	5,553	0,804	0,855
	Q6_3	17,19	5,440	0,769	0,862
	Q6_4	17,25	5,494	0,718	0,874
	Q6_5	17,27	5,668	0,682	0,882

Table 5.6.10: Item-Total Statistics

5.5.6. Reliability of Firm size

This construct consists of three items. On average, Cronbach’s alpha for this construct is 0,811. The individual item values are between 0,648 and 0,831and are therefore adequate to be analysed further because they are above 0,6. While item Q7_3 has Cronbach’s alpha of 0,831, which higher than the overall one, removing it will only result in an insignificant adjustment of this construct’s Cronbach’s alpha.

Table 5.6.11: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,811	3

Thus, there was no need to increase the overall Cronbach’s alpha through deletion of any item. The overall Cronbach’s alpha reliability statistics are also indicated in table 5.6.11. In addition, the scale mean, variance and total correlation for the four items and Cronbach’s alpha, resulting from deletion of any item are shown below in table 5.6.12.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Firm size	Q7_1	7,76	2,347	0,723	0,695
	Q7_2	7,44	2,780	0,746	0,648
	Q7_3	7,05	4,034	0,589	0,831

Table 5.6.12: Item-Total Statistics

5.5.7. Reliability of Coercive pressures

This construct consists of three items. Item Q8_4 has excess of outliers and extreme values and indicated possible contamination therefore removed as discussed in data normality section 5.3.7. These items Cronbach’s alpha is between 0,599 and 0,783. On average, Cronbach’s alpha for this construct is 0,759 and therefore adequate to be analysed further because it is above 0,6. Therefore, all three items will be further analysed. While item Q8_3 has Cronbach’s alpha of 0,783, and it is above the overall one, removing it will only result in an insignificant adjustment of this construct’s Cronbach’s alpha.

Table 5.6.13: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,759	3

Thus, deletion of items to improve the overall Cronbach's alpha was unnecessary. The overall Cronbach's alpha reliability statistics are also indicated in table 5.6.13. In addition, the scale mean, variance and total correlation for the three items and Cronbach's alpha, resulting from deletion of any item are shown below in table 5.6.14.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Coercive pressures	Q8_1	7,79	2,204	0,596	0,686
	Q8_2	7,81	2,138	0,702	0,599
	Q8_3	8,29	1,438	0,572	0,783

Table 5.6.14: Item-Total Statistics

5.5.8. Reliability of Mimetic pressures

This construct has of four items. These items Cronbach's alpha ranges from 0,734 to 0,760. On average, Cronbach's alpha for this construct is 0,795 and are therefore adequate to be analysed further because it is above 0,6. No item had a Cronbach's alpha that is higher than the overall one for this construct.

Table 5.6.15: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,795	4

Thus, there was no need to increase the overall Cronbach's alpha through deletion of any item. The overall Cronbach's alpha reliability statistics are also indicated in table 5.6.15. In addition, the scale mean, variance and total correlation for the four items and Cronbach's alpha, resulting from deletion of any item are shown below in table 5.6.16.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Mimetic pressures	Q9_1	12,35	2,962	0,575	0,760
	Q9_2	12,27	2,916	0,615	0,739
	Q9_3	12,33	3,048	0,629	0,734
	Q9_4	12,34	2,959	0,605	0,744

Table 5.6.16: Item-Total Statistics

5.5.9. Reliability of Normative pressures

This construct consists of three items. These items Cronbach's alpha ranges from 0,564 to 0,740. On average, Cronbach's alpha for this construct is 0,736 and are therefore adequate to be analysed further because it is above 0,6. While item Q10_2 has a value below 0,6; Su and Yang (2010) suggest that the items with a Cronbach's alpha higher than 0,5 should be considered for analysis. Therefore, was analysed further. In addition, item Q10_3, has Cronbach's alpha of 0,740, and higher above the overall one, removing it could only result in an insignificant adjustment of this construct's Cronbach's alpha.

Table 5.6.17: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,736	4

Thus, there was no need to increase the overall Cronbach's alpha through deletion of any item. The overall Cronbach's alpha reliability statistics are also indicated in table 5.6.17. In addition, the scale mean, variance and total correlation for the four items and Cronbach's alpha, resulting from deletion of any item are shown below in table 5.6.18.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Normative pressures	Q10_1	12,96	2,843	0,557	0,681
	Q10_2	12,76	3,173	0,715	0,564
	Q10_3	12,34	4,574	0,414	0,740
	Q10_4	12,85	3,758	0,500	0,692

Table 5.6.18: Item-Total Statistics

5.5.10. Reliability of Mandate

This construct has four items. On average, Cronbach's alpha for this construct is 0,857. The individual item values are between 0,779 and 0,871 and are therefore adequate to be analysed further because they are above 0,6. While item Q11_4, alpha is 0,871, and higher above the overall one, removing it will only result in an insignificant adjustment of this construct's Cronbach's alpha.

Table 5.6.19: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,857	4

Thus, there was no need to increase the overall Cronbach's alpha through deletion of any item. The overall Cronbach's alpha reliability statistics are also indicated in table 5.6.19. In addition, the scale mean, variance and total correlation for the four items and Cronbach's alpha, resulting from deletion of any item are shown below in table 5.6.20.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Mandate	Q11_1	11,95	3,942	0,800	0,779
	Q11_2	11,95	3,934	0,791	0,782
	Q11_3	12,04	4,311	0,648	0,839
	Q11_4	12,25	3,788	0,605	0,871

Table 5.6.20: Item-Total Statistics

5.5.11. Reliability of Industry

This construct consists of four items. These items Cronbach's alpha ranges from 0,476 to 0,615. On average, Cronbach's alpha for this construct is 0,640 and are therefore adequate to be analysed further because it is above 0,6. Item Q12_4 has an unacceptable Cronbach's alpha of 0,476 and will not be further analysed. While items Q12_2 value is below 0,6; Su and Yang (2010) suggest that the items with a Cronbach's alpha higher than 0,5 should be considered for analysis. Therefore, was analysed further. No item had a Cronbach's alpha that is higher than the overall one for this construct.

Table 5.6.21: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,640	4

Thus, there was no need to increase the overall Cronbach's alpha through deletion of any item. The overall Cronbach's alpha reliability statistics are also indicated in in table 5.6.21. In addition, the scale mean, variance, total correlation for the four items and Cronbach's alpha, resulting from deletion of any item are shown below in table 5.6.22.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Industry	Q12_1	11,36	3,151	0,429	0,600
	Q12_2	11,41	1,749	0,494	0,543
	Q12_3	11,35	3,219	0,398	0,615
	Q12_4	11,26	1,921	0,538	0,476

Table 5.6.22: Item-Total Statistics

5.5.12. Reliability of IT Servitization

This construct consists of three items. Item Q13_4 has excess of outliers and extreme values and indicated possible contamination therefore removed as discussed in data normality section 5.3.12. On average, Cronbach's alpha for this construct is 0,908. The individual item values are between 0,791 and 0,905 and are therefore adequate to be analysed further because they are above 0,6. No item had a Cronbach's alpha that is higher than the overall one for this construct.

Table 5.6.23: Overall Reliability Statistics

Cronbach's Alpha	N of Items
0,908	3

Thus, there was no need to increase the overall Cronbach's alpha through deletion of any item. The overall Cronbach's alpha reliability statistics are also indicated in table 5.6.23. In addition, the scale mean, variance and total correlation for the three items and Cronbach's alpha, resulting from deletion of any item are shown below in table 5.6.24.

Construct	Item code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
IT servitization	Q13_1	7,58	0,924	0,938	0,791
	Q13_2	6,70	1,239	0,730	0,905
	Q13_3	8,54	0,875	0,870	0,859

Table 5.6.24: Item-Total Statistics

The Cronbach’s alpha for synchronism readiness construct was the only one that was unacceptable to be analysed further because the values were less than the threshold. Given the rest of the constructs’ Cronbach’s alphas, there is limited significance for this result. The next section discusses the suitability and validity of data collected for factor analysis.

5.6. Validity analysis - Exploratory factor analysis

In the current study, to test data validity, exploratory factor analysis (EFA) has been chosen. As discussed in chapter 4, the selected statistical technique was used for the present for its strength in determining the correct number of common factors required to explain relationships between variables being observed without imposing a pre-conceived structure on the results (Jomnonkwao & Ratanavaraha, 2016).

EFA performs validity tests of methods employed for analysis of the collected data in order to achieve the objectives of the study, i.e., to explain the determinants which influence South African SOEs to adopt IT servitization; to analyse whether the determinants affect each other and to subsequently determine the significance of the effect, thereof; and to determine the extent of each influencer and its significance on the adoption of IT servitization.

5.6.1. Data suitability for factor analysis

As discussed in the previous chapter, the five-step EFA protocol is used for the current study for factor analysis. The next two sections examine the collected data to check the first step: *Is the data suitable for factor analysis?* Kaiser-Meyer-Olkin test, Bartlet’s test of sphericity and communalities were used and are discussed below.

Kaiser-Meyer-Olkin (KMO) and Bartlett's test for sphericity

To determine the suitability of the collected data for factor analysis, KMO and Bartlet's test were used. KMO test measures how the collected data is suited for analysis of factors through checks for shared variance in the items (Beavers, Lounsbury, Richards & Huck, 2013; Glen, 2016).

Guidelines for interpreting the KMO test were discussed in Chapter 4, measurement model section 4.7.5.1. Bartlett's test (also discussed in Chapter 4) checks for redundancy between variables that could be grouped together with some factors (Beavers et al., 2013). For factor analysis to be suitable, the Bartlett's test of sphericity should be significant at $p < 0.05$ (Hair et al., 1998).

The current study achieved KMO and Bartlett's Test of Sphericity value of 0.774 and $p \leq 0.000$ respectively. Therefore, the sample is considered adequate for factor analysis with KMO value middling (0.70 to 0.79) and p-value considered significant. Overall, the construct correlation structure is adequately significant to allow for factor analysis.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0,774
Bartlett's Test of Sphericity	Approx. Chi-Square	2842,301
	df	820
	Sig.	0,000

Table 5.6.1 KMO and Bartlett's Test

Communalities

The degree to which correlation between a specific individual item associates with other items is shown through communalities (Gerber& Finn, 1999). When items have values closer to 1, that indicates high correlation with their related items. However, when the communalities are low i.e. below 0.3, Hosany, Ekinci and Uysal (2006) recommend that items should be eliminated. Principal Component Analysis (PCA) extraction method (discussed in the next section) was used. Communalities for 41 out of 48 items had values close to 1 and therefore observed to be reasonable as per below Table 5.6.2. Items Q2_1, Q3_4, Q8_4, Q10_1, Q10_3, Q12_1, Q12_3, Q13_4 have low communalities and were disregarded.

Communalities

Item	Initial	Extraction	Item	Initial	Extraction
Q2_2	1,000	0,688	Q7_2	1,000	0,795
Q2_3	1,000	0,712	Q7_3	1,000	0,671
Q2_4	1,000	0,728	Q8_1	1,000	0,669
Q2_5	1,000	0,634	Q8_2	1,000	0,668
Q3_1	1,000	0,846	Q8_3	1,000	0,623
Q3_2	1,000	0,880	Q9_1	1,000	0,695
Q3_3	1,000	0,866	Q9_2	1,000	0,791
Q4_1	1,000	0,724	Q9_3	1,000	0,712
Q4_2	1,000	0,550	Q9_4	1,000	0,697
Q4_3	1,000	0,675	Q10_2	1,000	0,648
Q4_4	1,000	0,684	Q10_4	1,000	0,680
Q5_1	1,000	0,766	Q11_1	1,000	0,838
Q5_2	1,000	0,563	Q11_2	1,000	0,812
Q5_3	1,000	0,634	Q11_3	1,000	0,655
Q5_4	1,000	0,626	Q11_4	1,000	0,631
Q6_1	1,000	0,850	Q12_2	1,000	0,739
Q6_2	1,000	0,895	Q12_4	1,000	0,689
Q6_3	1,000	0,729	Q13_1	1,000	0,847
Q6_4	1,000	0,771	Q13_2	1,000	0,611
Q6_5	1,000	0,725	Q13_3	1,000	0,784
Q7_1	1,000	0,809			

Extraction Method: Principal Component Analysis.

Table 5.6.2 Extraction of communalities

5.6.2. Extraction of factors

This section discusses the method used for factor extraction which is the second step of the five-step EFA protocol: *How will factors be extracted?* Principal Components Analysis is used in the current study to extract factors as shown below.

Principal Components Analysis (PCA)

There are eleven (11) factors which are strong having an Eigenvalue above 1. See Table 5.6.3 and Appendix C for the original table. According to the Eigenvalue>1 rule these 11 factors qualify for extraction.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10,471	25,538	25,538	10,471	25,538	25,538	4,170	10,170	10,170
2	3,945	9,623	35,161	3,945	9,623	35,161	3,862	9,419	19,590
3	2,901	7,075	42,236	2,901	7,075	42,236	3,827	9,335	28,925
4	2,222	5,419	47,654	2,222	5,419	47,654	3,289	8,022	36,947
5	2,088	5,093	52,748	2,088	5,093	52,748	2,925	7,135	44,081
6	1,654	4,035	56,782	1,654	4,035	56,782	2,757	6,724	50,806
7	1,538	3,750	60,532	1,538	3,750	60,532	2,531	6,174	56,979
8	1,393	3,399	63,931	1,393	3,399	63,931	1,879	4,582	61,561
9	1,249	3,046	66,977	1,249	3,046	66,977	1,582	3,860	65,421
10	1,126	2,746	69,723	1,126	2,746	69,723	1,422	3,469	68,890
11	1,028	2,508	72,231	1,028	2,508	72,231	1,370	3,342	72,231

Extraction Method: Principal Component Analysis.

Table 5.6.3 Extraction of Factors

In addition, the current study applied the cumulative percentage explaining the factors 60% or greater to determine the number of factors to be retained. According to Hair et al. (2006), items over 60% are good as they are an indication of validity. Eleven factors that explained 72,231% of the variance in the individual items were extracted. All eleven factors have Eigenvalues greater than 1.

5.6.3. Factor extraction criteria

This section discusses the factor extraction criteria, the third step of the five-step EFA protocol: *What criteria will assist in determining factor extraction?* Three measures are used in the current study for extraction of valid determinants influencing IT servitization adoption, in the context of South African State-Owned Enterprises. These are: scree test

Kaiser's Eigenvalue and method of rotation. Williams, Onsman and Brown (2010) suggest these criteria since it is commonly used for extraction of factors.

Scree plot

The visual inspection of the scree plot was applied to find the number of factors that are ideal to be analysed. Kaiser Guttman rule (Kaiser's criteria) suggests that all factors that are above the eigenvalue of 1 should be retained. The graph was inspected with an aim to determine a natural bend where the curve flattens out to establish the qualifying factors that are kept for further analysis. The Scree plot shows eleven (11) components above the Eigenvalue of 1. Additionally, there is substantial decline in the Scree plot after 11 components as demonstrated below.

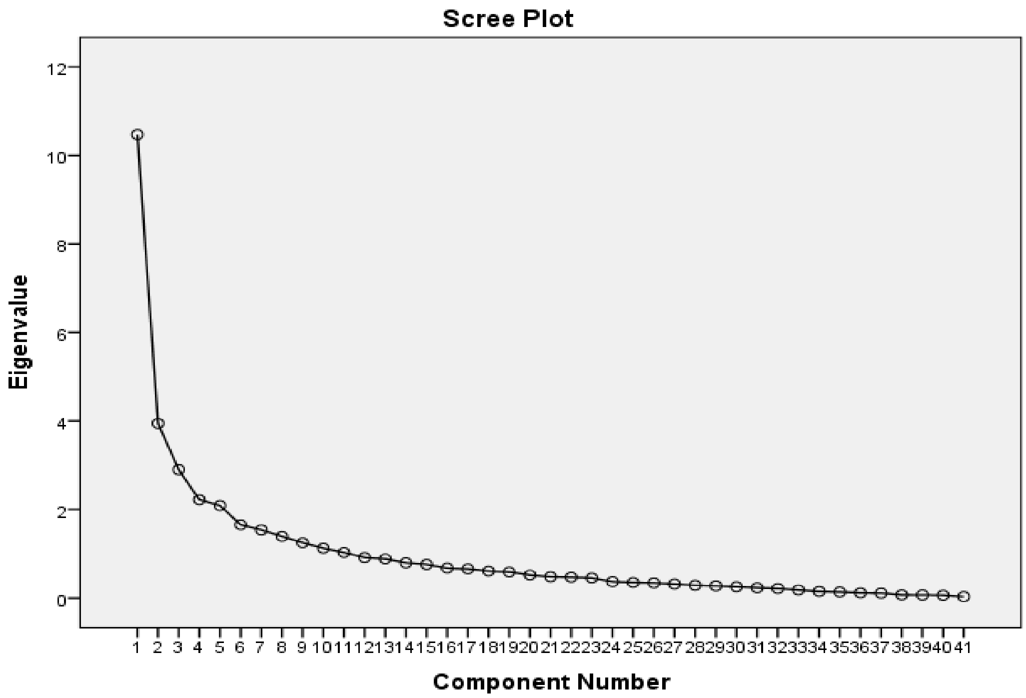

Figure 5.6.3 Scree plot for factor retention

5.6.4. Rotational method

This section discusses the fourth step of the five-step EFA protocol: *Selection of rotational method*. The current study used orthogonal(varimax) rotational method with Kaiser normalization through SPSS Version 25. The convergence of the rotated component matrix took place after 16 iterations and individual items fitted well except Q2_1, Q3_4, Q8_4, Q10_1, Q10_3, Q12_1, Q12_3, Q13_4. Also, items loaded to their groups as per the below Table 5.6.4.

The extraction method aimed to determine and retain factors that have more items loading with higher values and exclude those that do not meet the set minimum criteria. Tabachnick and Fidell (2007) suggest that the factors that have a minimum loading of 0.3 to be retained and factors loading lower than 0.3 to be excluded. All items loaded above the minimum threshold and were retained (See table 5.6.4).

Rotated Component Matrix[a]

	Component										
Item	1	2	3	4	5	6	7	8	9	10	11
Q2_2					0,611						
Q2_3					0,704						
Q2_4					0,717						
Q2_5					0,625						
Q3_1				0,879							
Q3_2				0,927							
Q3_3				0,912							
Q4_1									0,751		
Q4_2									0,656		
Q4_3								0,758			
Q4_4								-0,782			
Q5_1					0,556						
Q5_2					0,464						
Q5_3					0,444						
Q5_4					0,457						
Q6_1	0,879										
Q6_2	0,910										
Q6_3	0,770										
Q6_4	0,706										
Q6_5	0,736										
Q7_1						0,778					
Q7_2						0,829					
Q7_3						0,692					
Q8_1		0,475									
Q8_2		0,442									
Q8_3		0,482									
Q9_1							0,709				
Q9_2							0,803				
Q9_3							0,584				
Q9_4							0,508				

Q10_2											0,376
Q10_4											0,502
Q11_1			0,886								
Q11_2			0,868								
Q11_3			0,733								
Q11_4			0,685								
Q12_2										0,643	
Q12_4										0,640	
Q13_1		0,678									
Q13_2		0,573									
Q13_3		0,682									

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 16 iterations.

Table 5.6.4 Rotated Component Matrix

5.6.5. Labelling

This section discusses the final step of the five-step EFA protocol: *Interpretation and labelling* which involves examining the variables that are related to a factor then labelling them (see Table 5.6.5). This last step seeks to reveal factors that together give an explanation to responses provided by the majority which is the main purpose of factor analysis (Williams, Onsman & Brown, 2010). The item codes correspond with the question sequence on the questionnaire (see Appendix D).

Construct	**Item code**	**Measurement items**	**Factor Loading**
Sensory readiness	Q2_2	I like to see the products before purchasing them.	0,611
	Q2_3	I like to touch the products before purchasing them.	0,704
	Q2_4	I like to hear the products before purchasing them.	0,717
	Q2_5	I like to smell the product before purchasing them.	0,625
Relationship readiness	Q3_1	It is important for me to have a relationship with the seller when purchasing a product or service.	0,879
	Q3_2	I consider my relationship with the seller when purchasing a product or service.	0,927
	Q3_3	I would like to have a relationship with the seller when purchasing a product or service	0,912
Synchronism readiness	Q4_1	On the day that I place an order for a product or service, I like to take care of all purchasing-related activities.	0,751
	Q4_2	I like to take care of all purchasing-related activities a week or more later after placing an order for a product or service.	0,656

	Q4_3	After I purchase a product or service, I would like to get it on that day or the next.	0,758
	Q4_4	Waiting for a week or more to receive a product or service after purchase is acceptable.	-0,782
Identification & control readiness	Q5_1	Identification of people in a virtual process is important to me.	0,556
	Q5_2	Being able to track and monitor others' behaviour and activities conducted in a virtual process is important to me.	0,464
	Q5_3	I believe it is possible that people can hide their identities in processes that are virtual.	0,444
	Q5_4	I believe that virtual process participants can be properly identified.	0,457
Top management support	Q6_1	Top management sponsorship is a significant factor in successful adoption of IT servitization.	0,879
	Q6_2	Top management support is a significant factor in successful adoption of IT servitization.	0,910
	Q6_3	The implementation of initiatives to servitize IT require support from top management.	0,770
	Q6_4	The acceptance of initiatives to servitize IT require support from top management.	0,706
	Q6_5	Top management support can help overcome possible resistance in the adoption of IT Servitization.	0,736
Firm size	Q7_1	The number of employees in an organisation should influence the decision to adopt IT servitization.	0,778
	Q7_2	The number of employees who receive IT service should influence the decision to adopt IT servitization.	0,829
	Q7_3	The frequency of IT service requests should influence the decision to adopt IT servitization.	0,692
Coercive pressures	Q8_1	Laws and regulations that have to be adhered to by an organisation should influence their IT service model.	0,475
	Q8_2	Laws and regulations that have to be adhered to by an organisation should influence their IT service delivery.	0,442
	Q8_3	Pressures from the government directives should influence the organisation's decision to servitize IT.	0,482
Mimetic pressures	Q9_1	Experienced vendors and consultants should provide advice on IT Servitization adoption.	0,709
	Q9_2	The need to remain competitive and/or to stay ahead of industry peers should influence decision to servitize IT.	0,803
	Q9_3	Industry leaders are always followed with regards to new IT trends or emerging technologies.	0,584
	Q9_4	Environmental uncertainties and rapid change in the technology market forces IT servitization.	0,508
Normative pressures	Q10_2	IT professionals should have formal IT qualifications and/or IT certifications.	0,376
	Q10_4	Professionalisation of the IT industry should regulate IT servitization	0,502
Mandate	Q11_1	In my view, the organisation's mandate requires creation and collection of high amounts of data.	0,886
	Q11_2	In my view, the organisation's mandate requires maintenance and storage of high amount of data.	0,868
	Q11_3	In my view, the organisation's mandate requires publication of relevant and on- demand information.	0,733
	Q11_4	In my view, authority to sanction and the related sanctioning activities of the organisation should influence the adoption of IT servitization.	0,685
Industry	Q12_2	I like to see the products before purchasing them.	0,643
	Q12_4	I like to touch the products before purchasing them.	0,640
	Q13_1	I currently practise IT servitization on a regular basis.	0,678

IT Servitization	Q13_2	I practised IT servitization regularly in the past.	0,573
	Q13_3	I currently practise IT servitization sometimes.	0,682

Table 5.6.5 Factor Loading, Interpretation and labelling

Next, CFA statistical technique is applied.

5.7. Confirmatory factor analysis (CFA)

Al-Qeisi (2009) recommends that post the empirical testing of the EFA method then CFA method be applied to create a hybrid method with best of both, meaning start with EFA to explore then proceed with CFA for confirmation. In the current study, CFA is used to was used to reduce the measurement error and determine the model fit. The measurement model was drawn on AMOS version 25 software.

Barrett (2007) recommends that when a measurement model is designed, there should be a distinction between dependent and independent variables. There is a further suggestion to differentiate between the latent and observable variables. Latent variables are the decision variables which are not directly observed but inferred and can only be measured by their individual indicators. On the other hand, observable variables can be directly observed and measured (Dodge, 2003). Figure 5.7.1 symbolise latent variables with circular or oval shapes while the observable variables are symbolised with rectangular or square shapes. An error term is attached to its respective observable variable.

Figure 5.7.1 shows latent variables that are associated with each other with double-headed arrows that represent the covariance between those latent variables (Dion, 2008). On the other hand, the observed variables for each latent variable connect to each other by single-headed arrows. The connection represents the causal path from the latent variable to its indicator (Byrne, Stewart, Kennard & Lee, 2007).

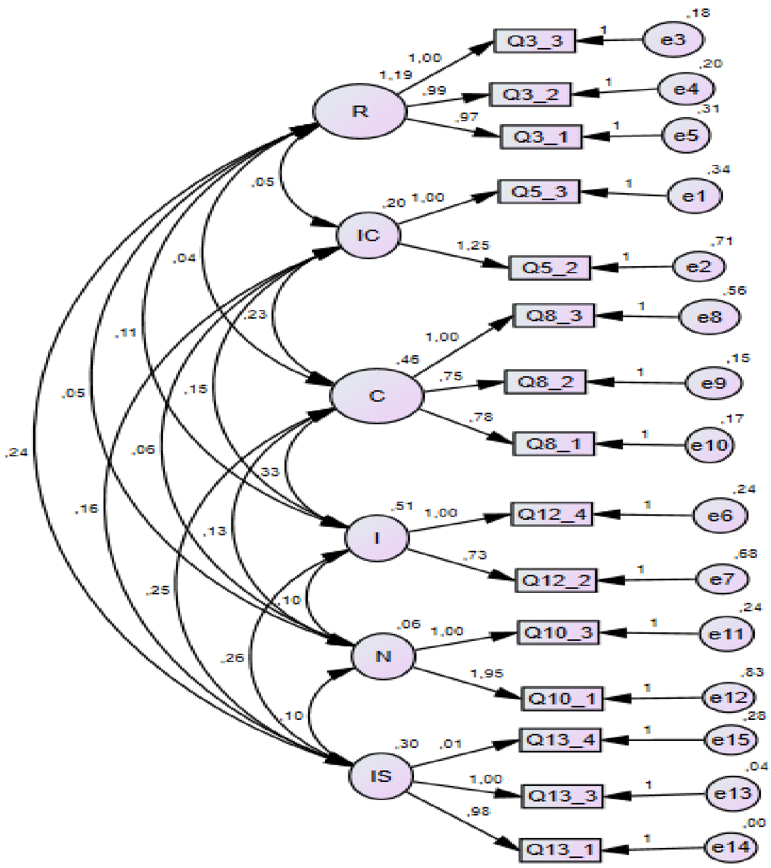

Figure 5.7.1 Measurement Model of determinants that influence the adoption of IT servitization.

Model Fit Indices

Chi-square, Comparative Fit Index (CFI), root mean square error of approximation, Tucker-Lewis Index (TLI) and the Goodness of Fit (GFI), parsimonious fit and Bentler-Bonett Normed Fit Index (NFI) were used for the determination of the goodness of fit for the measure model presented above. Thresholds were discussed in section 4.7 of chapter 4. The results are presented below.

The chi-square (χ 2) fit statistic tests a precise fit of the proposed model for the population (Nevitt & Hancock, 2000). The chi-square value should be read together with its degrees of freedom(df). The value is obtained by the calculation of a ratio using chi-square divided by degrees of freedom. If a chi-square value is below three then it is regarded to be an acceptable model fit (Chinomona, 2011). The χ 2 /df (87,587/75) which equated to 1,168 was obtained with a probability level of 0,152.

Minimum was achieved Chi-square = 87,587 Degrees of freedom = 75 Probability level = 0,152

CMIN

CMIN is a chi-square method used for comparison of the default model and the independence one to the (just identified) saturated model. NPAR represents the number of parameters in the model. For the saturated model there are 120 parameters. The default model has 45 parameters meaning 75 parameters were discarded. For the independence model there are 15 parameters representing the 6 components variances. CMIN/DF, the relative chi-square, is a guide of how much the fit of data to model is lessened by discarding paths. The recommendation is to keep enough paths so that the index is less than 3. The CMIN/DF value of 1.168 was considered as an acceptable fit for the model. The value is consistent and within the recommended range for a good model fit of chi-square value.

Model	NPAR	CMIN	DF	P	CMIN/ DF
Default model	45	87,587	75	0,152	1,168
Saturated model	120	0	0		
Independence model	15	928,236	105	0	8,84

Table 5.7.1 CMIN

RMR, GFI

The root mean square residual (RMR), is an index of the quantity by which the estimated model variances and covariances are different from the observed ones. The RMR value of 0.042 was considered a fit that is adequate for the model. Tabachnick and Fidell (2007) state that the goodness-of-fit (GFI) is used to calculate the variance accounted for by the estimated population covariance. The value of the index is 0.911 and above the recommended threshold of ≥ 0.90 and was considered as an acceptable fit for the model. The adjusted GFI, AGFI is an alternate GFI index where the value of the index is adjusted according to the number of parameters in the model. The fewer number of parameters in the model relative to the number of data points, then the AGFI would be closer to the GFI, the values on table 5.7.2 show that the values are close i.e. 0.911 and 0.858 (0.053 difference). PGFI is adjusted to support the model or alternatively not support the model where less paths are discarded.

Model	RMR	GFI	AGFI	PGFI
Default model	0,042	0,911	0,858	0,57
Saturated model	0	1		
Independence model	0,244	0,407	0,322	0,356

Table 5.7.2 RMR, GFI

Baseline Comparisons

In Table 5.7.3 below, the NFI indicator value of 0.906 falls within the recommended threshold, that is ≥ 0.90. TLI is above GFI and satisfactory in conjunction with RFI. IFI indicates the ratio that shows the variance between the independence model chi-square in which variables are uncorrelated and target model chi-square. The default model chi-square calculation is worked out through the division of the difference between the chi-square of the default model and its degrees of freedom (Dion, 2008). TLI indicator value of 0,979 also falls within the recommended threshold, which is ≥0.90. This therefore means that this result signifies acceptable model fit.

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	0,906	0,868	0,985	0,979	0,985
Saturated model	1		1		1
Independence model	0	0	0	0	0

Table 5.7.3 Baseline Comparisons

RMSEA

Root Mean Square Error of Approximation (RMSEA) is normally used as an alternative for the chi-square test. It considers population error of approximation. Chinomona (2011) suggests that a good model fit for RMSEA should be less than or equal to 0.05 and an adequate fit if RMSEA is less than or equal to 0.08. LO 90 indicates 90% confidence interval lower limit for the estimate and HI 90 upper limits. PCLOSE is the p-value that is used to test if RMSEA null hypothesis is less than 0.05. Table 5.7.4 shows that the model has an RMSEA less than 0.05 (0.039) and a good fit.

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	0,039	0	0,07	0
Independence model	0,268	0,252	0,284	0

Table 5.7.4 RMSEA

Summary of the model evaluation for overall fit measurement

Given that all six goodness-of-fit indices in table 5.7.5 are meeting the required threshold, the conclusion is that the data perfectly fits the model.

Index	**Recommendations**	**Output**	**Acceptable /Not acceptable**
TLI	≥0.95	0.979	Acceptable
CFI	≥0.95	0.985	Acceptable
GFI	≥0.90	0.911	Acceptable
PCFI	<=1	1	Acceptable
RMSEA	< 0.08	0.039	Acceptable
NFI	≥0.90	0.906	Acceptable

Table 5.7.5 Summary of the model evaluation for overall fit measurement

Correlations

Table 5.7.6 indicates simple correlations between predictor variables ranging from 0,051 to 0,763. Table 5.7.7 indicates that all items except IC and R, R and I, R and C, R and N are significant at 5% ($p < 0.05$). There is a strong correlation between IC and I, IC and N, I and N, C and N, N and IS. Similarly, IC and C, IC and IS, R and IS, I and C, I and IS and C and IS have a strong ($p < 0.00$) bidirectional correlation.

Where:

R: Relationship readiness

IC: Identification & control readiness

C: Coercive pressures

I: Industry

N: Normative pressures

IS: IT servitization adoption

e1- 14: Error terms

			Estimate
IC	<-->	R	0,093
IC	<-->	I	0,481
IC	<-->	C	0,763
IC	<-->	N	0,534
IC	<-->	IS	0,636
R	<-->	I	0,143
R	<-->	C	0,051
R	<-->	N	0,179
R	<-->	IS	0,404
I	<-->	C	0,675
I	<-->	N	0,572
I	<-->	IS	0,663
C	<-->	N	0,747
C	<-->	IS	0,66
N	<-->	IS	0,71

(Source: AMOS 25)

Table 5.7.6 Correlations (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P
IC	<-->	R	0,045	0,068	0,667	0,505
IC	<-->	I	0,153	0,056	2,741	0,006
IC	<-->	C	0,231	0,062	3,741	***
IC	<-->	N	0,059	0,029	2,068	0,039
IC	<-->	IS	0,156	0,041	3,816	***
R	<-->	I	0,111	0,092	1,209	0,227
R	<-->	C	0,038	0,082	0,46	0,645
R	<-->	N	0,049	0,046	1,05	0,294

R	<-->	IS	0,243	0,065	3,728	***	
I	<-->	C	0,328	0,078	4,198	***	
I	<-->	N	0,102	0,04	2,556	0,011	
I	<-->	IS	0,261	0,053	4,882	***	
C	<-->	N	0,127	0,042	3,025	0,002	
C	<-->	IS	0,247	0,055	4,528	***	
N	<-->	IS	0,098	0,03	3,261	0,001	

(Source: AMOS 25)

Table 5.7.7 Covariances (Group number 1 - Default model)

5.8. Pearson's Correlation Technique

Pearson correlation technique is used in the current study to test for association/link between constructs or variables. The eleven variables are examined independently for a relationship to IT servitization adoption through correlation analysis. Table 5.8.1 illustrates the results.

Table 5.8.1 further illustrates that the r-values range from 0.000 to 0.572. This range shows a reasonable variables association. In research, the range of r-value is between -1 and 1 and the closer the value to 1 and further away from zero, then a stronger linear relationship is evident between variables. The p-value of 0.05 indicates that there is only a 5% chance that results obtained occurred by chance, similarly, p-value of 0.01 indicate that there is only 1% chance. Therefore, p-values below 0.05 show that there is a correlation between the variables which is significant. Following the validity and reliability tests, the associations were examined. These results address the second objective of the study as stated in the first chapter, i.e. To determine if there is a positive or negative relationship between each determinant and the adoption of IT servitization.

		Sensory	Relationship	Synchronism	Identification Control	Top Management Support	Firm Size	Coercive	Mimetic	Normative	Mandate	Industry	IT Servitisation
Sensory	Pearson Correlation	1	.401**	,093	.393**	,000	.232*	,133	,133	.291**	,160	.271**	.418**
	Sig. (2-tailed)		,000	,336	,000	,996	,015	,167	,166	,002	,095	,004	,000
	N	110	110	110	110	110	110	110	110	110	110	110	110

Relationship	Pearson Correlation	.401**	1	.214*	,009	,046	,186	,035	,153	,066	,131	,173	.375**
	Sig. (2-tailed)	,000		,025	,922	,632	,051	,719	,111	,495	,174	,071	,000
	N	110	110	110	110	110	110	110	110	110	110	110	110
Synchronism	Pearson Correlation	,093	.214*	1	.203*	,124	,098	.193*	.189*	,113	,150	,118	.298**
	Sig. (2-tailed)	,336	,025		,033	,195	,309	,043	,048	,242	,117	,220	,002
	N	110	110	110	110	110	110	110	110	110	110	110	110
IdentificationControl	Pearson Correlation	.393**	,009	.203*	1	.305**	.237*	.501**	.458**	.303**	.320**	.310**	.482**
	Sig. (2-tailed)	,000	,922	,033		,001	,013	,000	,000	,001	,001	,001	,000
	N	110	110	110	110	110	110	110	110	110	110	110	110
TopManagement Support	Pearson Correlation	,000	,046	,124	.305**	1	.223*	.492**	.399**	.215*	,129	.212*	.317**
	Sig. (2-tailed)	,996	,632	,195	,001		,019	,000	,000	,024	,181	,026	,001
	N	110	110	110	110	110	110	110	110	110	110	110	110
Firm Size	Pearson Correlation	.232*	,186	,098	.237*	.223*	1	.513**	.362**	.416**	.376**	.499**	.513**
	Sig. (2-tailed)	,015	,051	,309	,013	,019		,000	,000	,000	,000	,000	,000
	N	110	110	110	110	110	110	110	110	110	110	110	110
Coercive	Pearson Correlation	,133	,035	.193*	.501**	.492**	.513**	1	.515**	.497**	.447**	.468**	.572**
	Sig. (2-tailed)	,167	,719	,043	,000	,000	,000		,000	,000	,000	,000	,000
	N	110	110	110	110	110	110	110	110	110	110	110	110
Mimetic	Pearson Correlation	,133	,153	.189*	.458**	.399**	.362**	.515**	1	.316**	.471**	.367**	.512**
	Sig. (2-tailed)	,166	,111	,048	,000	,000	,000	,000		,001	,000	,000	,000
	N	110	110	110	110	110	110	110	110	110	110	110	110
Normative	Pearson Correlation	.291**	,066	,113	.303**	.215*	.416**	.497**	.316**	1	.412**	.383**	.542**
	Sig. (2-tailed)	,002	,495	,242	,001	,024	,000	,000	,001		,000	,000	,000
	N	110	110	110	110	110	110	110	110	110	110	110	110
Mandate	Pearson Correlation	,160	,131	,150	.320**	,129	.376**	.447**	.471**	.412**	1	.451**	.458**
	Sig. (2-tailed)	,095	,174	,117	,001	,181	,000	,000	,000	,000		,000	,000
	N	110	110	110	110	110	110	110	110	110	110	110	110
Industry	Pearson Correlation	.271**	,173	,118	.310**	.212*	.499**	.468**	.367**	.383**	.451**	1	.517**
	Sig. (2-tailed)	,004	,071	,220	,001	,026	,000	,000	,000	,000	,000		,000
	N	110	110	110	110	110	110	110	110	110	110	110	110
IT Servitisation	Pearson Correlation	.418**	.375**	.298**	.482**	.317**	.513**	.572**	.512**	.542**	.458**	.517**	1
	Sig. (2-tailed)	,000	,000	,002	,000	,001	,000	,000	,000	,000	,000	,000	
	N	110	110	110	110	110	110	110	110	110	110	110	110

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

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

Table 5.8.1 Pearson Correlations between the variables

Table 5.8.1 shows that there is a link between sensory readiness and IT servitization adoption. The Pearson's r is 0.418. The p value is 0.000 at 0.01 level, therefore significant for this correlation. Thus, there is a linear correlation that is positive for IT servitization adoption and sensory readiness which is significant. Meaning, by allowing participants to like the process interaction experience and the other process objects, this capability then positively influences process virtualization and thus IT servitization adoption.

Table 5.8.1 shows that there is an association between relationship readiness and the adoption of IT servitization. The Pearson's r is 0.375. The p value is 0.000 at 0.01 level, therefore significant for this correlation. Thus, a linear correlation that is positive exists for IT servitization adoption and relationship readiness which is significant. Meaning, by enabling process participation virtually anytime and anywhere, the relationship readiness capability positively influences process virtualization and thus IT servitization adoption.

Table 5.8.1 shows that there is a link between synchronism readiness and the adoption of IT servitization. The Pearson's r is 0.298. The p value is 0.002 at 0.01 level, therefore significant for this correlation. Thus, a linear correlation that is positive exists for IT servitization adoption and synchronism readiness which is significant. Meaning, synchronism which enables multiple participants, regardless of physical location to participate in a process simultaneously positively influences process virtualization and thus IT servitization adoption.

Table 5.8.1 shows that there is an association between identification and control readiness and the adoption of IT servitization. The Pearson's r is 0.482. The p value is 0.000 at 0.01 level, therefore significant for this correlation. Thus, a linear correlation that is positive exists for IT servitization adoption and identification and control which is significant. Meaning, ability to identify the process participants accurately and being able to track and monitor participants' behaviour and activities conducted in a virtual process as well as analyse them in an automated and systematic manner positively influences process virtualization and thus IT servitization adoption.

Table 5.8.1 shows that there is a link between top management support and the adoption of IT servitization. The Pearson's r is 0.317. The p value is 0.000 at 0.01 level, therefore significant for this correlation. Thus, a linear correlation that is positive exists for IT servitization adoption and top management support which is significant. Meaning, adoption of IT servitization is more likely to be accepted by employees and subsequently integrated into organisations' business if top management provides a vision and commitment to create a supportive environment for it. Thus, when top management recognise the benefits of IT servitization and create a supportive environment and provision of adequate resources, there will be support for its adoption in the organisation.

Table 5.8.1 shows that there is a link between firm size and the adoption of IT servitization. The Pearson's r is 0.513. The p value is 0.000 at 0.01 level, therefore significant for this correlation. Thus, a linear correlation that is positive exists for IT servitization adoption and firm size which is significant. Meaning, that larger firms with more employees, especially those who receive frequent IT service requests are expected to facilitate technology innovation adoption because they tend to possess resource advantages due to the available financial resources that better enable them and implement innovations. Small firms, by contrast, are less able to often due to lack resources. Thus, firm size is a significant factor that affects IT servitization adoption.

Table 5.8.1 shows that there is an association between coercive pressures and the adoption of IT servitization. The Pearson's r is 0.572. The p value is 0.000 at 0.01 level, therefore significant for this correlation. Thus, a linear correlation that is positive exists for IT servitization adoption and coercive pressures which is significant. Meaning, formal or informal pressures that are exerted onto the organisation to adopt the same practices by external organisations upon which they are dependent affects the adoption of IT servitization. Thus, if an organisation receives a high level of coercive pressures, the adoption of IT servitization will increase.

Table 5.8.1 shows a link between mimetic pressures and the adoption of IT servitization. The Pearson's r is 0.512. The p value is 0.000 at 0.01 level, therefore significant for this correlation. Thus, a linear correlation that is positive exists for IT servitization adoption and mimetic pressures which is significant. Meaning, when successful high-status organisations adopt IT servitization they are imitated by competitors with a similar structure even when there are no power relationships. Thus, if an organisation receives a high level of mimetic pressures, the adoption of IT servitization will increase.

Table 5.8.1 shows an association between normative pressures and the adoption of IT servitization. The Pearson's r is 0.542. The p value is 0.000 at 0.01 level, therefore significant for this correlation. Thus, a linear correlation that is positive exists for IT servitization adoption and normative pressures. Meaning, norms specified by institutions such as professional or industry associations where companies share information and rules have potential to influence organisational behaviour even though they have no authority to enforce compliance as well as sanction non-compliance. Thus, if an organisation learns about IT servitization from adopters in the industry with whom they have direct or indirect relationships, thereby receiving high level of normative pressures, their adoption of IT servitization will increase.

Table 5.8.1 shows that there is a link between organisation's mandate and the adoption of IT servitization. The Pearson's r is 0.458. The p value is 0.000 at 0.01 level, therefore significant for this correlation. Thus, a linear correlation that is positive exists for IT servitization adoption and organisation's mandate which is significant. Meaning, if the nature of the organisation requires it to create, collect, maintain store and publish a high amount of data and information as mandated, then the regulatory requirement and the related sanctioning activities should lead to the necessity for IT servitization adoption. Thus, organisation's mandate is an is a significant factor that affects IT servitization adoption.

Table 5.8.1 shows that there is a link between organisation's industry and the adoption of IT servitization. The Pearson's r is 0.517. The p value is 0.000 at 0.01 level, therefore significant for this correlation. Thus, a linear correlation that is positive exists for IT servitization adoption and organisation's industry which is significant. Meaning, the kind of product and services offered by an organisation, their competition, the population they serve, industry laws and regulations where the organisation operates, should lead to the necessity for IT servitization adoption. Therefore, if an organisation receives a high level of regulatory pressures as a result of the industry they are mandated operate in, the adoption of IT servitization will increase. Discussed next, is the regression analysis.

5.9. Regression analysis

The previous section tested the eleven hypotheses of the current study using the correlation technique. This section uses multiple regression technique to further test the different hypotheses. Regression is an extension of the simple correlation and was run in SPSS version 25. The technique is used for prediction of the dependent variable using the independent variables (Cooper & Schindler, 2006) and is also known as causal relationships modelling (Pallant, 2001).

5.9.1. Multiple Regression

Multiple linear regression analysis will be used for the current study. According to Dion (2008) and Pallant (2013), it makes the following key assumptions:

- Linear relationship between the dependent variable and the independent variables is required. The below Figure 5.9 scatterplot confirms that there is a linear relationship between the said variables.

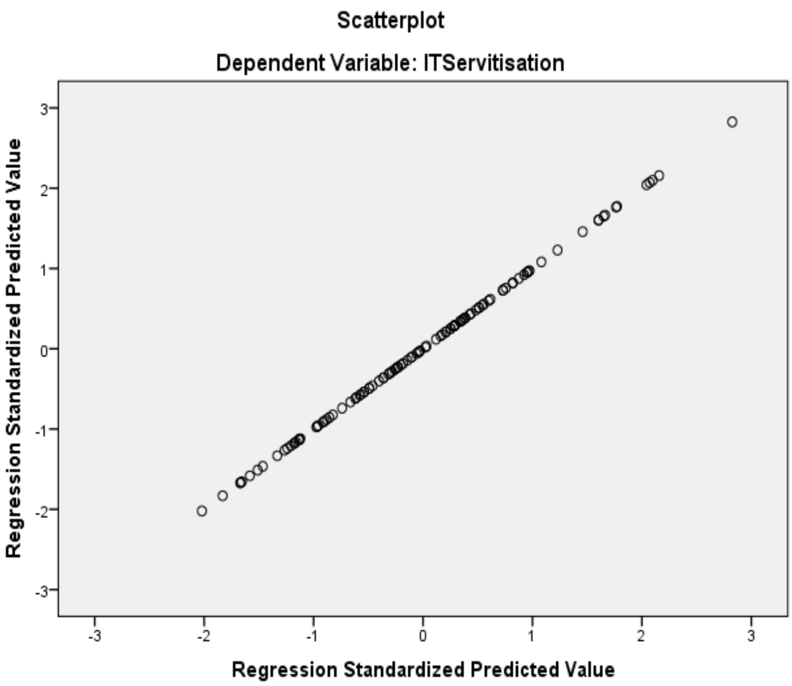

Figure 5.9 Scatterplot for the regression of standardised predicted value

In addition, the normal p-p plot was used to assess standardized residuals normality. Figure 5.10 plots the relationship between the observed residuals against the expected condition of normality. The blow plot provides good support for evidence of residuals that are normally distributed.

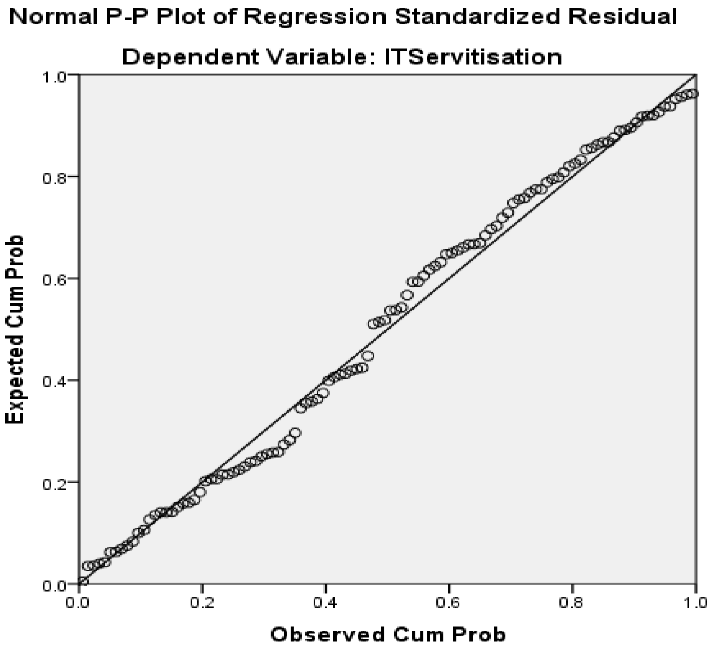

Figure 5.10 Normal p-p plot of regression of standardised residual

- There should be at least two independent variables, and can be ordinal, nominal or interval/ratio level variables. The current study used Likert scales for the measurements of variables, thus suitable.

- The sample size- a representative sample is required for regression analysis. The sampling procedure section 4.5.3 in chapter 4 shows how the sample was obtained and discusses suitability.

- Multiple regression also makes an assumption that the residuals are normally distributed, and this assumption could be possibility checked by a means of a histogram. The below Figure 5.11 histogram confirms that there is normal distribution of residuals with only a minor departure from normality.

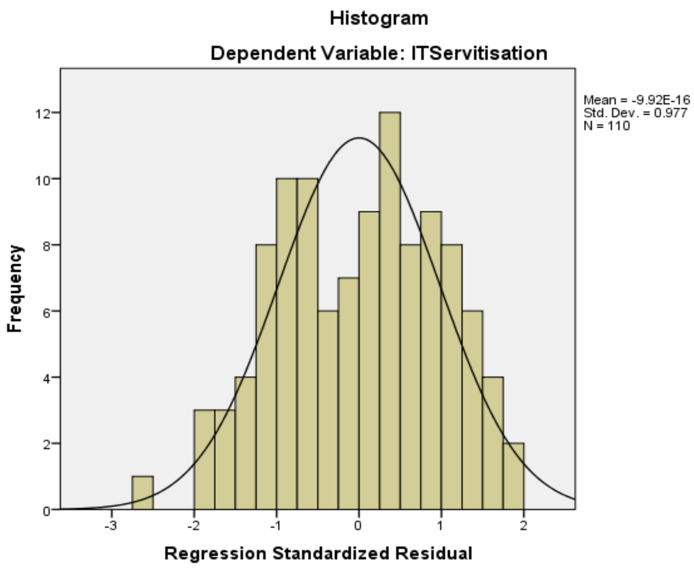

Figure 5.11 Histogram for the data set used

- Multiple regression also makes an assumption of homoscedasticity and this can be viewed from the scatter plot. Meaning there shouldn't be any clear pattern in the distribution. Figure 5.9 scatterplot shows that the data is homoscedastic with Durbin Watson score within the recommended the range of 3 and -3.

- Lastly, multiple regression also makes an assumption of no-multicollinearity, meaning the independent variables may not highly correlate with each other. Williams, Grajales and Kurkiewicz (2013) state that collinearity indicates the presence of correlations between the predictors (relationship between two predictor variables) whereas multicollinearity indicates the presence of correlations between the predictors (relationships between more than two predictors).

  According to Pituch & Stevens (2016) multicollinearity creates interpretive issues if the examined variables are not discriminant because it increases standard errors, thus reducing the power of regression coefficients tests. To test this assumption tolerance and Variance Inflation Factor (VIF) values are used.

  Chen (2008) suggests that tolerance scores ranging from 0 indicate perfect collinearity of up to 1 indicate no collinearity. If the values are ranging between 0 to 0.25, then that indicates a high level of multicollinearity. On the other hand, Norusis

(2002) suggests that, if VIF levels equates to or above 4.0 that also indicates multicollinearity.

This concluded the regression assumptions discussion and conditions have been addressed and assumptions met to avoid the results considered untrustworthy. Next, multiple regression analysis results are discussed.

The multiple regression analysis result is shown in Tables 5.9.1 to 5.9.4. The general multiple regression model is significant at a 95% level of confidence together with a p-value less than 0.05. The R-square values are 0,308; 0,430; 0,497; 0,533 and 0,566 respectively. The following percentages are indicated: 30.8%, 43.0%, 53.3%, and 56.6% of the variation in coercive pressures, relationship readiness, industry, normative pressures and synchronism readiness predictors respectively as depicted in Table 5.8.1 for IT servitization adoption. This is a statistically significant contribution as shown by the Sig. F change value of (0.000) which is below 0.05.

The Durbin-Watson test is one of the most popular tests for checking autocorrelation in regression of the residuals of a time series (Preinerstorfer & Pötscher, 2014). The Durbin-Watson values vary from zero to four (i.e., 0≤DW≤4). If there is no serial correlation for the residuals, then p = 0, and thus DW = 2. This suggests that if the value is close to 2, the residual series can be regarded as autocorrelation free at a certain significance level, for instance p < 0.05(Chen, 2016). The results of the current study show that the Durbin Watson score was 2,050, which is a good value to measure of autocorrelation independence (see Table 5.9.1). This value shows a high isolation level of among the model independent variables.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.555[a]	0,308	0,302	0,33226	0,308	48,171	1	108	0,000	
2	.656[b]	0,430	0,419	0,30311	0,121	22,773	1	107	0,000	
3	.705[c]	0,497	0,482	0,28610	0,067	14,098	1	106	0,000	

4	.730[d]	0,533	0,515	0,27706	0,036	8,032	1	105	0,006	
5	.752[e]	0,566	0,545	0,26837	0,033	7,907	1	104	0,006	2,050
a. Predictors: (Constant), Coercive										
b. Predictors: (Constant), Coercive, Relationship										
c. Predictors: (Constant), Coercive, Relationship, Industry										
d. Predictors: (Constant), Coercive, Relationship, Industry, Normative										
e. Predictors: (Constant), Coercive, Relationship, Industry, Normative, Synchronism										
f. Dependent Variable: ITServitisation										

Table 5.9.1 Model Summary[f]

The ANOVA table indicates that the overall model is significant. *(F (5,104) = 27.075, p = .000)* which indicates p<0.05 as shown in Table 5.9.2 below.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5,318	1	5,318	48,171	.000[b]
	Residual	11,923	108	,110		
	Total	17,241	109			
2	Regression	7,410	2	3,705	40,328	.000[c]
	Residual	9,831	107	,092		
	Total	17,241	109			
3	Regression	8,564	3	2,855	34,876	.000[d]
	Residual	8,677	106	,082		
	Total	17,241	109			
4	Regression	9,181	4	2,295	29,900	.000[e]
	Residual	8,060	105	,077		
	Total	17,241	109			
5	Regression	9,750	5	1,950	27,075	.000[f]
	Residual	7,491	104	,072		
	Total	17,241	109			
a. Dependent Variable: ITServitisation						
b. Predictors: (Constant), Coercive						
c. Predictors: (Constant), Coercive, Relationship						
d. Predictors: (Constant), Coercive, Relationship, Industry						
e. Predictors: (Constant), Coercive, Relationship, Industry, Normative						
f. Predictors: (Constant), Coercive, Relationship, Industry, Normative, Synchronism						

Table 5.9.2 ANOVA[a]

The coefficients Table 5.9.3 shows to what extent variables make a contribution to the model. The significance column shows that there are only five variables out of eleven that provide a contribution that is statistically significant $p < 0.05$. The standardized regression coefficients (β-beta) shows that coercive pressures at beta of β=.280 has the strongest predictive relationship to the IT Servitisation dependent variable adoption followed by independent variables: relationship readiness at β=.258, industry at β=.257, normative pressures at β=.220 and lastly synchronism readiness at β=.190 as depicted in Table 5.9.1.

The corresponding tolerance scores range from 0,645 to 0,920 (above 0,3 = good) and VIF scores range from 1,081 to 1,551 (below 4,0 = good) both showing a low degree of multicollinearity.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2,468	,196		12,599	,000		
	Coercive	,337	,049	,555	6,941	,000	1,000	1,000
2	(Constant)	2,090	,195		10,698	,000		
	Coercive	,330	,044	,543	7,438	,000	,999	1,001
	Relationship	,124	,026	,349	4,772	,000	,999	1,001
3	(Constant)	1,906	,191		9,984	,000		
	Coercive	,246	,047	,406	5,197	,000	,779	1,284
	Relationship	,108	,025	,302	4,311	,000	,967	1,034
	Industry	,151	,040	,297	3,755	,000	,757	1,322
4	(Constant)	1,662	,204		8,148	,000		
	Coercive	,191	,050	,315	3,838	,000	,661	1,514
	Relationship	,106	,024	,298	4,389	,000	,967	1,034
	Industry	,129	,040	,255	3,268	,001	,729	1,371
	Normative	,132	,047	,222	2,834	,006	,723	1,382
5	(Constant)	1,260	,244		5,170	,000		
	Coercive	,170	,049	,280	3,479	,001	,645	1,551
	Relationship	,092	,024	,258	3,843	,000	,925	1,081
	Industry	,130	,038	,257	3,395	,001	,729	1,371
	Normative	,131	,045	,220	2,900	,005	,723	1,382
	Synchronism	,156	,056	,190	2,812	,006	,920	1,088
a. Dependent Variable: ITServitisation								

Table 5.9.3 Coefficients[a]

Predictor variables from models b to f, i.e., (Sensory readiness, Identification Control, Top Management Support, Firm size, Mimetic pressures and Mandate) had p values at insignificant levels greater than 0.05. as shown on Table 5.9.4, and their corresponding models were excluded for further analysis.

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	Sensory	.301[b]	3,980	,000	,359	,982	1,018	,982
	Relationship	.349[b]	4,772	,000	,419	,999	1,001	,999
	Synchronism	.256[b]	3,280	,001	,302	,963	1,039	,963
	IdentificationControl	.189[b]	2,075	,040	,197	,748	1,336	,748
	TopManagementSupport	.021[b]	,228	,820	,022	,758	1,319	,758
	FirmSize	.299[b]	3,361	,001	,309	,736	1,358	,736
	Mimetic	.203[b]	2,217	,029	,210	,735	1,361	,735
	Normative	.293[b]	3,317	,001	,305	,753	1,328	,753
	Mandate	.181[b]	2,051	,043	,195	,800	1,250	,800
	Industry	.358[b]	4,255	,000	,380	,781	1,280	,781
2	Sensory	.191[c]	2,433	,017	,230	,825	1,213	,825
	Synchronism	.190[c]	2,555	,012	,241	,920	1,087	,920
	IdentificationControl	.193[c]	2,332	,022	,221	,748	1,336	,748
	TopManagementSupport	.008[c]	,091	,928	,009	,757	1,321	,757
	FirmSize	.229[c]	2,712	,008	,255	,708	1,412	,708
	Mimetic	.143[c]	1,670	,098	,160	,716	1,396	,716
	Normative	.271[c]	3,369	,001	,311	,751	1,332	,751
	Mandate	.133[c]	1,627	,107	,156	,787	1,271	,787
	Industry	.297[c]	3,755	,000	,343	,757	1,322	,757
3	Sensory	.143[d]	1,875	,064	,180	,796	1,256	,730
	Synchronism	.191[d]	2,743	,007	,259	,920	1,087	,756
	IdentificationControl	.164[d]	2,081	,040	,199	,741	1,350	,640
	TopManagementSupport	.017[d]	,208	,835	,020	,757	1,322	,617
	FirmSize	.146[d]	1,703	,092	,164	,637	1,570	,637
	Mimetic	.101[d]	1,235	,219	,120	,702	1,425	,638
	Normative	.222[d]	2,834	,006	,267	,723	1,382	,661
	Mandate	.053[d]	,648	,519	,063	,721	1,387	,693
4	Sensory	.099[e]	1,288	,200	,125	,752	1,329	,658
	Synchronism	.190[e]	2,812	,006	,266	,920	1,088	,645
	IdentificationControl	.152[e]	1,991	,049	,192	,738	1,354	,566
	TopManagementSupport	.024[e]	,316	,753	,031	,756	1,323	,535
	FirmSIze	.111[e]	1,310	,193	,127	,620	1,612	,601
	Mimetic	.091[e]	1,144	,255	,111	,700	1,428	,563
	Mandate	.009[e]	,117	,907	,011	,693	1,443	,630
5	Sensory	.103[f]	1,387	,168	,135	,752	1,330	,642
	IdentificationControl	.127[f]	1,687	,095	,164	,726	1,378	,561

TopManagementSupport	.018[f]	,248	,805	,024	,755	1,324	,526
FirmSize	.122[f]	1,492	,139	,145	,619	1,615	,586
Mimetic	.075[f]	,965	,337	,095	,696	1,436	,556
Mandate	-.002[f]	-,020	,984	-,002	,691	1,446	,617
a. Dependent Variable: IT Servitisation							
b. Predictors in the Model: (Constant), Coercive							
c. Predictors in the Model: (Constant), Coercive, Relationship							
d. Predictors in the Model: (Constant), Coercive, Relationship, Industry							
e. Predictors in the Model: (Constant), Coercive, Relationship, Industry, Normative							
f. Predictors in the Model: (Constant), Coercive, Relationship, Industry, Normative, Synchronism							

Table 5.9.4 Excluded Variables[a]

Multiple linear regression is a noteworthy analysis in this current study. The regression analysis results as presented above show a number of values that are critical in the analysis of the data and central for making inferences about IT servitization adoption by South African SOEs.

5.10. Structural Equation Model

Structural equation modelling (SEM) was used for testing of the hypotheses against the research model variables. Furthermore, in order to answer the research questions, SEM was used to understand main determinants leading to IT servitization adoption in South African SOEs. Through SEM, an estimation of all coefficients was evaluated for significance and relationship strengths within the model. This method is considered suitable because it allows for addressing questions that involve multiple regression factor analysis carried out for one dependent variable and a set of independent variables (Ullman, 2007).

Figure 5.12. shows the test values of the hypothesis which have been rounded-off to two decimals. An error term was appended for the indicator. The error term is a random name with a term e and a numerical value (e1). In order to indicate the relationships, double headed arrows are used to represent the covariance. In order to indicate the relationship that is causal among the dependent and independent variables, the single headed arrows are used. The constructs are indicated by the rectangle shape. Next sections 5.10.1 to 5.10.4 discusses the model on Figure 5.12.

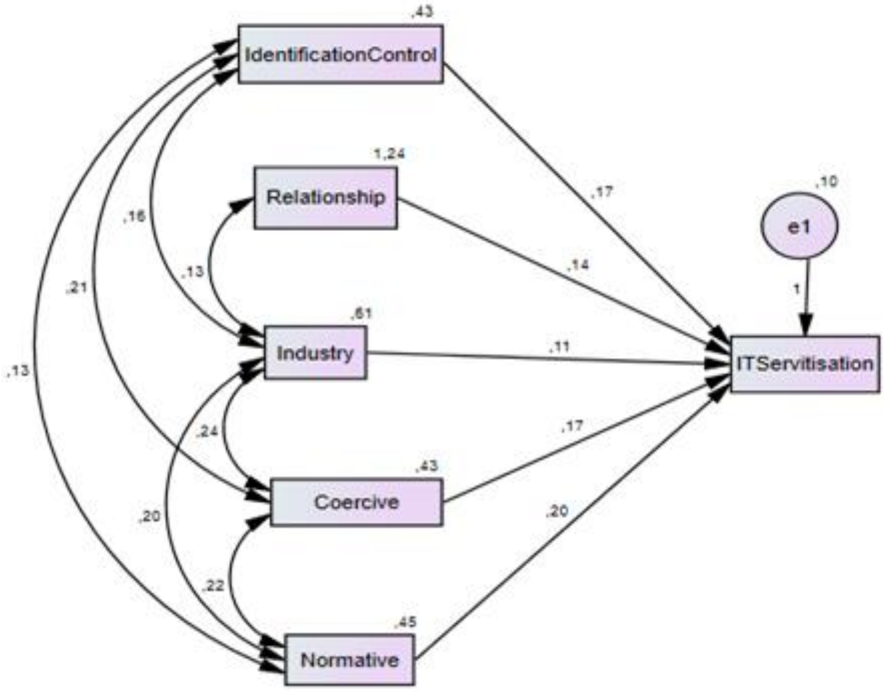

Figure 5.12 Structural equation modelling *(Source: AMOS 25)*

5.10.1. Maximum likelihood estimates

In the current study, the maximum likelihood parameter estimation was selected as opposed to other available estimation methods such as weighted least squares, two-stage least squares and Augmented Dickey-Fuller because the data was normally distributed. The ordinary least square methods minimise the squared deviations between values of the criterion variable and those predicted by the model and most used for functional relationship modelling between variables (Mutan, 2004) whereas the chosen maximum likelihood method is iterative and tries to maximise the likelihood that attained criterion variable values will be predicted accurately, which the study considers important.

Standardised regression weights

The path coefficients in Table 5.10.1 tie too those that are attained from multiple regressions which forms part of the SEM process and significant at 5% and positive.

			Estimate	S.E.	C.R.	P
ITServitisation	<---	Relationship	0,14	0,027	5,13	***
ITServitisation	<---	Coercive	0,172	0,061	2,837	0,005
ITServitisation	<---	Normative	0,198	0,052	3,772	***
ITServitisation	<---	Industry	0,114	0,045	2,543	0,011
ITServitisation	<---	IdentificationControl	0,169	0,053	3,204	0,001

(Source: AMOS 25)

Table 5.10.1 Standardised regression weights (Group number 1 - Default model)

Correlation

Table 5.10.2 indicates simple correlations between predictor variables ranging from 0,149 to 0,501. Coercive pressure has a correlation with identification control, normative pressure and industry. Similarly, normative pressure, relationship readiness and industry have a bidirectional correlation. Lastly, identification control has a correlation to both Normative pressure and industry.

			Estimate
Relationship	<-->	Industry	0,149
Coercive	<-->	IdentificationControl	0,501
Normative	<-->	IdentificationControl	0,303
Industry	<-->	IdentificationControl	0,31
Coercive	<-->	Normative	0,497
Coercive	<-->	Industry	0,464
Normative	<-->	Industry	0,375

(Source: AMOS 25)

Table 5.10.2 Correlations

The path coefficients provided in Table 5.10.3 show that all items are significant at 5% ($p < 0.05$) and have a statistically significant contribution of $p < 0.05$ in relation to each other except relationship readiness and industry at β=0.129 (p = 0.077). The β-beta weights (estimates) shows that coercive pressures and industry have the highest beta of β=0,236 (p = 0.000), followed by coercive and normative pressures at β=0,217 (p = 0.000), coercive pressures and identification and control readiness at β=0,215 (p = 0.000), normative pressures and industry at β=0,195 (p = 0.000), industry and identification and control readiness at β=0,158 (p = 0.002), normative pressures and identification and control readiness at β=0,133 (p = 0.002).

			Estimate	S.E.	C.R.	P
Relationship	<-->	Industry	0,129	0,073	1,769	0,077
Coercive	<-->	IdentificationControl	0,215	0,046	4,68	***
Normative	<-->	IdentificationControl	0,133	0,044	3,031	0,002
Industry	<-->	IdentificationControl	0,158	0,051	3,121	0,002
Coercive	<-->	Normative	0,217	0,047	4,647	***
Coercive	<-->	Industry	0,236	0,053	4,438	***
Normative	<-->	Industry	0,195	0,053	3,702	***

(Source: AMOS 25)

Table 5.10.3 Covariances (Group number 1 - Default model)

Table 5.10.4 indicates squared multiple correlation coefficient in the multiple regression. A high squared multiple correlations coefficient for the indicator shows a strong relation to the latent construct. Furthermore, the squared multiple correlation coefficient for the latent construct, IT servitization adoption indicate that about 60% of the variability is accounted for in the model.

	Estimate
ITServitisation	0,589

(Source: AMOS 25)

Table 5.10.4 Squared multiple correlations

5.10.2. Model fit indices

RMR, GFI

The root mean square residual (RMR), is an index of the amount by which the estimated model variances and covariances are different from observed variances and covariances. The RMR value of 0.014 was considered as an acceptable fit for the model. Tabachnick and Fidell (2007) state that the goodness-of-fit (GFI) is used to calculate the variance accounted for by the estimated population covariance. The value of the index is 0.999 and above the recommended threshold of ≥ 0.90 and was considered as an acceptable fit for the model. The adjusted GFI, AGFI is an alternate GFI index where the value of the index is adjusted according to the number of parameters in the model. The fewer number of parameters in the model relative to the number of data points, then the AGFI would be closer to the GFI, the values on table 5.10.3 show that the values are close i.e. 0.99 and 0.999(0.009 difference).

Model	RMR	GFI	AGFI	PGFI
Default model	0,014	0,999	0,99	0,143
Saturated model	0	1		
Independence model	0,143	0,561	0,385	0,401

Table 5.10.3 RMR, GFI

RMSEA

Root Mean Square Error of Approximation (RMSEA) is normally used as an alternative for the chi-square test. It considers the population error of approximation. Chinomona (2011) suggests that a good model fit for RMSEA should be less than or equal to 0.05 and an adequate fit if RMSEA is less than or equal to 0.08. The current model value is 0.00 indicating good model fit. LO 90 indicates 90% confidence interval lower limit for the estimate and HI 90 upper limits. PCLOSE is the p-value that is used to test if the null RMSEA hypothesis is less than 0.05.

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	0	0	0,056	0,945
Independence model	0,335	0,294	0,377	0

Table 5.10.4 RMSEA

5.10.3. Model evaluation results

Given that all seven goodness-of-fit indices in table 5.10.5 are meeting the required threshold, the conclusion is that the data perfectly fits the model.

Index	Recommendations	Output	Acceptable /Not acceptable
TLI	≥0.95	1	Acceptable
CFI	≥0.95	1	Acceptable
GFI	≥0.90	0.999	Acceptable
PCFI	<=1	1	Acceptable
RMSEA	< 0.08	0.000	Acceptable
NFI	≥0.90	1	Acceptable
PCLOSE	<0.05	0.000	Acceptable

Table 5.10.5 Summary of the model evaluation for overall fit measurement

5.10.4. Results of the hypothesis test

This study aimed to test eleven hypotheses and this section provides the summary of the results. Hypothesis one to hypothesis eleven (H1 – H11) were obtained through multiple regressions which forms part of the SEM process and results indicate which hypotheses are accepted or rejected (see Table 5.10.6). The path coefficients provided in Table 5.10.1 show that five variables out of eleven make a statistically significant contribution $p < 0.05$. The β-beta weights (estimates) shows that normative pressures have the highest beta of $\beta=0.198$ ($p = 0.000$) to the IT servitisation adoption dependent variable adoption followed by: coercive pressures at $\beta=0.172$ ($p = 0.005$), identification and control readiness at β=0.169 (p = 0.001), relationship readiness at β=0.14 (p = 0.000), and lastly industry at β=0.114 (p = 0.011). The results link with those shown in Figure 5.12.

Hypothesis	Description	Condition
H1	*Sensory readiness positively influences the adoption of IT servitization.* ***No statistically significant effect.***	*Rejected*
H2	*Relationship readiness positively influences the adoption of IT servitization.* ***β=0.14 (p = 0.000)***	*Supported*
H3	*Synchronism readiness positively influences the adoption of IT servitization.* ***No statistically significant effect****.*	*Rejected*
H4	*Identification and control readiness positively influence the adoption of IT servitization.* ***β=0.169 (p = 0.001)***	*Supported*
H5	*Top management support positively influences the adoption of IT servitization.* ***No statistically significant effect****.*	*Rejected*
H6	*Firm size positively influences the adoption of IT servitization.* ***No statistically significant effect****.*	*Rejected*
H7	*Coercive pressures positively influence the adoption of IT servitization.* ***β=0.172 (p = 0.005)***	*Supported*
H8	*Mimetic pressures positively influence the adoption of IT servitization.* ***No statistically significant effect****.*	*Rejected*
H9	*Normative pressures positively influence the adoption of IT servitization.* ***β=0.198 (p = 0.000)***	*Supported*
H10	*Organisation's mandate positively influences the adoption of IT servitization.* ***No statistically significant effect****.*	*Rejected*
H11	*Organisation's industry positively influences the adoption of IT servitization.* ***β=0.114 (p = 0.011)***	*Supported*

Table 5.10.6 Summary of hypothesis test results

Further discussion of results is undertaken in chapter 6.

5.11. Chapter summary

The chapter began by presenting the data normality analysis for skewness and kurtosis, both of which are important for data cleaning. This was followed by a discussion of descriptive statistics on demographics and constructs, including frequency distribution, central tendency, and dispersion of the constructs. Following that, the inferential statistics were examined, including the instrument testing. Various formulae, such as Cronbach Alpha, were used to test validity and reliability.

Following that, the model fit was evaluated using thresholds and indices derived from the literature. Thereafter, the structural model fit was tested using various indices to determine model fit, followed by hypothesis testing. Five of the eleven hypotheses were supported, while six were rejected. The following chapter interprets the study findings and presents the integrated model for IT servitization adoption.

CHAPTER 6

INTERPRETATION OF RESULTS AND THE INTEGRATED MODEL FOR IT SERVITIZATION ADOPTION

6.1. Introduction

The preceding chapter provided an analysis of the data collected, followed by a discussion of the results. This included data normality checks, descriptive and inferential statistics analysis, and instrument reliability and validity testing. The structural equation model was used after CFA and EFA. A closest fit model was established based on the structural model results, which was supported and confirmed suitable for the data sample of South African SOEs. Finally, hypotheses testing was carried out.

This chapter interprets the previous chapter's results and introduces the integrated model for IT servitization adoption. The next section interprets the study's main results.

6.2. Main study results and their interpretations

IT servitization manifests itself in multiple forms, such as IT outsourcing, virtualization and cloud computing. As such, there are various determinants which influence South African SOEs to adopt IT servitization. The current study sought to explore and explain these the determinants.

6.2.1. Sensory readiness and IT servitization adoption

Sensory readiness in the technological context refers to the degree to which participants can enjoy a full sensory experience of the virtualized process similar to a process that is physical. Thus, in order to favourably virtualize a process, the sensory requirement factor must be minimal (Overby, 2008, 2012). An example is organisations that can host their electronic mail communication in the cloud i.e., Microsoft Office 365 and users still have the full sensory experience as the locally hosted mailbox.

The current study results posit that sensory readiness is a statistically non-significant determinant in the adoption of IT servitization by SOEs, although a positive relationship between the two was identified through Pearson's correlation. The results of the current study are inconsistent with existing literature. Due to the newness of process virtualization theory (PVT), the empirical testing studies are still limited though emerging (Overby, 2012). The available literature indicates that by allowing participants to like the process experience interaction, then sensory readiness capability positively influences its amenability to virtualization (Overby, 2008), thereby enabling IT servitization adoption.

A probable explanation for this insignificance in the current study could be explained by Thomas, Costa and Oliveira (2016). In their study, where they were assessing IT aided virtualization of process on adoption of green IT through PVT found that sensory readiness is a statistically non-significant determinant. The results of their study indicated that sensory readiness had no effect, therefore inconsistent with the propositions suggested by PVT. They discussed that, although the sensory readiness effect seems plausible, it does not directly contribute as a determinant.

From a practitioner's perspective, it should be noted that overall, sensory readiness is a non-significant determinant in the adoption of IT servitization. Thus, in the SOE technology context, although enabling participants to like their involvement of the virtual process interaction is good to provide, it does not directly contribute as a determinant that could influence the adoption of IT servitization within the SOE.

Overall, hypothesis 1 proposed that sensory readiness positively influences the adoption of IT servitization. The results have demonstrated that this is false, therefore H1 is not supported.

6.2.2. Relationship readiness and IT servitization adoption

Relationship readiness is the degree to which the need for professional interaction amongst process participants is enabled. This refers to the need for process participants to interact professionally with one another, such as through LinkedIn, and to connect participants with similar interests in order to build professional relationships with one another (Bose & Luo, 2011).

The current study results reveal that relationship readiness is a statistically significant determinant in the adoption of IT servitization by SOEs ($\beta=0.14$; $p = 0.000$). A positive relationship between the two was also identified through Pearson's correlation. The results of the current study are consistent with existing literature. Literature indicates that by enabling process participation virtually anytime, anywhere the relationship readiness capability influences the process amenability to be virtualized positively (Bose & Luo, 2011; Overby, 2008), thereby enabling IT servitization adoption.

From a practitioner's perspective, it should be noted that overall, relationship readiness is a significant determinant in the adoption of IT servitization. Thus, practitioners, managers and decision makers should pay close attention to understanding the importance of relationships between parties or participants in a virtual process and ensure that the interaction is seamless. With the adoption of IT servitization, the need to examine and understand the relationship requirement on the SOEs technological context is important. This is because the establishment of relationship requirements while conducting a virtual process can trigger knowledge acquisition, trust, and friendship development (Bose & Luo, 2011; Overby, 2008).

In summary, hypothesis 2 proposed that relationship readiness positively influences the adoption of IT servitization. The results have demonstrated that this is true, therefore H2 is supported.

6.2.3. Synchronism readiness and IT servitization adoption

Synchronism readiness is the degree to which the activities that comprise a process must occur as quickly as possible with as little delay as possible (Bose & Luo; 2011). Because synchronous participation is important in the technological context, the synchronism requirement factor must be minimal in order to favorably virtualize a process (Srivastava, Vishnoi & Srivastava, 2016). One example is technological enablers such as video conferencing and multi-party collaboration, which allow participants to communicate instantly even if they are in different locations (Thomas, Costa & Oliveira, 2016)

The current study's results suggest that synchronism readiness is a statistically insignificant determinant of SOEs' adoption of IT servitization, despite the fact that a positive relationship between the two was discovered using Pearson's correlation. The current study's findings are at odds with previous research. According to the literature, synchronism readiness capability positively influences its amenability to virtualization (Overby, 2008), thereby enabling IT servitization adoption by enabling participants to interact with others with little to no delay as if they are all located in the same physical setting.

A probable explanation for this insignificance in the current study could be explained by Thomas, Costa and Oliveira (2016). Their study where they were assessing IT enabled process virtualization on the adoption of green IT through PVT found that synchronism readiness is a statistically non-significant determinant. The results of their study indicated that synchronism readiness had no effect, therefore inconsistent with the propositions suggested by PVT. They discussed that although the synchronism readiness effect seems plausible, it does not directly contribute as a determinant.

From a practitioner’s perspective, it should be noted that overall, synchronism readiness is a non-significant determinant in the adoption of IT servitization. Thus, in the SOE technology context, although enabling participants to interact with others with little to no delay as if they are all located in the same physical setting experience is good to provide, it does not directly contribute as a determinant that could influence the adoption of IT servitization within the SOE.

Overall, hypothesis 3 proposed that synchronism readiness positively influences the adoption of IT servitization. The results have demonstrated that this is false, therefore H3 is not supported.

6.2.4. Identification and control readiness and IT servitization adoption

The degree to which the process requires unique identification of process participants and provides the ability to exert control over participants and influence their behaviour is referred to as identification and control readiness (Overby, 2008). According to

Srivastava, Vishnoi, and Srivastava (2016), the requirement for identification and control has a negative impact on virtual processes because it introduces threats such as hacking and identity spoofing, which may result in unauthorised access to a virtual process. Although virtualization allows participants to become anonymous, sophisticated technologies in identification management, such as biometrics and password verification, allow parties to accurately identify participants (Bose & Luo, 2011).

The current study results posit that identification and control readiness is a statistically significant determinant in the adoption of IT servitization by SOEs ($\beta=0.169$; $p = 0.001$). A positive relationship between the two was also identified through Pearson's correlation. The results of the current study are consistent with existing literature. Literature indicates that by enabling unique identification of process participants and provides the ability to exert control over participants and influence their behaviour, the identification and control readiness capability influences the process amenability to be virtualized positively (Bose & Luo, 2011; Overby, 2008), thereby enabling IT servitization adoption.

From a practitioner's perspective, it should be noted that overall, identification and control readiness is a significant determinant in the adoption of IT servitization. Thus, practitioners, managers and decision makers should pay close attention to understanding the importance of enabling unique identification of process participants and provide the ability to exert control over participants and influence their behaviour. With the adoption of IT servitization, the need to examine and understand the identification and control on the SOEs technological context is important. This is because research on relationship development has argued the importance of knowing the identity of the other party when developing a relationship (Dombrowski, LeMasney, Ahia & Dickson, 2004).

In summary, hypothesis 4 proposed that identification and control readiness influences IT servitization adoption positively. The results have demonstrated that this is true, therefore H4 is supported.

6.2.5. Top management support and IT servitization adoption

When top management recognizes the benefits of an innovation, they are more likely to provide the resources required to accelerate its adoption. Furthermore, they have an influence on the members of the organisation to drive implementation. When top management fails to recognize the value of an innovation to the organisation, they will be opposed to its adoption (Oliveira, Thomas & Espadanal, 2014).

The current study's results suggest that top management support is a statistically insignificant determinant of SOE adoption of IT servitization, despite the fact that a positive relationship between the two was discovered using Pearson's correlation. The current study's results are at odds with previous research. According to the literature, top management support is critical for creating a supportive environment and providing adequate resources for the adoption of new technologies (Lin & Lee, 2005; Wang, Wang & Yang, 2010).

Furthermore, literature suggests that top management support may be required to ensure resource commitment and integration into an organisational climate conducive to successful adoption (Ilin, Iveti, & Simi, 2017). The general consensus throughout the articles that examined the role of top management and examined the role of their support indicates that it significantly contributes to the decision to adopt innovation (Borgman, Bahli, Heier & Schewski, 2013; Low, Chen & Wu, 2011; Oliveira, Thomas & Espadanal, 2014).

Asatiani could provide a plausible explanation for the current study's insignificance (2015). Asatiani (2015) discovered that the narrow top-down data collection approach could be underrepresenting some factors while overrepresenting others while conducting a study that included a systematic review of literature for cloud computing adoption (which is another form of IT servitization) in organisations. According to Asatiani (2015), when researchers conduct studies and collect data, IT professionals tend to be a minority of informants and top management of the organisation is the majority, with no other members of the organisation included.

According to Asatiani (2015), while these actors are highly influential in the innovation adoption process, other members of the organisation also play a role. As a result, the bias toward top decision-maker study informants is blamed for the dominance of determinants such as top management support for innovation adoption literature. In this study, IT specialists received the most responses, followed by a few (three) C-level positions in

SOEs. As a result, this could explain why a different perspective on top management support was obtained.

From a practitioner's perspective, it should be noted that, while insignificant or weak, top management support is a determinant in IT servitization adoption. Thus, putting too much emphasis on top management support when embarking on IT servitization adoption in South African SOEs may not be necessary because it will have little effect on adoption. This is because, while top management has influence over the adoption process, other members of SOEs play a role as well, and their support should be considered.

In summary, hypothesis 5 proposed that top management support has a positive influence on IT servitization adoption. The results have demonstrated that this is false, therefore H5 is not supported.

6.2.6. Firm size and IT servitization adoption

According to research (e.g., Dholakia & Kshetri, 2004; Hong & Zhu, 2006; Pan & Jang, 2008), firm size is one of the major adoption determinants of technology innovation.

The current study results show that firm size as a non-significant determinant statistically in the adoption of IT servitization by SOEs, despite a positive relationship between the two identified by Pearson's correlation. The current study's results are at odds with previous research. According to the literature, large firms have an advantage over small firms because they have more resources, which allows them to take greater risks associated with innovation adoption (Zhu, Kraemer, & Xu, 2006; Thiesse, Staake, Schmitt, & Fleisch, 2011). Furthermore, those with more employees, particularly those who receive frequent IT service requests, have an advantage. Smaller firms, on the other hand, while frequently regarded as open to new innovative ideas, may frequently face challenges in raising the necessary resources for innovation adoption (Rowe, Truex & Huynh, 2012).

A probable explanation for this insignificance could be the context. Studies like, for example Oliveira, Thomas and Espadanal (2014) were conducted in the manufacturing and services sectors in Portugal and Thiesse et al. (2011) in the German car manufacturer sector respectively which are in the private sphere, whereas the current study was conducted in the government enterprises sphere in South Africa. In the South African SOEs context, firm size may not be a significant determinant because availability of resources that enable them to take greater risks associated with innovation adoption is guaranteed through state funding, unlike private sectors which are largely not state funded.

As an example of this, Eskom adopted a software technology innovation through Carab Technologies which gathers data and monitor the performance of its boilers between 2011 and 2017 (Masondo, 2019). This was done despite Eskom lacking financial resources as indicated in Figure 6.2. This indicates the difference in dynamics between private and government enterprises regarding availability of financial resources which could be playing out in this instance.

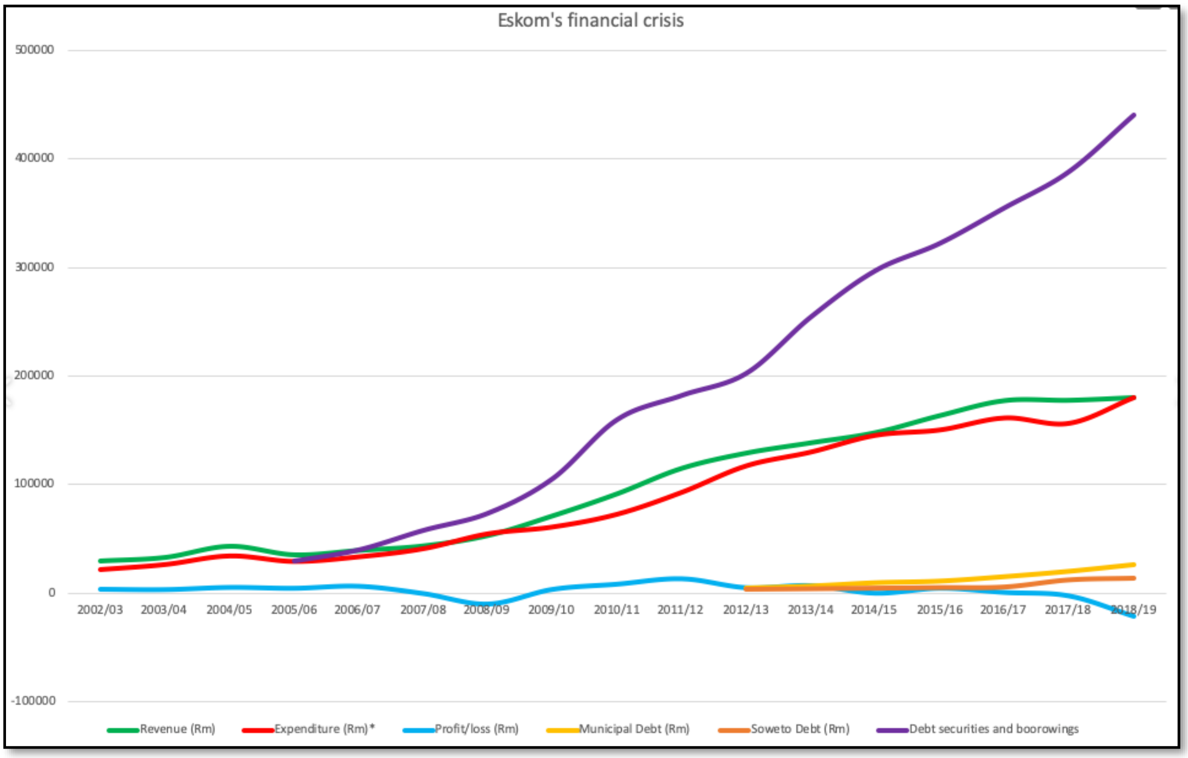

Figure 6.2. Eskom Financial crisis (Business Tech, 2019)

From a practitioner's perspective, it should be noted that overall, firm size is a determinant in the adoption of IT servitization, although insignificant or weak. Thus, when embarking on IT servitization adoption, the size of the SOE should be considered although if resources are available, will not significantly affect the adoption. Furthermore, firm size may not be ignored in the situation where there are green fields (new system adoption) vs switching (replacing a system) as slack due to large firm size may play a role (Schneider & Sunyaev, 2016).

In summary, hypothesis 6 proposed that firm size positively influences the adoption of IT servitization. The results have demonstrated that this is false, therefore H6 is not supported.

6.2.7. Coercive pressures and IT servitization adoption

Coercive pressures are formal or informal pressures that are exerted onto the organisation to adopt the same practices by external organisations upon which they are dependent (DiMaggio & Powell, 2000; Teo, Wei & Benbasat, 2003).

The results of the current study revealed coercive pressures as a statistically significant determinant in the adoption of IT servitization by SOEs (β=0.172; $p = 0.005$). A positive relationship between the two was also identified through Pearson's correlation. The results of the current study are inconsistent with existing literature. Literature indicates that when an organisation is pressured to adopt technology innovation from regulatory bodies, professional networks, resource dominant organisations or when key organisations on whom they depend already adopted it, they are more likely to also adopt (DiMaggio & Powell, 2000). Thus, suggesting that if an organisation receives a high level of coercive pressures, the adoption of IT servitization will increase. Similar observations made in the current study on the importance of coercive pressures on innovation adoption were made by studies (e.g., Jan, Hsi-Peng & Chou, 2012; Tomás, Thomas & Oliveira, 2018) therefore in line with literature in the field.

From a practitioner's perspective, it should be noted that overall, coercive pressure is a significant determinant in the adoption of IT servitization. Thus, practitioners, managers and decision makers should pay close attention to understanding how this institutional pressure impacts their SOEs and have appropriate strategies in place to deal with it and enable the adoption. With the adoption of IT servitization, it is critical to examine and understand the external influences exerted on the SOE's environmental context by regulatory bodies, government, professional networks, industry associations, and their subsidiaries, if any.

Overall, hypothesis 7 proposed that coercive pressures positively influences the adoption of IT servitization. The results have demonstrated that this is true, therefore H7 is supported.

6.2.8. Mimetic pressures and IT servitization adoption

Mimetic pressures are the propensity of an organisation to copy the actions of other successful and high-status organisations with a similar structure even when there are no power relationships (Teo, Wei & Benbasat, 2003; Shi, Shambare & Wang, 2008). This institutional pressure is observed when organisations adopt innovations and practices by imitating competitors (Soares-Aguiar & Palma-Dos-Reis, 2008).

The results of the current study found that mimetic pressures are statistically non-significant determinant in the adoption of IT servitization by SOEs, although a positive relationship between the two was identified through Pearson's correlation. The results of the current study are inconsistent with existing literature. According to the literature, when organisations face uncertainty and their goals are ambiguous, mimicry occurs by reducing search costs by minimizing and saving on experimentation costs (Shi, Shambare, & Wang, 2008) or avoiding the risks of being the first adopters (Teo, Wei & Benbasat, 2003). Meaning, when an SOE sees better results from other SOEs that have already servitized their IT, they are more likely to follow suit; however, the current study does not support this assertion.

A probable explanation for this insignificance in the current study could be explained by Tomás, Thomas and Oliveira (2018). Their study found mimetic pressures not to have a positive influence in the adoption of SaaS which is a cloud computing (another form of IT servitization) strategy. Their study suggest that mimetic pressures are only significant when the innovation adoption is perceived to have a high degree of complexity (e.g., studies by Teo, Wei & Benbasat, 2003; Liang, Saraf, Qing & Xue, 2007). In this instance, participants may have perceived IT servitization as having a low degree of complexity, therefore low level of uncertainty is associated with the adoption thereof. This explains why SOEs have minimal to imitate the actions of others.

From a practitioner's perspective, it should be noted that overall, mimetic pressure is a non-significant determinant in the adoption of IT servitization. Thus, while practitioners, managers and decision makers are encouraged to understand how this institutional pressure impacts their SOEs and have appropriate strategies in place to deal with it and enable the adoption, it is not deemed significant to adoption of IT servitization by SOEs. Moreover, where IT servitization adoption complexity is low and copying other organisations is unnecessary.

In summary, hypothesis 8 proposed that mimetic pressures positively influence the adoption of IT servitization. The results have demonstrated that this is false, therefore H8 is not supported.

6.2.9. Normative pressures and IT servitization adoption

Normative pressures are pressures that originate from norms specified by institutions such as professional or industry associations where companies share information and rules (Teo, Wei & Benbasat, 2003; Krell, Matook & Rohde, 2016).

The results of the current study found normative pressures to be a statistically significant determinant in the adoption of IT servitization by SOEs with the highest beta of β=0.198 ($p = 0.000$). A positive relationship between the two was also identified through Pearson's correlation. The results of the current study are consistent with existing literature. Literature indicates that when conformation to specific standards by organisations that are trading partners to allow for information sharing throughout the supply chain is encouraged, normative pressures arise (Liu, Ke, Wei, Gu & Chen, 2010) because organisations tend to learn about innovations from adopters in the industry with whom they have direct or indirect relationships (Sherer, Meyerhoefer & Peng, 2016). Similar observations made in the current study on the importance of normative pressures on innovation adoption were made by studies (e.g., Schneider & Sunyaev, 2016; Tomás, Thomas & Oliveira, 2018) therefore in line with literature in the field.

From a practitioner's perspective, it should be noted that overall, normative pressure is a significant determinant in the adoption of IT servitization. Thus, where conformation to specific standards by SOEs to trading partner (e.g., South African Airways and trading partner Airports Company South Africa) to allow for information sharing throughout the supply chain is required, normative pressures should be carefully considered and practitioners, managers and decision makers should ensure that this pressure is managed throughout IT servitization adoption.

Also important to note, is the effect of externally set norms arising from professionalisation and standardisation of job titles and roles in the industry, as well as the centralisation of IT (Nicholson & Sahay, 2009; Jeyaraj & Sabherwal, 2008; Currie, 2009; Pearson & Keller, 2009) that practioners in the field maybe subject to, that may need to be adhered to when servitizing IT. It is important to note, however, that institutions that exert normative pressure on SOEs lack the authority to enforce compliance and sanction non-compliance.

Overall, hypothesis 9 proposed that normative pressures positively influences the adoption of IT servitization. The results have demonstrated that this is true, therefore H9 is supported.

6.2.10. Organisation's mandate and IT servitization adoption

Mandate refers to the output responsibilities of the organisation or subsidiary (Cantwell & Mudambi, 2005). SOEs by nature are required to create, collect, maintain, store and publish a high amount of data and information (Kalampokis, Tambouris & Tarabanis, 2011a, b). This suggests that if an SOE receives a high level of regulatory or sanctioning requirement as a result of the nature of the sphere they are mandated operate in, as well as their business activities, the adoption of IT servitization will increase.

The results of the current study found that organisation's mandate is statistically non-significant determinant in the adoption of IT servitization by SOEs, although a positive relationship between the two was identified through Pearson's correlation. Although literature in this area is lacking, the results of the current study are inconsistent with existing literature that was found. A study by Altayar (2018) indicates the importance of mandate to regulatory environment and sanctioning activities on the state entity.

Due to the scarcity of literature in the field of mandate and its relationship to IT servitization adoption, one possible explanation for this insignificance could be the context. Transnet, for example, emphasised the importance of information technology in their 2016/2017 annual report, despite the fact that they are a transportation and logistics SOE. It is stated that the evolution of IT capability beyond business enablement is required for their operations. As a result, despite the fact that their mandate does not impose IT regulatory and sanctioning activities, technology is still pervasive in their operations and to a greater extent in their context than in some SOEs, such as the KwaZulu-Natal Museum and the Eastern Cape Provincial Arts and Culture Council, which are both SOEs but have a lower adoption of IT innovations.

From a practitioner's perspective, it should be noted that mandate is a non-significant determinant in the adoption of IT servitization. However, there have been IT servitization initiatives implemented, such as third-party data centre hosting and outsourcing of certain IT functions to the private sector. These initiatives were undertaken with the goal of capitalizing on private-sector efficiencies while also transforming SOEs. However, there were some challenges to such initiatives. The expected outcomes of such initiatives were inconsistent for the majority of South African SOEs, resulting in inefficiencies and financial pressures. As a result, when adopting IT servitization, the SOE mandate should be considered to avoid initiatives that do not necessarily add value to the SOE due to its mandate.

Overall, hypothesis 10 proposed that organisation's mandate positively influences the adoption of IT servitization. The results have demonstrated that this is false, therefore H10 is not supported.

6.2.11. Organisation's industry and IT servitization adoption

Industry is conceptually referred to as the sector of business within which the organisation operates (Yao, Lee & Lee, 2010). This suggests that if an SOE receives a high level of competition and regulatory requirements as a result of their industry, the adoption of IT servitization will increase.

The results of the current study found that organisation's industry is statistically significant determinant in the adoption of IT servitization by SOEs (β=0.114; p = 0.011). A positive relationship between the two was also identified through Pearson's correlation. The results of the current study are consistent with existing literature. Literature indicates that the competition in the industry may drive the adoption of technology innovations in order to maintain a competitive edge (Zhu, Kraemer & Xu, 2003). Additionally, the influence of laws and regulations are an important influencer in the adoption of technology innovations (Zhu, Kraemer & Xu, 2006).

From a practitioner's perspective, it should be noted that overall, industry is a significant determinant in the adoption of IT servitization. As a result, practitioners, managers, and decision makers must pay close attention to how their industry affects their SOE context. Understanding the competition in the industry in which the SOE operates, the population served by the SOE, and the competition is critical. The type of product and services offered, as well as industry laws and regulations, are also important considerations. Appropriate strategies for dealing with industry-wide factors must be in place in order to enable and, where necessary, deal with issues that may affect the adoption of IT servitization.

Telkom SA Limited, a state-owned enterprise, has been one of the leading organisations in enabling IT service adoption, competing with international companies such as Amazon Web Services (AWS) and Microsoft Azure that have established data centres in South Africa (Moyo, 2020). According to the annual results for the fiscal year that ended 31 March 2020, the SOEs cloud data centre business performed well, increasing by 10% from 2019. (Telkom annual report, 2020). This confirms the South African business landscape's interest in IT servitization adoption by organisations in various industries.

In summary, hypothesis 11 proposed that organisation's industry positively influences the adoption of IT servitization. The results have demonstrated that this is true, therefore H11 is supported.

6.2.12. Covariances between predictor variables

Understanding the relationship between the independent (predictor) variables to each other in order to explain the which determinants influence each other and their significance is important. The results (β-beta weights) show that coercive pressures and industry have the highest beta of β=0,236 (p = 0.000). They are followed by coercive and normative pressures at β=0,217 (p = 0.000), coercive pressures and identification and control readiness at β=0,215 (p = 0.000), normative pressures and industry at β=0,195 (p = 0.000), industry and identification and control readiness at β=0,158 (p = 0.002), normative pressures and identification and control readiness at β=0,133 (p = 0.002).

This meaning that, there is a directional relationship between the five pairs, i.e. (1) coercive pressures and industry, (2) coercive and normative pressures, (3) coercive pressures and identification and control readiness, (4) normative pressures and industry, (5) normative pressures and identification and control readiness. In this instance all of them have a positive directional relationship indicating that they move together in the same direction and change together. When one increases the other does the same and are not inversely related.

6.3. Integrated Model for IT Servitization Adoption

An integrated model for IT servitization adoption in South African SOEs is shown in Figure 6.3. The model is based on determinants whose hypotheses were supported by the structural equation model.

The data gathered in the current study reveals the following:

Relationship readiness: by enabling process participation virtually anytime and anywhere, the relationship readiness capability positively influences process virtualization and enables adoption. Meaning, when technology allows interaction for participants with each other professionally through virtual interactions, this allows for building of professional relationships and thus IT servitization adoption.

Identification and control readiness: when technology provides unique, verifiable and accurate identification of process participants as well as automated and systematic identity analysis of process participants, then this has a positive influence on process virtualization and enables adoption. Meaning, the ability to identify the process participants accurately and being able to track and monitor participants' behaviour and activities conducted in a virtual process positively influences process virtualization and thus IT servitization adoption.

Coercive pressures: the formal or informal institutional pressures that are exerted onto the SOE organisation to adopt the same practices by regulatory bodies, organisations on whom the SOE depend, professional networks, and/or resource dominant organisations results in IT servitization adoption. Meaning, if an SOE receives a high level of coercive pressures, the IT servitization adoption requirement increases.

Normative pressures: the direct or indirect institutional pressures that are exerted onto the SOE that originate from norms specified by professional institutions, industry associations where organisations share information and rules and conformation to specific industry standards by trading partners throughout the supply chain results in IT servitization adoption. Meaning, if an organisation learns about IT servitization from adopters in the industry with whom they have direct or indirect relationships, thereby receiving high level of normative pressures, their requirement to adopt IT servitization could increase.

Industry: the sector of business within which the SOE operates, laws and regulatory requirements as a result of the industry, the kind of product and services the SOE provides, the population the SOE caters to, competition in the industry and/or requirement to maintain a competitive edge influence IT servitization adoption. Meaning, if an SOE receives a high level of regulatory pressures as a result of the industry they are mandated by the government operate in, their requirement to adopt IT servitization could increase.

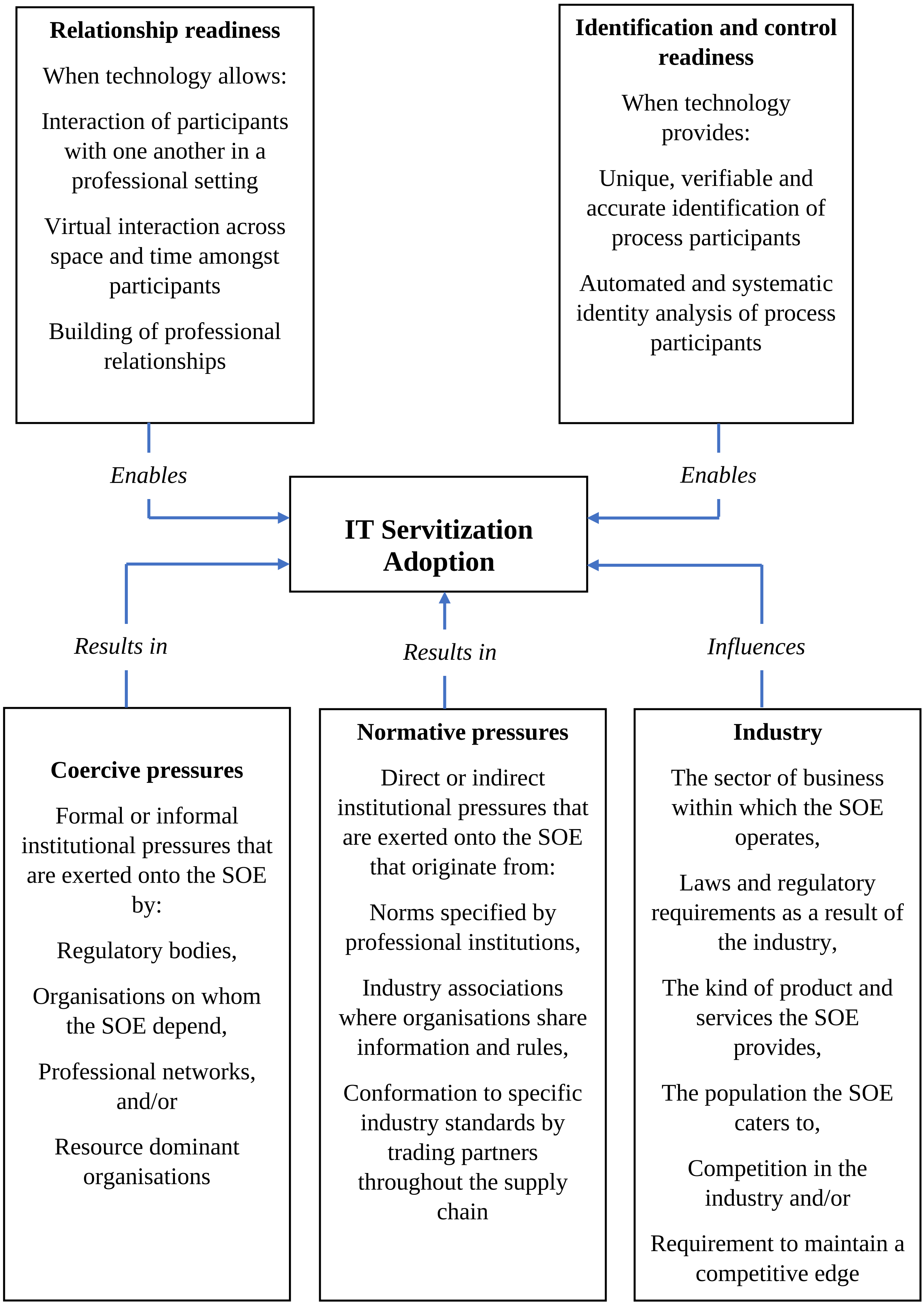

Figure 6.3 An Integrated Model for IT Servitization Adoption in South African State-Owned Enterprises

In summary, the study's results show that when technology allows for virtual interaction of participants in a professional setting (relationship readiness) as well as provide an automated process that uniquely and accurately verifies the identity of process participants (identification and control readiness), SOEs are enabled to adopt IT servitization. Moreover, when coercive and normative pressures are exerted, formally or informally, directly or indirectly, through regulatory bodies, trading partners, professional associations, and organisations on which SOEs rely, SOEs adopt IT servitization. Furthermore, the industry, or the business sector within which the SOE operates, has an influence on their adoption of IT servitization.

6.4. Summary of the chapter

This chapter interpreted the main results from the research outcomes discussed in Chapter 5, as well as presented the integrated model for IT servitization adoption. The rest of the chapter interpreted both the significant and non-significant determinants that contribute to South African SOEs' adoption of IT servitization. The current study's results were compared to what has previously been observed in the field's literature. The interpretations reflected where the literature supported the results. Similarly, where inconsistencies with existing literature were found, a probable explanation for the inconsistencies was provided.

The next chapter summarises the overall research evaluation, contributions, limitations, and recommendations for further research, before concluding the thesis.

CHAPTER 7

RESEARCH EVALUATION, CONTRIBUTIONS, AND CONCLUSION

7.1. Introduction

The previous chapter presented the integrated model for IT servitization adoption and provided the main interpretations of the study's results based on the research findings. The significant and non-significant determinants that contribute to the adoption of IT servitization by South African SOEs were also discussed. This chapter evaluates the research and seeks to assess whether the study addresses what was purposed in the beginning. This chapter is organised as follows: a research overview is provided. This is followed by a revisiting of the primary and secondary questions, objectives, and an evaluation of the research's relevance. Following that, the practical, theoretical, methodological, and contextual contributions are discussed. Following that, limitations and future research directions are discussed. Closing the chapter, a summary of the study is provided, followed by the research conclusion.

7.2. Thesis overview

This thesis is divided into seven chapters, each of which lays the groundwork for and informs the study. Below is a synopsis of the chapters.

Chapter one introduced the study by defining key terms in the thesis title to help the reader gain a common understanding. The background to the research problem, as well as the study context and location, were also to be provided. The research problem and its formulation were also presented in the chapter. The current research was then placed within the context of existing literature by identifying knowledge gaps. Researchers such as Barrett and Davidson (2008) emphasised that, given the significant role that IT plays in servitization, it is surprising that the body of knowledge in this area has not significantly contributed to the growing debate about the role of IT in servitization. The purpose, goal, and objectives of the research were discussed. Furthermore, the study's limitations and the main underlying assumption that IT servitization adoption will continue to be an important strategic imperative for South African SOEs, validating the need for an integrated model. Finally, a summary of the thesis structure was provided.

Chapter two surveyed the scholarship in the general servitization area of research before narrowing in on servitization in IT. The literature survey revealed that IT servitization literature is widespread but somewhat ambiguous due to the various forms in which it manifests. There is a section that consolidates the various views and forms of IT servitization, as well as its adoption, in an effort to contribute to the literature in this area. The surveyed scholarship was primarily used to highlight current contributions by identifying gaps in current knowledge. Although claiming completeness for any literature review is difficult, this chapter of the thesis aimed to be as comprehensive as possible in the coverage of the literature in the identified criteria and place this study within the context of existing literature to understand why this area of research is currently relevant.

Chapter three presented the theoretical frameworks that were used as lenses for this study, namely the Technology, Organisation, and Environment (TOE) framework, Institutional theory, and Process Virtualization theory (PVT), as well as their limitations and justifications. The integration of the Institutional theory to analyse institutional pressures in the environmental context and PVT to analyse the technological contexts were incorporated into the well-established theoretical lens of TOE framework to understand why IT servitization is adopted with difficulty in South African SOEs. This chapter also discussed the research model, its associated hypotheses, and construct operationalisation.

Chapter four discussed the current study's research methodology using a research onion analogy to neatly unpack and explain the research methodology. The current study's positivistic philosophical orientation, deductive approach, quantitative method, survey technique, and correlational designs were discussed. In detail, aspects of research design where an overall methodology that aided the study in a systematic manner were discussed to enable the development of an integrated theoretical and practical model for IT servitization adoption in the chosen context. Data were collected through a self-administered Web-based questionnaire guided by De Leeuw, Hox and Snijkers (1999). The Web-based questionnaire produce a higher response rate when compared to paper-based questionnaires. Concerns about the sampling frame not perfectly matching the population were also raised. This is due to the fact that SOE IT departments change all the time, new IT professionals are hired while others leave, and it can take time for all of those changes to be reflected in all relevant systems. Similarly, some SOEs are formed, while others are merged or dissolved, resulting in a sampling frame that does not perfectly match the population. The chapter was concluded with a discussion of the study's time horizon, method limitations, and ethical considerations.

Chapter five began by presenting the discussions and interpretation of the results obtained from the survey. Data normality through skewness and kurtosis of the variables were analysed. This was followed by the descriptive statistics on demographics and constructs where frequency distribution then central tendency and dispersion of the constructs were discussed. Subsequently, the inferential statistics were analysed including the testing of the instrument used. Reliability through Cronbach’s alpha, validity through EFA and CFA to verify the factor structure of the variables was tested as well. Next, the eleven constructs were examined independently for a relationship to IT servitization adoption through Pearson correlation analysis. Thereafter, the presentation of the structural equation model followed by hypothesis testing. The model fit was evaluated though the use of thresholds and indices obtained from literature. The results of the hypotheses tests showed that out of the eleven that were tested, five were supported and six were accordingly rejected.

Chapter six presented the interpretation of results which were provided in Chapter 5. An integrated model for IT servitization adoption is then developed based on the interpretations. Both the significant and non-significant determinants that contribute to the adoption of IT servitization by South African SOEs were then subsequently discussed.

7.3. Relevance of the research

How relevant is the research theme to IS studies?

This study aimed to address the call made by researchers such as (Barrett & Davidson, 2008; Ilk, 2012; Sultan, 2014; Barrett, Davidson, Prabhu, & Vargo, 2015) to better theorise this emerging discipline, as more research is needed to examine servitization in the IT context. The use of multiple IS theories and foundations, which are typically used as lenses for this IS study, aided in the interpretation of the IT servitization adoption phenomenon and facilitated a comprehensive understanding of the determinants that influence IT servitization adoption in South African SOEs.

Is the population and unit of analysis appropriate for an IS study?

Individuals were used as the unit of analysis; that is, IT practitioners and executives who are familiar with or have insights into the inner workings of IT in the context of SOEs. Individuals were chosen as the unit of analysis because the study sought to explore and explain the determinants of IT servitization adoption from the perspective of the individual rather than the perspective of the organisation. The reason for this was to obtain a variety of perspectives rather than limit the study to a small number of informants, who are typically at middle to senior management levels for these types of studies. Individuals in the IT units at various levels of the SOEs provided the input required for this study.

Does the data collected support the context as well as the research outcomes?

The data was gathered from IT practitioners and executives who are acquainted with or have insights into the inner workings of IT in the context of SOEs. A questionnaire-based Web survey was used to test our research model, which was based on measurement items validated and developed from literature. The study's results indicate that the data collected was appropriate. Through data analysis and interpretation, an integrated theoretical and practical model for IT servitization adoption in South African SOEs was developed.

How relevant is the research topic to IS researchers and practitioners?

The study was problem conscious when selecting the research topic. As discussed in the current study's problem formulation section, Opresnik and Taisch (2015) observe the prevalence of servitization as a business strategy across industries. This has enabled organisations to maintain their competitive advantage in the face of increasing product commoditisation by focusing on service-led growth (Salonen, Saglam & Hacklin, 2017).

Can the outcomes of the research be used by practitioners?

This study can be applied in the practical IS world. The outcomes may be used to provide practitioners with insights in to IT servitization adoption by providing a model that talks to their environment with respect to understanding the adoption determinants which positively or negatively affect their IT servitization adoption venture so that they may pro-actively manage them where necessary. The model therefore provides the “know what” and the “know why” within the South African SOE context for practitioners.

Is the writing style of the thesis appropriate for both IS practitioners and academics?

The thesis was written in simple English with as little jargon as possible to allow both IS practitioners and academics to easily understand it. The language is neither overly casual nor overly formal. To facilitate a common understanding with the reader, the first chapter of the study included definitions of terms in the thesis title. The first chapter also includes an overview of the thesis structure, as well as explanations of the objectives of each of the seven chapters. Each chapter also includes an introduction and a summary section for practitioners who only want the highlights. To avoid losing the reader who is unfamiliar with the context, the background to the research problem was also provided, along with the study context and location.

7.4. Contributions of the thesis

This study provides important results for academics and practitioners on the current determinants that influence IT servitization adoption in South African SOEs. The following are the thesis' contributions to practice, theory, methodology, and context:

7.2.1. Contributions to Practice

The thesis provides practitioners with insights to IT servitization adoption through a model that has been posited. The model lays out the adoption determinants that could positively or negatively affect IT servitization adoption endeavours. The model may, therefore, help practitioners pro-actively manage the adoption determinants where necessary.

7.2.2. Contributions to Theory

A group of scholars (e.g., Chesbrough, 2005; Chesbrough & Spohrer, 2006; Spohrer & Maglio 2008) have been cultivating the term “Service Science, Management, and Engineering” (SSME) as a scientific discipline in order to promote service science research. Spohrer and Kwan (2009) also mention the rapid growth of the global service economy and emphasise that the main challenge in this area of research is the integration of multiple disciplines to create a new and unique service science. The research area of IT servitization has received little attention in the IS field of study.

Barrett and Davidson (2008) observe that, in comparison to other disciplines, the IS discipline has made little contribution to the development of this growing area of research in the literature. Furthermore, Barrett and Davidson (2008) emphasise that, given the significant role that IT plays in servitization, it is surprising that the body of research in this area has not significantly contributed to the growing debate about the role of IT in servitization. This study accepts the challenge of better theorizing this emerging discipline and agrees that more research in the IT context for servitization is required.

As the academic literature has yet to adequately examine this area, the study makes a theoretical contribution to the IS field of research by explaining the determinants of IT servitization adoption and by presenting an integrated model. This study investigated IT servitization adoption from the Technology Organisation Environment framework (Tornatzky & Fleisher, 1990) and triangulated it with the Institutional Theory (DiMaggio & Powell, 2000) and Process Virtualization Theory (DiMaggio & Powell, 2000). (Overby, 2008).

This approach has not been implemented, particularly in the context of South African SOEs. This study thus bridged the knowledge gap in the existing theory by triangulating theories, which had not previously been applied to understanding why IT servitization is or is not implemented in South African SOEs. The integrated model developed in the current study adds to the body of knowledge and is available for scholars to use in order to further investigate and improve this field of study.

7.2.3. Contributions to Research Methodology

Research philosophy; IS studies could take an interpretive or positivist stance in terms of philosophy. The study employed a positivist philosophy in conjunction with a quantitative survey to investigate why IT servitization is or is not implemented in South African SOEs. The deductive process was used to propose a theory about IT servitization adoption, which was then narrowed down into eleven hypotheses for which data was collected to enable hypotheses testing and finally used to prove or disprove the theory for adoption by South African SOEs through regression analysis. The findings supported five hypotheses and refuted six others. As a result of the method used, the results also revealed that, while other determinants were insignificant, they did show a positive relationship with IT servitization adoption via Pearson's correlation. This study made additional contributions to methodology, which are listed below.

Unit of analysis; Individuals were the unit of analysis in this study; that is, IT practitioners and executives who are familiar with or have insights into the inner workings of IT in the context of SOEs. Individuals were chosen as the unit of analysis because the study sought to investigate and explain the determinants of IT servitization adoption from the perspective of the individual rather than the perspective of the organisation. The organisations' point of view has some disadvantages, such as the narrow top-down data collection approach, which underrepresents some factors while overrepresenting others because informants chosen by organisations to represent them tend to be at higher management levels. According to Asatiani (2015), when researchers collect data, IT professionals are in the minority of informants, with top management in the majority and other members of the organisation excluded. The current study bridged that gap by being inclusive, thereby contributing to the method by bringing in new voices in this field. IT practitioners and executives, including Chief Information Officers, IT directors, IT/IS managers, business analysts, project managers, IT architects, IT administrators, and other IT-related specialists, were surveyed for their opinions.

Data collection technique; in reality, most researchers rarely achieve a 100% response rate (Taherdoost, 2016). Given that South African SOEs are geographically dispersed across the country's nine provinces, the self-administered Web-based questionnaires allowed the study to reach a larger number of participants. To encourage greater participation, the study employed a low-cost, simple-to-implement data collection method, which proved beneficial to the study.

Data analysis strategy*;* The use of multiple regression technique which was used to further test the different hypotheses further to the simple correlation performed through Pearson’s correlation. This enabled for prediction of the dependent variable i.e., IT servitization adoption using the independent variables also known as the modelling of causal relationships. This was a critical input to the integrated model that was created, as shown in Chapter 6 Figure 6.3.

Factor analysis*;* Measurement of a model can be achieved using three methods, namely: the exploratory factor analysis (EFA) method, confirmatory factor analysis method (CFA) and the hybrid method (Ahire & Devaraj, 2001). The use of both EFA and CFA approach to assess the measurement model further enriched this study. EFA allowed the researcher to explore and generate a model from the set of constructs then CFA to verify the factor structure of the observed variables and assess the measurement model. The use of the hybrid model further allowed the researcher to reduce the measurement error and determine the model fit as well as statistically test the hypothesis through SEM which tested IT servitization adoption theoretical model.

7.2.4. Contributions to Context

The need to study why IT servitization is adopted in the context of South African SOE is important. Until now, there hasn’t been studies that have focused particularly on exploring and explaining determinants which influence the adoption of IT servitization at an individual level in the local SOE’s context. The benefit of conducting the study at an individual level has brought forward the voices and opinions of practioners in the field who have hands on experience in SOE’s to be heard , rather than just a few voices at executive and senior management levels of the organisation, as would have been the case if the study had been conducted at an organisational level.

With the insights gained from this study, there will be a better understanding of why the identified determinants may influence SOEs to adopt IT servitization in depth, as a result of data collected from a variety of participants with the SOEs. In addition, SOEs can predict or understand their industry influencers and identify the most appropriate adoption strategy in their context, as opposed to relying on international studies, which may fail to account for the local context and unique nuances.

Coercive and normative pressures on SOEs brought on by industry associations, as well as competitive pressures, have been identified as important determinants of IT servitization adoption, alongside other previously mentioned determinants. Thus, with the knowledge gained from this study, policymakers can play an important role in developing laws and regulations to reduce restrictions and assist SOEs in their efforts to adopt IT servitization in the South African context.

This study remains important in the South African context, as President Cyril Ramaphosa stated in his State of the Nation Address in 2018 that revitalisation of SOEs is required due to the important role they play in the economy. Furthermore, IT continues to be a driver of efficiencies in SOE business operations and has a relatively large budget because it is regarded as critical in driving the fourth industrial revolution.

7.2.5. Limitations of the study

As it understood, no study is without limitations. The study's limitations are influences that are beyond the researcher's control and impose constraints on the researcher's methodology and conclusions (Simon, 2011). The following section discusses the study's limitations.

Scope and context - some of the limitations of this study stem from the fact that it is limited to South African SOEs. To address this limitation, the scope of the survey of scholarship is not limited to South African literature, and thus reference to the global context is used to provide a broader lens through which to understand this emerging phenomenon.

Chosen definition - the literature review for Servitization was based on the definition presented by Vandermerwe and Rada (1988). This definition was written over two decades ago, and while the scientific research community broadly accepts it, it may need to be revised to incorporate technological aspects that have emerged in the field of servitization. To address this limitation, other definitions, such as tertiarization by Leo and Philippe (2001) and servicizing by Rothenberg (2007), were considered for this study but were found to add no real value to the chosen definition because, despite their different terminology, they still mean the same thing.

Population - a limitation of this quantitative study is the access to the study population i.e. practitioners working in South African State-Owned Enterprises. The total number of SOEs in the national and provincial spheres of government at the time of the study was 277, but there is no database with comprehensive information pertaining to numbers employed in the IT departments of the respective SOEs and contact details of the population. Furthermore, the number of South African SOEs is constantly changing. Some are created, while others merge or dissolve. Additionally, IT professionals join while others leave their respective organisations. This limitation is beyond the researcher's control.

Time horizon - another limitation of this study is time. It is true that a study conducted over a specific time horizon is a snapshot of the conditions that existed at the time. Despite the fact that a cross-sectional time horizon is used, the researcher acknowledges that a longitudinal time horizon could yield more significant results. This limitation, however, has no bearing on the study's outcome because the study's goal is not to examine changes in data gathered over time.

Limited prior studies – A lack of prior research studies or literature in IT servitization adoption may also be a potential limitation of this study. While some may see a lack of prior or current literature as a potential limitation, the researcher saw it as an important indication of a need for additional research in this area, thus confirming the need for this study.

7.5. Suggestions for Further Research

Future research could proceed to look into several areas. The first could be a study similar to this one conducted in the South African private sector to see if different determinants emerge. Second, conduct cross-industry or cross-sector comparisons. Within these various contexts, there should be some differences in the determinants of IT servitization adoption. Third, the impact of IT servitization on SOEs has not been fully investigated; future research should look into this.

Finally, longitudinal studies should also be conducted in the future to assess how the changes in regulations such as South Africa’s (POPI) Act, which was scheduled to take effect from 1 April 2020, however, due to the coronavirus outbreak in the country, was delayed (McKane, 2020). These longitudinal studies could reveal the impact of such regulations on IT servitization adoption in various contexts when they go into effect.

Overall, given the dynamic nature of the IS field of study, the study acknowledges that despite the efforts to provide a comprehensive study, there are some determinants for IT servitization adoption that may possibly be significant but were not tested. Thus, future studies should look more into the use of other theoretical frameworks that have been developed especially from the service sciences field to investigate this emerging IT servitization phenomenon.

7.6. Chapter summary

This chapter assessed whether or not the study met the objectives and, ultimately, the goal established in the first chapter. This chapter demonstrated that the objectives and goals outlined in the first chapter of the current study were achieved. The study's goal of developing an integrated theoretical and practical model for IT servitization adoption in the context of South African SOEs was achieved.

The chapter also assessed the study's relevance within the field of information systems research and practice. The contributions to practice, theory, method, and context were then discussed in order to assess value. Suggestions for future research were then discussed. Finally, the thesis conclusion is presented next.

7.7. Thesis Conclusion

Adoption of IT servitization is still in its infancy within South African state-owned enterprises, so the relevance of this thesis is in explaining the adoption problem and challenges. IT servitization will continue to be a critical strategic imperative for South African SOEs, confirming the need for and importance of an integrated model for IT servitization adoption, which this study now provides.

Overall, as the National Development Plan suggests, technology will be the most important driver in South Africa's plan to eradicate poverty and reduce inequality by 2030 by growing an inclusive economy with mechanisms enabled by IT, such as ensuring citizens' access to high-speed, low-cost international bandwidth. The South African National Development Plan - 2030 envisages:

> *"an ecosystem of digital networks, services, applications, content, and devices that will connect public administration to the active citizen; promote economic growth, development, and competitiveness; drive the creation of decent work; underpin nation-building and strengthen social cohesion; and support local, national, and regional integration. By 2030, the government will make extensive use of ICT to engage with and provide services to citizens. All South Africans will be able to use core ICT services and enjoy access to a wide range of entertainment, information and educational services. The e-strategy collaborations between the state, industry and academia will stimulate research and innovation, and promote local content production and multimedia hub establishment."* (National Development Plan, 2012).

This thesis responded to the above call. It adds to the body of knowledge in theoretical, practical, methodological, and contextual ways, so that academics, policymakers, and practitioners can use this integrated model to guide their decisions. The thesis has also demonstrated that the triangulation of three theories is invaluable as a lens for addressing the research problem. The model reveals why IT servitization is adopted in South African SOEs as well as explaining the necessary determinants.

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Appendices

Appendix A: Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Chuene

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H19/08/04**
PROJECT TITLE	An intergrated model for IT servitization adoption in South African state-owned enterprises
INVESTIGATOR(S)	Mrs P Chuene
SCHOOL/DEPARTMENT	School of Economic and Business Science/
DATE CONSIDERED	16 August 2019
DECISION OF THE COMMITTEE	Approved
EXPIRY DATE	03 November 2022

DATE 04 November 2019 **CHAIRPERSON** J. Knight
(Professor J Knight)

cc: Supervisor : Dr R Kekwaletswe

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature

11 / 11 / 2019
Date

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix B: South African Enterprises Industries

SCHEDULE 1

The new National Small Enterprise Act thresholds for defining enterprise size classes by sector, using two proxies

Column 1	Column 2	Column 3	Column 4
Sectors or sub-sectors in accordance with the Standard Industrial Classification	**Size or class of enterprise**	**Total full-time equivalent of paid employees**	**Total annual turnover**
Agriculture	Medium	51 - 250	≤ 35,0 million
	Small	11- 50	≤ 17,0 million
	Micro	0 – 10	≤ 7,0 million
Mining and Quarrying	Medium	51 - 250	≤ 210,0 million
	Small	11- 50	≤ 50,0 million
	Micro	0 – 10	≤ 15,0 million
Manufacturing	Medium	51 - 250	≤ 170,0 million
	Small	11- 50	≤ 50,0 million
	Micro	0 – 10	≤ 10,0 million
Electricity, Gas and Water	Medium	51 - 250	≤ 180,0 million
	Small	11- 50	≤ 60,0 million
	Micro	0- 10	≤ 10,0 million
Construction	Medium	51 - 250	≤ 170,0 million
	Small	11- 50	≤ 75,0 million
	Micro	0- 10	≤ 10,0 million
Retail, motor trade and repair services.	Medium	51 - 250	≤ 80,0 million
	Small	11- 50	≤ 25,0 million
	Micro	0 – 10	≤ 7,5 million
Wholesale	Medium	51 - 250	≤ 220,0 million
	Small	11- 50	≤ 80,0 million
	Micro	0 – 10	≤ 20,0 million
Catering, Accommodation and other Trade	Medium	51 - 250	≤ 40,0 million
	Small	11- 50	≤ 15,0 million
	Micro	0 – 10	≤ 5,0 million
Transport, Storage and Communications	Medium	51 - 250	≤ 140,0 million
	Small	11- 50	≤ 45,0 million
	Micro	0 – 10	≤ 7,5 million
Finance and Business Services	Medium	51 - 250	≤ 85,0 million
	Small	11- 50	≤ 35,0 million
	Micro	0- 10	≤ 7,5 million
Community, Social and Personal Services	Medium	51 - 250	≤ 70,0 million
	Small	11- 50	≤ 22,0 million
	Micro	0 – 10	≤ 5,0 million

Lindiwe D Zulu, MP
Minister of Small Business Development
Date: 24/02/2019

2

Initial

Appendix C: Factor extraction using Principle Component Analysis (PCA)

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10,471	25,538	25,538	10,471	25,538	25,538	4,170	10,170	10,170
2	3,945	9,623	35,161	3,945	9,623	35,161	3,862	9,419	19,590
3	2,901	7,075	42,236	2,901	7,075	42,236	3,827	9,335	28,925
4	2,222	5,419	47,654	2,222	5,419	47,654	3,289	8,022	36,947
5	2,088	5,093	52,748	2,088	5,093	52,748	2,925	7,135	44,081
6	1,654	4,035	56,782	1,654	4,035	56,782	2,757	6,724	50,806
7	1,538	3,750	60,532	1,538	3,750	60,532	2,531	6,174	56,979
8	1,393	3,399	63,931	1,393	3,399	63,931	1,879	4,582	61,561
9	1,249	3,046	66,977	1,249	3,046	66,977	1,582	3,860	65,421
10	1,126	2,746	69,723	1,126	2,746	69,723	1,422	3,469	68,890
11	1,028	2,508	72,231	1,028	2,508	72,231	1,370	3,342	72,231
12	,914	2,230	74,461						
13	,883	2,155	76,616						
14	,796	1,940	78,556						
15	,758	1,849	80,406						
16	,677	1,652	82,058						
17	,657	1,603	83,660						
18	,610	1,488	85,148						
19	,590	1,439	86,587						
20	,519	1,266	87,853						
21	,480	1,170	89,023						
22	,471	1,148	90,171						
23	,452	1,103	91,274						
24	,369	,900	92,175						
25	,350	,855	93,029						
26	,340	,830	93,859						
27	,316	,771	94,630						
28	,286	,699	95,329						
29	,275	,671	96,000						
30	,255	,621	96,621						
31	,231	,563	97,183						
32	,217	,528	97,711						
33	,183	,445	98,157						
34	,151	,368	98,524						
35	,137	,334	98,858						
36	,117	,286	99,144						
37	,111	,271	99,415						
38	,073	,177	99,593						
39	,069	,169	99,762						
40	,065	,158	99,920						
41	,033	,080	100,000						

Appendix D: Questionnaire

An Integrated Model for IT Servitization Adoption in South African State-Owned Enterprises

Page 1

Dear Potential Participant,

Due to your profession and experience in the IT field, you have been identified as a suitable participant in a short research survey. The purpose of the short survey is to explore and explain the determinants that influence the adoption of IT servitization in South African State-Owned Enterprises(SOEs).The results of the survey is reported in an aggregate form, therefore, ensuring participant's anonymity and confidentiality; That is, your name and other identifying information are not required nor displayed. The data from the short survey are held securely and are not made available to anyone else but the researcher and the survey supervisor. Participation in the survey is voluntary although invaluable.

IT servitization refers to an evolution of making IT a service and organisations emphasizing customer-oriented service in the delivery of IT solutions to business. This signifies transition from traditional models of ownership where physical assets such as data centres, storage and servers were an important determinant for accessing high-end resources and applications to current models of access to services on-demand. IT servitization adoption is measured considering its multiple forms, namely: IT outsourcing, virtualization and cloud computing.

If you have any questions about the research, please feel free to contact my research supervisor whose details are listed below. This study will be written up as a research report which will be available online through the university library website. If you have any queries, concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (non-medical), telephone + 27 11 717 1408, email: Shaun.Schoeman@wits.ac.za

Yours sincerely,
Palesa Chuene
email: 432649@students.wits.ac.za
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School of Economic and Business Sciences, University of the Witwatersrand, Johannesburg 2050

1. **I have read and understood the information provided above and I now consent to voluntarily participate in the study.** *

- ◯ yes
- ◯ no

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Please indicate the extent to which you agree or disagree with the following statements:

Section A: Independent Variable - Technological context

2. Sensory readiness

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is important for me to physically inspect products before purchasing them.	◯	◯	◯	◯	◯
I like to see the products before purchasing them.	◯	◯	◯	◯	◯
I like to touch the products before purchasing them.	◯	◯	◯	◯	◯
I like to hear the products before purchasing them.	◯	◯	◯	◯	◯
I like to smell the product before purchasing them.	◯	◯	◯	◯	◯

3. Relationship readiness

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is important for me to have a relationship with the seller when purchasing a product or service.	◯	◯	◯	◯	◯
I consider my relationship with the seller when purchasing a product or service.	◯	◯	◯	◯	◯
I would like to have a relationship with the seller when purchasing a product or service.	◯	◯	◯	◯	◯
My relationship with the seller when purchasing a product or service is not important.	◯	◯	◯	◯	◯

4. Synchronism readiness

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
On the day that I place an order for a product or service,I like to take care of all purchasing-related activities.	◯	◯	◯	◯	◯
I like to take care of all purchasing-related activities a week or more later after placing an order for a product or service.	◯	◯	◯	◯	◯
After I purchase a product or service, I would like to get it on that day or the next.	◯	◯	◯	◯	◯
Waiting for a week or more to receive a product or service after purchase is acceptable.	◯	◯	◯	◯	◯

5. Identification & control readiness

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Identification of people in a virtual process is important to me.	◯	◯	◯	◯	◯
Being able to track and monitor others' behaviour and activities conducted in a virtual process is important to me.	◯	◯	◯	◯	◯
I believe it is possible that people can hide their identities in processes that are virtual.	◯	◯	◯	◯	◯
I believe that virtual process participants can be properly identified.	◯	◯	◯	◯	◯

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Section B: Independent Variable - Organisational context

6. Top management support

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Top management sponsorship is a significant factor in successful adoption of IT Servitization.	◯	◯	◯	◯	◯
Top management support is a significant factor in the successful adoption of IT servitization.	◯	◯	◯	◯	◯
The implementation of initiatives to servitize IT require support from top management.	◯	◯	◯	◯	◯
The acceptance of initiatives to servitize IT require support from top management.	◯	◯	◯	◯	◯
Top management support can help overcome possible resistance in the adoption of IT Servitization.	◯	◯	◯	◯	◯

7. Firm size

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The number of employees in an organisation should influence the decision to adopt IT Servitization.	◯	◯	◯	◯	◯
The number of employees who receive IT service should influence the decision to adopt IT Servitization.	◯	◯	◯	◯	◯
The frequency of IT service requests should influence the decision to adopt IT Servitization.	◯	◯	◯	◯	◯

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Section C: Independent Variable - Environmental context

8. Coercive pressures

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Laws and regulations that have to be adhered to by an organisation should influence their IT service model.	◯	◯	◯	◯	◯
Laws and regulations that have to be adhered to by an organisation should influence their IT service delivery.	◯	◯	◯	◯	◯
Pressures from the government directives should influence the organisation's decision to servitize IT.	◯	◯	◯	◯	◯
External parties such as suppliers and customers should influence the organisation's decision to servitize IT.	◯	◯	◯	◯	◯

9. Mimetic pressures

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Experienced vendors and consultants should provide advice on IT Servitization adoption.	◯	◯	◯	◯	◯
The need to remain competitive and/or to stay ahead of industry peers should influence decision to servitize IT.	◯	◯	◯	◯	◯
Industry leaders are always followed with regards to new IT trends or emerging technologies.	◯	◯	◯	◯	◯
Environmental uncertainties and rapid change in the technology market forces IT Servitization.	◯	◯	◯	◯	◯

10. Normative pressures

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Professional certifications should be considered when recruiting IT professionals.	◯	◯	◯	◯	◯
IT professionals should have formal IT qualifications and/or IT certifications.	◯	◯	◯	◯	◯
IT professionals should continuously be trained to remain current.	◯	◯	◯	◯	◯
Professionalisation of the IT industry should regulate IT servitization. (Professionalisation is when collective members of an occupation define the standards and methods of their work).	◯	◯	◯	◯	◯

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Section D: Independent Variable - Organisational context

11. Mandate

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In my view, the organisation's mandate require creation and collection of high amount of data.	◯	◯	◯	◯	◯
In my view, the organisation's mandate require maintenance and storage of high amount of data.	◯	◯	◯	◯	◯
In my view, the organisation's mandate require publication of relevant and on-demand information.	◯	◯	◯	◯	◯
In my view, authority to sanction and the related sanctioning activities of the organisation should influence the adoption of IT servitization.	◯	◯	◯	◯	◯

12. Industry

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The kind of product and services offered by an organisation should dictate the adoption of IT servitization.	◯	◯	◯	◯	◯
The population the organisation caters to should dictate whether IT servitization is adopted or not.	◯	◯	◯	◯	◯
The competition in the industry where the organisation operates should influence the need to servitize IT.	◯	◯	◯	◯	◯
The industry laws and regulations where the organisation operates should influence the need to servitize IT.	◯	◯	◯	◯	◯

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13. IT Servitization

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I currently practise IT servitization on a regular basis.	◯	◯	◯	◯	◯
In the past I practised IT servitization on a regular basis.	◯	◯	◯	◯	◯
I currently practise IT servitization sometimes.	◯	◯	◯	◯	◯
In the past I practised IT servitization sometimes.	◯	◯	◯	◯	◯

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Section E: Demographic Information

14. Job Title

Please indicate your Job Title... ▾

15. Industry

Please indicate your Industry... ▾

» **Redirection to final page of SurveyHero (formerly eSurveyCreator)**