AGILE INNOVATION: INNOVATING WITH ENTERPRISE SYSTEMS

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Keywords

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Abstract

In an era of technological advances and hyper-competition, it is no surprise that the phenomenon of innovation enabled through information systems to achieve competitive parity is a core topic of interest for scholars and practitioners. While there is a rich body of literature on innovation, much of the focus has been on uncovering the antecedents of innovation, or on the diffusion of innovation. Relatively little attention has been given to the complex process of attaining innovation, especially innovations enabled through enterprise systems (ES). Understanding the process of innovation attained through ES is especially critical given the contradictory beliefs surrounding the role of ES in attaining innovation.

While much of the literature acknowledges the role of ES in innovation, a considerable number of studies question this view and highlight the rigidity of ES. Considering the substantial investments made by organisations in implementing and managing ES and the fact that these systems are rarely replaced or retired, it is important to understand how contemporary organisations attain innovation through their ES. Further, the advent of mobile technologies, cloud computing and business intelligence (referred as digital technologies) has also impacted the way organisations seek innovation through ES. Thus, this study seeks to address the limited understanding on innovating through ES and digital technologies.

A qualitative study was conducted, comprising an integrated approach of deduction phase followed by an induction phase as the research methodology. The study involved the analysis of data collected through nine case organisations. The study attempts to understand how organisations innovate through ES and digital

technologies and also to identify the new advanced role of ES in supporting innovation.

The results indicate that ES facilitates a new way of attaining innovation using integration of systems, referred to in this study as "agile innovation," which consists of characteristics that differ from existing innovation typologies (i.e. incremental and radical innovation). Such a new way of innovation is enabled through the orchestration of multiple components whereby the innovation enables and triggers IT resources and organisational stakeholders such as executive-level IT managers and line-of-business managers. The study identifies the specific characteristics of agile innovation and explains the process of attaining agile innovation through a meta-theory. Further, as a theoretical extension to the meta-theory, the study introduces new modes of orchestration, providing valuable insights for academics and practitioners.

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List of Abbreviations

CIO	- Chief Information Officer
CTO	- Chief Technology Officer
ERP	- Enterprise Resources Planning
ES	- Enterprise Systems
IS	- Information Systems
IT	- Information Technology
LOB	- Line of Business
UHREC	- University Human Research Ethics Committee

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signature:

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Chapter 1: Introduction

"*If you want something new, you have to stop doing something old.*"

— Peter F. Drucker

Innovation has long been a topic of interest among academics and practitioners as a result of the never-ending competition, market expectations and the pace of technological advancements (Damanpour 1987; Nagji and Tuff 2012). In the last decade or so, the emphasis on innovation has undergone considerable change in most industries (Latzer 2009; Nambisan 2013). One simple yet visible change is that innovation has changed from being a priority of those who wear a lab coat to being a priority of senior executives worldwide (Maxwell 2009). Innovation has become much more open, global and collaborative in nature; it involves a diverse network of partners and emphasises distributed innovation processes (Yoo et al. 2010). Regardless of the industry sector, many senior executives have embraced new technologies in order to innovate in the competitive market (Harrison et al. 1997; Kim et al. 2012).

Organisations' use of information technology (IT) as a source of innovation has been documented since the 1990s (Swanson 1994). For example, the technology advancements made during the past few years have assisted organisations to innovate through enhanced decision-making capabilities (Brynjolfsson 2011; Huber 1990), increased customer connectedness (Bharadwaj et al. 2013; Kumar et al. 2010), increased number of channels for reaching customers/suppliers (Bharadwaj 2000; Kleis et al. 2012) and enhanced communication facilities (Olesen and Myers 1999; Youmans and York 2012). In particular, there has been some evidence of organisations attempting to use enterprise systems (ES) to increase the efficiency and effectiveness of business

processes, products, service development, delivery and administrative functionalities (Srivardhana and Pawlowski 2007). The introduction of ES creates a 'radical change' embedding the idea of possible continuing innovation capabilities through the system (Kraemmerand et al. 2003). The majority of past studies discuss the influence and importance of the features and functions of ES that bring forth operational flexibility (Karimi et al. 2007), business process improvements (Grover and Segars 2005), productivity (Shang and Seddon 2007), transparency (Akkermans et al. 2003), innovation (Srivardhana and Pawlowski 2007) and profitability (Romero et al. 2010; Staehr et al. 2012). Yet, the rigid and complex nature of ES has dashed the hopes for continuous innovation in many organisations and made the system a burden rather than an advantage (Kharabe et al. 2013; Kharabe and Lyytinen 2012).

The advancement of new technologies has changed the corporate technology landscape and has opened new pathways for organisations to innovate regardless of their access to resources (e.g. human and financial) relative to their counterparts (Nylén and Holmström 2015). In particular, after the dotcom crash, organisations are offered with enhanced functionalities in information, communication and connectivity technologies (Bharadwaj et al. 2013). These digital technologies are changing the business landscape enabling organisations to work globally disregarding the time, distance and the function (Bharadwaj et al. 2013; Kohli and Grover 2008; Sambamurthy et al. 2003). In the digital era for the survival in the competitive market, these digital technologies facilitate organisations different approaches to innovate (Pavlou and El Sawy 2010). Yet, the existing body of knowledge falls short in explaining the present trajectory of innovation through the use of digital technologies, which represents a new and different context. In line with these observations, the focus of this dissertation is on the innovation process

through the modern IT portfolio of ES and digital technologies. This chapter provides an overview of the research, with the structure of this chapter depicted in Figure 1.

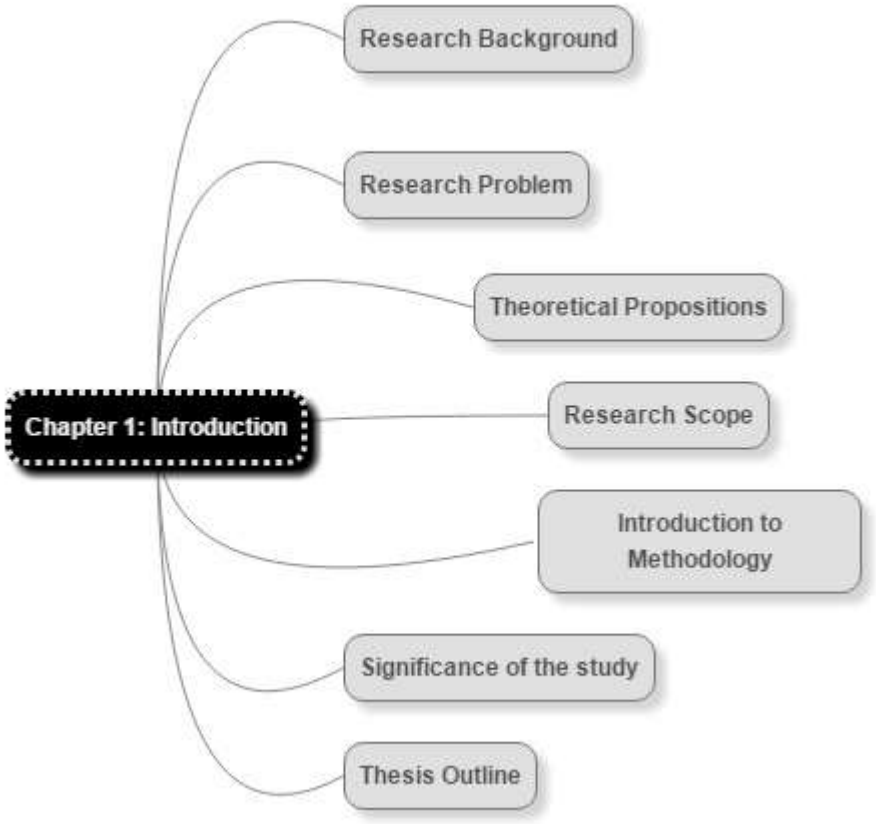

Figure 1: Thematic structure of Chapter 1

1.1 RESEARCH BACKGROUND

Information systems (IS) scholars have recognised ES as an enabler of innovation (Seddon et al. 2010; Srivardhana and Pawlowski 2007; Van den Bergh and Viaene 2013). The innate characteristics of ES such as integration, standardisation has enabled the organisations to innovate by offering increased knowledge capabilities (Srivardhana and Pawlowski 2007). Yet, the realization of ES capabilities depend on the integration mechanisms and collaboration among departments (Srivardhana and Pawlowski 2007). Since the 1990s, organisations have embraced these packaged applications expecting benefits through standardisation, process orientation, integration, corporate governance and platform flexibility (Gable et al. 2008; Seddon et al. 2010; Sedera and Gable 2010). Furthermore, ES purport to introduce best practices (Wagner et al. 2006), bringing radical changes to business processes (Kraemmerand et al. 2003; Liang et al. 2007). Several academic studies explicitly or implicitly recognise innovation as a major outcome or expectation of the advent of ES (Karim et al. 2007; Shang and Seddon 2007), which is often characterised as a 'radical change' (Kraemmerand et al. 2003) to business processes (Bingi et al. 1999) and management structures (Sasidharan et al. 2012) in the IS literature. However, scholars question the long-term value of ES for innovation (Davenport 2000a; Davenport et al. 2004; Dutta et al. 2014; Kemp and Low 2008; McAfee and Brynjolfsson 2008).

As Swanson and Dans (2000) explain, systems deteriorate over time and eventually are retired or upgraded. However, as Eden et al. (2014) point out, ES is rarely replaced or retired, emphasising the need for organisations to continuously innovate using ES. Studies also outline that organisations are often not ready for lifecycle-wide innovation through ES (Kemp and Low 2008; Lokuge and Sedera 2014a; Lokuge and Sedera 2014b; McAfee and Brynjolfsson 2008). Moreover, research on ES use (Burton-Jones and

Grange 2012; McLean and Sedera 2010) and ES benefits (Seddon et al. 2010) allude to the necessity for continuous innovation using ES. ES vendors and implementation partners are under growing pressure to deliver solutions that lead to lifecycle-wide innovation (Esteves 2009). ES clients are also under pressure to justify the heavy resource-intensiveness of ES, to manage skill shortages and to rationalise the continuous mandatory investments for upgrades (Srivardhana and Pawlowski 2007). Some scholars suggest that widely accepted ES implementation critical success factors could be considered for the entire lifecycle to facilitate innovation (King and Burgess 2006).

On the other hand, the effective use of ES is innately challenged by the systems' lack of flexibility (Kharabe and Lyytinen 2012). In 2007, the practitioner outlet, The Economist (in Kharabe and Lyytinen 2012), metaphorically describe ES as 'liquid concrete,' stating that "implementing SAP [a leading enterprise system] is like pouring concrete into a company." However, ES vendors eliminated some of the inflexible features of ES and enhanced openness of ES. As a result ES is now evolving to take a more salient role as a *technology platform* (Schenk 2015). The 'ES technology platform' is facilitating an ecosystem of third-party software products, services, technologies and suppliers to integrate with the ES, paving a new path for organisations to innovate (Ceccagnoli et al. 2012).

Since the mid-2000s, corporate IT has been presented with an opportunistic flux triggered by the growth in the consumerization of IT and the advent (and rapid adoption) of mobiles technologies, cloud computing and business intelligence. These changes have created an ecosystem of providers and suppliers of tools, techniques and practices, beyond the conventional boundaries (Adomavicius et al. 2008; Harris et al. 2012; Yoo et al. 2012), providing opportunities for organisations to reach their customers directly through corporate IT (Martín-Rojas et al. 2013). As such, the decisions related to

corporate IT consumption and strategy are no longer the exclusive responsibility of IT managers. Recent studies and anecdotal evidence suggest that end-users actively demand IT applications that can be consumed through mobile technologies, the cloud and this usage is contributing to strategic IT (Kopetzky et al. 2013; Leeson 2013; Park and Ryoo 2013).

Cloud computing, mobile technologies and business intelligence (including big data)—referred to collectively as 'digital technologies'—denote a broad and evolving set of models of highly distributed computing and related solutions that rely on open, heterogeneous, ubiquitous network services and associated protocols (Chee and Franklin Jr 2010). The digital technologies are defined as combinations of information, computing and connectivity technologies in the current era. Similar references have been made in Nambisan (2013), Yoo et al. (2012), Nylén and Holmström (2015) and Bharadwaj et al. (2013). Many scholars and practitioners argue that digital technologies are transforming business processes and practices in a new way that enable new types of innovation processes (Berman et al. 2012; Nylén and Holmström 2015; Stahl et al. 2012). Tiwana et al. (2010), for example, highlight the importance of the integrative nature of digital platforms such as mobile technologies for creativity, innovation and growth. Although studies have identified the benefits of end-to-end core business process coverage through ES (Palaniswamy and Frank 2000), anecdotal evidence suggests that organisations employ digital technologies at the functional level. This is a substantial departure from the traditional corporate software foundation (Davenport 2000a), and marks a new era of corporate computing.

1.2 RESEARCH PROBLEM

The "importance of innovation to organisational competitiveness" (Wolfe 1994, p.405) has been acknowledged by many scholars (e.g. Teece 1992). This point of view is particularly relevant in the current era, when the use of digital technologies within organisations is found to foster continuous innovation (Nylén and Holmström 2015; Yoo et al. 2012). Thus, it is no surprise that IS scholars are increasingly focusing on understanding the organisational innovation that is triggered and facilitated by digital technologies.

The term 'innovation' in this research refers to 'organisational innovation' which encompasses product, process, administrative and technological innovations that emerge due to the use of technologies such as ES and digital technologies within the organisational boundaries. This study subscribes to the definition of organisational innovation proposed by Crossan and Apaydin (2010, p. 1155) as the "production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems." This definition provides a generalised view of innovation, taking into account the innovation that takes place in everyday organisations. It goes beyond the definitions that ideate innovation as a "new-to-the-world" concept (e.g. Garcia and Calantone 2002). This definition captures internally-initiated innovations, as well as adopted (imitated) innovations. For the majority of common organisations dealing with common products or services, the term 'innovation' does not resonate with the new-to-the-world concept, as it would for technology or manufacturing innovators like Google, Apple Inc. or BMW. Thus, past innovation studies, typically measuring innovation through patents (Xue et al. 2012), new products and new markets (Lyytinen and Rose 2003) or using Tobin's-Q

(Adams et al. 2006), have been criticised for lacking relevance to day-to-day innovation pursuits as the common business practices would rarely involve the creation of patents or even the allocation of dedicated research and development funds (Adams et al. 1992; Cordero 1990). Researchers (e.g. Lai et al. 2009; Lyytinen and Rose 2003) concur with the view that innovation need not be a totally new concept to the world and could even be considered as an imitation of something already used elsewhere, but new to the unit of adoption.

As such, this research studies innovation in relation to common business practices. For an organisation to be considered innovative in the present market conditions, it demands consideration of how the organisation faces challenging environments swiftly, effectively and mindfully (Swanson and Ramiller 2004). Furthermore, being innovative also means how ordinary organisations move quickly out of political and social turbulences (Melville et al. 2004).

Wolfe (1994, p.406) argues that given the "complex, context-sensitive nature of the phenomenon itself [innovation]," it is advisable for innovation researchers to focus on a particular stream of innovation, which can be related to: (i) the diffusion of innovation, (ii) the antecedents of an organisation's propensity to innovate, or (iii) the innovation process itself. While there is a strong tradition of research on the diffusion of innovation (Rogers 1995), the antecedents of innovation (Jansen et al. 2006), and even some aspects of organisational innovation (Camisón and Villar-López 2014; Damanpour 1991; Hage 1999), the existing body of knowledge falls short in explaining the black box of the innovation process (Swanson and Wang 2005) – how to innovate with ES in the presence of digital technologies.

Yoo et al. (2012) argue that the process of innovation itself has shifted dramatically in recent times, thus requiring a separate investigation. For example, with

the advancement of digital technologies the process of innovation has become faster, unstable, rapid and difficult to control and predict (Henfridsson et al. 2014; Nylén and Holmström 2015; Yoo et al. 2012). Digital technologies are redesigning the traditional innovation processes and enabling the organisations to carry out business functions across boundaries of time, distance, and function (Bharadwaj et al. 2013; Kohli and Grover 2008). As Bharadwaj et al. (2013) explain the innate characteristics of digital technologies facilitate the organisations to connect better with the stakeholders such as customers, vendors and employees. Further, scholars such as Henfridsson et al. (2014) and Nylén and Holmström (2015) concur with the idea that the advancement of the digital technologies facilitate new types of innovation processes.

ES is one of the largest corporate systems aim to streamline the majority of business processes and enhance the efficiency and effectiveness of the organisational processes (Kharabe et al. 2013). However, it is evident that even though these systems introduce radical changes in the organisation in the beginning, they impede the continuous innovation potential required to survive in the contemporary competitive business environment. In the recent volatile markets, organisations are keen to seek out opportunities to be agile (Tallon and Pinsonneault 2011). Especially, organisations focus on increasing efficiency, reducing costs and attaining higher productivity using their existing systems such as ES.

Researchers such as Aral et al. (2006) have empirically shown that ES has been a significant and causal source of increased productivity and efficiency in organisation. Moreover, ES initiatives are considered as the most lengthy and expensive IT projects of contemporary organisations (Markus et al. 2000; Scott and Vessey 2002). As Rettig (2007) states organisations end up spending hundreds of millions of dollars on ES. Thus,

there is no surprise that organisations turn to their existing ES in order to innovate in the competitive business landscape.

Another key reason for turning towards ES for attaining innovation is the technology platform itself. ES is increasingly viewed as the core technology platform in organisations, since they allow tools to be incorporated so that technology and data resources can be shared seamlessly (Tilson et al. 2010). Gawer (2009) recognises that ES acts as a building block, providing essential functions as a technological system. This technological system acts as a foundation upon which other complementary products, technologies or services can be developed. The widespread adoption of ES across industry sectors, geographical locations and the emergence of open platform architectures (e.g. the NetWeaver platform interface by SAP), further recognise ES as a dominant corporate technology platform (Gawer and Cusumano 2012). Moreover, adhering to the fundamentals of a platform (Gawer 2009; Tiwana et al. 2010), the ES technology platform facilitates an ecosystem of third-party software products, services and suppliers (Ceccagnoli et al. 2012). Yet, only a handful of studies have investigated ES as a technology platform.

The advent and proliferation of digital technologies have transformed the modern organisation from a single, monolithic ES-centric technology landscape, into a portfolio of IT with an eclectic collection of technologies (Altman et al. 2015; McAfee and Brynjolfsson 2008). Similar observations have been made in practitioner outlets as well (e.g. Brinker and McLellan 2014). They argue that contemporary organisations have a portfolio of IT and the companies are much eager to integrate digital technologies with ES to innovate and augment the functions of existing business processes. For example, Gawer and Cusumano (2012) observe that the openness of the ES leads organisations to integrate other technologies and innovate. The internal focus of the ES hinders the ability

of the organisations to innovate for the customer needs. Yet, the marriage between dynamic, external-focused (e.g. customers, vendors) technologies such as digital technologies opens up numerous pathways for organisations to innovate. For example, through integrating mobile applications with ES, organisations introduce new campaigns; provide novel support for stakeholders that introduce new business processes, practices and services to the organisation. Given the pervasiveness of ES in organisations, it is important to examine the innovation enabled by such ES and digital technologies. The amalgamation of digital technologies and ES provides superior customer experiences, superior employee experience and better connection with vendors. Further, organisations should leverage their collective resources in a consistent manner. According to Gartner, the worldwide corporate IT spending has reached $3.8 trillion in 2014 (Gartner 2015). Further, the advent of digital technologies has a substantial impact on organizations. Anecdotal evidences outline that digitization through digital technologies – business intelligence, cloud computing and mobile technologies – will make a substantial impact on the delivery of businesses and business models. It is estimated that digital initiatives will deliver annual growths and cost efficiencies of 10% or more in the next 3-5 years (Dobbs et al. 2015). As such organizations are provided with myriad opportunities to integrate digital technologies with traditional corporate systems to facilitate innovation.

In line with the aforementioned discussion, this study aims to understand how organisations innovate through the modern IT portfolio of ES and digital technologies deriving the following research question.

RQ: How do organisations innovate through the modern IT portfolio of ES and digital technologies[1]*?*

This research question encourages an understanding of the unique roles of ES and digital technologies in relation to organisational innovation. Further, it requires investigating the nature of innovation attained through the modern IT portfolio and the process of attaining innovation through the modern IT portfolio.

1.3 THEORETICAL PROPOSITIONS: ENTERPRISE SYSTEMS AND DIGITAL TECHNOLOGIES

The advancements in the technological landscape has changed the way organisations attain innovation through the existing technology portfolio (Nylén and Holmström 2015). According to Nambisan (2013, p.216) "innovation has become more open, global and collaborative in nature to involve a diverse network of partners and emphasising distributed innovation processes…All of these changes have significantly enhanced the importance and relevance of IT." Considering the innate characteristics of the contemporary technologies, a corporate IT portfolio consists of two main types of technologies: ES and digital technologies. ES is a corporate-wide large system that enables end to end business process integration. ES is costly and it requires specialized skills for implementing the system in the organisations. Even the upgrades of an ES incur a huge cost. Digital technologies on the other hand consist of characteristics as opposed to ES that offers organisations to innovate in the contemporary competitive market. As Nambisan (2013, p.216) highlights, digital technologies play an imperative role in

[1] Given the unwieldy terminology of 'Modern IT portfolio of ES and digital technologies', henceforth we use modern IT portfolio, where the inclusion of ES and digital technologies are assumed.

modern innovation and "are being embedded to an ever increasing range of products and services…thereby expanding the role and relevance of IT in any innovation."

Nambisan (2013) conceives the contemporary IT portfolio through the two primary roles of IT: (i) the role of IT as an operand resource, and (ii) the role of IT as an operant resource. An operand resource is a resource which enables an operation or act to produce an effect, while an operant resource triggers new actions. Although the notion of operant and operand resources provides a useful classification of technologies in an IT portfolio, how such triggers and enablers work together for innovation is yet to be discovered (an extended discussion of the application of operand and operant technologies for innovation is presented in Chapter 2).

1.3.1 Enterprise Systems and Innovation

Davenport (1998b, p.122) states that the embrace of ES "may in fact be the most important development in the corporate use of IT in the 1990s" highlighting the innovation potential of ES. The advent of ES introduces best practices that revolutionise the existing business processes and practices of an organisation (Karim et al. 2007; Wagner et al. 2006; Wu et al. 2005). Srivardhana and Pawlowski (2007, p. 54) highlight the innovation potential of ES, stating that ES provide "new opportunities to acquire knowledge from external sources, develop common cognitive structures among employees from different functional areas, and implement new routines and processes." Swanson (1994) and Fichman (2001) point out the innovation potential of ES by highlighting how such systems penetrate to the core business processes, triggering an array of interrelated innovations.

The advent of an ES triggers innovation in business processes, practices, products and services (Kraemmerand et al. 2003), opening a new era of computing in an organisation through integration (Bingi et al. 1999), process orientation (Bernroider

2013) and standardisation (Wagner et al. 2006). Considering these innate characteristics of ES, these corporate-wide systems can be viewed as operand IT resources (a detailed discussion is presented in Chapter 2). Referring to the two lifecycle phases proposed by Markus and Tanis (2000), namely, the shakedown phase and the onward and upward phase, the shakedown phase relates closely to radical innovation as it involves many disruptions to the organisational structures (Wagner et al. 2006), processes (Somers and Nelson 2003) and the normality of the business (Kraemmerand et al. 2003).

The onward and upward phase denotes a stable period with a continuing interest in the potential of the ES, aligning closely with the notions of incremental innovation (Latzer 2009). As Swanson and Dans (2000) explain, systems deteriorate over time and eventually must be retired or upgraded. Yet, since ES are rarely replaced or retired, organisations must actively seek innovation through their ES beyond the implementation phase (Eden et al. 2014).

Organisations attain incremental innovation by introducing new ES modules, making timely upgrades, adopting ES technologies, that lead to continuous business process improvements (Chua and Khoo 2011; Ng 2001). In general, such innovations do not represent radical innovation, but are classified as incremental innovation (Srivardhana and Pawlowski 2007). Zand and van Beers (2010) based on their empirical analysis suggest that the impact of ES on process innovation is stronger as ES adoption entails various process changes in the organisation. Further, ES provides vast process related information that can be later used for innovation using ES. The evidences of Zand and van Beers (2010) concur with the findings of Aral et al. (2006) where they suggest that ES is more difficult to implement, yet, a successfully implemented ES is more effective.

When analysing the literature, scholars adopt two contradicting schools of thought with regard to the innovation contribution of ES. Some scholars argue that ES facilitates innovation while some argue that ES hinders innovation (Srivardhana and Pawlowski 2007). Scholars (e.g. Kharabe et al. 2013; Kharabe and Lyytinen 2012) argue that the innate rigidity and complexity of ES advocates the hindering effects. The in-built processes and procedures can cause structural and procedural limitations that exhibits inertia and rigidity towards change (Zand 2011). Further, as ES is an organisation-wide system, the complexity of the system is high and it is difficult to update/manipulate the system (Davenport 2000b; Zand 2011; Zand and van Beers 2010). As a result it can be argued that ES hinder innovation (Gattiker and Goodhue 2000; Gattiker and Goodhue 2005; Robey et al. 2002).

On the other hand, some scholars argues that ES facilitates innovation through its capabilities such as it provides access to information and facilitates integration whereby it promotes collaboration (Lokuge and Sedera 2014b; McAdam and Galloway 2005; Schenk 2015; Zand and van Beers 2010). Leonard-Barton (1995) states that information and knowledge are essential elements in enabling innovation process in an organisation. ES offers the access to and flow of real-time and accurate information and also it facilitates idea generation (Seddon et al. 2010; Volkoff et al. 2004; Wagner et al. 2006). Further, ES enhances the problem solving and decision making capabilities that supports innovation (Seddon et al. 2010; Zand 2011; Zand and van Beers 2010). Scholars such as Srivardhana and Pawlowski (2007) highlight the potential of ES in increasing the absorptive capacity of organisation. This leads the organisations to acquire new knowledge and innovate (Kim 1998; Ko et al. 2005; Srivardhana and Pawlowski 2007; Volkoff et al. 2004).

1.3.2 Digital technologies and Innovation

The advent of digital technologies in the mid-2000s signifies an era of technology that epitomises flexible, easy-to-deploy and cost-effective IT solutions (Vodanovich et al. 2010). For organisations, the growth of digital technologies has provided an ecosystem of providers and suppliers of tools, techniques and practices beyond the conventional boundaries of traditional corporate IT (Adomavicius et al. 2008; Harris et al. 2012; Yoo et al. 2012). As Yoo et al. (2012) identify, digital technologies denote broad and evolving models of highly distributed computing and related solutions that rely on heterogeneous, ubiquitous network services and associated protocols (Chee and Franklin Jr 2010; McAfee et al. 2012).

The last decade has seen a substantial change in IT through the advent and mass proliferation of mobile technologies and analytic technologies, cloud computing and business intelligence (including big data). According to PwC (2012) there are four key technologies that have converged to drive innovation: social networking, mobile computing, analytics, and cloud computing. These technologies facilitate new ways to develop products and interact with stakeholders such as customers, vendors and employees. Contemporary organisations leverage these technologies to innovate and create value.

Digital technologies have begun to penetrate the corporate IT landscape in the past several years (Kirilenko and Lo 2013; Yoo et al. 2012) and have created novel opportunities for resource integration (Lusch and Nambisan 2014). IS scholars have studied this emergence and the impact of digital technologies on organisational strategies, structures and processes (Im et al. 2013; Tams et al. 2014). In particular, there is strong advocacy for the role of digital technologies in triggering innovation (Kleis et al. 2012; Kohli and Grover 2008; Nevo and Wade 2010). Researchers attribute the ability

of digital technologies to trigger innovation to its innate characteristics such as the ease of deployment (Armbrust et al. 2010), cost effectiveness (López-Nicolás et al. 2008), and the need for less specialised skills (López-Nicolás et al. 2008). These characteristics are the epitome of innovation-favouring technologies for which the factors that typically form innovation barriers, such as financial and human resources (e.g. specialised skills), are required at a minimal level (Nylén and Holmström 2015). Minimising such barriers has disrupted the traditional linear equation of technology and innovation, whereby innovation is no longer proportionate to the resource availability, providing organisations with an opportunity to innovate regardless of their access to resources.

Further, the use of digital technologies provides a rich user experience; as such, the innate characteristics such as the ease of use and ease of learning enhance the innovation adoption and diffusion (Nylén and Holmström 2015). This, in turn, increases the probability of achieving innovation through the digital technologies. For the traditional ES custodians, these digital technologies provide an alternative approach, as well as providing them the opportunity to embed such applications into their ES. As operant resources, such tools introduce new organisational arrangements, structures and processes, while at the same time increasing the risk of failure (Lusch and Nambisan 2014).

Two theoretical propositions are derived through the above discussion:

i. ES facilitates innovation and

ii. Digital technologies facilitate innovation.

Within each of these two propositions, this study analyses the type of innovation (e.g. radical, incremental), the innovation lead time, and whether the technology is an enabler or a trigger. Data was collected from pre-implementation and post-

implementation phases to compare the true impact of each technology on innovation. Although the propositions were individually assessed, a cross analysis of the cases and propositions led to rich observations in relation to how a contemporary IT portfolio enables innovation (a detailed discussion of the constructs of innovation is presented in Chapter 2).

1.4 RESEARCH SCOPE

The study builds a deeper understanding of how organisations innovate through ES in the presence of digital technologies. The term 'innovation' in this research refers only to 'organisational innovation' incorporating product, process, administrative and technological innovations that emerge due to the use of ES and digital technologies within the organisational boundaries. Chapter 2 presents a detailed discussion on innovation as part of the literature review.

Generally, considering the degree of newness, two main types of innovation are discussed in the literature: radical innovation and incremental innovation (Chang et al. 2014; Dewar and Dutton 1986; Lyytinen and Rose 2003; Norman and Verganti 2014). In this study, the nature of the innovation attained through the modern IT portfolio is compared against both incremental and radical innovation. A detailed discussion on these two types of innovation is presented in the literature review in Chapter 2. Guided by the research question, this research explores the nature of the innovation process and the characteristics of the process of innovation attained through the modern IT portfolio.

Utterback (1971) describes the process of innovation occurs in three overlapping phases. They are; idea generation, problem solving and implementation probably followed by diffusion of innovation. In the idea generation phase the design, proposal or

the concept is developed through the existing information. In the problem solving phase, the technical solution is developed and the problem is divided into sub problems where the organisation assess the solution against the goals. In the implementation phase the solution is introduced to the market. The diffusion of innovation involves mechanisms used for communicating and increasing the use of the solution. This thesis particularly analyse the implementation phase of the innovation process. Even though it captures where and who initiates the ideas, fundamentally it analyses the implementation phase of the innovation process.

The digital technologies are defined as combinations of information, computing and connectivity technologies in the current era. In particularly, the dissertation takes into account technologies such as mobile, cloud computing, analytics including big data. The study does not distinguish the type of digital technology. Instead, it bundles all available technology types such as mobile technologies, cloud computing and analytics technologies as one. The reason for selecting these technology types as one is that they consist similar characteristics such as low cost or subscription based, thin infrastructure, ease of use, easy to deploy and these technologies can be adopted on demand (Buyya et al. 2009; Delen and Demirkan 2013; Son et al. 2014). Further, these technologies are agile, device and location independent, easy to maintain, multi-tenet and productive (Chong et al. 2012; López-Nicolás et al. 2008; Sheng et al. 2005). This simplistic view was necessary as the complexity of differentiating digital technologies would have introduced undue complexity. The data made available through social media is captured in the analytics and business intelligence digital technologies. The communication perspective of social media is not considered as a part of a digital technology in this study, and should rather be considered as a communication platform (Kietzmann et al. 2011).

Organisations strive to innovate across the ES lifecycle phases (Lokuge and Sedera 2014a; Lokuge and Sedera 2014b). The present study focuses only on the innovation attained in the onward and upward phase (Markus and Tanis 2000), where organisations typically start to realise the true benefits of ES. Moreover, in this phase, organisations attempt to innovate using the existing system. Thus, it is interesting to study how organisations use their modern IT portfolio for innovation when they arrive at the onward and upward phase. Yet, a comparison of the innovation attained in the pre-implementation and post-implementation stages is carried out to compare the significance of innovation attained through the introduction of ES and digital technologies. The ES lifecycle phases and the characteristics of each phase are discussed in detail in the literature review in Chapter 2.

1.5 INTRODUCTION TO METHODOLOGY

The objective of this study is to investigate how organisations innovate through the modern IT portfolio. A qualitative approach with multiple case study method was selected for two reasons: (i) it answers what, how and why questions well and (ii) it is well suited for understanding contemporary and complex phenomena (Yin 2009). For investigating a topic such as 'innovation' and particularly for a practice based research the experience and the action of the actors are critical (Benbasat et al. 1987). Thus, multiple case studies were employed for investigating the social context.

The overall methodological approach in the study consists of an integrated approach of two sequential steps: first, the propositions about ES, digital technologies and innovation discerned from the extant mainstream literature are subjected to deductive examination (Lee 1989; Yin 2009). In deduction phase, from a more general to more

focused investigation of the phenomenon is carried out. The objective of the deduction phase is to test whether data are consistent with prior assumptions, theories, or propositions identified or constructed (Thomas 2006, p. 238). The developed propositions are tested against data to confirm the phenomenon and critically examine the state-of-the-art knowledge about innovation attained through ES and digital technologies separately.

According to Thomas (2006, p. 238), in deductive analyses, for example, those used in experimental and proposition testing research, "key themes are often obscured, reframed, or left invisible because of the preconceptions in the data collection and data analysis procedures imposed by investigators." Thus, to carry-out a goal-free evaluation, an empirically grounded inductive approach was considered as appropriate for studying the phenomenon thoroughly (Glaser and Strauss 1967). The specific observations made in the deduction phase are generalised in the induction phase (Strauss and Corbin 1998). Vogt (1993) explains inductive analysis as the inference of generalised conclusions from data as opposed to starting from theory to conclusion about a particular phenomenon. The analysis strategies in the induction phase was guided by less procedural view of grounded theory (Bryant and Charmaz 2007). Most social science researchers combine these two reasoning approaches in their studies (e.g. Bergin and Savage 2011; Reed et al. 2014; Rettig et al. 1996) which allows the researchers to "continually cycles from theories down to observations and back up again to theories (Thomas 2006, p. 24)."

1.6 SIGNIFICANCE OF THE STUDY

The topic investigated in this dissertation has significant contributions and importance for both academics and practitioners. The theoretical contribution of this research is its extension of the innovation, digital technologies and ES literature. The study builds a conceptual bridge between these key areas. Prior research on IT and innovation has treated IT as a whole and has not taken into consideration the innate characteristics of different types of IT. Further, prior research disregards how organisations can deploy these different IT resources for attaining different objectives. This study extends the knowledge of different IT resources, for example ES and digital technologies, by identifying their extended role in the current technology landscape, especially in a hyper-competitive business environment. The massive consumerization of IT and the abundance of digital technologies requiring relatively low resource allocations have necessitated a re-thinking of the role of IT and innovation in organisations.

Further, the adoption of digital technologies and ES together for attaining innovation has not been discussed with a proper theoretical framework. As such, this topic remains predominantly anecdotal and atheoretical. Researchers have argued the impeding nature of ES, yet, there is relatively dearth of studies in IS discussing the advanced role of ES in the presence of digital technologies and how innovation is attained through modern IT portfolio. This dissertation proposes the characteristics of innovation attained through the modern IT portfolio. In doing so, the study alludes to the important, yet dormant, role of ES in facilitating innovation, thereby, contributing to resolve the paradox of enterprise systems' ability in enabling innovation.

For practitioners, this dissertation provides significant insights for justifying the continuous investments in IT for attaining organisational innovation. Further, the

dissertation proposes a new strategy for surviving in the competitive market. The key point is that, rather than seeking out of the organisational boundaries, this study proposes a method for seeking innovation from the existing systems such as ES. Further, this dissertation proposes the advanced roles of CIOs and department managers through the meta-theory extensions. Thus, it can be claimed that the dissertation will be of interest to both academics and practitioners.

1.7 THESIS OUTLINE

This thesis consists of five chapters. Chapter 1 provides an introduction to the study. It discusses the broad research problem and narrows it down and discusses the boundaries of the study. A brief introduction to the methodology adopted for investigating the research problem is also presented, with the theoretical propositions used in the study for investigating the phenomenon. The chapter also covers the significance of the research through presenting a synopsis of the theoretical contributions and the practical contributions.

Chapter 2 presents a review of the key areas of literature that are relevant for answering the research question. They are ES, digital technologies and innovation. Further, the chapter provides a detailed explanation of operant and operand IT resources proposed by Nambisan (2013) for describing the role of each of the technology type. The chapter concludes with a summary of the chapter, highlighting the research gap that inspired for investigating the phenomenon.

Chapter 3 describes and justifies the methodology used in the study. The chapter begins with an introduction to available qualitative methodologies and justifies the use of multiple case-studies approach. A description of the case organisations and the case

selection criteria are also presented in this chapter. Then, the types of data collected and an introduction to the approach used to code, analyse and interpret the data is also presented. The chapter concludes with the ethical considerations that arose in the study followed by providing a summary of the chapter.

Chapter 4 presents the findings from the case studies. It presents the findings of deduction and induction phase. The chapter provides a detailed description of the results of the induction phase, the characteristics of the innovation attained through the modern IT portfolio, the meta-theory and the theoretical extension to the meta-theory.

Chapter 5 presents the concluding remarks and highlights the theoretical and practical contributions of the study. It further presents the limitations of the study and possible future research directions for IS scholars.

Chapter 2: Literature Review

The objective of this chapter is to review and delineate various theoretical positions in the literature and develop a conceptual base for generating propositions to analyse the research question. The literature review has the following structure: It first introduces the key notions of innovation, defining innovation and providing a comprehensive overview of the types of innovations. Furthermore, literature on innovation speed and outcomes of innovation are also discussed. Second, the literature review discusses the key technological concepts of this thesis: ES and digital technologies. Herein, defining each technology type, their characteristics and how they facilitate innovation are discussed. Finally, the chapter concludes with an overview of the theoretical foundation of the study, with a detailed description of IT resources classification of Nambisan (2013). The structure of this chapter depicted in Figure 2.

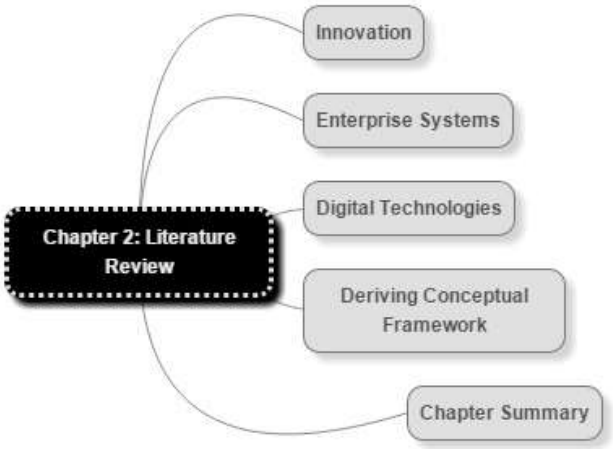

Figure 2: Thematic Structure of Chapter 2

2.1 INNOVATION

This section presents the background to the innovation studied in the dissertation. Despite the agreement on the importance of innovation to organisations, there is much confusion in the field of innovation literature. The objective of the innovation section is to discuss the constructs of innovation and define he context of innovation in this study. As this section explains the fundamentals of innovation in the literature, the original references are used. Recent papers on innovation too refer back to the fundamental innovation papers.

2.1.1 **Defining Innovation**

Innovation is considered to be a complex subject due to the mystical nature of its creation and adoption within an organisation (Van de Ven 1986). It has been a core topic of interest among academics as well as practitioners (Davenport 2013; Simpson 2014; Srivastava et al. 2013). In the contemporary competitive world, innovation is considered as a strategic initiative (Barkema et al. 2002) necessary for survival and the attainment of competitive advantage (Leifer et al. 2000; Lewis et al. 2002; Utterback 1994).

Even though innovation is an established and extensively studied subject area, there are multiple definitions of innovation and researchers have moved towards developing a multi-disciplinary definition for innovation (Baregheh et al. 2009; Sears and Baba 2011). Citing Shakespeare, Garcia and Calantone (2002, p. 110) state "A rose is a rose is a rose. And a rose by any other name would smell just as sweet," highlighting how scholars have used multiple keywords to identify innovation. Yet, number of definitions of innovation and other keywords such as creativity, change and invention gives rise to further confusions. The main objective of this section is to distinguish innovation from other key terms such as invention,

change and creativity in order to clarify the definition of innovation that is followed in this study.

Innovation scholars such as Amabile (1996) and Glynn (1996) have differentiated creativity from innovation. Creativity is an individual activity whereas innovation is an outcome of creative activities (Amabile 1996). Further, creativity is about coming up with new ideas whereas innovation is the implementation of new ideas into use (Cumming 1998).

Similarly, change is used interchangeably in the innovation literature. The two terms innovation and change are considered as two overlapping concepts (Brown and Osborne 2012). As Van de Ven Vernon (2000) states, innovation is a change that happens in an organisation, yet every change is not an innovation. Innovation is a nontrivial change that occurs in a product, process, social system, service or a business model (Freeman 1989).

In the innovation literature there is continuous conflict among scholars in identifying innovation as a totally new idea or an imitation (Ruttan 1959). For the majority of common organisations dealing with common products or services, the term ‘innovation’ does not resonate with the ‘new-to-the-world’ concept. As such, Lai et al. (2009) and Lyytinen and Rose (2003) argue that innovation need not be a totally new concept to the world and could even be considered as an imitation of something already used elsewhere, but new to the unit of adoption. This differentiates innovation from invention. Utterback (1994) states that an invention is always a new idea, product, process or technique. Innovation does not require a completely novel idea to the world. As Ruttan (1959) states, an innovation could be an invention, but an invention is not an innovation unless it has actually been used.

The following definitions of innovation were analysed when selecting the definition of innovation for the present study:

1. Any idea, practice, or material artefact perceived to be new by the relevant unit of adoption (Zaltman et al. 1977)
2. The generation, acceptance and implementation of new ideas, processes products or services (Thompson 1965)
3. New product or service, new process technology, new organisation structure or administrative systems, or new plans or programs pertaining to organisation members (Damanpour 1996)
4. Implementation of an idea whether pertaining to a device, system, process, policy, program or service that is new to the organisation at the time of adoption (Damanpour and Evan 1984)
5. The effective application of processes and products new to the organisation and designed to benefit it and its stakeholders (Wong et al. 2009)
6. The adoption of an idea or behaviour that is new to the organisation; it can be a new product, service or technology; it is related to change, which can be radical or incremental (Du Plessis 2007)
7. A means of changing an organisation, either as a response to changes in the external environment or as a pre-emptive action to influence the environment; it encompasses a range of types, including a new product, service, process technology, organisation structure or administrative systems, or new plans or programs pertaining to organisation members (Damanpour 1996)
8. An idea that is perceived as new to the people involved, even though it may appear to others to be an imitation of something that exists elsewhere (Van de Ven 1986)

9. The multi-stage process whereby organisations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace (Baregheh et al. 2009).

This study follows the definition of Crossan and Apaydin (2010, p. 1155) who define organisational innovation as a "production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems." This definition takes into account a more generalised view of innovation that takes place in 'every-day organisations.' As oppose to the idea of innovation proposed by Garcia and Calantone (2002) this definition goes beyond the definitions that ideate innovation as 'new to the world.' Further, this definition captures internally-initiated innovations, as well as adopted (imitated) innovations.

2.1.2 **Types of Innovation**

Organisational innovation encompasses different types of innovation occur within the organisational boundary. The objective of this section is to define the different types of innovation available in innovation literature. Wolfe (1994) states that scholars have paid little attention to the types of innovations and their characteristics. To this date, this view remains relevant in contemporary research. Different innovation types reflect different characteristics; as a result, measuring innovation is challenging for academics (Slappendel 1996). As Wolfe (1994, p. 415) states, "the problem of not specifying innovation attributes remains a substantial obstacle to innovation research generalisability." Wolfe (1994) identifies 17

attributes or characteristics of innovation that are useful in classifying innovation, namely, adaptability, pervasiveness, architectural impact, centrality, compatibility, complexity, cost, divisibility, duration, magnitude, observability, organisational focus, uncertainty, status, risk, relative advantage, radicalness and physical properties. Many scholars follow the unidimensional or dichotomous categorisation of innovation (Damanpour 1987; Damanpour and Evan 1984). However, it is important to clearly distinguish innovation types in order to understand the adoption patterns as well as to understand the antecedents of each innovation type (Knight 1967; Slater et al. 2013).

Innovation is widely classified into numerous typologies of innovation such as radical innovation, incremental innovation, product innovation, process innovation, technical innovation and administrative innovation (Benner and Tushman 2003; Damanpour 1987; Damanpour 1991; Norman and Verganti 2014). In addition to these types of innovation, some scholars identify further classifications such as modular innovation and architectural innovation (Garcia and Calantone 2002). The definitions of the most widely used innovation types are presented in Table 1.

Table 1: Definitions of innovation types		
Innovation Type	**Definition**	**Reference**
Radical Innovation	"…involving commercialisation of products based on significant leaps in technological development, with the potential for entirely new features and improvement in performance or cost, compared with the existing substitutes."	(Leifer et al. 2000) cited in (Chang et al. 2012, p. 442)
Incremental Innovation	"…involves the adaptation, refinement, and enhancement of existing products or/ and production and delivery systems."	(Song and Montoya-Weiss 1998, p. 126)
Product Innovation	"…new products or services introduced to meet an external user or market need."	(Damanpour 1991, p. 561)
Process Innovation	"…the efficient improvement of the production process." It leads to product innovation.	(Garcia and Calantone 2002, p. 112)
Technical Innovation	"…innovations that occur in the technical system of an organisation and are directly related to the primary work activity of the organisation."	(Damanpour and Evan 1984, p. 394)
Administrative Innovation	"…those that occur in the social system of an organisation. The social system here refers to the relationships among people who interact to accomplish a particular goal or task."	(Damanpour and Evan 1984, p. 394)

Table 1: Definitions of innovation types		
Innovation Type	**Definition**	**Reference**
Service Innovation	"…Re-bundling of diverse resources that create novel resources that are beneficial (i.e., value experiencing) to some actors in a given context; this almost always involves a network of actors, including the beneficiary."	(Lusch and Nambisan 2014, p. 162)
Organisational Innovation	"…the adoption of an idea or behaviour that is new to the organisation adopting it."	(Daft 1978, p. 197)
Architectural Innovation	"…forges new market linkages with new technology through the creation of new industries or the reformation of the existing ones."	(Garcia and Calantone 2002, p. 117)
Modular Innovation	"…involves the introduction of new technology that overturns the core design concepts of individual components while leaving the established linkages between components relatively untouched."	(Magnusson et al. 2003, p. 5)

The distinction between technical and administrative innovation is, administrative innovation impacts on the social systems whereas technical innovation represents new ideas, processes and practices pertaining to products, processes and technology (Daft and Becker 1978; Damanpour 1987; Damanpour and Evan 1984). As discussed earlier, different antecedents and adoption patterns relate to technical and administrative innovations (Daft 1978; Daft and Becker 1978; Knight 1967).

Similarly, product and process innovations also have different adoption patterns (Ettlie and Reza 1992). When analysing the innovation literature it is evident that extensive attention has been paid to product and process innovation as competitive advantage is attained through the introduction of these two types of innovation (Benner and Tushman 2003; Ettlie and Reza 1992). As Davenport (2013) states, process innovation entails improvement of the production process. An efficient business process might lead to the development of new products as well. As a result, process innovation may lead to and encompasses product innovation (Frishammar et al. 2011).

2.1.2.1 Incremental and Radical Innovation

As Ettlie et al. (1984, p. 683) state:

"…one of the theoretical typologies that have emerged in the literature on organisational innovation is the dichotomy of radical versus incremental innovation introduction and adoption. One aspect of this dimension appears to be whether or not the innovation incorporates technology that is clear, risky departure from existing practice (Duchesneau et al. 1979; Hage 1980). If the technology is new to the adopting unit and new to the referent group of organisation (Daft and Becker 1978), or if it requires both throughput (process) as well as output (production or service)

change (Hage 1980), perhaps the magnitude or the cost of change required by the organisation is sufficient to warrant the designation of a rare and radical, as opposed to incremental innovation."

The classification of incremental and radical innovation is based on the 'newness' of an innovation (Dewar and Dutton 1986; Nohria and Gulati 1996). Zaltman et al. (1977), following Schumpeter, embrace the viewpoint that radicalness is measured by the newness of an innovation. A radical or discontinuous innovation is a costly initiative (Benner and Tushman 2003) which normal organisations are reluctant to initiate (Carlo et al. 2014). Yet, on the other hand, it is difficult for an organisation to survive by launching incremental innovations only (Chang et al. 2014).

Anecdotal evidences suggest that three types of innovation can be attained through technologies. They are; radical innovation, incremental innovation and disruptive innovation (PwC 2012). In the contemporary competitive market, organisations are not able to bear disruptive innovations as they are costly. As a result, using technologies organisations attain incremental or radical innovation. Table 2 presents a summary of the characteristics of radical and incremental innovation. These characteristics of radical and incremental innovation are compared against the innovation attained through ES and digital technologies. This comparison is not done through the data coding, but through a review of literature and the observations from the surface. The following characteristics of incremental innovation and radical innovation are adapted from Latzer (2009), Ettlie et al. (1984), Slater et al. (2013) and Norman and Verganti (2014).

Table 2: Characteristics of radical and incremental innovation	
Incremental Innovation	**Radical Innovation**
Continuous (linear improvement in the value received by customers)	Discontinuous (with or without predecessor; substantial, non-linear improvement)
Based on old technology	Based on new technology
Dominant design unchanged	Leads to new dominant design
Does not lead to paradigm shift	Can lead to paradigm shift
Involves low uncertainty	Involves great uncertainty
Feature improvements	Entire new set of performance features
Existing organisation and qualifications are sufficient	Need for re-education, new organisation and skills
Result of rational response, of necessity	Attributed to chance, not to necessity; might be influenced by R&D policy
Driven by market pull (important in late phase of technology)	Driven by technology push (important in early phase of technology)
To achieve economic short-term goals	To achieve economic long-term goals

The table (Table 2) is adapted from Latzer (2009). The characteristics were verified from Ettlie et al. (1984), Slater et al. (2013) and Norman and Verganti (2014).

2.1.3 Dimensions of Innovation

Innovation is widely classified into numerous typologies such as product innovation, process innovation, technical innovation, administrative innovation, organisational innovation and service innovation (Damanpour 1987; Damanpour 1991; Evanschitzky et al. 2012; Frishammar et al. 2012; Yen et al. 2012). Innovation is generally differentiated by the radicalness, speed of the innovation process, and also by the frequency at which organisations deliver innovations to the market (Barkema et al. 2002; Benner and Tushman 2003; Hill and Rothaermel 2003). Each dimension of innovation is described below.

2.1.3.1 **Innovation Speed**

Innovation speed is one of the most widely researched areas in innovation in the past decade (Banu Goktan and Miles 2011; Kessler and Chakrabarti 1996; Vega et al. 2013). The reason for this increased attention is that academics as well as practitioners have realised the importance of shortening the complete lifecycle of innovation (Banu Goktan and Miles 2011; Dumaine 1989; Vega et al. 2013). As Kessler and Chakrabarti (1996, p. 1143) state, this "emphasis on speed represents a paradigm shift from more traditional sources of advantage, such as experience-curve strategies in the 1960s, portfolio management in the 1970s, and restructuring in the 1980s, toward a strategic orientation specifically suited to today's rapidly changing business environments (Stalk 1993; Vega et al. 2013)."

Innovation speed can be defined as the time between the ideation or the initial development of an idea and the commercialisation of an innovation (Kessler and Chakrabarti 1996). An organisation in a competitive market needs to minimise the time lapse from ideation to commercialisation. Following Ali et al. (1995), the

innovation speed is measured in person-years. In a review of the innovation speed literature, Kessler and Chakrabarti (1996) point out that the literature on innovation speed can be classified into two categories, namely, the level of analysis and type of analysis.

Innovation speed is analysed at the individual, project and organisational level. As Kessler and Chakrabarti (1996) state, studies that investigate individual innovation speed discuss the individual preferences and viewpoints in accelerating innovation speed, project-level studies discuss the process-specific activities in accelerating innovation speed, and organisational-level studies investigate the organisational policies and processes in improving the innovation speed. The present study investigates the latter in determining the innovation speed. Thus, the innovation speed is analysed at the organisational level and the study investigates the organisational processes. An organisation that innovates faster than the competitors becomes the pioneer and gains competitive advantage. However, depending on the innovation half-life, the benefits and the success of innovating faster will diminish over time.

Innovation frequency and innovation speed are two related yet different terms in the innovation literature. Innovation speed, as discussed earlier, refers to the time lapse from ideation to commercialisation in person-years (Ali et al. 1995) and innovation frequency refers to how often an organisation introduces and delivers new products and services to the market (Pettigrew et al. 2001). The study investigates how organisations innovate using the IT portfolio. Therefore, this study does not take into consideration how many new products or processes an organisation introduces to the market, but the innovation process itself. Thus, in studying the innovation

attained through ES and digital technologies, this study examines the innovation speed rather than the innovation frequency.

2.1.3.2 **Outcomes of Innovation**

The market forces and technological advancements in the contemporary dynamic business world have made innovation a critical activity for contemporary organisations (Alegre and Chiva 2008; Amabile 1996; Ellonen et al. 2009). Researchers have extensively studied the nature of innovation and have contemplated it as a discrete product or outcome (Meyer and Goes 1988) or as a process (Knight 1967). Most innovation scholars adhere to the view that innovation is a process in which new ideas and practices are created and developed (Knight 1967; Rogers 1995).

The sole objective of innovation is to benefit the individuals, teams, organisations and society (Camisón and Villar-López 2014; Lusch and Nambisan 2014; Nambisan et al. 1999). However, most innovation studies focus on the characteristics of successful implementation of innovation or the antecedents of innovation (Damanpour 1991; Laforet 2010) and limited attention has been paid to the outcomes of innovation.

Laforet (2013, p. 490) claims that:

"Most research tends to focus on innovation outcomes of product or process. Few studies examine innovation outcomes at the firm level empirically, or the relationship between organisational innovation, and financial performance. They also neglect negative innovation outcomes. Investigating unintended outcomes is essential for any companies with an involvement in organisational innovation. These firms must balance inputs and outputs, and ensure that innovation does not have an adverse

impact on the firm's internal and external environments that could lead to potentially high costs to the firm."

This view of Laforet (2013) highlights that studying innovation outcomes is as important as studying the antecedents or adoption of innovations. The investigation of innovation outcomes allows researchers and practitioners to identify and minimise the negative outcomes of innovation and maximise the positive outcomes of innovation (Siguaw et al. 2006; Simpson et al. 2006).

Innovation outcomes include the early identification of new markets and customer needs (Laforet 2013; Stock and Zacharias 2011; Vesey 1991), enhanced market positioning (Harris et al. 2013; Porter 2011), increased productivity (Hall et al. 2013; Simpson 2014), reduced operational cost, increased market share, enhanced financial positioning (Nagji and Tuff 2012; Oke et al. 2012), competitive advantage (Alexy and Reitzig 2013; Qian et al. 2013; Teece 1992), and improved efficiency and effectiveness (Simpson et al. 2006; Simpson 2014).

2.1.4 **Innovation Measures**

The objective of this section is to introduce the available innovation measures and describe the measures of innovation used in the study. Two types of measurement approaches are prevalent in past innovation studies (Adams et al. 2006; Cordero 1990): (i) absolute indicators such as the number of patents (Xue et al. 2012) or the number of new products/services or new market segments (Lyytinen and Rose 2003), and (ii) proxy measures of innovation, such as the allocations of funding to research and development or market changes to investment decisions through Tobin's-Q (Adams et al. 2006). Studies that use proxy measures observe the inputs (e.g. research and development funds) and the outputs of innovation (e.g. new patents).

These two approaches have been criticised for lacking relevance to day-to-day innovation as common organisations would rarely engage in creating patents or allocating dedicated funds to research and development (Adams et al. 1992; Cordero 1990). When considering the financial performance of an organisation, scholars evaluate the outcomes of an organisation over a 3–5 year period (Laforet 2013) in terms of the market share, profits, sales growth, new products, market position and return on investment (Fichman 2001; Wong et al. 2009).

According to Laforet (2013, p. 493):

"Scholars argue that measuring company performance in terms of turnover, sales, and profits are subjective. Furthermore, respondents have different perceptions, and/or abilities to comment on more sophisticated financial measurement such as profitability, and return on investment, adding to the difficulty in recording a trend. In the context of small firms, a further difficulty arises when researchers cannot obtain their financial accounts for analysis."

Further, Laforet (2013) explains that, when measuring organisational performance, feedback needs to be obtained from those managers who initiated or were immediately affected by the innovative endeavours. As such, in the present study, the CIOs or equivalent senior officers who were responsible for initiating technology-related innovations were interviewed. This enhanced the reliability and accuracy of the data collected in the study.

In order to determine whether or not an organisation can be characterised as innovative under the present market conditions it is necessary to consider whether or not the organisation faces challenging environments swiftly, effectively and mindfully (Swanson and Ramiller 2004). Furthermore, investigating innovativeness also means assessing how quickly organisations move out of political and social

turbulence (Melville et al. 2004). Such measurements of innovation in the IS discipline are lacking.

2.2 ENTERPRISE SYSTEMS

2.2.1 ES Characteristics and Benefits

ES is an organisational-wide transaction processing software solutions that integrate and automate enterprise-wide business processes (Davenport 1998b). ES has been studied extensively in the past two decades in research highlighting their use (Bagchi et al. 2003; Gable et al. 2008; Sedera and Dey 2013), success (Gable et al. 2008; Sedera 2006; Sedera and Tan 2005) and innovation potential (Lokuge and Sedera 2014a; Rajagopal 2002; Srivardhana and Pawlowski 2007).

The following definitions of ES are proposed in the literature:

1. ES are IS packages that integrate common business processes such as procurement, human resources, and payroll (Klaus et al. 2000).
2. ES are comprehensive, packaged software solutions that seek to integrate the complete range of business processes and functions in order to present a holistic view of the business from a single information and IT architecture (Gable 1998).
3. ES are comprehensive packaged software solutions that integrate organisational processes through shared information and data flows (Shanks and Seddon 2000).
4. ES are configurable IS packages that integrate information and information-based processes within and across the functional areas in an organisation (Tarn et al. 2002).

5. An enterprise system is the IS or information management system of an organisation that consists of the IT infrastructure, application systems and the personnel who employ IT to deliver information and communication services for the transaction processing/operations and administration/management of an organisation (Davis 2000).

When analysing these definitions of ES, a few key characteristics of ES can be highlighted, namely, integration (Volkoff et al. 2004), best practices (Wagner et al. 2006) and standardisation (Davenport 1998a; Davenport 2000a; Lee et al. 2003). ES integrates all the business processes and provide a holistic view of the organisation (Klaus et al. 2000). The departments such as marketing, HR, finance, operations and warehouse get connected through a centralised database (Markus and Tanis 2000). The centralised database enables the integration and minimises the data redundancies and duplications of business functions (Somers and Nelson 2003). The integration of business processes enables the business functions across the organisation to be standardised (Samaranayake 2009). Further, ES enables real-time propagation of data across the departments (Bingi et al. 1999). These standardised systems are developed after extensive analysis of business practices across industries (Klaus et al. 2000). As Davenport (1998b) states, these best practices introduced for the business processes sweep all the messy practices and norms which an organisation used to follow. ES integrates organisational transaction processing activities, analyse data, and report these information across the organisational functions and processes.

The characteristics such as integration, standardisation, real-time data and best practices have led to the popularity of ES adoption among large organisations, small and medium organisations and family-owned businesses (Chan 1999; Seddon et al.

2010). Even though these are costly packaged applications the adoption of these systems has become a necessity for the survival.

Shang and Seddon (2002) classify the benefits of ES into five categories, namely, operational, managerial, strategic, organisational and IT infrastructure. Apart from these benefits, ES also enable the integration of third party applications and technologies which has created unique opportunities for organisations to innovate (Ceccagnoli et al. 2012; Gawer and Cusumano 2012).

2.2.2 **ES Lifecycle**

This section discusses the key phases of the ES lifecycle and their characteristics. Various models such as the models by Chang and Gable (2000) and Markus and Tanis (2000) are proposed in the literature to explain the continuous nature of ES implementation. This study follows the four-phase ES experience cycle proposed by Markus and Tanis (2000). The four phases in their model are: (i) The chartering phase, (ii) The project phase (configuration and roll-out), (iii) The shakedown phase and (iv) The onward and upward phase. The characteristics of each stage are described as follows:

Chartering phase – In this phase, the executives, vendors and consultants collaborate to develop a business case for implementing the ES in the organisation. The key players (client, vendors and consultants) (Finney and Corbett 2007; Nah et al. 2001) select the packaged application to be implemented in the organisation, set and approve the budget, and develop a schedule for implementation (Markus 2000). Further, in this stage, the key performance indicators are developed and the roll-out plan and communication plan are confirmed. Successful completion of this stage leads to the confirmation of the plan to implement the ES in the organisation.

Project phase – In this phase, the project managers, consultants, vendors and IT and business specialists work together to implement the system. The ES is configured and customised, and business processes and systems are integrated. Testing is completed, data is cleaned, training is conducted, and the system is rolled-out (Markus and Tanis 2000).

Shakedown phase – This phase represents the period immediately after 'go-live'. Ross and Vitale (2000) suggest that ES performance undergoes a performance dip after go-live and after each major upgrade. This dip is represented in Figure 3.

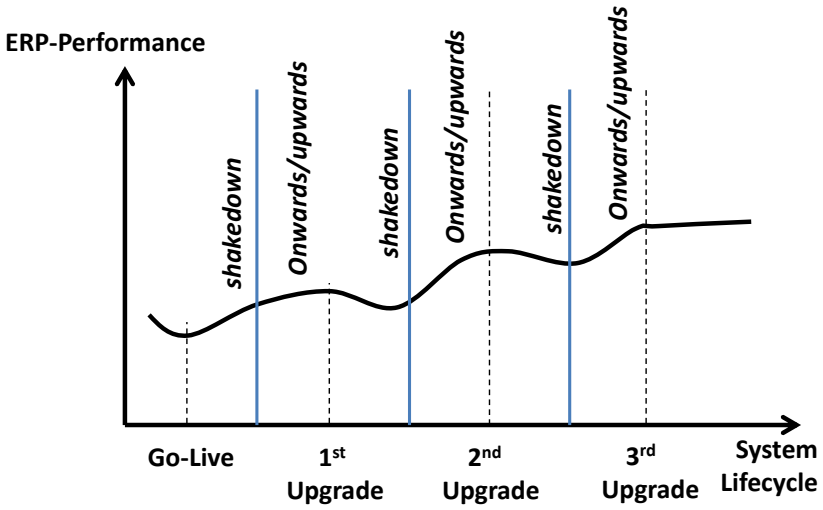

Figure 3: Variation of system performance in the ES lifecycle (Adapted from Lokuge and Sedera 2014a)

During the shakedown phase, the productivity drops as the system users are not familiar with the system (Sedera and Dey 2013). Ross and Vitale (2000, p. 237) refer to this as the "productivity dip" or the "ERP shock." According to Markus and Tanis (2000, p. 195), this phase includes "bug fixing and rework, system performance tuning, retraining, and staffing up to handle temporary inefficiencies" representing the chaotic period after implementing the ES. This phase is known to be extremely challenging for organisations. The 'radical change' (Kraemmerand et al.

2003) introduced through the system has an impact not only on the business processes but also on the job roles, practices, responsibilities and organisational culture (Nah et al. 2001; Niu et al. 2011).

Onward and upward phase – In this phase, organisations become familiar with the system and continue their operations. According to Markus and Tanis (2000), organisations are able to realise the benefits of implementing the ES. As Markus and Tanis (2000, p. 195) explain: "characteristic activities of this phase include continuous business improvement, additional user skill building, and post-implementation benefit assessment; however, these 'typical' activities are often not performed." In this phase, the business process absorptive capacity has increased (Srivardhana and Pawlowski 2007); therefore, organisations tend to identify and improve business processes when required.

Considering these key characteristics of the onward and upward phase, it has been identified that innovation through ES could happen in this phase (Lokuge and Sedera 2014a; Lokuge and Sedera 2014b). The key reasons are, (i) organisations have started realising the benefits of ES, (ii) the users are familiar with the system and (iii) organisations expect continuous innovation through the ES. Thus, when selecting the case organisations in the present study, the phase in which each organisation was operating was taken into consideration. All the case organisations selected for the present study had completed their ES implementation 5–10 years previously. Thus, all the case organisations were in the onward and upward phase.

2.2.3 **ES as a Platform**

The first known use of the word "platform," which originates from the Middle French word "plate-forme," was in 1535[2]. Since then, the term has been employed in multiple disciplines, especially in the context of continuance and growth (Gawer 2014). In biology, the human genome database has become a platform upon which many companies and laboratories build complementary products and services. Despite the term "platform" appearing in the IS and IT literature in abundance, little conceptual and fundamental thinking has been devoted to understanding it. In general, the following five fundamental characteristics can be used to define a platform in the IS context:

(i) The platform should perform at least one essential function or solve an essential technological problem in an industry,

(ii) It provides the basis for further action (e.g. to build, debate or connect),

(iii) The actions conducted on a platform are restricted by the parameters of a platform (e.g. a platform's restrictions will determine which type of connectivity is allowed),

(iv) It provides a basis upon which to make a comparison with another platform or actions built on another platform, and

(v) Platforms change and evolve, but in a stable manner. Radical changes may disrupt an existing platform and may give rise to a new platform.

Taking the five fundamental characteristics, the term "technology platform" refers to technology that enables the development and/or delivery of software

[2] Online Etymology Dictionary Retrieved 2014-12-07.

services. While some technology platforms provide tools and techniques to develop software applications, other technology platforms may only provide the delivery mechanism of a software service. In either case, the platform will provide either a conceptual or practical boundary on the software being developed or delivered. Competing platforms have emerged with the growth of proprietary software that competes with other technology platforms in a marketplace. In most cases, technology platforms evolve in a manner that allows higher capabilities.

Over a period of time, if the platform attracts enough adopters, it has the potential to create an ecosystem. With the growth of the ecosystem, the number of applications and the services offered on the platform will also increase. This also impacts on the rate of evolution of a platform, since more products and services will push new ideas to evolve a platform.

From a technical standpoint it is important to distinguish three related terms presented in the IS literature to clarify the role of a platform: (i) platform, (ii) module and (iii) ecosystem. Gawer (2009) defines a platform as "a building block, providing an essential function to a technological system – which acts as a foundation upon which other organisations, loosely organised in an innovation ecosystem, can develop complementary products, technologies or services." Meyer and Lehnerd (1997) define a platform as a set of sub-systems and interfaces that form a common structure from which a stream of derivative products can be efficiently developed and produced. Katz and Shapiro (1994) provide a technical viewpoint to the understanding of a platform, stating that a platform specifies the design rules that describe how the platform and modules interact and exchange information. The SAP NetWeaver is an ideal example of a platform.

The majority of past studies discuss the influence and importance of the features and functions of ES that create operational flexibility (Karimi et al. 2007), business process improvements (Grover and Segars 2005), productivity (Shang and Seddon 2007), transparency (Akkermans et al. 2003), innovation (Srivardhana and Pawlowski 2007) and profitability (Romero et al. 2010; Staehr et al. 2012). Such observations have been made using characteristics such as ease of use and ease of learning, and these observations were captured through the end-user functional perspective (Gable et al. 2008; Gorla et al. 2010; Sedera and Dey 2013; Tate et al. 2013). However, there is a growing recognition that ES are now evolving to take a more salient role as a technology platform. Researchers such as Gawer (2014), Ceccagnoli et al. (2012) and Yoo et al. (2012) praise the role of an enterprise system as a platform.

A module, according to Baldwin and Clark (2000), is an add-on software sub-system that connects to the platform in order to add functionality to the platform. Such modules will include system features and functions with which business end-users engage for daily business processes. The term "ecosystem" refers to a collection of platforms and those who offer services and products to support the platforms as well as their modules (Ceccagnoli et al. 2012; Gawer and Cusumano 2012).

A conceptual view of an IT platforms is presented by Tiwana et al. (2010). The literature also suggests that there is a natural tendency to build digital applications on ES (the ability of ES to act as a platform) (Yoo et al. 2012). The use of ES as a platform is prevalent in the corporate systems landscape, as demonstrated in the proliferation of ES as the preferred technology platform on which to digitally engrave corporate data and business processes (Ceccagnoli et al. 2012). The use and

continued growth of ES has yielded the practices of big data, data warehousing and business intelligence, where the ES (as a platform) allows additional technologies to be deployed on the existing platform (Nwankpa et al. 2013). As Schenk (2015) proposes ES vendors have seen the need to make ES as chronically unfrozen systems as a result have transformed their role from process supporting tool to a source of process innovation.

2.3 CHARACTERISTICS OF DIGITAL TECHNOLOGIES

Following the definition of Bharadwaj et al. (2013) digital technologies are defined as combinations of information, computing and connectivity technologies in the current era. Similar references have been made in Nambisan (2013), Yoo et al. (2012) and Nylén and Holmström (2015). Digital technologies are widely recognised as "revolutionary" (Hofmann and Woods 2010), "innovative" (Sheng et al. 2005) and at the same time cost-effective (López-Nicolás et al. 2008). Forecasting by practitioner outlet Gartner (Cearley and Hilgendorf 2014) makes strong suggestions regarding how organisations could derive innovation capabilities through digital technologies. Tiwana et al. (2010), for example, claim that creativity, innovation and growth are contingent upon the existing platforms. Given that digital technologies extract and write-back data from the existing ES (as a platform) (Ceccagnoli et al. 2012), it is logical to investigate the ES as a platform delivering innovation through digital technologies.

Among the key characteristics of digital technologies, these technologies can be easily maintained (Chakravarty et al. 2013), allow easy connectivity with other technologies (Rai and Tang 2010), are trialable (Cea et al. 2014; Mallat et al. 2009), flexible (Nambisan 2013), have higher processing capability, low cost (Nylén and Holmström 2015) and enable the same infrastructure to be re-used for different

purposes (Yoo et al. 2012; Yoo et al. 2010). Further the ease of use of digital technologies enable increase the likelihood of user innovation (Nylén and Holmström 2015). On the other hand, the ease of development and deployment enable the organisations to augment, replace the existing business functions. These innate characteristics of digital technologies facilitate a new way of attaining innovation in an organisation and the innovation processes enabled through digital technologies are known to be "rapid and difficult to control and predict (Nylén and Holmström 2015, p. 58)."

2.4 DERIVING CONCEPTUAL FRAMEWORK

In the contemporary business landscape, organisations are presented with a truly diverse IT portfolio with eclectic collection of technologies. In the contemporary IT portfolio, mainly two types of technologies can be seen. They are: ES and digital technologies. Though there is a wealth of studies discussing the two streams of literature under two headings, much less emphasis has been given to the portfolio of IT and how such a portfolio could change the way organisations employ the IT portfolio to innovate. The following discussion explains how ES and digital technologies innovate in the contemporary business landscape.

2.4.1 ES and Innovation

The role of IT in innovation has been studied for several decades (Bengtsson and Ågerfalk 2011; Johannessen 1994). Advancements in the technology landscape, rising market demands and the impact of globalisation have necessitated innovation for the survival of contemporary organisations (Amabile 1996; Chae et al. 2014a; Gorodnichenko et al. 2010). Thus, innovation is considered as the life blood of corporate survival and growth (Slater et al. 2013; Zahra and Covin 1994). The

technological advancements made during the past few years have assisted organisations to innovate through: (i) improved decision-making capabilities (Brynjolfsson 2011; Huber 1990), (ii) increased customer connectedness (Bharadwaj et al. 2013; Kumar et al. 2010), (iii) increased channels for reaching customers/suppliers (Bharadwaj 2000; Kleis et al. 2012), and (iv) enhanced communication facilities (Olesen and Myers 1999; Youmans and York 2012).

In studying innovation through ES (or on the broader topic of innovation through IT), past studies have employed traditional innovation concepts (e.g. Rajagopal 2002; Srivardhana and Pawlowski 2007). Although they add a wealth of cumulative knowledge to the discipline, most innovation studies in IS assume that the available human and financial resources are adequate and that innovation is delivered through standard specifications (i.e. contract of delivery) (Bradford and Florin 2003). In the real business world, no resource is adequate. Weeks and Feeny (2008) point out that client expects vendor to act as the strategic partner for achieving organisational success. They expect these strategic partners to go beyond the specifications and innovate for the organisation's survival in the hyper-competitive business world. Weeks and Feeny (2008) argue that clients expect three categories of innovation through IT: (i) IT operational innovation (e.g. email platforms, hardware), (ii) business process innovation (e.g. ES), and (iii) strategic innovation (e.g. new markets). According to Davenport (1998b, p. 122), the embrace of ES "may in fact be the most important development in the corporate use of information technology in the 1990s." Unlike the legacy systems, ES captures reusable best practices and require the organisation to undergo business process re-engineering (Wagner et al. 2006).

The introduction of ES revolutionises the existing practices and introduces new behaviours to the organisational sub-systems and its members (Karimi et al. 2007). Damanpour (1988) states that radical innovation causes deep changes in an organisation, such as changes in the organisational structure, roles and responsibilities: simply put, it drastically changes the way in which the organisation carries out its business practices. Similarly, the introduction or implementation of ES, cause numerous changes in the organisation. Thus, this risky, complicated and resource-consuming process can be characterises as a radical innovation (Sorescu et al. 2003).

Green et al. (1995) introduce a reliable multi-dimensional measure of radical innovation comprising technological uncertainty, technical inexperience, business inexperience and technology cost as the four dimensions measuring the extent of radicalness. When considering these four dimensions from the clients' perspective it is clear that the introduction of ES to an organisation has the characteristics of a radical innovation. One prominent feature of radical innovation is that obtaining the support for a radical initiative is very difficult since it involves major changes in the organisational culture and creates immense pressure on the organisation and its members. From the ES literature it is evident that top management support is critical for successful ES implementation (Nah et al. 2001; Nah et al. 2003). In addition, the innovation literature highlights the criticality of leadership roles, team composition and the role of informal networks for the successful completion of a radical innovation project (McDermott and O'Connor 2002). Similarly, ES scholars highlight the critical success factors of the ES implementation project (Finney and Corbett 2007) including the need for a balanced team that consists of the best and the

brightest staff, a project champion, empowered decision-makers and effective communication (Nah et al. 2003).

Thus, the introduction of ES to an organisation can be viewed as a radical innovation. The adoption of ES promises operational, managerial, strategic, IT infrastructure and organisational-wide benefits (Shang and Seddon 2007). Yet, in most organisations radical innovation introduced through the advent of ES seldom continues after the implementation. There are two major factors limiting the use of ES for innovation: (i) ES deployments are costly and time consuming and (ii) organisations lack the right expertise needed for innovation-driven ES.

Innovation is an iterative process; similarly, the implementation of the ES is not the ultimate outcome. In order to gain the real benefits of ES, an organisation should introduce innovations throughout the ES lifecycle. However, the rigid nature of the ES and the perception of the users often lead to ES being seen as a one-off innovation until the next planned upgrade. Due to the advent of new technologies and pressure from competitors, it is important for an organisation to keep up with change in order to survive. Even though continuous innovation through ES is required, it is restricted since the innovation needs to be achieved within the already-implemented system boundaries.

2.4.2 Digital Technologies and Innovation

The last decade has seen a substantial change in IT through the advent and mass proliferation of mobile technologies, cloud computing and business analytics (including big data). These technologies, collectively referred to as digital technologies, provide organisations with unprecedented potential for innovation due to affordability, ease of adoption and ease of connection with customers and suppliers (Yoo et al. 2012). Digital technologies have disrupted the traditional linear

equation of technology, whereby IT sophistication is no longer proportionate to the resource availability. This enables organisations with low capital availability to innovate in the same fashion as their resourceful counterparts (Nylén and Holmström 2015). As such digital technologies has become important for organisations to achieve their business goals (Nylén and Holmström 2015). The technologies such as ES facilitated restructuring of internal business processes, thus enabled innovation within organisational boundaries (Nwankpa et al. 2013). Further, digital technologies enabled organisations to connect with the customers and suppliers outside the organisations and opened up access to a massive amount of data, organisations never had access before (Nylén and Holmström 2015). Even for the traditional ES custodians, digital technologies provide the opportunity to embed such technologies in their ES.

Similarly, the digital technologies also have a stronger value proposition by connecting to an ES. For example, the corporate use of mobile technologies enables organisations to extract the frequently-used functions of a business process and set up the functions to be completed on either mobile device, social media or the exposed or selected function can be augmented by using either mobile technologies, analytics, social media or cloud computing (Figure 4). In this approach, organisations could employ digital technologies that rely on the master data and business rules embedded in ES, while returning the updates to the ES. Similarly, ES can be utilised as a foundational platform for business intelligence, cloud computing and analytics (Gawer and Cusumano 2012; Yoo et al. 2012).

The conceptual view of the integration and synchronisation of digital technologies with ES (as a platform) for innovation is illustrated in Figure 4. The figure alludes to two possible scenarios of the business processes involving both

internal and external parties (i.e. customers and/or suppliers) posed by the advent of digital technologies: (i) the co-existence of the ES (as a platform) and digital technologies in a single business process, or (ii) the replacement or substitution of ES. In both scenarios, the digital technologies have the potential to provide an augmented, value-adding and innovative option for completing a business process (the dotted line in Figure 4), compared to the default ES process (the straight line in Figure 4). The focus here shifts to functional-orientation, as opposed to process-orientation. The engagement focus of digital technologies is not on providing a platform to automate the entire business process, but rather on innovating through exposing a selected platform component to build a function that would provide maximum innovation capacity to the organisation. A real world example for this scenario can be Delta Airlines allowing passengers to complete the entire ticketing process through Facebook. This can also be done through other technologies as well.

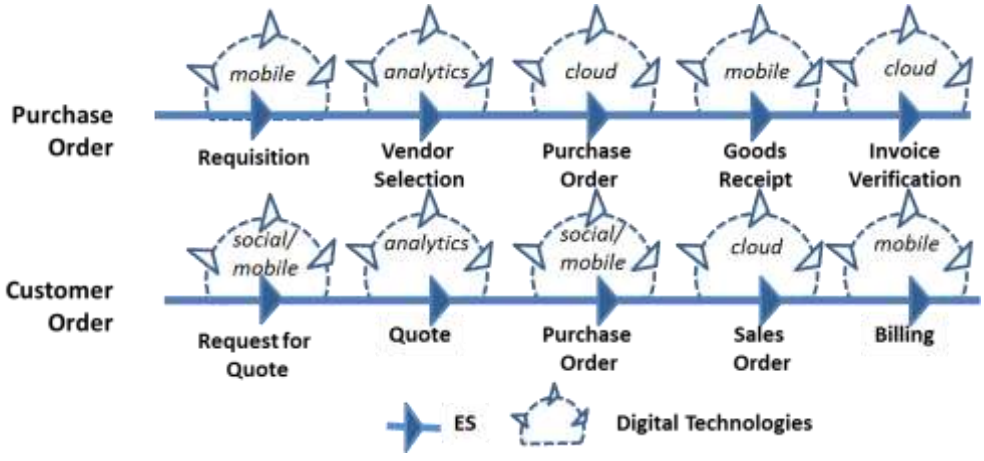

Figure 4: Augmented value of business processes through ES and digital technologies

2.4.3 **IT portfolio as operand and operant IT**

The review demonstrated that each type of IT (ES and digital technologies) with its characteristics, their advantages and disadvantages. For example, ES and digital technologies have the potential to innovate in different ways. The nature of innovation and the role played by IT in innovation have changed substantially over the past decade (Nylén and Holmström 2015). According to Nambisan (2013, p.216), "innovation has become more open, global and collaborative in nature to involve a diverse network of partners and emphasising distributed innovation processes … All of these changes have significantly enhanced the importance and relevance of IT." Further scholars such as Yoo et al. (2012) and Henfridsson et al. (2014) concur with this view highlighting the openness of innovation and how the advancement of digital technologies have changed the innovation processes. As Nambisan (2013, p.216) highlights, digital technologies play an imperative role in modern innovation, where they are "being embedded to an ever increasing range of products and services…thereby expanding the role and relevance of IT in any innovation."

The nature of innovation and the role that IT plays in innovation have changed substantially over the past decade. Scholars such as Bharadwaj et al. (2013) and Sambamurthy et al. (2003) suggest that organisations should innovate and concur the competitive markets using IT with speed and surprise. Admittedly, the advancements in the technology landscape have made this an attainable goal for any organisation. As opposed to single, monolithic one system view, contemporary organisations are offered with heterogeneous collection of technologies that drives innovation (Aral et al. 2006). Nambisan (2013) classifies the contemporary IT portfolio by reference to two primary roles: (i) IT as an operand resource, and (ii) IT as an operant resource.

The operant IT triggers innovation, while operand IT enables innovation. The two notions are conceptual rather than objective. In other words, a technology can be conceived as operant or operand based on the nature of innovation and the context that it is embedded in the innovation process. As such, for example, Constantin and Lusch (1994) report that *all* information technologies are operant resources. A technology as an operand IT is defined by Nambisan (2013, p. 217) as "those resources that an actor acts on to obtain support for executing a task," where the enabling role of IT highly depend on the fit of the IT with the organisation. An operand resource is defined as a resource on which an operation or act is performed to produce an effect. The role of an operand IT resource is to enable innovation. Therefore, the main objective of an operand IT resource is to increase efficiency and effectiveness. Thus, the value of an operand resource to an organisation is greater when the tool fits well for the objectives, organisational structures and strategies that facilitate innovation. In general, an operand resource is static and stable. As Lusch and Nambisan (2014, p. 18) state, the operand role of IT is emphasised in "the way digital infrastructures can help hold together diverse actors and enable collaboration in the ecosystem." Nambisan (2013) acknowledges that there are a wealth of studies discussing the role of IT as an operand resource (Nambisan and Baron 2010; Xu et al. 2007).

On the other hand, Nambisan (2013) recognises that, despite the strong emergence, the operant role of IT is seldom discussed in academia. The operant role of IT is defined by Nambisan (2013, p. 217) as "those resources that act on other resources to produce effects; that is, they act or operate on other things rather than being operated on." These operant IT resources can initiate or lead to new innovation processes or associated organisational routines and mechanisms. The role of IT as an

operant resource in innovation relates to the ability of IT resource to independently trigger innovation (Nambisan 2013). The terms 'independently' and 'trigger' highlight the potential of operant resources to create innovation unassisted. For example, the role of an operant resource is not to enable the delivery of an idea for innovation; rather, the technology itself will initiate innovation.

Compared to operand resources, operant resources are dynamic. As Nambisan (2013) states, the impact of operant IT resources on innovation is often unpredictable and may not always be positive. As a result, operant IT resources are considered as risky initiatives and caution must be applied in introducing and managing them. Furthermore, an operant IT resource could deliver different outcomes to the organisation depending on how it has been applied in the organisation. As such, operant resources enable differentiation that ultimately leads to competitive advantage.

Furthermore, IT enablers and triggers must have the potential to synergise their efforts in attaining innovation. Here the objective should be that either an enabler or a trigger does not work alone, but rather as a portfolio. The creation of a portfolio (of IT) allows organisations to take advantage of both enablers and triggers, while minimising their limitations and risks of the individual technologies. The objective of this section is thus to recognize the specific roles of ES and digital technologies in innovation in the contemporary organizations.

2.4.3.1 Enterprise Systems as operand resources

Relating the notions of operand and operant roles of IT to ES, it can be argued that ES portrays the characteristics of operand resources. The advent of an ES it-self triggers innovation in business processes, practices, products and services. ES initiate (trigger) a new era of computing in an organisation through integration, process orientation and standardisation. Consistent with pioneering innovation literature (e.g. Zaltman et al. 1977), the introduction of an enterprise system it-self is an innovation to the organisation (Kharabe et al. 2013; Kharabe and Lyytinen 2012). From a functional view point, ES enables integration acting as a collaborative platform for diverse actors and technologies to act upon (Lusch and Nambisan 2014; Nambisan 2013). Similarly, features of ES will enable business practices that will lead to enhancement of efficiency and effectiveness of business practices, acting as a foundation for other applications (Yoo et al. 2012). Such characteristics, together with its integration ability, demonstrate role of ES as an operand technology. Moreover, the congruence between the ES and organisational strategy, structure and processes becomes a key success factor for innovation. Over time, ES tends to lose its ability to trigger (operant) innovation and increase its role as an innovation enabler (operand). As an operand technology, ES provides a vital platform to enact upon for triggering innovation through modern digital technologies like cloud computing, mobile technologies and BI / analytics. This role of ES as an operand IT resource is proposed by Schenk (2015). ES that is in the onward and upward phase can be considered as operand resources as they have passed the implementation phase and can be argued that it has decreased its triggering ability. In conclusion, a matured ES can be considered as an operand IT resource.

2.4.3.2 Digital technologies as operant resources

Firstly, from a technology view point, digital technologies have provided organisations with unprecedented potential for innovation through affordability, ease of adoption, and ease of connection with customers and suppliers. Digital technologies have extended innovation capabilities of the organisation and have introduced new routines, organisational arrangements, structures and business processes which epitomise the innate characteristics of operant resources. Secondly, from business point of view, the introduction of digital technologies may lead to unpredictable outcomes. Similar to operand IT resources they will also increase the risk of failure when triggering innovation. Yet the risk could be minimised with careful planning of the selection and deployment strategy. Thirdly, digital technologies can be integrated with ES and augment the value delivered. Lusch and Nambisan (2014) highlight that operant IT resources engage with (or act upon) other resources in the innovation ecosystem and thereby lead to innovation or value co-creation. Considering these facts, it is evident that digital technologies can be contemplated as operant resources.

Though the current research offers a sense of direction to conceive the role of IT resources in innovation, further studies are essential. Furthermore, a conceptual and a theoretical explanation of the evolution, relationship and interaction of operant and operand IT resources would offer fascinating insights. Practical considerations here relate to; (i) how organisations could select new resources based on the current landscape, and (ii) how, in general, organisations attain competitive advantage through the combination of operand and operant IT resources. Analogues research on enterprise architecture will undoubtedly provide further scientific merit to the discussion of the role of IT as operand and operant resources.

What this review of literature shows is that operant IT and operand IT enable innovation individually. Each technology type has its own merits and flaws. Therefore, organisations must take into account all of these characteristics when using these technologies for innovation. Even though much literature praises each type of IT in the innovation process, the process of innovation through the collective use of operand and operant IT has not been discussed before. Thus, this study investigates how organisations innovate through operand IT and operant IT to survive in the competitive business landscape.

2.5 CHAPTER SUMMARY

The advancements in the technology landscape offer organisations an eclectic selection of technologies. As a result, organisations hold a portfolio of IT resources (e.g. ES and digital technologies). These technologies have innate characteristics and are applied to fulfil diverse objectives. Yet, an analysis of the literature indicates that contemporary theories do not consider the integration of these innate characteristics in the innovation process. Thus, in this study, to consider the different roles played by ES and digital technologies, the two types of technologies are classified according to Nambisan (2013) classification of IT resources for innovation.

This chapter discussed the emerging role of ES as a platform and the advanced role played by digital technologies for innovation. For example, through a literature analysis, it was established that the ES depicts the characteristics of operand IT resources. Schenk (2015) in his study also identifies the operand role of ES. Further, it was established that considering the characteristics digital technologies depict, they can be categorize as operant IT resources. Scholars highlight how the process of innovation has changed with the advancements of digital technologies (e.g.

Henfridsson et al. 2014; Nylén and Holmström 2015; Yoo et al. 2012). However, the literature seldom discusses how organisations innovate through eclectic collection IT resources, taking into account the individual characteristics they possess. Thus, the study investigates the unique roles of ES and digital technologies in relation to organisational innovation (even though this is established using literature, this has not been established using data). Further, it investigates the nature of innovation attained through the modern IT portfolio and also the process of attaining innovation through the modern IT portfolio. Having reviewed the relevant literature in this chapter, the next chapter presents the methodology that has been used to analyse the innovation phenomenon under investigation.

Chapter 3: Research Methodology

The objective of this chapter is to provide the theoretical rationale for selecting a specific research method and to present the philosophical assumptions underlying the study. This chapter describes the design adopted in this research to answer the research question stated in Chapter 1. Section 3.1.1 discusses the methodology used in the study, the stages by which the methodology was implemented, and the unit of analysis; Sections 3.3, 3.4, 3.5 detail the sampling procedure, case selection and data analysis, respectively; Section 3.6 discusses how the data was analysed; and Section 3.7 discusses the ethical considerations of the research and the study's limitations. Figure 5 presents the thematic structure of this chapter.

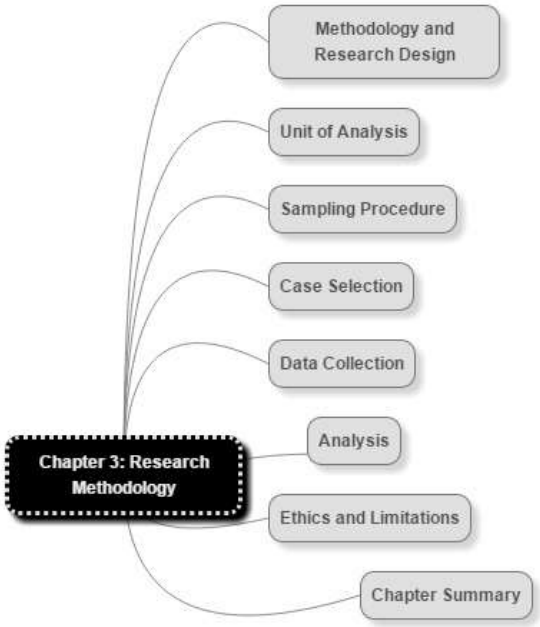

Figure 5: Thematic structure of Chapter 3

3.1 METHODOLOGY AND RESEARCH DESIGN

The study investigates how organisations innovate using the modern IT portfolio. To study this phenomenon thoroughly, it was critical to design the research carefully. When designing the research, the following five research principles proposed by Janesick (1999) and Cheek (2004) were taken into account:

(i) the connection of the design of the study to the paradigm,

(ii) the resources that permit the researcher to understand the phenomenon,

(iii) the study context (including the participants),

(iv) the methods of collecting the data, and

(v) the preferred instruments for collecting the data

The qualitative approach was selected as the research methodology for several reasons. First, according to Emory and Cooper (1991), the nature of the research question determines the research methodology. As Van De Ven (2007) states, the formulation of the research problem directly affects the design, data collection and analysis of the research. The research question posed in the present study is: '*How do organisations innovate through the modern IT portfolio of ES and digital technologies?'* Such fundamental question requires the adoption of a research method to check against the existing theory and to explore new possibilities. Thus, the qualitative approach (case study method) was selected as it is effective in answering 'what', 'how' and 'why' questions (Yin 2009). The unit of analysis of the study was the 'organisation.' According to the qualitative literature, when the primary focus is on an 'organisation' or a 'team', the best methodology to analyse such units are qualitative approaches (Sarker and Sarker 2009; Sarker et al. 2013).

To the best of the candidate's knowledge, no prior research has studied how organisations innovate using the contemporary IT portfolio. Instead of analysing the dependent and independent variables, this study aims to gain a deeper understanding of the process of innovation through ES and digital technologies in the contemporary competitive environment.

In summary, the choice of selecting a qualitative methodology occurs for three key reasons:

1. The phenomenon of interest in this study is process oriented and is difficult to measure
2. The nature of the research question and also the objective of the study deems it appropriate for the use of a qualitative approach
3. The innovation attained through a modern IT portfolio has little to no previous empirical research.

Considering all of the above stated reasons, the choice of a qualitative methodology was based on sound rationale.

3.1.1 Case study method

Case study methods are broadly categorised as positivist and interpretive case studies (Klein and Myers 1999). Orlikowski and Baroudi (1991) explain that the positivist approach consists of formal propositions, quantifiable measures of variables and proposition testing, and derives conclusions about the phenomena from a representative sample to a targeted population. The interpretive approach, on the other hand, is useful for researchers seeking to understand the thoughts and actions of individuals within social and organisational settings (deep insights into the phenomena of interest) (Klein and Myers 1999). Creswell (1988) states that one of

the key assumptions in interpretive case studies is that knowledge is shared through interactions and this shared knowledge is closely tied to individual biases and values. Thus, the interpretive approach allows the researcher to capture the qualities, rationales and processes that cannot be measured or quantified in terms of amount, frequency and intensity (Walsham 1993). In the interpretive approach, the focus is not on predefining the variables (Kaplan and Maxwell, 1994) but on understanding the phenomena through the interpretations of the individuals (Orlikowski and Baroudi 1991).

Benbasat et al. (1987, p.371) identify the following key characteristics of the case study method:

1. The phenomenon is examined in a natural setting.
2. Data is collected by multiple means.
3. One or few entities (person, group or organisation) are examined.
4. The complexity of the unit is studied intensively.
5. Case studies are more suitable for the exploration, classification and hypothesis development stages of the knowledge-building process; the investigator should have a receptive attitude toward exploration.
6. No experimental controls or manipulation are involved.
7. The investigator may not specify the set of independent and dependent variables in advance.
8. The results derived depend heavily on the integrative powers of the investigator.

9. Changes in site/case selection and data collection methods could take place as the investigator develops new hypotheses.
10. Case research is useful in the study of 'why' and 'how' questions because these deal with operational links to be traced over time rather than with frequency or incidence.
11. The focus is on contemporary events.

3.1.1.1 Multiple case study method

The investigation in the present study can be characterised as multiple case study. Yin (2009) states that case study research is one of the most challenging research strategies and that it is well suited for understanding contemporary and complex phenomena. In this study the phenomenon under investigation is 'the innovation attained through the modern IT portfolio.' Innovation scholars (e.g. Brynjolfsson 2011; Damanpour 1991; Dewar and Dutton 1986; Fichman 2001; Rogers 1995; Utterback 1971; Zaltman et al. 1977) have identified innovation as a complex phenomenon. Further, the innovation attained through the modern IT portfolio is a contemporary and also a complex topic that justifies the application of multiple case study method. To understand and investigate the innovation phenomenon an intensive, in-depth and details investigation needs to be carried out, thus further validating the use of a case study method (Yin 2009). As Meyer (2001) states case study method is useful for discovering new behaviours, processes or any phenomenon that has little knowledge on. As discussed in Chapter 2, limited attention has been given in investigating the innovation attained through the modern IT portfolio. Yin (2009) further explains that case study method is well suited for

providing explanatory answers for how and why questions. As such, the research question of this study is, '*How do organisations innovate through the modern IT portfolio of ES and digital technologies?'* warranting the application of case study method. To investigate a topic such as innovation and in particular to conduct practice-based research, understanding the experience and actions of the relevant actors such as CIOs, LOB manager is critical (Benbasat et al. 1987). Thus, a case study method is employed for investigating the social context. In addition, the use of multiple cases create more robust outcomes as findings are more deeply grounded in wide-ranging empirical evidence such as documents, web sites, observations etc. (Eisenhardt and Graebener 2007). Further, the use of multiple cases leads to better understanding and offer in-depth and multi-faceted insights into the phenomenon.

The multiple case study method is appropriate for theory building, theory testing and descriptive studies (Benbasat et al. 1987). The use of multiple cases allows researchers to carry out within-case analysis as well as cross-case analysis, which enhances the generalisability of a research outcome (Benbasat et al. 1987; Eisenhardt 1989). The objective of this study is to develop an understanding about the innovation sought through the modern IT portfolio. Generalisability is important, especially when studying a phenomenon like innovation. Therefore, the multiple case study method offers the opportunity for comparative analysis and generalisation (Yin 2009).

3.1.2 Introduction to Induction and Deduction

There are two approaches to reasoning in qualitative studies: induction and deduction. In deductive reasoning, the researcher's investigation moves from a more general to a more specific focus. In deductive reasoning, propositions are developed from theory and tested against data in order to confirm the phenomenon. This approach, also referred to as the 'top-down approach', is depicted in Figure 6. Deductive reasoning is also known as deduction. This usually starts with a general statement or hypotheses developed based on theory or a detailed literature review. By analysing these propositions/hypotheses the researcher examines the possibilities to reach a specific and logical conclusion. In deduction, if the premises are true then the conclusion is also true. Also, if a particular hypothesis/proposition is true for a class, then the hypothesis/proposition is true for all members of that class (Recker 2012). Usually, deduction involves theory testing.

Figure 6: Deductive reasoning Adapted from Trochim (2000)

Inductive reasoning starts from a specific observation and then generalises and builds a theory about the specific phenomenon. Vogt (1993) explains inductive reasoning as the inference of generalised conclusions from data, as opposed to starting from a theory and moving to a conclusion about a particular phenomenon. In inductive reasoning, patterns are developed and guiding hypotheses are developed to generalise the phenomenon or develop a theory that explains the phenomenon. In

inductive reasoning or induction, based on many observations a pattern is derived. The researchers then generalize this pattern and conclude an explanation for the phenomenon or derive a theory (Recker 2012). Figure 7 presents a graphical representation of inductive reasoning.

Figure 7: Inductive reasoning Adapted from Trochim (2000)

In conclusion, both deduction and induction methods have pros and cons. Deduction gives absolute proof and it never makes contact with the reality. Using deductive approach there is no place for observation or experimentation and there is no way to test the validity of the premises. Even though, induction is driven by observation and data, through induction actual proof of a theory cannot be attained.

3.1.3 Methodology followed in the study

Most social science researchers combine deduction and induction approaches in their studies (e.g. Bergin and Savage 2011; Reed et al. 2014; Rettig et al. 1996). Similarly, in this study the overall methodological approach consisted of two sequential steps. First, the propositions about ES, digital technologies and innovation discerned from the extant mainstream literature were subjected to deductive examination (Lee 1989; Yin 2009). In deduction phase, from a more general to more focused investigation of the phenomenon is carried out. The objective of the deduction phase is to "test whether data are consistent with prior assumptions, theories, or hypotheses identified or constructed (Thomas 2006, p. 238)." The

developed propositions are tested against data to confirm the phenomenon and critically examine the state-of-the-art knowledge about ES and digital technologies led innovation.

According to Thomas (2006, p. 238), "In deductive analyses, such as those used in experimental and hypothesis testing research, key themes are often obscured, reframed, or left invisible because of the preconceptions in the data collection and data analysis procedures imposed by investigators." Thus, to carry-out a goal-free evaluation, an empirically grounded inductive approach was considered as appropriate for studying the phenomenon thoroughly (Glaser and Strauss 1967). The specific observations made in the deduction phase are generalised in the inductive phase and allowed a theory to emerge from the data collected (Strauss and Corbin 1998). Vogt (1993) explains inductive reasoning as the inference of generalised conclusions from data as opposed to starting from theory to conclusion about a particular phenomenon. The data analysis in this phase was inspired by grounded theory, yet, following Bryant and Charmaz (2007), less procedural version of grounded theory was employed.

Most social science researchers combine these two reasoning approaches (deduction and induction) in their studies (e.g. Bergin and Savage 2011; Reed et al. 2014; Rettig et al. 1996). This integrated approach of deduction followed by induction allows the researchers to "continually cycles from theories down to observations and back up again to theories (Thomas 2006, p. 24)." The advantage of this approach is that it is possible to critically examine the state-of-the-art knowledge about a topic and incrementally build on the body of work by retaining the aspects found to be empirically valid and reformulating the aspects found to be questionable or invalid.

According to Eisenhardt (1989) when existing theories are not adequate to explain a phenomenon, or when a study involves a new phenomenon, researchers should use the following guideline:

1. Define the research question
2. Select the case
3. Develop the data collection instruments and protocols
4. Enter the field
5. Analyse the data
6. Refine the hypotheses by measuring constructs and verifying relationships
7. Check the emergent theory against the existing theories
8. Finish when theoretical saturation is reached.

During the analysis, within-case analysis and cross-case analysis are followed to develop properties. The codes and categories are developed in the initial stage, and these codes and categories become much more defined and stabilised after a number of iterations. The study design initially included a deduction phase only. That was deemed adequate given the nature of the research question and the two propositions. However, the observations made during the deduction phase required to investigate further. Having analysed the data in deduction led us to believe that in-depth, new insights could be derived through induction.

In essence, the study first analyses the existing literature of ES, digital technologies and innovation to understand the state-of-the-art knowledge about each of the technology type. Especially, ES has contradicting views in facilitating

innovation. Also, digital technologies facilitating innovation is fairly new topic to academia. As a result, the propositions developed through a literature review was tested against the data and established whether these technologies facilitate innovation in an organisation. The results in the deduction phase encouraged to analyse data inductively. In this phase, the cases used in the deduction phase were revisited, as well as new cases were added until the saturation point was reached. In the induction phase the less procedural grounded theory approach was used and open coding, axial coding and selective coding were developed. Through selective coding the core category was identified. The theory that emerged in the induction phase required theoretical scaffolding. Thus, an overarching meta-theory was employed to explain the phenomenon of interest (Paterson 2001; Sarker et al. 2001). In here, the meta-theory did not guide the coding process. The quality of the meta-theory was determined as it encapsulated all the constructs identified in the coding process. The study employs both positivist and interpretivist approach as it interprets data in two ways: through testing of propositions and combining data into a system of beliefs where the manifestation is specific to cases (Bernard 2011; Lin 1998). This combined approach is used mostly in sociology research but rarely used in IS research (Lee 1991). However, Lee (1991), Cavaye (1996) praises the use of combined approach in organisational research.

As such, the research design is presented in Figure 8 provides the key phases followed in this study. The research design is presented in Figure 8.

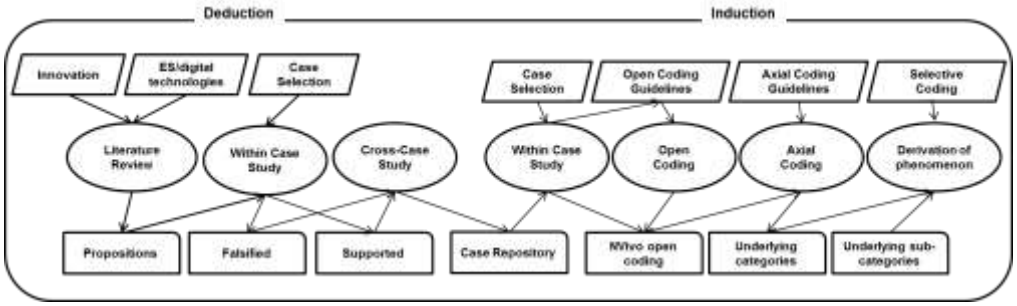

Figure 8: Research Design

3.2 UNIT OF ANALYSIS

The unit of analysis in the present study is the organisation. Although the unit of analysis is the organisation, interviews are held with individual members as the social groups are derived from individual members (Babbie 1989). The reason for selecting the organisation as the unit of analysis is that the research question is related to the innovation attained in an organisation, not individual innovation. For example, the research question specifically investigates *'How do organisations innovate through the modern IT portfolio of ES and digital technologies,'* where the focus is on the organisation.

3.3 SAMPLING PROCEDURE

Considerations of both control and variety guided the selection of cases (Dubé and Paré 2003) in the present study and the sampling was done in a deliberate fashion (Patton 2002). Sampling was done in both deduction and induction phases and in both phases purposeful sampling was employed. The study sought the participation of representatives of companies with a stable ES that had been implemented for at least 3-5 years. The 3-5 year time span is generally considered sufficient for organisations to reach the onward and upward phase of the ES lifecycle (Markus and Tanis 2000; Markus et al. 2000). In order to identify the lifecycle phase

in which each organisation was operating, the characteristics of the shakedown and onward and upward phases (Markus and Tanis 2000) of the ES lifecycle were gathered (as discussed in Chapter 2). The selection of organisations that had reached the onward and upward phase was important since it would allow a clear understanding of the effects of the ES on innovation; not only upon the system's introduction, but also after its core components had been routinized. Similarly, the effects of digital technologies on innovation is analysed in pre-implementation and post-implementation phases. Further, the case organisations represented diverse industry sectors and ownership structures (i.e. family-owned, publically-listed and multi-national, thereby supporting the generalisability of the results) representing different level of sophistication of their ES.

The respondent sampling was purposeful. Where possible, the snowballing technique was used to recruit interviewees in the first phase. The "CIO seminar series on Enterprise Systems" held by the Enterprise Systems Research Group of Queensland University of Technology, of which the candidate is a member, presented a useful opportunity to select the organisations. In these seminars, senior executives presented their strategic IT view with a particular focus on ES. The network developed through this seminar series assisted the candidate to develop sufficient background knowledge of the topic and helped in selecting the most appropriate cases.

In the second phase, purposive sampling was employed as the sampling technique. As Patton (2002) explain, purposive sampling can be done based on extreme or deviant cases, typical cases, maximum variation, intensity, critical cases, sensitive cases or the convenience. In this study the purposive sampling was done based on the intensity. Five more cases were used during the induction phase of the

study. These cases were selected as their ES were in different sophistication level. Some cases were not privately owned, thus, it was interesting to see how these organisations innovate with their existing ES. The codes were refined and the saturation point was reached after analysing five new cases. Therefore, in total nine case organisations were analysed in induction phase.

3.4 CASE SELECTION

The main informant sought in the case organisations was the CIO, or the individual holding an equivalent position (i.e. chief technology officer [CTO] or technology leader). The targeted CIO sample was appropriate for the study objectives, as these personnel would be able to comment knowledgeably on behalf of the organisation in relation to innovation, ES and digital technologies (Ross and Feeny 1999). The CIO or equivalent was selected for participation in the study based on consideration of the following factors:

1. As Grover et al. (1993) explain, a CIO manages the information resources that influence organisational strategy, and has the direct responsibility for the planning of the IT framework necessary to cope with an organisation's competitive environment.
2. A CIO can provide an overall opinion about the organisation and the industry (Ross and Feeny 1999).
3. A CIO is knowledgeable about the organisational policies, culture, initiatives and strategies.
4. A CIO has access to important research-specific data.

Nine organisations representing diverse industry sectors were contacted for the interview process. To ensure that data collection occurred in relevant organisations, a

preliminary telephone interview was conducted with the CIO/CTO of the organisation prior to engaging in more intensive data collection. During this conversation, the CIO was given a detailed explanation of the purpose of the study and the expectations. Consent was obtained from the CIO for participation in the subsequent interview. The organisations were contacted during the period from September 2013 to March 2014. All of the organisations agreed to participate in the study. The following screening qualifications were considered when selecting the organisations:

1. The organisation had a dedicated CIO and a team of IT staff that managed the organisation's IT portfolio, including a packaged ES.
2. The organisation had used an enterprise system for the past five years and documentation of the IT roadmap since implementation of the enterprise system was available.
3. At the time of the data collection, the CIO had been in the position for at least six months, was not in the last six months of their appointment, and was participating in regular meetings with the executive leadership team (e.g. CEO, CFO). This was essential in order to determine that the present IT leadership was not 'in transit'. This is an important consideration because it has been argued that companies with in-transit CIOs do not embark on strategic initiatives.
4. The case organisation should have recently initiated an IT-centric project using one or more of the digital technologies.

In addition to interviews with CIOs, interviews were also conducted with other respondents for two purposes.

(i) A member of the ES implementation team was selected in case the current CIO had not taken part in the organisation's ES implementation.

(ii) A department head or department manager was selected from a recent IT-centric project that was considered innovative by the organisation.

This is consistent with Laforet (2013), who advocates that when measuring innovation, observations must be made from managers who initiated or immediately affected by the innovative endeavours for the purpose of corroboration, triangulation and substantiation. Each case organisation was profiled using additional information gathered through the organisation's website and annual reports, and through general web searches of the organisation's name. The background knowledge gained was vital to better understanding the organisation and its environmental context.

3.5 DATA COLLECTION

As mentioned above, the data collection involved multiple interviews at each organisation. All the interviews were based on the same case protocol, which included interview guidelines with open-ended and semi-structured questions. This included questions about the case organisation as well as specific questions regarding the constructs of the study's theoretical propositions. The high-level interview guideline is provided in Appendix A. Table 3 presents a summary of the case organisations, including the pseudonym given to identify each organisation. Appendix B includes a detailed description of the case organisations.

Table 3: Summary of the case organisations					
Pseudo Name	**Industry Sector**	**Origin**	**Induction/ Deduction**	**Hours**	**ES**
LOGISTICS	Private Sector / Logistics	Europe	Deduction/ Induction	11	SAP
MULTI	Private Sector / Dairy	Europe	Deduction/ Induction	4	SAP
ENERGY	Private Sector / Energy	Europe	Deduction/ Induction	12	SAP
FARM	Private Sector / Manufacturing	Australia	Deduction/ Induction	12	SAP
TELECOM	Private Sector / Telecommunication	Asia	Induction	4	SAP
ROAD	Public Sector / Transport	Australia	Induction	11	Oracle
INSURANCE	Private Sector / Insurance	Asia	Induction	5	AS400
DAIRY	Private Sector / Dairy	Europe	Induction	8	SAP
HEALTH	Non-Profit / Health	Australia	Induction	6	Oracle

The four cases employed in the first phase were LOGISTICS, MULTI, ENERGY and FARM. All four case organisations had implemented SAP as their ES in the period from 1997 to 2008 by a reputed implementation partner (MULTI has done their implementation in 1997 and ENERGY in 2008). At the time of the data collection, LOGISTICS, MULTI and ENERGY were operating in more than two continents, while FARM – a leading producer of fruits and vegetables – had operations only in Australia. All four companies employed a location-based big-bang implementation approach using distributed implementation teams, managed by the company headquarters. All the case organisations had implemented the SAP Materials Management, Sales and Distribution, Financials and Controlling modules. The average implementation time was 25 months (minimum 22 months and maximum 27 months).

The second phase included five new cases, namely, TELECOM, ROAD, INSURANCE, DAIRY and HEALTH. The inclusion of the new cases added granularity to the tested propositions and provided key facets of differentiation to the four earlier cases in line with the idea of purposive sampling.

The five new cases:

i. Extended the geographical selection to Asia, where IT sophistication (especially in ES) may be lower (Popovič et al. 2012; Soh et al. 2000).

ii. Increased the diversity of the industry sectors to reflect various innovation environments (e.g. a not-for-profit, a public sector and an innovation-savvy telecommunication organisation). It might be argued that not-for-profit and public sector organisations would be expected to have low ambitions for

innovation, while private sector companies (such as TELECOM) would be expected to have high innovation ambitions.

iii. Increased the generalisability of the results by extending the sophistication level of ES.

The case protocol created for induction phase was used with minor modifications (included several follow-up questions) and the same principles were followed in selecting the participants. The five new cases were conducted through 34 person-hours of interviews.

The CIO and department managers in each case organisation were interviewed. In total, 54 semi-structured interviews (totalling 73 person-hours) were conducted in the study. Each interview took between 1 to 2 hours and, in most cases, follow-up interviews were conducted for the purpose of clarification or due to time constraints where the CIO was unavailable for lengthy meetings in a single session. All the interviews were conducted face-to-face, in English, between November 2013 and May 2014 (see Table 3 above for details of the cases). The interviews were audio-recorded and then transcribed.

Triangulation was achieved through the use of multiple data sources. The use of open-ended questions in the interviews, document analyses and publicly-available information about the organisation were used to verify the findings.

3.6 ANALYSIS

The essential features that were taken into account in this study were the statements that explained the lead time of the innovation, outcomes they experienced and how they described the impact of ES and digital technologies after the implementation. The information regarding these features was collected from CIO and line of business (LOB) managers.

Two propositions were developed analysing the existing literature on innovation potential of ES and digital technologies. As Robinson (1951) states, it is critical for a researcher to develop propositions as it narrows down the focus and allows the researcher to focus on specific data consistently. Further, the analysis of negative or challenged cases allows the researcher to explore in-depth and identify anomalies.

Chatterjee et al. (2009, p.625) summarise the essence of the deductive methodological approach as follows:

"A deductive approach involves starting with an already formulated theoretical proposition and using empirical evidence to assess the validity of the proposition (Sarker and Lee 2002). We note that, within this perspective, evidence that is consistent with the predictions "can only temporarily support" a proposition or a theory, since subsequent tests "can always overthrow it" (Popper 1985, p. 136)…Popper adds that "So long as a theory [proposition] withstands detailed and severe tests…,we may say that it has 'proved its mettle' or that it is 'corroborated' by past experience." If the evidence is not found to be consistent with the proposition in question, it casts doubts on the proposition (Ackroyd and Hughes 1992)."

Recapping the discussion in Chapter 1, the following propositions were developed in the present study:

i. ES facilitates innovation and

ii. Digital technologies facilitate innovation

The testing of the propositions involved pattern-matching whereby deliberately sought evidence related to the given propositions in the four cases (Dibbern et al. 2008; Sarker and Lee 2003; Yin 2009). The pattern matching followed in the deduction phase was followed by the guidelines given in Harris et al. (2009).

1. The interview was recorded, transcribed and took memos.
2. The audio tapes were played to identify broad themes.
3. The audio tape transcripts were analysed to formulate categories and codes. During this process, the data was analysed to ensure that the categories were exhaustive, included all relevant items, and were mutually exclusive, so that no single item could be coded in more than one category. Table 4 presents the initial categories and sub-categories.

Table 4 : Categories and Codes

Category	Codes
Actor	CIO, Department Manager
Innovation Type	Radical, Incremental
Technology Type	ES, Digital technologies [mobile, cloud, analytics]
Resource Allocation	Continuous, Sporadic, Ad-Hoc
ES Resource Role	Enabler, Inhibitor, Initiator
Digital technologies Resource Role	Enabler, Inhibitor, Initiator
Lead Time	Short, Long
Innovation Intensity	Low, Medium, High
Project	IT, [open classification]
ES Stage	Pre implementation, Post implementation

4. The data was analysed by coding the data and identifying the patterns and relationships within the data.
5. The propositions were analysed against the data and the patterns and relationships were identified.

Based on how well the empirical patterns fitted the patterns predicted by the proposition, the propositions were characterised as being "supported," "not supported", "conditionally supported" or "challenged" (implying there was some degree of inconsistency between the predicted pattern and the observed patterns).

The second phase of the analysis was predominantly inductive in nature. In particular, the study involved the engagement in theory building through iterative coding of the data guided by the notion of constant comparison that occurred concurrently with the data collection (Birks et al. 2013). Such ongoing analysis prompted the seeking of new data or revisiting data that had already been analysed based on a purposive sampling logic. The analytical steps in the study were inspired by the notions of open coding, axial coding and selective coding (Strauss and Corbin 1998). However, it is important to note that the theoretical understanding gained through the deduction did not guide the analysis in the induction phase. The results gained in the deduction were helpful to define the topic and areas that required the concentration. The initial theoretical formulations can be refined or modified through the analysis of data in the induction phase.

The open coding involved generating codes from the data, the axial coding involved organising the codes into categories, and the selective coding involved linking the categories in order to develop an integrative framework. As Strauss and Corbin (1998) explain, open coding allows the researcher to identify the key ideas and concepts hidden in the data. The codes and categories are developed in open

coding. In axial coding, the codes and the categories are aligned considering their properties and dimensions (Corbin and Strauss 1990). In selective coding, the core category is identified and the relationships between the core category and the sub-categories are determined (Corbin and Strauss 1990). It is noted that, in line with the tenets of less procedural grounded theory methodology (e.g. Bryant and Charmaz 2007; Glaser 1978), the study's theoretical sensitivity enabled the emergence of ideas and the formulation of a coherent framework based on the subjects' point of view, rather than the forcing of a particular theoretical view onto a focal phenomenon (Corbin and Strauss 1990).

When conducting qualitative research it is critical to ensure the analysis quality. Miles and Huberman (1994) explain that it is important to avoid 'holistic fallacy' which means not interpreting events as more congruent than they actually are. To ensure the quality in the data analysis process, conclusions were continuously documented. During and after the interviews, memos were created. Walsham (2006, p. 325) explain the process of reporting memos:

"In terms of learning from the data itself, grounded theory offers one way of doing this, although the 'coding' is a subjective process to some extent, because the researcher chooses the concepts to focus on. I tend to use a looser approach myself, where I write impressions during the research, after each interview, for example. I generate more organized sets of themes and issues after a group of interviews or a major field visit. I then try to think about what I have learnt so far from my field data." Miles and Huberman (1994) explain that memos are a rapid way of capturing and reporting data. However, theoretical memos were only created for induction phase. The theoretical memos were not created in the deduction phase. The findings of the data analysis phase in the present study are presented in Chapter 4.

3.7 ETHICAL CONSIDERATIONS OF THE STUDY

This study was considered to be in the category of negligible/low risk research and received approval from the QUT Research Ethics Unit. The research did not involve any physical, psychological, social, economic or legal harm to the organisations or individuals who participated in the data collection process; nor was the research detrimental to any company or individual participant. Approval was granted from the University Human Research Ethics Committee (UHREC) prior to data collection (with ethics application approval number 1400000220). The ethics approval letter is shown in Appendix C. As required by the ethics approval process, oral consent was obtained from the participants at the beginning of the interviews. Each participant was provided with a detailed outline of the study objectives and an explanation of the ethical principles such as privacy, confidentiality and the process of withdrawing from the interview process.

Throughout the study, the researcher paid careful attention to following the key ethical principles such as natural justice and respect for individuals. Pseudonyms were used for each organisation and individual participant in order to protect privacy. All the data was stored safely in a limited access, password-protected environment.

3.8 CHAPTER SUMMARY

This chapter described the methodology used to answer the research question posed in the study. As explained, an integrated approach of deduction phase followed by an induction phase was used as the data analysis method. Two main propositions were developed to analyse the research questions. The analysis was done in two phases. In the first phase four cases were selected (LOGISTICS, MULTI, ENERGY and FARM). Five new cases were used for the analysis in the second phase

(TELECOM, ROAD, INSURANCE, DAIRY and HEALTH). The purposive sampling was used as the sampling method in both phases and the data collection involved multiple interviews at each organisation. The interviews followed an interview guideline and used open-ended and semi-structured questions. The data was continuously documented in order to avoid the holistic fallacy. The induction phase included open coding, axial coding and selective coding. The next chapter presents the results and the findings from the data.

Chapter 4: Results and Findings

This chapter presents the analysis results and the findings of the research. It contains a detailed discussion of the analysis process and the outcomes, interpretation and evaluation of the results with reference to the literature. This chapter also discusses the theory building and the meta-theory.

The structure of this chapter is as follows. The initial guidelines for the analysis are presented and then the analysis of the propositions is presented in Section 4.2. The findings of the research are discussed in Sections 4.3 and 4.4 under the sub-topics Deduction phase cross-case summary and Induction phase: analysis and results respectively. The thematic representation of the chapter structure is given in Figure 9.

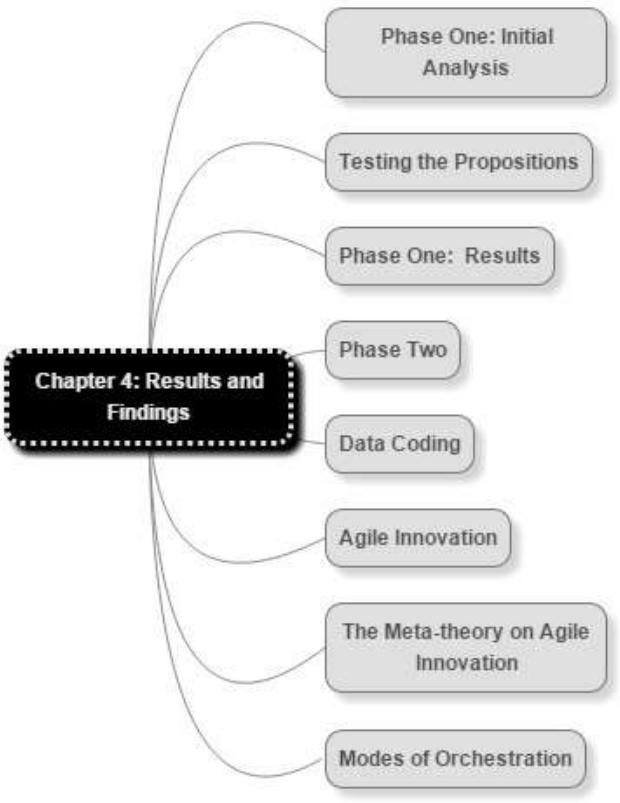

Figure 9: Thematic representation of Chapter 4

4.1 DEDUCTION PHASE: TESTING THE PROPOSITIONS

The deduction phase contributed to the conceptual understanding of how organisations innovate through the modern IT portfolio (Yu 1994). In this phase, the two propositions derived through the literature review were tested using the data collected from, four cases, namely, LOGISTICS, MULTI, ENERGY and FARM. In deduction phase pattern matching was employed as the analysis method following the analysis guidelines by Harris et al. (2009).

To operationalize the propositions the study first defined innovation. The transcripts were categorised and each category was defined. The definitions of the categories were broad that it allowed the emergence of alternative definition for the category. A within-case analysis and cross-case were followed in the deduction phase. The goal in the deduction phase was to study multiple cases to allow replication. The four case organisations used in the deduction phase allowed us to provide the saturation of the constructs. The triangulation of data was attained through the analysis of multiple means of data (LOB managers' view point, CIO's viewpoint and document analysis).

This section summarises the results of the propositions. Within-case and cross-case analyses were carried out for each proposition. An objective of the cross-case analysis is to determine whether or not empirical evidence for each proposition, in each case, can be observed across the four cases (Eisenhardt 1989). This process enhances confidence in the validity of the observed relationships (Dibbern et al. 2008; Sarker and Lee 2003). The two propositions were analysed under four key areas: (i) Respondent (CIO, LOB manager), (ii) Innovation type (incremental innovation, radical innovation), (iii) Lead time and (iv) Lifecycle phase (pre-implementation, post-implementation). The innovation type and lead time are the

dimensions used in innovation literature to measure innovation. The definitions of these two can be found in Chapter 2. The interview protocol used in the deduction phase specifically asked the questions such as, 'What are the advantages and disadvantages you see in introducing these technologies? What are the changes you see in the organisation after introducing these technologies?' to analyse and compare the pre-implementation and post-implementation impact of these technologies. Example quotations for each of the propositions are presented in the following sub-sections.

4.1.1 Proposition 1: ES facilitates innovation

The objective of this proposition was to understand how organisations innovate using their existing ES.

4.1.1.1 Within-Case Analysis: Respondent

a. LOGISTICS

CIO of LOGISTICS:

The CIO of LOGISTICS had a very positive view about ES for innovation. The CIO discussed how the ES enabled integration, standardisation and real time data accessibility. Introduction of their enterprise system had swept away the messy processes LOGISTICS was following and introduced new business processes. Thus, the introduction of SAP led them to experience process innovation.

> *"SAP certainly made our business processes better, so all the core functions are on SAP. We don't have the issues that we used to have with data, systems going down and everything in one place…It introduced new business processes, that's huge for a company like ours"*

LOB Manager of LOGISTICS:

According to the LOB manager, the employees found it difficult to grasp the functionalities of ES. The system introduced new processes and their roles and responsibilities changed drastically. The characteristics of a radical innovation such as, low technical knowledge, uncertainty, high cost were highlighted evidencing radical innovation.

> *"Introduction of SAP changed the whole company. The roles and the responsibilities of the employees were changed. Some were happy, some were not happy. But overall, it changed the business processes in a good way"*

b. MULTI

CIO of MULTI:

The CIO of MULTI considers the introduction of the ES as a blessing to their organisation. The CIO explained how difficult it was to manage their large business in 100+ companies. They were unable to see the financial positioning of their company previously (globally). With the introduction of the ES, the business processes and practices changed, in a positive way.

> *"SAP connects across all boundaries. We have businesses in 100+ countries and mind you that's a huge thing. So we can see everything as 'one company'. That was a massive thing for us. It [SAP] helped us to sweep all the messy practices we used to follow and introduced new processes"*

LOB Manager of MULTI:

The data collected from the LOB manager of MULTI emphasised that SAP (ES) provided the IT backbone. Their enterprise system looks after their entire business functions, even digging deep into minor details such as a material ID. Every bit of details changed due to the introduction of ES.

> *"The implementation of SAP incurred a huge cost. It [SAP] changed everything, even simple things like a SKU [raw material id] was standardized. The change was so drastic that it took few months for us to digest it"*

c. ENERGY

CIO of ENERGY:

The CIO of ENERGY agreed that all their financial processes, HR processes were standardised. They are able to develop real-time reports using the ES. This was a major issue they were facing and ES resolved it.

> *"After implementing SAP, all main processes were standardised, and then it was all real-time. Even now we rely so much on it [SAP] to run our core business processes."*

LOB Manager of ENERGY:

The LOB manager of ENERGY was happy with the changes introduced through the ES. The system rebranded their responsibilities, and reduced all the redundancy points. According to the LOB manager ES gave a new life to their messy business processes.

> *"Our business processes were all messy…When SAP was introduced, it was a huge change, and our employees did not know how to use it [SAP]…it was a brand new experience to all of us"*

d. FARM

CIO of FARM:

The CIO of FARM referred to their SAP (ES) as the IT backbone. Their ES does all the compulsory work. The introduction of their SAP had allowed them to manage their sales activities and helped them to save lot of money.

> *"SAP does a huge workload in the company…with regard to the main business processes"*

LOB Manager of FARM:

The LOB manager of FARM explained that SAP (ES) was the organisation's main IT system, yet it was too complex and resource-intensive. They found it difficult to use the system. Yet, they were amazed by the capabilities of the ES. The managers did not have to crunch the numbers for days to create a report, the system offered all the information required. However, they found it difficult to use in the beginning.

> *"When SAP was introduced, the business practices, processes, and everything we followed earlier changed radically. We didn't know how to use it to our day-to-day business. It was an upside down change"*

Cross-Case Analysis: Respondent

Overall, this measure analysed the overall view of the CIOs and LOB managers with regard to ES's role in facilitating innovation. The introduction of ES enabled standardisation, integration, real-time data and best practices in the organisation. Further, the case organisations highlighted complexity, resource intensiveness and inflexibility as the main reasons why innovation was difficult to attain continuously through the ES.

4.1.1.2 Within-Case Analysis: Type of innovation

This facet will analyse whether radical innovation and incremental innovation were attained through ES. Latzer (2009) proposes the following characteristics of radical innovation: it is discontinuous (with or without a predecessor; substantial, non-linear improvement); it is based on new technology; it leads to a new dominant design; it can lead to paradigm shift; it involves great uncertainty; it includes an entirely new set of performance features; it requires re-education and new organisational roles and skills; it is attributed to chance, not to necessity; it might be influenced by R&D policy; it is driven by technology (important in the early phase of technology); and it helps to achieve long-term economic goals. The innovation attained in each case organisation was compared against these radical innovation characteristics. Similarly, the incremental innovation characteristics proposed by Latzer (2009) was taken into consideration when analysing the incremental innovation.

a. LOGISTICS

Radical Innovation:

The LOB manager at LOGISTICS considered the movement from the then-legacy system to SAP as a radical shift, equating it to a shift from the stone-age to a new world. The introduction of the new technology was a paradigm shift.

> *"The shift to SAP had to happen for the survival of the company. The MM / SD modules alone were making a new world for us. We [department staff] could see the schedules and sales in one click"*

Incremental Innovation:

At LOGISTICS, all the routine and daily activities were done through the ES; however, they treated the ES as a barrier to innovation. They did not allocate

additional or continuous resources for the ES; rather, they had increased their investments in other non-ES technologies.

> *"We wait for the maximum time before we upgrade our SAP system. Now, there are plenty of cheaper specialised systems...well more like applications. Some you can just plug-in to SAP; we don't need to spend money on SAP at all. We agree that SAP helps us to run the company - simply keeping the lights on. It's too big, complex and cumbersome to initiate innovation"*

b. MULTI

Radical Innovation:

The introduction of SAP (ES) radically changed all the core processes, roles and responsibilities of the employees and organisational structure. MULTI identified them as a radical innovation that occurred in the organisation.

> *"The first few months of SAP, we were looking at immediate cost and process efficiencies…they were massive…just by introducing SAP"*

Incremental Innovation:

MULTI treated SAP as an inflexible, static system that didn't give any competitive advantage. They had undergone three major upgrades, and recently the company had sought to introduce non-ES technologies to their SAP. This new change has led them to innovate.

> *"We are using the SAP system in the same way for quite some time now. It [SAP] cannot help us with innovation anymore. Time-to-time, we see SAP [company] is giving us service packs. We sometimes use those times to push some changes, but those things don't lead to innovation…sometimes, upgrades do. We have much better, cheaper, and rapid technological solutions [non SAP] to invest on, rather than SAP"*

c. ENERGY

Radical Innovation:

ENERGY created a global IT help centre when they implemented SAP (ES) for the first time. The help centre was created because their employees did not have the necessary technical experience to use SAP. The change introduced through the introduction of ES drastically changed the business process, roles and responsibilities of the employees.

> *"Everything was new, and we felt it…the improvements were pretty visible. It [SAP] was accountable, transparent, connected…of course it [SAP] was difficult to learn at first"*

Incremental Innovation:

In ENERGY, several projects were identified in which the organisation's SAP system could support innovation through integration with non-ES technologies. The main issue with initiating innovation with SAP was that such innovation is reduced by the SAP global templates. The company had completed three major software upgrades. The dominant design was not changed as they introduced upgrades to their ES. They identify this initiative as a small improvement [incremental innovation] in the business processes.

> *"We have some experienced staff coming up with innovative ideas, but SAP global templates are killing innovation, and also we can't wait for years to upgrade [SAP] to see some innovation"*

d. FARM

Radical Innovation:

FARM replaced all ad-hoc purchasing with the SAP best practice procurement strategy, re-structuring warehouse and purchasing departments. This drastically

changed their business practices and the role and responsibilities were changed. This was a long-term investment made by FARM. They incurred a huge amount of money on implementing SAP, but the respondents agreed that the change introduced worth the money.

> *"We went from legacy of legacies [systems] to SAP. All of a sudden we can see the footprint of the company. We got the same reaction from ground [operational] staff too"*

Incremental Innovation:

FARM had not made any internal changes to SAP, other than vendor-supported patches, since its implementation. They stated that the rigidity of the system prohibited them from thinking beyond the ES boundaries. The second SAP upgrade had provided some innovations through the vendor-managed inventory. However, no further such activities were planned for the third upgrade which was scheduled to take place 2017.

> *"We upgrade the system [SAP] to mitigate risk of not having a compliant system, not to innovate. That too we wait till they [SAP Company] make it mandatory"*

Cross-Case Analysis Innovation type

All the case organisations agreed that the introduction of ES was a radical change and that the ES implementation demonstrated the characteristics of a radical innovation. The radical innovation characteristics such as changes in organisation structure, culture, processes and work practices were evident in all the cases. The technical inexperience, high cost, high risk, technological uncertainty were evident through the case data emphasising the radical innovation introduced in the introductory phase of ES. However, the radical innovation attained through the

introduction of ES did not continue. They found rigid structures, inflexibility and high cost of the ES inhibiting further innovation possibilities.

All the case organisations affirmed that the innovation attained through ES after the introduction phase is minimal. They highlighted the high cost, specialised skills required for ES-led innovations. Yet, all the case organisations affirmed that when they introduce upgrades they have the characteristics of incremental innovation. However, these incremental innovations usually yielded minimal improvements, but these improvements were not adequate to support the survival or growth of the company. All the case organisations alluded to the possibility that non-ES technologies could be used in parallel with ES for innovation.

4.1.1.3 Within-Case Analysis: Lead time of Innovation

Lead time becomes important when the market is competitive. A low lead time of innovation enables organisations to innovate faster compared to their rivals. This facet analyses the lead time of innovation of ES innovations.

a. LOGISTICS

LOGISTICS initiated some SAP projects to lead innovation, but cancelled due to the lengthy lead times. They reported that the execution time of the project was increased by the technical knowledge and the cost they would have to incur for the implementation. As a result, they decided to shut down the projects.

> *"A big problem with SAP is that it takes much too long to put the system to action. Even a small change takes massive lead time"*

b. MULTI

The senior manager at MULTI explained that innovating through the ES alone was difficult and lengthy. He further explained that since they are a multi-national

company, the development of country-specific, highly innovative sales campaigns took too long to implement in the SAP system. The global templates hindered their initiatives.

> *"Changes to our global templates are accepted once a year. That's a minimum 12 month lead time for any SAP project idea. Forget about the time for development, prototype, testing and use"*

c. ENERGY

Like the other case organisations, ENERGY agreed that ES-led innovations took a long time to deploy. The hindrance of global templates, in relation to time, was discussed at all their global IT meetings in 2013.

> *"Even activating a standard SAP feature is a massive effort. Last year, we introduced standard SAP contracts and it took nearly 2 years to implement it"*

d. FARM

FARM commenced on an Evaluated Goods Receipt settlement in SAP, but withdrew due to lengthy implementation times. They agreed that SAP has some value adding options, yet they are reluctant to introduce these changes. They stated that even a minor change to the ES took a long time to introduce, and it costs a lot to train the employees. As a result, they find it difficult to innovate continuously with their ES.

> *"We know that SAP has some cool features for innovation, but it takes years to implement. We see lot of potential in our system, only problem is the lead time"*

Cross-Case Analysis

All the case organisations agreed that ES-led innovations have a higher lead time. Usually, the implementation of ES-led innovations incurs a huge cost for the

organisations. As these functions are complicated, organisations need to launch trainings causing financial burden to the organisation. As a result, the CIOs are reluctant to introduce changes to the ES.

4.1.1.4 Within-Case Analysis: Lifecycle Phase

a. LOGISTICS

Pre-implementation:

The respondents from LOGISTICS agreed that they found it really difficult to manage all their business activities before the introduction of SAP. They had to wait weeks or sometimes months to develop a report. Especially, LOGISTICS respondents mentioned the difficulty and the costs they had to incur managing their organisational assets.

> *"Before SAP, it was a nightmare….It [SAP] led us through a big transformation…both in terms of business processes and technical"*

Post-implementation:

The analysis of the LOGISTICS data indicated that the SAP (ES) increased the accountability and enabled integration of business activities. SAP introduced best practices for the organisation to follow. However, as SAP is commonly available, every organisation has the potential to launch similar strategies. Therefore, currently, they do not make much change to their SAP, but they have introduced mobile technologies to feed data to and from SAP.

> *"…but, we don't make any changes to SAP now, we now have many other systems [non-ES] feeding data from SAP and to SAP to do much creative business activities"*

b. MULTI

Pre-implementation:

Before the introduction of ES, MULTI managed 1200+ systems. Due to this reason they had unbelievable amount of data repetitions. The business functions were not optimised and the systems were not standardised. As a result, completion of every single activity took more time.

> *"We had 1200+ 'administrative systems,' we went from there to 1 [SAP]. Oh it [SAP] put us miles ahead from where we were…our 'core' was re-invented"*

Post-implementation:

As the respondents stated MULTI is now keen on investing non-ES technologies than investing further on their SAP. Their ES is in a stabilised stage, it acts as a platform for enabling non-ES technologies to work with ES.

> *"…but we do not invest much on SAP, we now have many other systems [non-SAP] to do very innovative stuff"*

c. ENERGY

Pre-implementation:

The respondents from ENERGY stated that in the beginning they were curious about the change that was going to occur. They did not expect a single system to do a major clean-up as such.

> *"SAP implementation went on for about 2 years…it [SAP implementation] cleaned up old business processes…it [SAP implementation] was like driving a brand new sports car"*

Post-implementation:

The reliance of ENERGY on SAP (ES) was very high compared to the other case organisations. ENERGY had improved process efficiencies because of SAP but realised that they were unable to further innovate with their ES.

> *"...but the presence of SAP almost stops us from bringing in new technologies for innovation…it's too constrained"*

d. FARM

Pre-implementation:

At first, FARM management was not convinced to introduce ES. With the competitive pressure FARM realised the importance of implementing ES. They did not expect a major change in their business, but ES helped them to optimise their business processes.

> *"They [farm senior management] thought that it was impossible to optimise business processes in a farm…but SAP triggered a raft of new developments"*

Post-implementation:

FARM, an agricultural organisation, explained how beneficial it was for them to introduce their ES at first. Yet, SAP is a back office system, and they believed that it is not supporting innovation alone.

> *"...but we don't see SAP supporting our innovations…it's [SAP] a back office system"*

Cross-Case Analysis

All the case organisations agreed that, in the contemporary hyper-competitive market, it is difficult to survive with ES-led innovations alone. Organisations have realised that the combination of ES and non-ES technologies opens up new pathways for organisations to innovate with much better outputs.

4.1.2 Proposition 2: Digital technologies facilitate innovation

The objective of this proposition was to understand how organisations innovate through digital technologies. All case organisations have initiated projects that use digital technologies. The technology-enabled adoption (in this context, ES) facilitated the further integration of digital technologies, allowing organisations to make strategic investments to enhance the value of initially-adopted technologies (Fichman 2004; Karimi et al. 2007). Organisations that do not consider the evolving changes can potentially limit the inherent benefits that such underlying technologies can offer (Nwankpa et al. 2013).

Within-Case Analysis: Respondent

a. LOGISTICS

CIO of LOGISTICS:

The CIO of LOGISTICS agreed that SAP (ES) has enabled innovation in their organisation. Yet, the CIO believed that the use of digital technologies is the only way to gain competitive advantage. SAP is a commonly available system that has no power to give the competitive edge. They use mobile technologies to get closer to the customers.

> *"Accountability is much greater with our SAP system. However, we have a better reach to our customers through mobile apps…we now have huge insights through BI which runs on top of SAP"*

LOB Manager of LOGISTICS:

In LOGISTICS the LOB manager stated that the SAP (ES) covered most of the core business processes, and much of the new innovation did not happen using SAP alone, but using mobile technologies and business intelligence technologies (digital

technologies) working synergistically to attain innovation. A recently developed mobile application has made the life easier for truck drivers. The manager is happy that he did not have to worry too much about training how to use the app. It was simple as making a call from their mobile phones.

> *"My warehouse management team made a suggestion for an app for trucks management. Drivers can now do their registration of stock receipt without getting off…they [drivers] love it"*

b. MULTI

CIO of MULTI:

CIO of MULTI clearly stated that the organisation was keen to invest in mobile technologies and analytic technologies (digital technologies) for innovation. The organisation saw the innovative ways of utilising digital technologies to attain innovation especially when operating in a hyper-competitive market. The CIO highlighted the characteristics of digital technologies such as cost efficiency, less complexity as the factors that encouraged them to invest on them.

> *"Overall IT investment is up by about 15% [compared to last year]. We will keep investing on IT. Mostly on mobile technologies and BI, because it [the technologies] has helped us to sustain, to improve our productivity, reduce the cost and most importantly to innovate"*

LOB Manager of MULTI:

The LOB manager of MULTI explained how the introduction of digital technologies added value to their business. The sales representatives at MULTI can get the sales data immediately and decide on the discount available for customers. This can be done in real-time. Earlier these kinds of functionalities were not possible as the sales representative did not have access to the SAP. Currently, the sales department have not given direct access for the sales staff to the SAP, rather, they

have fetched data from SAP and showed these data on the mobile applications that sales staff use. The LOB manager stated how these technologies have helped them to innovate and win the hearts of the customers.

> *"Sales and marketing data are now on finger tips…We don't need to delay, instantly we will tell the discount for customers and the best part is that, all that's in the iPad"*

c. ENERGY

CIO of ENERGY:

The CIO of ENERGY stated that all their financial activities and transactions run on SAP. Since they have not made any improvements to their SAP, they have not experienced any productivity improvements. Yet, for managing all the external relationships, especially, when it comes to exploring new business opportunities ENERGY have introduced digital technologies.

> *"We have 100% reliance on SAP for transactions and financials. But we don't have any new productivity improvements. We rely on 3rd party IT solutions for new business opportunities"*

LOB Manager of ENERGY:

LOB manager of ENERGY stated how the presence of digital technologies enhanced the innovation attained through ES. By introducing digital technologies such as mobile technologies and cloud computing, ENERGY has increased the efficiency and effectiveness of their business.

> *"Our electrical plant generator maintenance used to be a very challenging task. Lots of similar parts and the paper manuals were very hard to maintain. Now we have all images loaded to cloud and a mobile app brings up all pictures to the engineer at the site"*

d. FARM

CIO of FARM:

The CIO of FARM explained that the company had seen the advantages of using cloud computing, mobile technologies and analytics technologies (digital technologies). The CIO believed that in order to survive in the competitive business landscape, organisations cannot solely depend on SAP. The new solution is digital technologies.

> *"SAP's incremental benefits to our business is so marginal, it's not even worth considering. It's pointless to invest on such technologies, if what we need is innovation; the solution is mobile technologies, analytics, and big data"*

LOB Manager of FARM:

The LOB manager explained how effectively they have used digital technologies at FARM. Through the mobile application, the farm inspectors send pictures to the relevant department informing them any important information they observe regarding the crops. The email not only contains the pictures and the details of the situation, but also it includes the geographical coordinates of the relevant location.

> *"Farm inspectors now have an app that they [farm inspectors] can take pictures of unusual events in our crops, they can then attach a comment and workflow to the correct department, it's much more than sending an email…you get the geographic coordinates and our lab can work on them straightaway"*

Cross-Case Analysis: Respondents' viewpoints

Overall, all the case organisations agreed that digital technologies facilitate innovation. Further, the case organisations agreed that the characteristics of digital technologies such as ease of maintenance (Chakravarty et al. 2013), ease of

connectivity with other technologies (Rai and Tang 2010), trialability (Cea et al. 2014; Mallat et al. 2009), flexibility (Nambisan 2013), user experience (Nylén and Holmström 2015) and the ability to be re-used for different purposes (Yoo et al. 2012; Yoo et al. 2010) are key reasons for adoption. Especially, all the organisations discussed how digital technologies can be integrated with ES and how they have introduced new processes and practices to their organisations.

4.1.2.1 Within-Case Analysis: Type of innovation

The objective of this facet was to analyse whether the innovation attained through digital technologies had the characteristics of radical innovation and incremental innovation. Latzer (2009) proposes the characteristics of radical and incremental innovation. The innovation attained in each case organisation using digital technologies was compared against these innovation characteristics.

a. LOGISTICS

Radical Innovation:

When SAP was first introduced at LOGISTICS, lots of employees were reluctant to use it. Even though they had all the trainings in place, employees found it difficult to embrace. But when they introduced a mobile app for the staff, on the very first day they had more than 50% employees downloading the app. The introduction of these apps added value to the business; it was a major deviation from their day to day business processes. But it was not a difficult change for the employees.

> *"I sent an email introducing the App…in the first day, we had 69% of users downloading it; by the end of the first week; we had nearly 100%"*

Incremental Innovation:

At LOGISTICS, they had increased their investments in digital technologies. LOGISTICS highlighted that they have multiple possible ways of innovating with ES and digital technologies together, which did not require spending too much money. The mobile app was upgraded a few times. LOGISTICS have added a functionality to retrieve these data from the mobile app and integrate it with their SAP. The employees are unknowingly using the SAP. Unlike to ES upgrades employees had not even noticed a difficulty in using the mobile application.

> *"We had 4 major updates to the app in less than 2 years. Guess what? They [staff] didn't even know that there were upgrades. This [mobile app] is now one of the most frequently used technologies in our company"*

b. MULTI

Radical Innovation:

The CIO of MULTI stated that any innovative solution in business expires within a very short period. Further, organisations are required to come up with new solutions, as it is necessary for their survival. MULTI had developed many innovative solutions by introducing digital technologies. The CIO stated how mobile technologies are connected to their ES to launch innovative solutions. The advantage of launching digital technologies according to MULTI CIO is that they are cost efficient. It took few months for them to develop mobile apps, the employees learned to use the application in no time.

> *"This [the sales portal on mobile technologies platform] was the smoothest technology project that we have ever had…we deployed it for 3000 users with no training at all"*

Incremental Innovation:

Similar to LOGISTICS, MULTI has introduced few upgrades to their mobile apps. These mobile apps received data from SAP, and write them back to SAP. MULTI has developed number of mobile apps for different departments, for different customers and for different brands. Through this they have increased the connectivity with the customers, vendors and employees. Further, MULTI collect information about their customers through the application. The analytics technologies crunch the gathered information and allowed MULTI to forecast and identify new markets, products etc. All these initiatives have become possible through the introduction of digital technologies and the integration with ES.

> *"We had a choice of adding more and more things to the current App, or developing new Apps…we went with the second route to develop stand-alone new Apps because every connection to SAP requires a new approval. This way is easy for us"*

c. ENERGY

Radical Innovation:

ENERGY has introduced a mobile app for their maintenance functions. Previously when SAP was introduced employees have found it difficult to use. However, when they introduced mobile technologies and cloud technologies they found it easy to use. The application talks to SAP and update the details entered through the mobile app. This radical change introduced to their business process was not difficult for the employees. Thus, the initiatives launched through Digital technologies were embraced by the employees.

> *"It was a substantial part of the entire asset and plant maintenance process [what the new App covered]. We didn't change anything because of the technology"*

Incremental Innovation:

In ENERGY, several projects were identified in which the organisation's SAP system could support innovation through integration with digital technologies. The main issue with initiating innovation with SAP was that such innovation is reduced by the SAP global templates. The company had introduced down-stream maintenance app and after experiencing the success of the application, they decided to extend the app to include up-stream as well. Even though the application was upgraded several times, the employees have not found it difficult to use. They found it interesting and made their life much easier.

> *"First we had the down-stream maintenance App, then we quickly converted the same to include up-stream as well…we are now in version 16 that combines both up and down stream"*

d. FARM

Radical Innovation:

FARM has introduced number of cloud-based mobile application to their field staff. These applications talk to farmers, horticulturists and they found the introduction of the application as a success. The innate characteristics of digital technologies such as ease of learning, cost effectiveness and flexible deployment are the key advantages that made their projects successful.

> *"This was the first time we had farmers, farm-hands and horticulturists walking with technology. You ask anyone from a farm, that's a huge challenge..."*

Incremental Innovation:

The integration of SAP and Google maps (mobile app) had given FARM myriad opportunities to innovate. FARM has created a portal that includes all the information related to the farmers. Reviewing this information on their mobile

phones is just a click away. The farmers have benefited immensely with the new integration.

> *"We now connect the App with Google Maps, Weather and we have plans to include a community portal to share knowledge of crop diseases and best practices at farms"*

Cross-Case Analysis Innovation type

All the case organisations agreed that the introduction of digital technologies was a radical change. The radical innovation characteristics such as changes in organisation structure, culture, processes and work practices were evident in all the cases. However, even though the roles and the responsibilities of the employees were changed due to the introduction of digital technologies, employees did not find it difficult to follow. The introduction of digital technologies was always connected to their ES.

All the case organisations alluded to the possibility that digital technologies could be used in parallel with ES for innovation. While these were not minor improvements, they were not radical innovations either. Usually an incremental innovation is attained through improvements to old technologies; however, in all the case organisations the innovation was attained through ES as well as digital technologies. The integration changed the dominant design and the processes. The cost of these innovations was comparatively low.

4.1.2.2 Within-Case Analysis: Lead time of Innovation

The objective of this facet was to identify the process of the innovation attained through the digital technologies. Lead time becomes important when the market is competitive. A low lead time of innovation enables organisations to innovate faster compared to their rivals.

Within-Case Analysis

a. LOGISTICS

LOGISTICS highlighted that the low technical knowledge required for implementing digital technologies, the ease-of-use, low cost and low development time of digital technologies had opened up new avenues for them to innovate. From the inception to execution of the mobile application had taken less than 2 months. According to CIO of LOGISTICS, these are the technologies they need in order to survive in the competitive market.

> *"The blueprint of the App took a while…that's to decide what features we should include…then 2 weeks for prototype, 2 weeks to development, and may be a week each for testing and we were on it [start using the technology]"*

b. MULTI

The respondents at MULTI highlighted that their updated SAP system helped them to integrate digital technologies by providing data and allowing the digital technologies to write-back data on SAP. This allowed them to come up with completely new thinking. In addition, the richness of the data gained through the ES and the ease of deployment and high connectivity of digital technologies allowed them to develop and deploy quick innovative solutions (low lead time).

> *"Cloud made it easier...we could change the plan [access and storage] instantly. Other than the time it takes for an approval [connecting to SAP] that there are no major delays. It [initiation and implementation] is a very quick process"*

c. ENERGY

ENERGY stated how easy it was to develop the mobile application they use currently. They compared the upgrade they did last time and stated how difficult it was for the employees. ENERGY stated that in the contemporary business world

time plays a key role. Therefore, for the survival an organisation always need to be ahead of time. Digital technologies have given them the opportunity to achieve this.

> *"There was a delay in getting approval to connect to SAP…about 6 months in some cases. Once that was done, it took only 6 weeks to build and test the App. …changes take much less time"*

d. FARM

FARM had introduced new projects using digital technologies. The employees too have suggested new functionalities for the mobile application. FARM has taken them into account and upgraded them. The idea inception to execution has taken a very short time, evidencing short lead time enabled through digital technologies.

> *"People [employees] are happy to share their [employees] new ideas [about the app], because they see that changes are almost instant"*

Cross-Case Analysis

All the case organisations agreed that Digital Technology-led innovations have a shorter lead time. The innate attributes of digital technologies to trigger innovation such as ease of deployment (Armbrust et al. 2010), cost effectiveness (López-Nicolás et al. 2008), and ease of learning for both the developer and the user (López-Nicolás et al. 2008) are the key reasons for the adoption of digital technologies. Further, the ability to integrate with ES provided organisations countless opportunities to innovate and employees embraced these changes as they were easy-to-use (Nylén and Holmström 2015).

4.1.2.3 Within-Case Analysis: Lifecycle Phase

a. LOGISTICS

Pre-implementation:

Before the introduction of digital technologies, LOGISTICS was using their SAP for innovation. When SAP was first introduced, it dramatically changed the business processes and swept away all the messy practices. Yet, the complexity of the SAP was difficult for the operation staff to digest. As a result, IT was not providing the true benefits for the organisation.

> *"For years, IT and our operational staff [e.g. truck drivers, packaging department] didn't get along at all"*

Post-implementation:

SAP is commonly available; every organisation has the potential to launch similar strategies. Differentiation was attained by LOGISTICS through integrating digital technologies such as mobile technologies and business intelligence technologies. The analysis of the LOGISTICS data indicated that the use of digital technologies offered the advantages of increased reach to customers and increased customer connectedness.

> *"The App was a hit with the operational staff, especially the delivery drivers. They [delivery drivers] didn't need any training. It was straight from development to use"*

b. MULTI

Pre-implementation:

As a multi-national company, MULTI has faced immense difficulties in introducing SAP. Even though multiple advantages were gained through the introduction of SAP, they could not achieve continuous innovation through their

SAP. One reason was employees were not happy with the complexity of the system. As a company they were waiting for an easy to use, easy to deploy, cost effective technological solutions.

> *"We were longing for this [mobile technologies, cloud] kind of a change for a long time, but could not get it [positive change] earlier"*

Post-implementation:

The respondents of MULTI stated that digital technologies allowed the organisation to reach customers much faster and cheaper. As a result they started investing in these technologies (mobile technologies and business intelligence technologies) rather than SAP. SAP was a difficult system to use, yet, the mobile application they introduced resolved their issues. The employees are using SAP disguised in mobile application.

> *"We have some issues in connecting to SAP, but compared to our user base, the costs of running this App is almost negligible. It [investment on mobile technologies] has been a worthwhile investment"*

c. ENERGY

Pre-implementation:

ENERGY was solely dependent on their ES and did not look for opportunities to innovate. Yet, with the advanced technologies and the competition from the rivalries have demanded them to seek out ways to innovate. The employees were actually looking for a new change; they have found new technologies to innovate. Yet, ENERGY took some time to embrace these changes.

> *"The first proposal to have handheld image based manuals came from some engineers who had seen this kind of a thing on YouTube"*

Post-implementation:

Even though the reliance of ENERGY on SAP (ES) was very high compared to the other case organisations, they too have realised they need a change. ENERGY had improved process efficiencies because of SAP but realised that they were able to reap better organisational outcomes when digital technologies were introduced to their organisation.

> *"The regional head office manages the SAP system from Malaysia. It was pretty annoying that we have Apps, but no data was released for a while…we now have one App like that waiting for approval"*

d. FARM

Pre-implementation:

When FARM introduced SAP for the first time, their business processes were standardised, they were able to collect real-time data. Yet, due to unbearable cost the CIO was not happy with SAP. They did not upgrade their system until it was made mandatory. FARM was waiting for a change, so badly. Yet, they were not able to do any innovative programs until digital technologies were introduced.

> *"We could not have done this [advancements introduced by new technologies] any earlier…the infrastructure [for mobile technologies] was poor and the phones were not capable of handling them [apps]"*

Post-implementation:

The CIO of FARM explained how beneficial it was for them to integrate their ES with other third-party technologies. The CIO was fascinated by the IT capabilities and the opportunities that lay in front of them because of technological advances. The CIO explained the low-risk, low-cost and efficient strategies they had launched

because of the advances in the technological landscape (referring to digital technologies).

> *"Especially, the users really like that they have something to create content. This simple App has made it possible for us to bring operational staff to voice their view and share their knowledge."*

Cross-Case Analysis

All the case organisations agreed that, in the contemporary competitive business world, it is difficult to survive with ES-led innovations alone. Organisations have realised that the combination of ES and digital technologies opens up new pathways for organisations to innovate with much better outputs. The ES and digital technologies offer organisations the ability to 'think out of the box' and innovate.

4.2 DEDUCTION PHASE: CROSS-CASE SUMMARY

Analysing the two propositions the following results were obtained. Organisations innovate using their ES and digital technologies. ES is capable of introducing radical innovation when it was first introduced. All the case organisations in the present study highlighted the dramatic changes introduced through the adoption of ES to their business processes and organisational culture. The dramatic improvements introduced through best practices were highlighted with a strong focus on business process standardisation, real-time integration and enhanced functional coupling (Teng et al. 2002). Yet, in the onward and upward phase where ES users are familiar with the system, organisations found that radical innovation is difficult to attain through ES. All the case organisations affirmed that rigidity of the ES and the extensive cost was among the factors that inhibited innovation through ES.

All the case organisations suggested that apart from the innovation introduced through the upgrades, there was no indication of the ES individually catalysing innovation beyond the initial implementation. Specifically, the case organisations found that their ES contributed to unacceptable lead times for innovation and, as such, did not deliver the anticipated outcomes. For example, even upgrading the ES, they had to plan carefully as the system impacts the whole business. Further, the cost these organisations had to bear, refrained them from innovating only with their ES. The revelation of the ES (as a platform) not enabling incremental innovation presented an anomaly and called for a better understanding. It prompted this study to question how organisations innovate, given the apparent lack of continuous innovation capabilities of the ES.

On the other hand, all four case organisations broadly agreed with digital technologies enabling innovation. Further, there is general agreement from all four case organisations that companies reap benefits from digital technologies through characteristics like low cost, ease of adoption, and ease of learning. In relation to innovation type, it was evident that digital technologies facilitate innovation that has features of both radical and incremental, yet contradicting to historical characterisation of each innovation type. For example, though organisational changes are viewed as 'radical' implementation and adoption has been unperturbed. Even though a radical change is introduced to the organisation, employees did not find it difficult to embrace the change. Similarly, incremental innovation through digital technologies does not necessarily adhere to characteristics reported in the literature either. The summary of the cross-case analysis is presented in the following table (Table 5).

Table 5: Summary of Cross-Case Analysis - Deductive Analysis					
	LOGISTICS	**MULTI**	**ENERGY**	**FARM**	**Cross-Case Summary**
P1	***Challenged.*** The ES seem to have provided radical innovation when it was first introduced. Yet, much of new innovation do not happen using SAP, but using mobile technologies and BI technologies.	***Challenged*** The ES provides a strong IT backbone to the organisation. Process standardisation across all countries made a substantial radical innovation led by the ES. New investments in IT are mostly on mobile technologies, BI.	***Challenged.*** SAP's introduction was perceived as a radical innovation, which led to process standardisation and real-time operations at a global scale. However, SAP's presence has been identified as a barrier now.	***Challenged.*** SAP is the main IT system that introduced radical innovation through business process standardisation and optimisation, which replaced inefficient practices. The ES is too complex and too resource intensive to provide continuous innovation.	All cases agreed that ES facilitated innovation, when ES was first introduced. None of the cases recognised ES as a major resource for innovation. Cases highlighted complexity, resource intensiveness and inflexibility as the main reasons why innovation is not attained through ES.

Table 5: Summary of Cross-Case Analysis - Deductive Analysis					
	LOGISTICS	**MULTI**	**ENERGY**	**FARM**	**Cross-Case Summary**
P2	***Supported.*** There are many IT projects that used mobile apps, cloud that made substantial changes to business processes. Ease of access and cost effectiveness has been recognised as key characteristics of Digital Technology-led innovation.	***Conditionally Supported.*** Innovating through digital technologies in accordance with SAP is challenging, and creative. Innovation through business intelligence, analytics, mobile technologies and cloud were prevalent. Flexibility is highlighted as the main advantage.	***Conditionally Supported.*** The organisation uses cloud, mobile, in-memory applications to connect to the SAP system. Connectivity to SAP comes across as a salient barrier, thus hampering innovation abilities of digital technologies.	***Supported.*** The company has introduced number of cloud-based mobile application to their field staff, evidencing innovation. Ease of learning, cost effectiveness and flexible deployment are being identified as the key advantages of digital technologies.	There was either complete or conditional support for this proposition. Overall, there were evidences that digital technologies assist as a major resource for innovation. Unlike ES, digital technologies are benefiting organisations through low cost, ease of adoption, flexibility and innovation lead time.

Observations made from the cross-case analysis can be summarised under two points:

(i) It was revealed that the ES facilitated innovation only at the beginning of the lifecycle, and that there was no innovation resulting solely from ES in the current phase of the lifecycle. Yet, it was observed that innovation at all four case organisations continued and yielded substantial benefits beyond the implementation phase

(ii) It was evident that all four case organisations innovate through digital technologies. However, when referred to instances of digital technologies enabling innovations, they always made affiliations to the ES.

The two observations titled as (i) digital technology-led innovation, (ii) digital technology reliance on ES, are described below required that the study investigates them using an inductive approach. It is important to note that these observations came about as part of the deductive analysis, in discussing support for the propositions. These observations are described below, but add granularity as the inductive analysis was conducted subsequently.

4.2.1 Digital technology-led innovation

The cross-case analysis of the propositions provided insights into how organisations engage in innovation without the direct involvement of ES. The first evidence of this was demonstrated through a de-coupling of the terms ‘innovation types,’ ‘resource allocation’ and ‘technology responsible for innovation.’ Here, the case organisations illustrated no rational connection between the investments made

in the ES and the innovation sought. This phenomenon was observed in all four case organisations and was initially coded as "digital technology-led innovation." An investigation of digital technology-led innovation revealed three key points (where applicable, sample quotes are provided to exemplify the notions that led to the derivation of digital technology-led innovation). As depicted in Figure 10, all the case organisations demonstrated a continuous upward trend for innovation across the phases of the ES lifecycle. Figure 10 is a conceptual representation and the lines disregard the type of innovation attained.

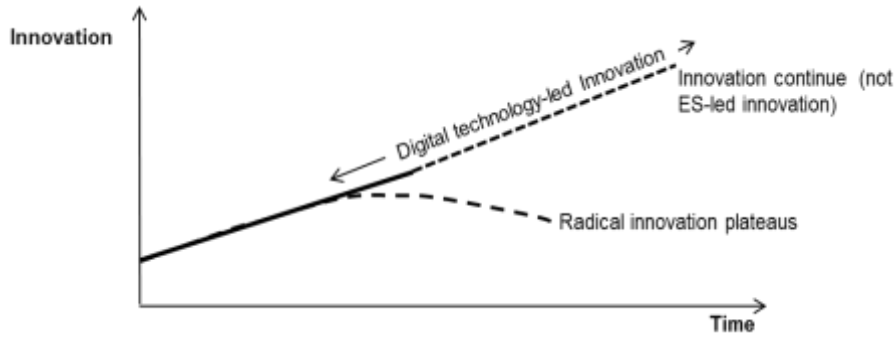

Figure 10: Digital technology-led innovation

The first segment of the line of innovation can be described through the radical innovation received through the ES. As outlined in the literature, and as evidenced through the data on Proposition 1, a radical innovation enabled through ES tends to plateau over time. Further, there was insufficient evidence to suggest that the ES was extensively contributing for innovation and the innovation that attained through ES was when organisations upgraded their systems. This alluded to the possibility that the role of ES is changing from being a trigger of innovation, to taking a more passive role.

> *"SAP is playing a silent role in attaining innovation. When it [SAP] was first introduced it [SAP] played a huge role"* (LOGISTICS)

"*SAP is the backbone…we don't do much with it [SAP]…"* (MULTI)

"SAP is our IT backbone; SAP introduced best practices and paved us the pathway to innovate. But, SAP no more gives the competitive edge" (ENERGY)

"SAP was huge when it [SAP] was first introduced; But it [SAP] is no longer our focus" (FARM)

Second, all four case organisations agreed the importance of ES for innovation across all phases of the lifecycle. However, the respondents rarely mentioned innovation, resource allocation, and the ES in one coherent structure, beyond their references to the shakedown phase (immediate post go-live). When the three categories/codes were mentioned, such comments only pertained to the innovation received through 'must-have' ES upgrades. After the ES implementation, all the case organisations minimised their ES investments to 'bare-minimum' and 'essential.' Here, although the participants were well aware of the new ES products and services introductions, none had made substantial investments in such technologies beyond mandatory upgrades.

"We are not going to upgrade our SAP till 2020 until they [SAP Company] make it [upgrading the system] mandatory." (LOGISTICS)

"Changes to SAP impact the whole business; to initiate a small change, it has to go through multiple layers to get acceptance. It's [acceptance process] such a pain to wait till them get accepted" (MULTI)

"Changes to SAP are costly; we can't depend on them" (ENERGY)

"We don't even touch SAP; We have much better solutions for attaining innovation" (FARM)

Third, on the other hand, all the case organisations employ a range of digital technologies, especially digital technologies such as mobile technologies and cloud computing and analytics. This has become prominent, especially in the three years prior to the data collection (2012–2014). From the respondent's word, such technologies were introduced in 'specific', 'small', 'functional' areas, to 'trial-out' the potential, rather than employing them in large-scale, process-based IT projects. This narrow focus of contemporary projects demonstrated a clear departure from the ES philosophy of whole-of-organisation business process approach.

> "*Our employees find it easy to use mobile apps rather than working on SAP… It's easier for us to introduce these technologies because employees absolutely love the new changes"* (LOGISTICS)

> *"We have introduced pretty amazing projects with mobile applications and analytics. Customers are closer to us than before; we feel it"* (MULTI)

> *"Our maintenance department employees were so happy that the mobile app we introduced was much easy to use. We did not have to spend lot of money for training. It's a win-win for us"* (ENERGY)

> *"We now build software on free Google Apps for some functionality that we expected from SAP…When we have cheaper options why would we waste money unnecessarily. Every dollar we spend counts."* (FARM)

4.2.2 Digital Technology's Reliance on ES

Broadly, all case organisations collectively referred to the perceived advantages of digital technologies in enabling innovation. They focused and capitalised on such values of digital technologies like ease of access, affordability, ease of adoption, and ease of connection with customers and suppliers and embarked on innovations.

> "*We use the cloud quite a bit. The best part of it is that we can extend their services or when we don't want, we can reduce.*" (LOGISTICS on ease of adoption of cloud computing)

> "*The issue with SAP PM (plant maintenance module) is that we can't get smaller functionality, it's not worth it. We can get cost effective functions through our mobile app.*" (ENERGY on cost effectiveness of mobile technologies)

> *"We talked to customers through our mobile apps, they responded us. We analysed the data collected from mobile apps, and we responded to their needs. This was not possible with SAP; mobile technologies offered all these cool features."* (MULTI on innovativeness of mobile technologies)

> "*In the middle of the farm, my farm inspectors can log into their mobile app…they don't need to come back to the office to sit in front of the computer.*" (FARM on ease of access of mobile technologies)

The summary of the cross-case analysis provided an explanation to the continuing digital technology-led innovation described earlier. It became apparent that all four case organisations prefer to drive innovations with digital technologies, rather than through their ES. At the same time, and somewhat surprisingly, the case organisations demonstrated a strong reliance on ES for innovations sought through digital technologies (Proposition 1 and 2 – Post implementation). When referring to innovations enabled by digital technologies, the case respondents highlighted terms like 'extract from [the ES]', 'business rules of [the ES]', 'writing back to [ES]' / 'transfer to', and 'data integrity of [the ES]'.

> *"The mobile app that truck drivers use extracts information from SAP…"* (LOGISTICS)

> "*SAP has the business rules from the headquarters…whatever that we do with the mobile app, it [mobile app] has to align with the business rules"* (MULTI)

> "*The master data is in the SAP system, the handheld scanner picks all details from SAP master data image from the cloud.*" (ENERGY)

> "*When my farm supervisors come back to the office, they [farm supervisors] go on-line and transfer all data back to the SAP system."* (FARM)

In summary, the discussion above and the cross-case analysis of the two propositions highlight that ES, having triggered radical innovations when it was first introduced, currently do not trigger innovation. On the other hand, digital technologies seem to trigger innovation, fuelled by the consumerization of IT and its innate characteristics like ease of use and accessibility. Yet, the data analysis identified a strong association between ES and digital technologies, whereby for digital technologies to trigger innovation, it must have a strong association with the ES. This phenomenon, using the terminology of Nambisan (2013), highlights the role of ES as an enabler of innovation (operand IT resource).

While the results of the deduction phase were encouraging, it was required to add precision to these observations. The observations made in the deduction phase were fuzzy and required clarity. For instance the didactic relationship between ES and digital technologies is unclear. The data suggests that mature ES does not drive innovation but is important in fostering innovation through digital technologies. To further investigate how this interplay occurs required analysing data inductively. Such an approach was warranted for example, to understand the complex phenomenon such as innovation enabled by the complete IT portfolio and how ES and digital technologies in combination deliver innovation.

4.3 INDUCTION PHASE: ANALYSIS AND RESULTS

The research question of the study: '*How do organisations innovate through the modern IT portfolio of ES and digital technologies?'* required to analyse the phenomenon of innovation using the modern IT portfolio through an inductive approach. As Lee (1991) suggests an integration of positivist and interpretive approach was deemed necessary to answer this research question. The need for an induction phase was evident by the propositions (1 and 2) that were challenged. Further, the fuzzy observations in deduction phase required clarity.

As a result, in order to carry-out a goal-free evaluation, the second phase of the analysis was inductive in nature (Glaser and Strauss 1967), and a number of ideas from the grounded theory methodology were used, with suitable adaptation. In particular, the study involved the engagement in theory building through iterative coding of the data guided by the notion of constant comparison that took place concurrently with the data collection (Birks et al. 2013). The purpose of the induction phase was to give the deductive propositions sufficient empirical basis (Åsvoll 2014). Such ongoing analysis prompted the seeking of new data or revisiting data that had already been analysed. The analysis in the second phase of the study was inspired by the notions of less procedural grounded theory (Bryant and Charmaz 2007) and as the analytical steps open coding, axial coding, and selective coding were carried out (Strauss and Corbin 1998).

As Strauss and Corbin (1998) explain, open coding are words or phrases found in a transcript. Axial coding involved grouping the themes or categories by codes or labels given to words or phrases (Strauss and Corbin 1998). The selective coding involved linking the categories to develop an integrative framework. It is noted that, in line with the tenets of grounded theory methodology (e.g. Glaser 1978),

the study's theoretical sensitivity enabled the emergence of ideas and the formulation of a coherent framework based on the subjects' points of view, rather than the forcing of a particular theoretical view onto a focal phenomenon (Corbin and Strauss 1990).

The inductive phase involved five new case organisations, which allowed reaching theoretical saturation. The addition of the new case organisations enabled granularity to the emerging themes and provided key facets of differentiation to the four earlier cases in line with the idea of purposive sampling. Five more cases were selected using purposive sampling technique. During this phase, the codes were refined and reached the saturation point. Patton (2002) highlights that purposive sampling method allows the researcher extend the data collection by selecting cases that consists of varied intensities. The key requirement is that as the theory emerges from the collected data the researcher has to be theoretically sensitive and must not limit to specific aspects of a theory. This will delimit completion of the emerging theory.

The addition of the five new cases:

i. Extended the geographical selection to Asia, where IT sophistication (especially in ES) may be lower (Popovič et al. 2012; Soh et al. 2000),
ii. Increased the diversity of the industry sectors to reflect various innovation environments (e.g. a not-for-profit, a public sector and an innovation-savvy telecommunication organisation).

Table 3 presented the characteristics of the five inductive cases, represented herein using the pseudonyms INSURANCE, ROAD, HEALTH, DAIRY and TELECOM.

The same case protocol was appropriate for the inductive data collection and the same principles were followed in selecting the participants. The data gathering in the five new cases was conducted through 34 person-hours of interviews. Data analysis in the inductive phase was done in both formal and informal sessions. Consistent with the recommendations of Strauss and Corbin (1998), two researchers informally interacted with the data since the first inductive case. Given that most of the theoretical propositions formulated on the basis of the literature were conditionally supported or challenged, distancing from a captive theoretical understanding to allow creative theory building seemed natural and appropriate for the researchers (Strauss and Corbin 1998).

4.3.1 Data Coding

Open coding was done over five consecutive days. The candidate and another researcher listened to the recordings together, making notes separately of the key themes that they thought were emerging through the interview data. This approach (as compared to line-by-line coding of a transcript) provided a continuous free-flowing mental state in which to absorb the phenomenon of interest. The respondent's tone of voice was taken into careful consideration, as the emphasis made in the statements helped the researchers to understand the importance of the points being expressed (otherwise missed in an analysis of transcriptions). Data was analysed continuously by breaking the transcripts down into distinct concepts or objects and labelled any important information in the process until the existing labels were repeated. Then, as codes were generated and refined, the relationships between the codes were explored (i.e. axial coding) (Glaser and Strauss 1967). Specifically, the causal conditions, phenomenon and contexts were explored. Table 6 provides samples of the open coding derived through the five cases in the inductive phase.

Table 6: Illustrations of open coding		
Statements	**Case**	**Open Code (*in italics*)**
"The accident claims department launched our new claims processing mobile app in 2 weeks to allow us to connect with customers instantly. Once an incident is lodged, we verify and our assessor must reach the location in 30 minutes. He [the assessor] can complete the entire assessment of an accident using his mobile...and it talks to our AS400 for processing. We have given the sole responsibility of this project to claims department. First, we initiated this project as a trial. Developing a mobile app is very cheap, so cheap than improving our AS400. The market we are in is so competitive. We want new solutions to attract customers and keep our existing customers happy. Financial benefits are not the only outcome we expect, especially in this case we won the hearts of our customers"	INSURANCE	"The accident claims department launched ("*LOB department*" is the "*initiator*") our new claims processing ("*narrow focus*" "*selected business functions*") mobile app ("*mobile app*" "*Technology type*") in 2 weeks ("*short lead time*") to allow us to connect with customers instantly ("*objective*" "*connect with customers*" "*external focus*"). Once an incident is lodged, we verify and our assessor must reach the location in 30 minutes. He [the assessor] can complete the entire assessment of an accident using his mobile...and it talks to our AS400 ("*affiliation to ES*") for processing ("*outcome*" "*quick*"). We have given the sole responsibility of this project to claims department ("*controller*" "*LOB department*" "*decentralized*"). First, we initiated this project as a trial ("*project objective trial to progressive*"). Developing a mobile app is very cheap ("*Technology characteristics*" "*low cost*"), so cheap than improving our AS400 ("*Technology characteristics*" "*high cost*"). The market we are in is so competitive ("*competitive market*"). We want new solutions to attract customers and keep our existing customers happy ("*objective*" "*retain customers*"). Financial benefits are not the only outcome we expect; especially in this case we won the hearts of our customers ("*non-financial benefits*")."

Table 6: Illustrations of open coding		
Statements	**Case**	**Open Code (*in italics*)**
"We are trialling a BI [business intelligence] project to map all accident information against weather reports, Google Maps, National Stats on income…we use these reports to allocate internal resources to road maintenance through our Finance and HR systems. Even though we develop this, we collaboratively work with road maintenance department to manage it. Here, our Oracle system plays a more like a supporting role. Its ability to integrate with BI helps us to do amazing things. You know in my opinion BI is the new trend. Our backbone is working with super stars to bring in innovation"	ROAD	"We [IT department] are trialling ("*trialability*" "*initiator*" is "*CIO*" "*project objective*" "*trial*") a BI [business intelligence] ("*BI*" "*Technology type*") project to map all accident information ("*narrow focus*") against weather reports, Google Maps, National Stats on income…we use these reports to allocate internal resources to road maintenance through our Finance and HR systems. ("*affiliation with ES*") Even though we develop this, we collaboratively work with road maintenance department to manage it ("*controller*" "*collaborative*" "*networked*"). Here, our Oracle system ("*Technology type*" "*Oracle*") plays a more like a supporting role ("*operand role*"). Its ability to integrate with BI ("*characteristics*" "*integration*") helps us to do amazing things ("*operant role*"). You know in my opinion BI is the new trend, these technologies are available, low cost and we do not need specialized skills to use ("*characteristics*" "*availability*" "*low cost*" "*ease of use*"). Our backbone [Oracle] is working with super stars to bring in innovation ("*synergistic orchestration*")"

Table 6: Illustrations of open coding		
Statements	**Case**	**Open Code (*in italics*)**
"I want all my volunteering field staff to be on a cloud-mobile platform to find their work schedule. We developed an App with very less money that they [field staff] could tap and see their roster. They can bring their phone and our app works on that. We then integrate their apps into our Oracle finance systems for their petrol reimbursements. Oracle is like a platform that helps us to integrate new technologies."	*HEALTH*	"I [CIO] want ("*initiator*" "*CIO*") all my volunteering field staff ("*internal focus*" "*departmental focus*") to be on a cloud-mobile platform ("*Technology type*" "*cloud*" "*mobile*") to find their work schedule ("*narrow focus*"). We developed an App with very less money ("*cost effective*") that they [field staff] could tap and see their roster ("*objective*" "*work efficiency*"). They can bring their phone and our app works on that ("*ubiquitous*"). We then integrate their apps into our Oracle finance systems ("*synergistic orchestration*") for their petrol reimbursements. Oracle is like a platform ("*operand role of ES*") that helps us to integrate new technologies."
"We are in a super competitive market (telco), Our sales guys came up with a BI [business intelligence] based idea to dynamically offer new products to our customers…we are trialling out this with 5% of our new customers…We can't wait SAP to develop all for us."	*TELECOM*	"We are in a super competitive market (telco) ("*competitive market*"), Our sales guys came up with a BI [business intelligence] ("*LOB department*" "*initiator*" "*technology type*" "*BI*") based idea to dynamically offer new products to our customers… ("*external focus*" "*objective*" "*entice customers*") we are trialling out this with 5% of our new customers ("*trialability*" "*target group*" "*customers*" "*project objective*" "*trial*")…We can't wait SAP to develop all for us."

Table 6: Illustrations of open coding		
Statements	**Case**	**Open Code (*in italics*)**
"Milk de-regulation [in Australia] meant that we compete at diverse markets. We need big and small suppliers and customers...We now have a mobile app that connects all milk collection points and corner stores…it's much easier and everything feeds into SAP. Our SAP is our backbone. We always wanted to go an extra mile and do business in a better way. The financial problems with the SAP restricted us to ty out new things. Now with these new technologies [mobile] we are able to connect with the external world. It's like SAP is providing the stage for other technologies to dance and make us happy… even though we initiated this app, we get the help from our IT department to upgrade it. This app is only for our department, we have used analytics in forecasting department. We love this new IT gimmicks. We are not techy people, for us this is very easy to learn and easy to use unlike SAP"	*DAIRY*	"Milk de-regulation [in Australia] meant that we compete at diverse markets. We need big and small suppliers and customers... ("*competitive market*") We now have a mobile app that ("*technology type*" "*mobile*") connects all milk collection points and corner stores ("*objective*" "*connecting vendors*")…it's much easier and everything feeds into SAP. ("*affiliation with ES*") Our SAP is our backbone ("*operand role of ES*"). We always wanted to go an extra mile and do business in a better way. The financial problems with the SAP restricted us to ty out new things ("*characteristics*" "*too costly*"). Now with these new technologies [mobile] we are able to connect with the external world ("*characteristics*" "*connectivity*"). It's like SAP is providing the stage for other technologies to dance and make us happy… ("*Synergistic orchestration*") even though we initiated this app ("*initiator*" "*LOB manager*"), we get the help from our IT department to upgrade it ("*controller*" "*collaborative*" "*networked*"). This app is only for our department ("*departmental focus*" "*narrow focus*"), we have used analytics in forecasting department. We love this new IT gimmicks. We are not techy people, for us this is very easy to learn and easy to use unlike SAP ("*ease of use*" "*ease of learn*")"

The following observations were made using the summary presented in open coding (Table 6).

i. It was noted that each case organisation described a diverse technology landscape, whereby innovation (or the innovation potential) was discussed in relation to a portfolio of systems.

ii. Each case organisation described their relatively recent investments in digital technologies related to mobile technologies and cloud computing, analytics and big data.

iii. Further, all the case organisations described one or more successful projects that were initiated through digital technologies, in particular, using mobile technologies and analytic technologies.

iv. Finally, the case organisations highlighted the narrow functional scope of such projects and the low IT resources required to complete such projects.

Overall, the case organisations discussed innovation in relation to specific projects, and there was strong emphasis on the scope of innovation (at the functional level), collaboration of multiple technologies (e.g. ES and digital technologies) and the initiation of innovation through non-IT departments. When the candidate felt comfortable with the emerging themes, the transcriptions were entered into NVivo. Tools were not used to code the data; rather, a simple way of creating a record for the corresponding point in the transcription was employed. The NVivo software allowed

the representation of the rich, many-to-many relationships that existed between the respondents and codes across the nine cases.

The axial coding followed guidelines and adaptations in the literature (Sarker et al. 2001; Urquhart 2001), by deriving major categories based on the lower level codes and sub-categories. The following main categories were derived through open coding: (i) technology, (ii) project, (iii) innovation, (iv) human and (vi) outcomes. All the categories include sub-categories. For example, the sub-categories of project include scope, objective, coordination and duration. To illustrate, Figure 11 presents the sub-categories of project. Further, Figure 12, 13, 14, 15 represents the categories and sub-categories of technology, innovation, human and outcome respectively.

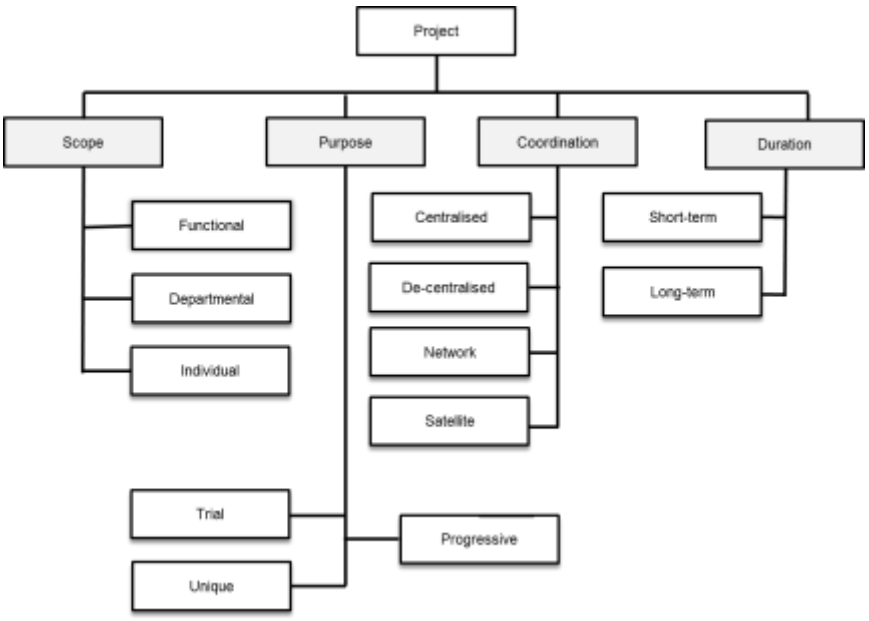

Figure 11: Sub-categories of project category

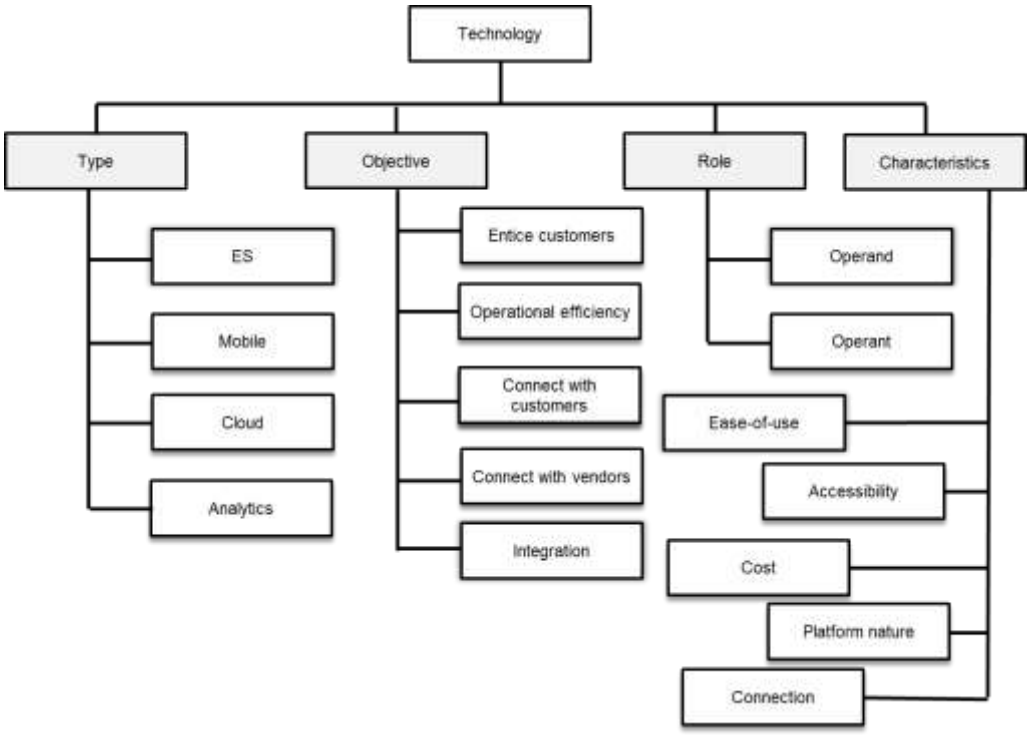

Figure 12: Sub-categories of technology category

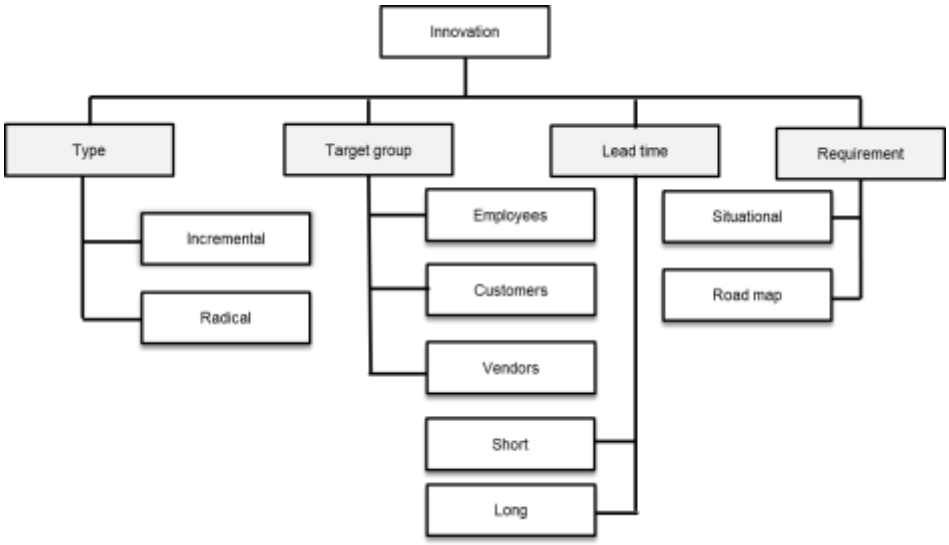

Figure 13: Sub-categories of innovation category

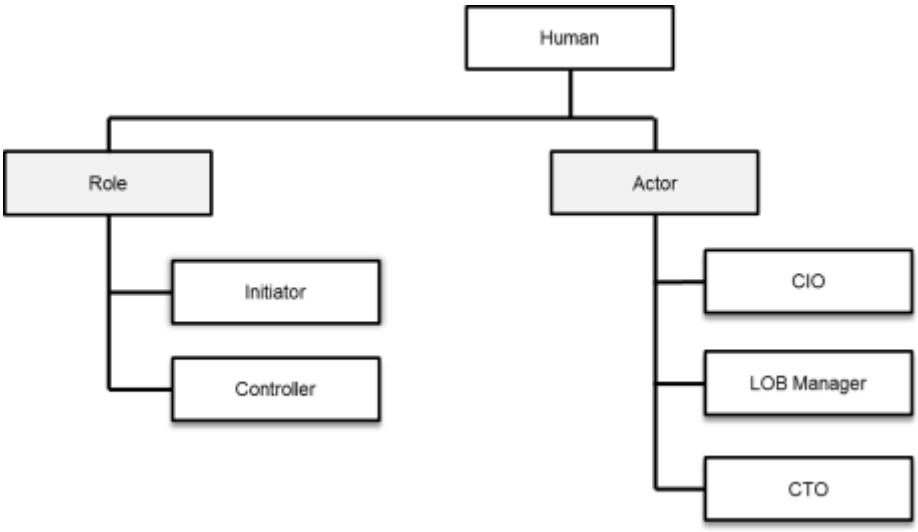

Figure 14: Sub-categories of human category

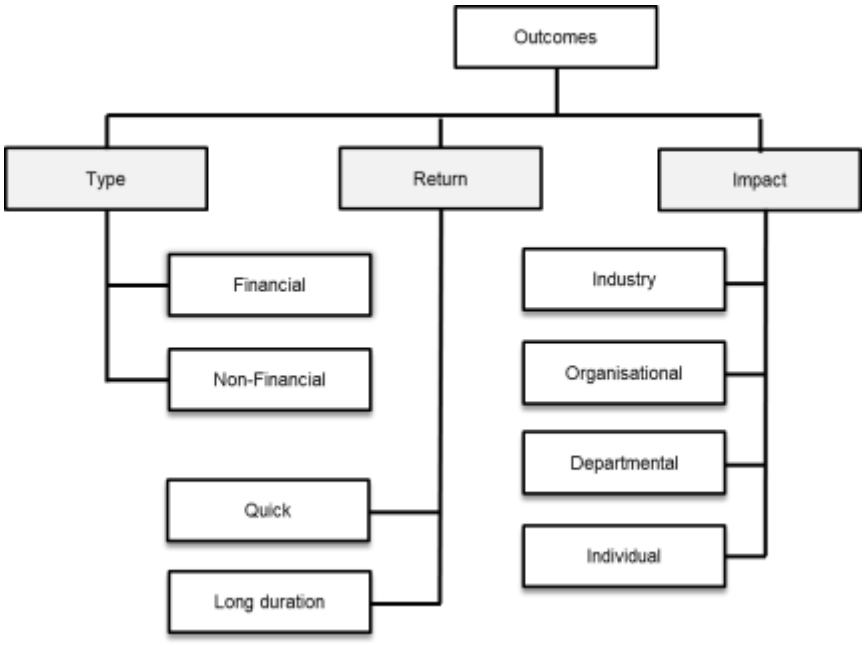

Figure 15: Sub-categories of outcomes category

Table 7 provides sample quotations and their cross-references to the axial codes. The cross-reference axial codes provide a sample set of codes employed in this study. The axial coding followed the model suggested by Strauss and Corbin (1998). The conditions that give rise to the phenomenon, context into which it is

embedded, action/interaction strategies in which it is handled, managed, carried out and the Consequences of those strategies were identified in this stage. Causal conditions refer to events, incidents that lead to the occurrence of a category. The open codes and categories were examined and identified the data for the conditions that give rise to the category phenomena. It was evident that the competitive environment, competitive pressure gave rise to the phenomenon. The phenomenon in this study is how organisation innovate with their back-end and front-end systems. The second item in axial coding is the context. The context is referred to as a set of properties that pertain to a category. The context seeks the answers for queries such as 'where is it they doing it,' when do they do it,' at what stage do they do it,' and 'with whom do they do it.' The answers for these questions are similar to all nine case organisations. The CIOs and LOB managers, innovate using their backbone or the back-end system and front-end systems such as digital technologies. The third item is, intervening conditions. It can be explained as broader structural context pertaining to category. As such factors such as space, time, culture, economic status, technological status and history is considered in this condition. All nine case organisations innovate with a matured ES system where the system has reached onward and upward phase. Further, all organisations are willing to invest on digital technologies for innovation. The fourth condition is action /interactional strategies. This condition focuses on action and interaction. For example, this investigates, what actions do individuals take with respect to the category and how do groups interact and act with respect to the category. This condition revealed that the organisations 'orchestrated' their front-end and back-end systems to innovate. They introduced new technologies to extract data from ES and also to write back to ES. This extended

the capabilities of ES to connect with the external parties. The following table (Table 7) depicts some of the properties found in axial coding.

Table 7: Axial coding		
Case	**Quotations (multiple)**	**Axial Codes (Properties)**
LOGISTICS	"*A decade ago, we had a monopoly in the continent, but now we have an aggressive competitor. To compete, we have to optimise our business functions* (1). *We now have to innovate where the needs are* (2) *to gain quick return* (3)." *"This innovation is happening at the grass-root levels* (4). *We had a logistics manager* (5) *in The Netherlands developed a mobile app to connect couriers* (6) *and logistic department itself manages this app* (7) (8). *That is a pretty sharp change from where we had a centralised IT plan for the next 5 years* (7)." *"We have to now be extremely agile in how we innovate* (*) *in business." "SAP has now become the stage* (9) *for us to apply new technologies for* (9) *introducing pretty new things for employees and customers* (10)."	1. Project scope – functional 2. Innovation requirement – situational 3. Outcomes return – quick return 4. Human role – initiator 5. Human actor – logistics manager 6. Technology type – mobile technologies 7. Project coordination – centralised 8. Human controller – logistics department 9. Technology role – operand (ES) and operant (mobile technologies) 10. Innovation target group – customers and employees (*) Consequence: agile innovation

Table 7: Axial coding		
Case	**Quotations (multiple)**	**Axial Codes (Properties)**
MULTI	"*We cannot introduce anything [local] new to the platform [ES]* (1) *because of the global templates* (2) (3)*... Our sales staff* (4) *is asking for simple things like iPads with sales data, and they know that others (their competitors) have these already plugged into their SAP systems* (5) (6). *But our plan to have this was rejected by Sydney (where the SAP global template is managed for the region)..." "Things coming out from Sydney are not delivering anything Agile* (*) *...they are the standard stuff that all SAP shops have."*	1. Technology type – SAP platform 2. Project coordination – satellite 3. Technology characteristics - inflexible 4. Human role – initiator (sales department) 5. Technology type – mobile technologies 6. Technology role – operand (ES) and operant (mobile technologies) (*) Consequence – agile innovation
ENERGY	"*We are a subsidiary of a giant company…still they [the parent company] have realised that importance of reacting to market through innovations* (1). *So they have de-centralised* (2) *global template to the regional levels* (5) *now, making us agile in innovating* (*) *things that are unique to us. (3)" "Ideas for technological innovation don't come from my IT department; it has to come from the consumers - the departments, customers and suppliers* (4). *Our IT department develops them* (5)"	1. Innovation requirement – situational 2. Project coordination – satellite 3. Technology purpose - uniqueness 4. Project contributor – customer, supplier 5. Project initiator – CIO/ IT department (*) Consequence – agile innovation

Table 7: Axial coding		
Case	**Quotations (multiple)**	**Axial Codes (Properties)**
FARM	"*SAP is too rigid* (1)*, we need to be agile* (*) *in innovating to the market place, based on easy to use technologies like mobile technologies* (1)*, for functionalities* (2) *that we know will add value immediately…*(3)." *"Automating the entire process with SAP is too costly* (4*) and to be frank with you…unnecessary." "We look at cheap technology* (4) *in the market and see what we use them on SAP* (5)."	1. Technology type – SAP, mobile technologies 2. Project scope – functional 3. Outcomes return – quick 4. Technology characteristics – too costly 5. Technology role – operand (SAP) and operant (mobile technologies) (*) Consequence – agile innovation
DAIRY	"*It's good that Italy [where the head office is] has recognised the threat of new markets…it is fierce." "We used to wait for SAP* (1) *to provide all solutions to innovate, but we have realised that we need to be different and better than our competitors, and trust me, they are opportunistic in innovating* (*) *new things to connect better with their customers and suppliers and get them to* (2) *our business functions." "Our IT projects now have a narrow focus* (3)*, more like lifting functions out and automating them through mobile technologies, BI [business intelligence] or cloud* (4)." *"It's like the app store now; we have the knowledge of handling all types of IT* (5)."	1. Technology type – SAP 2. Project contributor – customer, supplier 3. Project scope – functional 4. Technology type – mobile technologies, cloud and business intelligence 5. Technology characteristics – ease of use, ease of development, ease of learning (*) Consequence – agile innovation

Table 7: Axial coding		
Case	**Quotations (multiple)**	**Axial Codes (Properties)**
INSURANCE	"*I [CIO]* (1) *have brought different types of IT* (2) *to try and create a very dynamic* (*) *environment…we trial out* (3) *things [IT] to see whether they work. They don't have to give us profit* (4), *we focus on ease-of-access to information or better data layouts* (5), *If they don't, that fine…the cost is much less* (6)." *"Some of our new mobile stuff [solutions]* (7) *doesn't even talk to our AS400* (8)*…they are just automating small functions* (9) *of a business process."*	1. Human actor – CIO 2. Technology type – multiple 3. Project purpose – trial 4. Outcome type – financial 5. Outcome type – non-financial 6. Technology characteristics – low cost 7. Technology type – mobile technologies 8. Technology type – AS400 9. Project scope – functional (*) Consequence – agile innovation
ROAD	"*We have a suite of IT systems (1) that we brought to think outside the box... to see how we can become agile* (*) *in developing new stuff." "Unless we are agile in delivering new solutions* (*) *through IT, we will be left behind* (2)*... For example, we are trialling* (3) *a new accident reporting* (4) *BI [business intelligence] project* (5) *on our landscape to understand how weather, accidents and licensing data can mash-up... the hot app market* (6) *helped us identify potential apps too... we went this way, because it is relatively inexpensive* (7) *and flexible* (7)."	1. Technology type – multiple 2. Outcome type – non-financial 3. Project purpose – trial 4. Project scope – functional 5. Technology type – business intelligence 6. Project contributors – vendors 7. Technology characteristics – flexibility, low cost (*) Consequence – agile innovation

Table 7: Axial coding		
Case	**Quotations (multiple)**	**Axial Codes (Properties)**
HEALTH	"*Decentralisation of the health market has opened the gates for very strong American and European firms to operate in our market." "We are still #1, but we have to be quick and swift* (1) *in innovating new ways* (*) *we serve our customers through IT* (2)*...Especially over the past 2 years or so we trial (3) heaps of new technologies* (4) *to try new ways to deliver services...patient locator (5) is one such app* (6)*, which recognises the patients GPS location." "Customers are willing to engage with us directly with their phones* (7)."	1. Outcome return – quick 2. Technology objective – entice customers 3. Project purpose – trial 4. Type of technology – multiple 5. Technology objective – patient locator 6. Project scope – functional 7. Project partnership – customer (*) Consequence – agile innovation
TELECOM	"*Seven years ago, we were #5, and now we are #1 for the past 2 consecutive years…and it's only made possible* (1) *by using the army of IT working for us in different ecosystems (2), we have SAP, BI [business intelligence] tools, mobile apps* (3) *and they all help us to test* (4) *small niche markets that others had neglected." "Also we want to treat every customer differently* (5) *to provide a unique experience, and our IT solutions try to deliver those agile solutions* (*) *to our staff and customers...We have a usage based promotion system* (6) *using BI [business intelligence] that sits on SAP* (7)."	1. Outcome type – non-financial 2. Project partnership - vendor 3. Technology type – multiple 4. Project purpose – trial 5. Project scope – functional 6. Innovation requirement – situational 7. Technology role – operand (SAP) and operant (business intelligence) (*) Consequence – agile innovation

The following observations were made in the axial code analysis.

i. It was revealed that the case organisations employed multiple technologies as technology options, mixing their IT resources in a fluid manner that allowed them to innovate creating new opportunities and/or to respond to situations in a timely manner.

ii. The organisations did so (or preferred to do so) by developing IT solutions for focused functional areas, rather than focusing on the entire business process.

iii. The organisations engaged with the customers and/or suppliers directly on the functional touch-points, facilitated through the consumerization of IT.

iv. Further, the low cost of digital technologies enabled the organisations to trial new IT projects.

v. The engagement of the customer or/and the supplier in completing the selected functions through low-cost digital technologies allowed entities outside the departmental boundaries to add value to the business process.

vi. Moreover, there was substantial participation from non-IT departments in grassroots innovation.

vii. Finally, the projects were designed to deliver swift and quick tangible or intangible outcomes.

viii. However, the open and axial codes, and their related theoretical memos, did not correspond to the characteristics usually associated with radical or incremental innovations.

Patton (2002) describes two ways of presenting emergent patterns: indigenous typologies, where the analyst can use the categories developed and articulated in the program studied to organise the presentation of particular themes;

and analyst-constructed typologies, where the analyst may also become aware of categories or patterns for which the people in the study did not have labels or terms. In the case of analyst-constructed typologies, the analyst develops the terms to describe these inductively generated categories. As such, interestingly, even though the case protocol and follow-up questions did not include the word "agile" as a term of reference, all the respondents seemed to imply the need for organisational innovations to be agile. Through selective coding the core phenomenon was selected. The story of the case weaved around innovation and organisations being agile using these front-end and back-end systems. Thus, the term "agile innovation" was used as the core category. This led to the creation of the new term "agile innovation" through its binding axial coding categories (Figure 16).

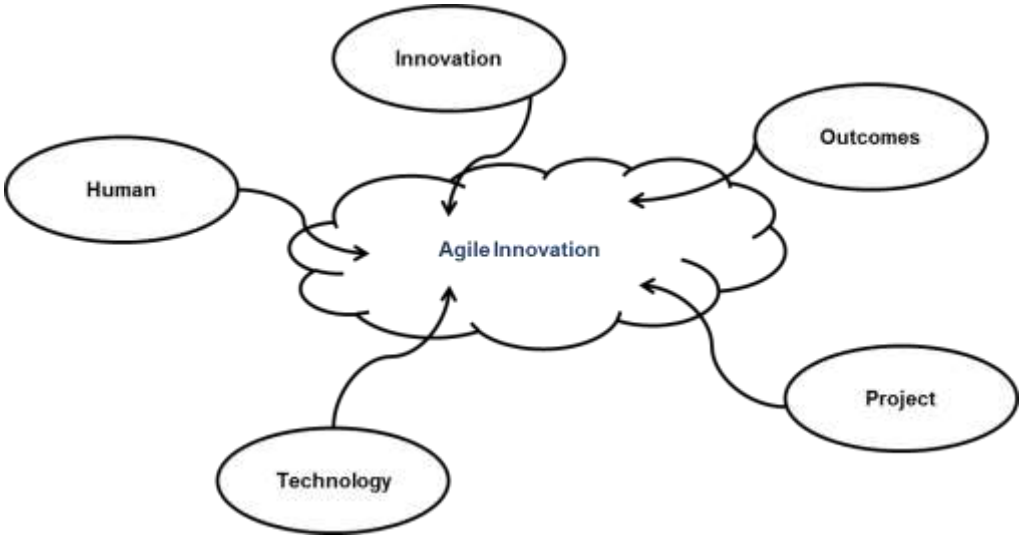

Figure 16: Agile innovation

Proceeding with the term "agile innovation" was deemed to be appropriate in this study given that it highlights a novel notion of innovation that relates more closely to the contemporary business and technological landscape. The growth of the consumerization of IT, the pervasiveness of digital technologies in organisations, and

in general the hyper-competitive markets that require dynamism in innovation justify further elaboration of the concept of agile innovation, and how it occurs.

4.4 AGILE INNOVATION

The axial codes in Table 7 identified that agile innovation:

i. Is ad-hoc/situational/opportunistic
ii. Usually initiated by non-IT departments
iii. Is functional-focused
iv. Is low resource-intensive
v. Enables the customer or supplier to interact with the functions
vi. Usually involves trialability
vii. Seeks immediate value propositions
viii. Employs a combination of both operand and operant technologies, and is likely to be triggered by an operant technology
ix. Thrive due to the consumerisation of IT.

Further, the notion of agile innovation attempts to provide a theoretical and conceptual explanation to the process of innovating with ES and digital technologies in the contemporary IT portfolio.

As Ettlie et al. (1984, p. 683) state "one of the theoretical typologies that has emerged in the literature on organisational innovation is the dichotomy of radical versus incremental innovation." With respect to types of innovation discussed in past literature (Latzer 2009), this study argues that agile innovation is neither radical nor incremental. However, the focus of agile innovation is *not* to maintain a middle ground between radical and incremental innovations. Indeed, our case studies

seemed to suggest that contemporary organisations do not have the option of introducing radical innovations on a regular basis. In general, a radical innovation is disruptive, and the adoption is costly for the organisation (Latzer 2009; Norman and Verganti 2014). Further, several studies in the literature and anecdotal evidence show that such disruptive innovations are risky to the organisation (Assink 2006; Slater et al. 2013). For example, through the study of Proposition 1 and 2, the impact of radical innovation introduced through the ES was witnessed, whereby each organisation underwent substantial organisational re-design, learning and resource allocations.

On the other hand, incremental innovation does not seem to provide the 'cutting-edge' required for the contemporary competitive world. Proposition 1and 2 examined how the organisations attempt to retain incremental innovation by scheduled upgrades and programmed improvements to the ES functions and features. However, such initiatives fell short of the organisation's expectations of innovation required for competitiveness. Much of today's business opportunities require immediate innovation, rather than seeking innovation through planned or scheduled IT roadmaps. Thus, incremental innovation, as discussed in the literature, although appropriate for keeping the lights on (Norman and Verganti 2014), fails to meet the innovation requirements of contemporary businesses.

It was further observed that agile innovation requires both operand and operant IT resources *collectively* (see Chapter 2 for the discussion on Operant and Operand resources) and that, to the extent to which operand and operant technologies are *combined effectively* for a specific objective, organisations are more likely to attain agile innovation.

Agile innovation goes beyond the traditional view of seeing IT *only* as an 'enabler' and highlights the potential of IT to 'trigger' innovation. Taking all these properties and examining the interview data, agile innovation is defined as "how organisations synergistically orchestrate operand and operant IT resources to innovate, where innovation is defined as production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems." The characteristics of agile innovation that emerged from the study are discussed below and sample quotations are provided to illustrate the theme. A comparison of agile innovation with incremental and radical innovation characteristics proposed by Latzer (2009) is discussed in Appendix D.

4.4.1 **Characteristic 1 – the technology backbone/platform**

From a technology standpoint, agile innovation will benefit from a strong and stable technology platform (e.g. ES). It was highlighted that digital technologies, takes a functional viewpoint and require data that may come from multiple business processes to operate. The standardised and integrated corporate ES with consistent data quality makes it easier for digital technologies assemble for a functional focus from multiple sources. Here, the ES will act, for example, as the technology platform to 'plug-and-play' flexible digital technologies.

> *"We have millions of customer records in SAP. The customers who use our mobile app and pay bills through the mobile app are synchronized to our SAP. There are no data redundancies and data is shared across departments. Especially, our customer service staff has the 360 degree view of the customer…"* (TELECOM)

> *"We plugged in a time sheet application to Oracle for our volunteer staff. Now we can manage all their [volunteer staff] information*

> *through our Oracle system. Our HR staff is happy about this initiative"* (HEALTH)

Furthermore, the growing openness of ES as platforms has empowered organisations to trial and uses multiple digital technologies from non-ES vendors, ultimately facilitating agile innovation.

> *"We now have much better accessibility to SAP…They [SAP company] have opened it [SAP system-open architecture] up with NetWeaver. We can now plug-in most wanted technologies."* (DAIRY)

Although a stable system is beneficial, agile innovation is independent of the IT sophistication of the organisation; thus, a high level of IT sophistication is not mandatory:

> *"We have not changed the SAP for a long time [no upgrades]."* (LOGISTICS)

> *"We still use AS/400…we do not have a high-end platform."* (INSURANCE)

4.4.2 Characteristic 2 – the trigger/initiator, scope and outcomes

Agile innovation relies heavily on the advancements of digital technologies. Therefore, it is likely that agile innovation continues through the advent of *operant IT resources.* Especially, new devices, technologies and new uses of existing technologies emerge through the consumerization of IT would further enable agile innovation.

> *"We added extra features like finding the closest fuel station to our app. This [addition of new features] increased the usage. We then analyse the usage data to identify new customer needs…This [analysis of customer usage data] was possible only because of analytics and mobile technologies."* (INSURANCE)

Agile innovation benefits from trialability, relatively low acquisition costs, ease of development and the deployment of digital technologies. Agile innovation is particularly accountable to contemporary dynamism of the business world. Thus, the outcomes of agile innovation are specific and must be attained in a relatively short period of time.

> *"We are trialling out this dynamic product offering with 5% of our new customers…It's is a BI [business intelligence] tool that helped us do this [trialling]. We recently bought it [BI] for a very cheap price… So far the results are so positive."* (TELECOM)

Moreover, the lead time of agile innovation must be short. To arrive at short lead times in agile innovation, organisational governance and business hierarchies must be hospitable to changes, as well as be conducive to fluid inter-departmental communication (discussed more in characteristic 3 below).

> *"We have a budget for each of the main department for IT…that's unusual for a public sector department. But, all new IT projects must be approved and governed by the central"* (ROAD)

> *"We came up with the idea of dynamic offers, and we developed it [new IT initiative]…within few weeks…"* (TELECOM)

The outcomes of agile innovation are measured using specific, short-term objectives with tangible or intangible key performance indicators. As such, the tolerance of failure or under-performance in agile innovation is much less, forcing under-performing initiatives to be culled instantaneously.

> *"New projects have to be simple and short-term. We want the outcome immediately…can't wait for 5 years. If they [the new initiatives] don't deliver, we have to cull-it."* (ROAD)

Agile innovation is functional-oriented (as opposed to being process-oriented). Its focus is not on automating the entire business process, but on augmenting a selected component or components that would provide maximum

benefit to the organisation. Here, the consumerization of IT provides an opportunity for organisations to engage with customers or suppliers to take part as actors to add value to the selected functional components. This is a substantial departure from the introverted 'process' thinking that was advocated through ES. Figure 17 illustrates the exposure of a function of a business process to the outside parties (e.g. customer) through digital technologies.

> *"Our customers are connected to us in the accident reporting app. They [customers] can enter their bank details and we can directly deposit the insurance claim. We don't have to enter [bank] details from our side…much faster and saves us time and money."* (INSURANCE)

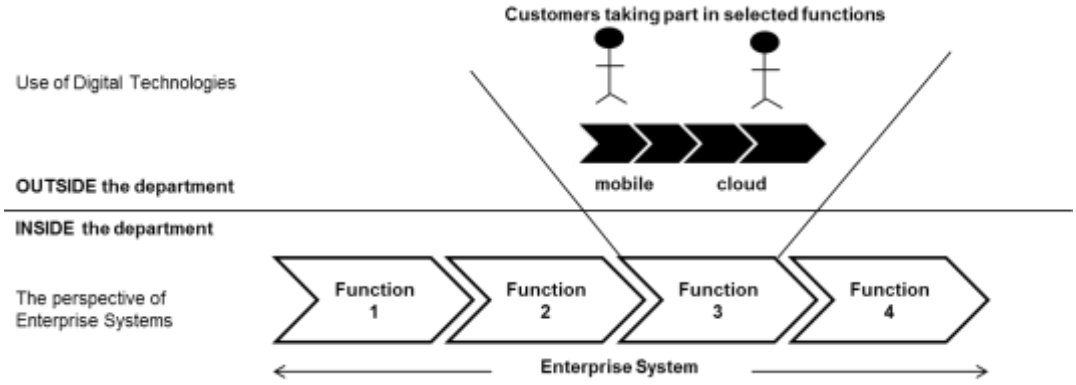

Figure 17: Exposure of a business process function to outside parties (e.g. customers) through digital technologies

4.4.3 Characteristic 3 – collaboration, coordination, configuration and management of operant and operand resources

Agile innovation depends on the effective coordination, configuration and management of operant and operand IT resources. To the extent an organisation seizes the opportunity to understand the possibilities of digital technologies, it has the potential to coordinate, configure and manage digital technologies with an ES in its pursuit of agile innovation:

> *"Our customers have many touch-points for tracking, placing orders and user detail updates. We have mobile, web and manual. They [these new technologies] are all essential for us to be a customer-centric company. They [mobile and web] all extract from and write to SAP."* (LOGISTICS)

As mentioned, agile innovation will benefit from a stable organisational IT platform such as an enterprise system that can extract and disseminate the data required for a functional-based application developed using operant IT resources:

> *"It was easier for us to introduce single-sign-on applications using Oracle back-end with a mobile application."* (HEALTH)

In agile innovation, the platform of interaction will move from the ES to operant technologies. Organisations will continue to invest in digital technologies that will create a layer of technology that is easy-to-use for their users (including customers and suppliers) and cost effective to the organisation. As stated above, investments in ES will pertain to maintaining it as a 'back office':

> *"My volunteer staff does not use SAP… They [volunteer staff] use the mobile app. The HR and Finance people consume the data the volunteer staff create through the mobile app"* (HEALTH)

4.4.4 **Characteristic 4 – initiate and manage agile innovation**

Contrary to the tradition whereby the IT department initiates technological innovations, agile innovation can be initiated at the grassroots functional department level as well. As such, to foster agile innovation, front-line departments should be encouraged to develop their own vision that incorporates the broader technology landscape of the organisation.

> *"Our logistics manager in The Netherlands developed a mobile app to connect couriers in a very short period with very little resources…we want to bring that [new mobile app] to all countries now."* (LOGISTICS)

Thus, agile innovation can be initiated not only by the CIO; rather, it can be initiated in an organic or inductive manner by the functional departments. Since agile innovation is technology-driven, the functional departments (e.g. any department such as sales, logistics etc.) must have competencies to identify appropriate technologies and should have the management latitude to recommend appropriate technologies for departmental solutions:

> *"We [the road safety and accident prevention division] now have a small budget to develop customer focused apps. All of us now periodically discuss how to serve our customers directly…we talk to IT [department] when we need some recommendations."* (ROAD)

Thus, agile innovation will thrive in a decentralised organisational structure, with appropriate coordination and encouragement from the central management. Further, initiatives must be managed using both centralised and decentralised practices, where the technology maintenance is shared between the CIO and the functional department:

> *"In recent times, we have asked the departments to manage their [each department] own mobile app projects. We still do the IT bits for them, but they [department staff] initiate them [new changes] and we charge them [departments]."* (MULTI)

Overall, the aforementioned characterisation of agile innovation highlights the importance of the careful selection of multiple technology resources (Characteristics 1 and 2), as well as their assembly, coordination, configuration and management by the CIO or the department manager (Characteristic 3). The process of assembly, coordination, configuration and management is a recursive process that is influenced by its outcomes (Characteristic 2). Further, agile innovation responds to the facilitation of ideas at the grassroots level (Characteristic 4) and is sensitive to organisational characteristics and human resources. Thus, a deeper understanding of

agile innovation can be developed by examining it through an integrative lens that enables one to see the role of the modern IT portfolio and its management on organisational phenomenon, which the candidate sought to find and describe below.

4.5 META-THEORY ON AGILE INNOVATION

There are several theories in IS that discuss the importance of IT-related resources and their management. For example, management theories like the resource-based view of the firm (Barney 2001), dynamic capabilities (Adner and Helfat 2003; Teece 1992) and the configuration theory (Miller 1997; Vorhies and Morgan 2003) discuss the importance of broad resource management and of resource coordination (Barney 1991). However, RBV theory has been criticized for its lack of applicability in dynamic business environments as well as being tautological (Priem and Butler 2001). Further, dynamic capabilities are similarly criticized as being less significant to attain continuous competitive advantage (Eisenhardt and Martin 2000). Sirmon et al. (2007, p.273) state that these exemplary theories show that "to realize value creation, firms must accumulate, combine, and exploit resources." Prior research on resource-based view of the firm (Barney 2001), dynamic capabilities (Adner and Helfat 2003; Teece 1992) configuration theory (Miller 1997; Vorhies and Morgan 2003) and the resource allocation (Sirmon and Hitt 2009; Sirmon et al. 2007) theories highlight the management of valuable and rare resources. Yet, this study focuses on attaining competitive advantage and innovation through commonly available resources. Nevo and Wade (2010) discuss how commonly available resources attain competitive advantage, yet, they discuss the integration of IT asset with the organisational resources such as materials, machines and human. But the uniqueness in this study is that, it explores how organisations can innovate with

operand and operant IT resources. The impact of operand and operant roles of IT and its management on organisational phenomenon in agile innovation highlight the importance of the assembly, coordination, configuration and management of IT. Further, agile innovation also highlights the essential role of the CIO or the LOB manager as the technology arbitrator, initiator or manager.

In this section, the instrumental orchestration theory (Trouche 2004) was used as a meta-theory to provide an integrative framework for the concepts of Agile Innovation that emerged from the coding efforts (i.e. the analysis). The study highlighted the role of 'orchestration' of resources. This view was stronger than the ability of the technology it-self in facilitating innovation. Though we acknowledge the existence of other theories like the RBV, configuration theory and dynamic capabilities, the study strived to identify a theory that includes the role of orchestration. The Instrumental Orchestration perspective not only provides the vocabulary for conceptually describing our observations about this new form of innovation but also helps in coherently tying together the coordination of IT portfolio of ES and digital technologies (i.e. resources) to attain Agile Innovation. The theoretical sensitivity allowed us to link the categories resulting from axial coding, and describe the process by which the core category – Agile Innovation – occurs in a rich, meaningful way.

The application of meta-theory combines the findings of multiple studies using a systematic process that involves induction (Britten et al. 2002). The combination of studies benefits in finding concepts, identifying inconsistencies, and extend the theory (Barnett-Page & Thomas, 2009). Further, the results of the studies can increase the depth of knowledge and lead to discover new aspects of the phenomenon (Barnett-Page and Thomas 2009). Considering these advantages, the

instrumental orchestration theory was used as a meta-theory to describe the attainment of agile innovation.

The instrumental orchestration perspective not only provides the vocabulary for conceptually describing our observations about this new form of innovation but also helps in coherently tying together the different aspects of agile innovation that were derived inductively. Given that the second phase of this study was influenced by the less procedural view of grounded theory method, it is important to note that the instrumental orchestration theory was used as a lens or scaffolding to weave together the pieces of agile innovation obtained through coding – it did not drive the coding process. The theoretical sensitivity allowed us to link the categories resulting from axial coding, and describe the process by which agile innovation occurs in a rich, meaningful way.

At the outset, the instrumental orchestration theory describes two central concepts that are very applicable to agile innovation: the orchestration and the orchestrator. The orchestration is the selection, assembly, coordination, configuration and management of IT, while the orchestrator denotes the initiator and management role of the CIO and the department head. The two terms relate to the central concept of interest in the instrumental orchestration theory, namely, instrumental genesis.

Overall, the instrumental orchestration theory describes the external steering of instrumental genesis, where the instrumental genesis denotes the progressive construction of an artefact or set of artefacts for a given purpose (Trouche 2004). Interestingly, the notion of instrumental genesis parallels the concept of agile innovation in this study. Trouche (2004) describes how an orchestrator (in music, with the orchestra master steering externally) selects and positions instruments to

create a beautiful harmony (purposive outcome) – similar to the role that CIO/manager plays in selecting, assembling and configuring IT resources.

In the present study, agile innovation is attained through the orchestration of operand and operant IT resources. Similarly, instrumental genesis in instrumental orchestration theory is described using two aspects that parallel the role of operand and operant technologies in agile innovation, where the two concepts – instrumentation and Instrumentalisation – demonstrate how operand and operant technologies are appropriated. These concepts are described below.

Trouche (2004, p.290) describes instrumentation as "precisely the process by which the artefact prints its mark on the subject, i.e., the instrument allows the subject to develop an activity within some boundaries." Trouche (2004) describes the role of instrumentation through the constraints and enablement of the instrument. Further, he notes that the instrumentation process "permanently conditions the actions of subjects through constraints and potentialities of the artefact (Trouche 2004, p.274)." In this study, the role of the operand technology in agile innovation is identical to the notion of instrumentation in the meta-theory. Here, the user (subject) is enabled by the ES, which imprints its mark on the business processes, moulded by the constraints and potentialities of the ES.

On the other hand, Instrumentalisation is directed towards the artefact. As Trouche (2004, p.293) explains, "instrumentalization can go through different stages: a stage of discovery and selection of the relevant functions, a stage of internalization and a stage of transformation of an artefact." Instrumentalisation resonates with this study's notion of how operant technologies are being used, which acts as a trigger. Similar to the process of Instrumentalisation, the organisation here discovers the capabilities of digital technologies, selects what is appropriate to trigger innovation

and then transforms the artefact through its enactment (the process of differentiation) on operant IT. The operant IT is then internalised to the organisation, where it would deliver competitive advantage, even if the same technology is available to its competitors.

Trouche (2004) defines instrumental orchestration as guiding instrumental genesis, or the intentional and systematic organisation and use of the various artefacts available in the environment (Drijvers et al. 2013) through the two processes of instrumentation and Instrumentalisation. Drawing from the meta-theory, the present study could employ intentional and systematic components to understand the selection of operant and operand IT resources available to the organisation (Drijvers et al. 2010). It is intentional and systematic that orchestration is partially prepared beforehand (planned) using the operand technologies and partially created 'on the spot' (ad-hoc) using the available new or existing resources – the operant technologies. Similar to the instrumental genesis, agile innovation too was attained in the case organisations through the application of partially prepared operand technologies (i.e. ES) and ad-hoc adoption of operant technologies (i.e. digital technologies).

An instrumental orchestration consists of two elements: (i) a didactic configuration, and (ii) an exploitation mode (Trouche 2004). A didactical configuration is an arrangement of instruments in the environment, or a configuration of the setting and the instruments involved in it (Drijvers et al. 2010). In the musical metaphor of orchestration, didactical configuration is similar to that of selecting the musical instruments to be included in the orchestra, and arranging their location (thus the role) so that the different sounds result in the most beautiful harmony (Drijvers et al. 2010). In agile innovation, didactical configuration will inform the selection of the

available technologies (operand and operant) for specific functional objectives (to reach harmony). For the notions of agile innovation, didactical configuration highlights the importance of the awareness of all available technologies (especially the operant technologies), as the CIOs'/ department heads' awareness of the technology capabilities will intensify the collective effect on didactical configurations.

An exploitation mode includes "decisions on the way a task is introduced and is performed, on the possible roles of the instrument to be played, and on the schemes and techniques to be developed and established by the subjects (Drijvers et al. 2010, p.215)." In an orchestra, this is similar to determining the partition for each of the musical instruments involved, focusing on the anticipated harmonies to emerge. In the context of agile innovation, the exploitation mode provides a theoretical framework to guide the objective-driven assembly of IT resources, with consideration of the organisational constraints, in order to attain the planned outcomes (harmony).

According to Trouche (2004), didactical configurations need to be thought of before engaging in action and cannot easily be changed during engagement. However, exploitation modes can be more flexible. As Drijvers et al. (2010, p.215) state, "instrumental orchestration has an incidental, local actualization appropriate for the specific didactical context and adapted to a specific objective and the didactical intentions." For each orchestration, the main objectives, originating from the necessity of the orchestration itself and the secondary objectives, and linked to the chosen exploitation modes, should be distinguished. The key concepts of instrumental orchestration theory are described in the following table (Table 8).

Table 8: Orchestration key characteristics				
Concept	**Case**	**Actor**	**Quotation**	
Instrumentation	DAIRY	SCM Manager	"*When we provide the product and supply details, we* (1) *rely on* (2) *the SAP SCM optimizer* (3) *to give the best demand plan and supply network plan* (4)"	1. The user 2. The tool imprints on the subject 3. Provides a boundary 4. Internalization
	ENERGY	Procurement Manager	"*Last year we introduced SAP* (1) *contracts* (2) *and it took nearly 2 years to implement. But it's worth it…because everyone now knows about the agreed terms and conditions* (3)"	1. The tool 2. The boundary 3. The tool imprints on the subject
	HEALTH	CIO	"*The HR and Payroll are* (1) *all under control. They are on Oracle* (2) *and my staff simply have to key in the hrs and times…the system does it for us* (3)"	1. The boundary 2. The tool 3. The tool imprints on the subject
Instrumentalisation	MULTI	IT Manager	"*We saw what BI* (1) *does with big data… It was amazing* (2). *We then went to SAP and a few partners to build reporting cubes for us* (3)"	1. The tool as a trigger 2. The discovery 3. Internalization
	ROAD	CIO	"*The potential* (1) *of Google Maps* (2) *to clearly display mashed-up data was quite unique* (3)"	1.The discovery 2.The tool as a trigger 3.Internalization
	HEALTH	HR Manager	"*Mobile technology* (1) *allows us to create a BYOD culture. Our staff can login to the internal systems using their own mobiles* (2)"	1. The tool 2. Selection of the technology

Table 8: Orchestration key characteristics				
Concept	**Case**	**Actor**	**Quotation**	
Instrumental Genesis	LOGISTICS	CIO	"*The ability of the SAP* (1) *to plug-in (2) mobile* (1) *technologies* ..."	1.One or more tools 2.Recognizing the role of technology
	HEALTH	CIO	"*ES* (1) *for us is the backbone…we don't touch it* (2)"	1.One or more tools 2.Recognizing the role of technology
	TELECOM	CRM Manager	"*I understand the value of our SAP system,* (1) *BI shows us a new path to connect with customers...* (2)"	1.One or more tools 2.Recognizing the role of technology
Instrumental Orchestration	LOGISTICS	Logistics Manager	*"Logistics manager* (1) *initiated the integration of* (2) *mobile technology to SAP* (3)*"*	1.External guidance 2. Recognizing the role of technology 3.One or more tools
Intentional	INSURANCE	Sales Manager	*"Sales Manager* (1) *initiated to launch a mobile app* (2) *to connect with customers* (3) *and retain them* (4)*"*	1.External guidance 2.One or more tools 3.Recognizing the role of technology 4.Purpose

Table 8: Orchestration key characteristics				
Concept	**Case**	**Actor**	**Quotation**	**Concept**
Systematic	HEALTH	CIO	"*I [CEO]* (1) *recognized the value of mobile technologies* (2) *to get an idea of what the customers really want* (3) *we are planning to find some interesting information applying BI to these data* (4)"	1. External guidance 2. One or more tools 3. Recognizing the role of technology 4. Plan
Didactical configuration	HEALTH	CIO	"*BI Data warehouse, collaboration tools, and mobile technology runs on top of our backbone* (1)"	1. Arrangement of artefacts
	DAIRY	SCM Manager	"*We use mobile technology to connect with customers and analyse these data using BI* (1)"	1. Arrangement of artefacts
	FARM	CIO	"*mobile technology running on SAP* (1) *helped us to connect with our farmers*"	1. Arrangement of artefacts
Exploitation mode	HEALTH	CIO	"*We plugged in a timesheet application to work on Oracle* (1), *for managing the working schedules* (2)"	1. Decisions on the way a tool worked on 2. Roles of the artefacts to be played
	LOGISTICS	Logistics Manager	"*The mobile and web applications run on top of SAP* (1) *for tracking orders* (2)	1. Decisions on the way a tool worked on 2. Roles of the artefacts to be played
	FARM	CIO	*We chose mobile because we could feed data to our SAP system through this* (1). *Mobile app connects us with the farmers* (2)"	1. Decisions on the way a tool worked on 2. Roles of the artefacts to be played

The present study's focus on agile innovation highlights a new perspective of instrumental orchestration theory. The notion of orchestration in the instrumental orchestration theory is centred on the 'music master', that is, the CIO/IT department in the present study context. However, instrumental orchestration in agile innovation was observed through two additional modes. Applying Trouche (2004) observation, the instrumental orchestration was led by the CIO/IT department. In addition, through the case data, it was noticed that, at least in some situations, the line-of-business (LOB)-led orchestration of IT resources had occurred. For example, it was observed in the cases that the orchestrator ('human role') could be located closer to the function of interest ('project scope'), regardless of the organisation size ('organisation size'), the coordination mechanisms ('organisation coordination') or hierarchy ('organisation hierarchy') to attain specific outcomes ('outcome type') – where the codes in the brackets were derived through induction. Further, when LOB-led orchestration took place, there was a need to orchestrate between the LOB managers and the CIO/IT department, creating a hierarchy of orchestration. This is explained below using case observations.

4.6 MODES OF ORCHESTRATION

As Trouche (2004) suggests, the unexpected complexity of instrumental genesis requires the assistance of external steering. As discussed above in relation to agile innovation, it was expected that the technology orchestration would be initiated by the CIO or the LOB manager. This demonstrates a theoretical extension to the instrumental orchestration theory, where multiple orchestrators are introduced. Thus, it requires three modes of orchestration (see Figure 18).

i. IT-led orchestration

ii. LOB-led orchestration

iii. synchronised orchestration

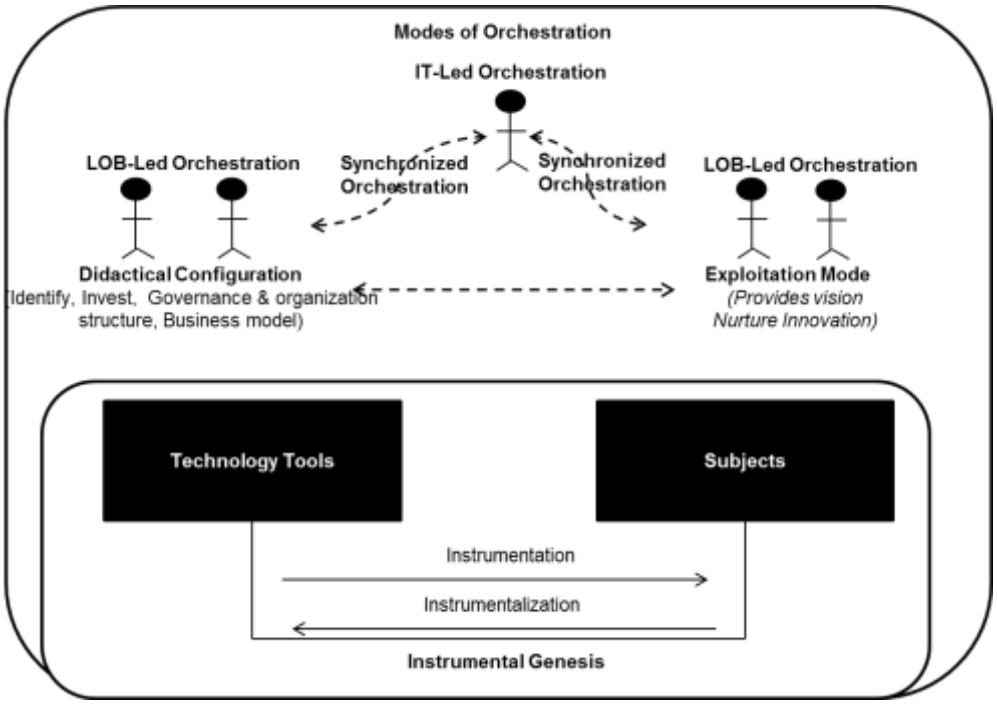

Figure 18: Modes of orchestration

4.6.1 IT-led orchestration

In agile innovation (and similar to other innovations), the CIO identifies or selects the technology solutions for innovation. In general, such IT systems contribute to the long-term strategy of the organisation and would typically involve several departments. These new technologies are introduced and orchestrated by the CIO and are skewed towards the party line of the organisation and its management. As the impact of IT-led orchestration diffuses across several departments, CIOs tend to rely on new technologies that are introduced by the same vendor as their dominant IT supplier (e.g. when the ES is SAP, CIOs tend to introduce new solutions from SAP).

Reliance on the vendor for driving innovation may hinder the innovation capabilities of the organisation and eventually compromise competitive advantage. This risk-averse approach is usually fostered in contemporary organisations by 'old-school-CIOs' who believe that one single IS is better than multiple systems. Thus, this approach of a single brand of IT organisation reduces the effort made to orchestrate multiple technologies and to attain instrumental genesis with fewer impediments. Finally, given the plethora of digital technologies, it is best that organisations rely on IT-led orchestration for corporate-wide IT solutions (operand technology):

> *"We [IT department] take the initiative to introduce new technologies…For anything new [technology]; our first port-of-call is SAP."* (ENERGY)

> *"The central IT department responsible for organisational-wide IT initiatives; if SAP needs a upgrade or if there's any issue, IT department looks after it [SAP]"* (MULTI)

> "*[The] addition of a module like HANA involves lot of money, time and makes changes to our existing platform. We [IT department] are in the process of planning whether to go ahead with this new module or not"* (LOGISTICS)

4.6.2 LOB-led orchestration

When the external steering is handled by a LOB manager, LOB-led orchestration occurs. Here the LOB manager has the latitude to buy and manage IT resources as per the requirements of their department. The technology options available for LOB-led orchestration are relatively inexpensive and the return on investment is immediate. In general, the LOB-led orchestration will only extend to the physical and management boundaries of the LOB manager's department.

Evidence from the case study data suggests that LOB-led orchestration is valuable for tailoring specific IT solutions to enable or trigger innovation in a narrow functional scope within a department. In orchestrating such IT resources, the LOB manager will derive resources from their department, rather than through the IT department. Thus, LOB-led orchestration is not concerned about the 'fit' between the operant and operand resources. A major concern in LOB-led orchestration is that it could lead to the excessive and discretionary orchestration of many IT resources, and thus damage the corporate IT portfolio:

> *"We [the road safety and accident prevention department] know what exactly we want. We wanted a solution that maps accidents with weather, road maintenance, demographics mapped on to Google Maps."* (ROAD)

> "*We added dynamic catalogues to our system. The importance of each product changes in each period and marketing team manages this*" (DAIRY)

> *"Our sales department manages the mobile app they [sales department] came up with, they [sales department] add new functions and manages it [the mobile app]"* (INSURANCE)

4.6.3 Synchronised orchestration

The objective of synchronised orchestration is to integrate all the orchestration efforts to attain synergy between the departments and the organisation as a whole. Synchronised orchestration will include the procedures and incentives for LOB-led orchestration to consider the wider implications of the technology, beyond its physical and management boundaries. The case study data highlights the role of business analysts in liaising with LOB managers to derive a harmonious and cohesive IT environment, deriving IT solutions that serve multiple departments and are highly congruent with the IT foundations of the organisation:

> *"Some of our departments have the latitude to build what they [departments] want [IT solutions]. They [department staff] consult with us [the IT department] and together we [IT staff] develop a management roadmap that sits well with the organisation."* (HEALTH)

> *"We talk to our farmers and see what they [farmers] need; Our IT department is capable of handling their [farmers] requirements"* (FARM)

> *"Our business analysts, talk to customer support department, we analyse their information and come up with new IT solutions"* (TELECOM)

The hierarchical extensions proposed in this meta-theoretical extension are similar to those that of IT governance and business-IT-alignment. For example, the theories focusing on the transactional and transformational leadership (Bass 1991; Judge and Piccolo 2004) can add further insights into the findings of this thesis. Moreover, IT professional practice methodologies like ITIL framework can also provide similar approaches to managing a complex IT portfolio.

4.7 CHAPTER SUMMARY

The research question posed in this study, '*How do organisations innovate through the modern IT portfolio of ES and digital technologies?'* was analysed using the case study method. Data was gathered from nine case organisations. This chapter presented the findings of the deduction and induction phases of data analysis.

In the deduction phase, the propositions that ES facilitates innovation and digital technologies facilitate innovation were challenged. Thus, an inductive approach was required to further analyse the phenomenon. This chapter provided a detailed description of the results of the induction phase. The results of the induction phase included identification of a new form of innovation, namely, agile innovation.

The characteristics of agile innovation attained through the modern IT portfolio were discussed. The meta-theory was applied to enhance the theoretical value of the study's findings.

Chapter 5: Conclusions

The objective of this chapter is to present the findings in the relevant theoretical contexts. The chapter begins with a summary of the findings of the study. The contributions of the study to academia and practice are then presented. Further, this chapter discusses the study's limitations, and concludes with suggestions for future research directions. The structure of the chapter is depicted in Figure 20.

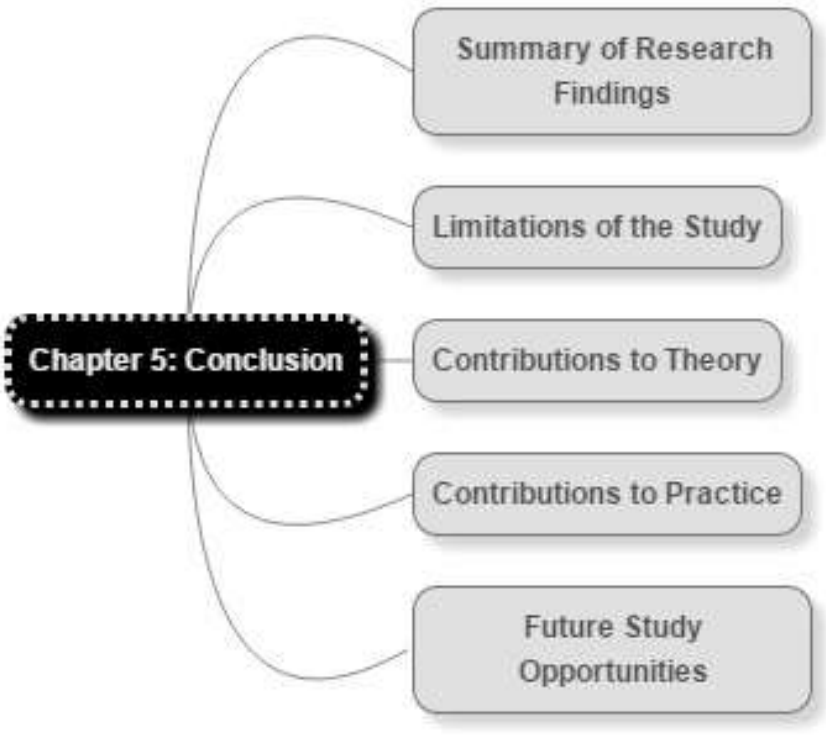

Figure 19: Thematic representation of Chapter 5

5.1 SUMMARY OF RESEARCH FINDINGS

The relationship between IT and innovation has been a much discussed topic in academia (Chae et al. 2014b; Melville et al. 2004) and practice (Davenport and Short 1990; McAfee 2006), with many studies taking a highly positive view of technology's role in assisting innovation (McAfee and Brynjolfsson 2008). In the current competitive and aggressive corporate environment, organisations are increasingly under pressure to continuously innovate (Nwankpa et al. 2013), especially to maximise the values and benefits embedded in their existing technologies such as ES (Nwankpa et al. 2013). Innovation has become ever more important to contemporary organisations due to the advancements of technology (Schaller 1997; Yoo et al. 2010), the consumerization of IT (Harris et al. 2012), the rising market demands, and globalisation (Amabile 1996; Gorodnichenko et al. 2010). Yet, anecdotal commentary suggests that most organisations are not ready to innovate (Lichtenthaler et al. 2011).

The process of how common organisations consider IT as a source of innovation has been documented since the 1990s (Swanson 1994). In particular, there has been strong evidence of organisations attempting to use ES to innovate management, process, product and service development, delivery and administrative functionalities (Srivardhana and Pawlowski 2007). The initial adoption of corporate-wide applications like ES led to radical changes in business processes and organisational structures (Kraemmerand et al. 2003).

Even though ES implementations have the potential to deliver innovation to organisations (Lokuge and Sedera 2014a), whether such systems support continuous innovation is highly contested (Kharabe and Lyytinen 2012). Some scholars have likened implementing ES to pouring cement into organisational business processes

(Kharabe et al. 2013; Kharabe and Lyytinen 2012), highlighting the rigidity of ES. The rigidity of the business structure enabled through ES is purported to hinder innovation (Srivardhana and Pawlowski 2007). The second stream of studies highlights that organisations continue to use their ES to remain innovative, specifically building on the foundational values of ES such as process integration (Bidan et al. 2012), standardisation (Batenburg et al. 2006) and real-time data (Shang and Seddon 2007). Despite the potential for ES to kick-start and continuously assist in innovation, ES-led innovation, left unattended, will diminish over time. As Swanson and Dans (2000) explain, the innovation potential of any system deteriorates over time and eventually the system must be retired or upgraded. Yet, due to the high cost of upgrades, the demand on human resources, implementation fatigue and also fear of the changes associated with innovation, organisations are reluctant to innovate with their ES (Chua and Khoo 2011). To the contrary, the testimonials of organisations using ES (Unilever 2015), vendor roadmaps (SAP 2015), commercial research reports (Gartner 2000) and sporadic empirical research suggest that planning for the lifecycle of system is essential for organisations to innovate beyond the ES implementation.

The advent and massive proliferation of mobile technologies, cloud computing, in-memory technologies and analytics (i.e. digital technologies) have purportedly presented organisations with an opportunity to innovate. The advent of digital technologies signifies an era of flexible, easy-to-deploy and cost-effective IT solutions (Nylén and Holmström 2015; Vodanovich et al. 2010). Researchers have also pointed out that digital technologies have the potential to trigger innovation in organisations, facilitated by their trialability, cost-effectiveness and ease of use (Mallat et al. 2009; Nylén and Holmström 2015; Yoo et al. 2012). Digital

technologies have been widely recognised as “revolutionary” (Hofmann and Woods 2010), “innovative” (Sheng et al. 2005) and at the same time being cost- effective (López-Nicolás et al. 2008). As such, research forecasting by Gartner (Cearley and Hilgendorf 2014) makes clear suggestions regarding how organisations could derive innovation capabilities through digital technologies.

Prior research on ES has discussed the influence and importance of the features and functions of ES such as operational flexibility (Karimi et al. 2007), business process improvements (Grover and Segars 2005), productivity (Shang and Seddon 2007), transparency (Akkermans et al. 2003), innovation (Srivardhana and Pawlowski 2007) and profitability (Romero et al. 2010; Staehr et al. 2012). Such observations were made using characteristics like ease of use, ease of learning, and these observations were captured through the end-user functional perspective (Gable et al. 2008; Gorla et al. 2010; Sedera and Dey 2013; Tate et al. 2013). However, there is a growing recognition that enterprise system is now evolving to take a more salient role as a *technology platform*. Gawer (2009) states that ES act as a building block, providing an essential function to a technological system which acts as a foundation upon which other complementary products, technologies or services can be developed. The ES technology platform is facilitating an ecosystem of third-party software products, services and suppliers (Ceccagnoli et al. 2012). The changing role of enterprise system as a platform is evident from the surging changes to the corporate IT landscape (Schaller 1997). The modern organisation is transforming from a single, monolithic ES-centric technology landscape, into a portfolio of IT with an eclectic collection of technologies such as mobile technologies, cloud computing, analytics and big data (Brinker and McLellan 2014). Although digital technologies have the option to be deployed and managed in isolation, they have the

potential to deliver better value by integrating or synchronizing with a high quality ES-Platform (Lee et al. 2003).

This dissertation was instigated with the aim to gain a deeper understanding of how do organisations innovate through the modern IT portfolio of ES and digital technologies (the process of innovation). Thus, the thesis addressed the following research question:

RQ: How do organisations innovate through the modern IT portfolio of ES and digital technologies?

This objective of the study was to build a deeper understanding of how organisations innovate through the modern IT portfolio of ES and digital technologies. Further, it investigated the role of ES and digital technologies in triggering or enabling innovation and explores the nature of such innovations. The research objectives were investigated using a methodological approach consisting of two sequential steps (an integrative approach). First, two propositions of the IT portfolio of ES and digital technologies for innovation were discerned from a review of the extant mainstream literature and then subjected to deductive analysis using four cases. The four cases were LOGISTICS, MULTI, ENERGY and FARM. Second, using five new cases and revisiting deduction case organisations, an inductive approach was adopted to discover concepts not accounted for in the original propositions and to investigate the phenomenon thoroughly.

The deductive analysis highlighted the role of the ES in the introduction phase in enabling radical innovations to the organisation. Yet the proposition was either challenged or conditional-accepted in the cross-case analysis (Table 5) raising doubts about the anticipated role of the ES in innovation, especially beyond the early stage of the ES lifecycle.

The inductive analysis suggested that, instead of being a trigger of innovation, ES in the latter stage of the lifecycle, act as a dormant technology platform upon which digital technologies can trigger innovation. This view is further investigated using Nambisan (2013) classification of operand and operant technologies to conceive the role of the ES and digital technologies. This discussion in the study adds further conceptual faculty to works such as those by Yoo et al. (2012) who suggest the "generativity" of IT, referring to the establishment of a platform that enables innovations by a third party (Benkler 2006; Tiwana et al. 2010; Tuomi 2002).

The analysis in the deductive phase resulted in observing two key observations: (i) digital technology-led innovation and (ii) digital technology reliance on ES. These two observations were unable to explain through the past literature, thus, required further analysis. As a result, the induction phase was initiated.

The second phase was inductive in nature and led to the identification of new way of innovation, called 'agile innovation' and through the inductive analysis the characteristics of agile innovation were identified. Four characteristics were identified to explain the nature of agile innovation. A meta-theory was applied to explain the new phenomenon of agile innovation. Among several theories in strategic management and IS studies, the theory of instrumental orchestration (Trouche 2004) was applied. This theory was used to explain the whole process of achieving agile innovation in an organisation. In instrumental orchestration theory, Trouche (2004) explains a concept called external steering, which is similar to the attainment of agile innovation. Considering this concept, three orchestration modes were identified as an extension of the theory. Case organisations supported the identification of the three

modes, namely, IT-led orchestration, LOB-led orchestration and synchronised orchestration.

The key conclusions of the study are highlighted as follows:

i. Consistent with past studies, ES enable radical innovation when introduced to organisations.

ii. Post-implementation, ES provide a strong technology platform

iii. The consumerization of IT has allowed customers and suppliers to directly engage in business functions, thus adding more value to business.

iv. Organisations encourage the trialability of low-cost digital technologies for innovation.

v. Digital technologies trigger innovation.

vi. The innovation attained through ES and digital technologies does not resemble the characteristics of radical innovation or incremental innovation.

vii. The lead time of the innovation attained through ES and digital technologies is low compared to the lead time of innovation attained through ES alone.

viii. The innovation attained through ES and digital technologies has better outcomes compared to the outcomes provided by ES alone.

ix. Innovation in contemporary organisations is driven not only by IT departments; rather, all functional departments contribute to grassroots innovation.

x. Contemporary organisations focus on innovating selective business functions, rather than business processes (i.e. a functional view as opposed to a process view).

5.2 LIMITATIONS OF THE STUDY

There are several limitations in the current study. The study does not distinguish the type of digital technology. Instead, it bundles all available types of digital technologies into one group. The reason for selecting these technology types as one is that they consist similar characteristics such as low cost or subscription based, thin infrastructure, ease of use, easy to deploy and these technologies can be adopted on demand (Buyya et al. 2009; Delen and Demirkan 2013; Son et al. 2014). Further, these technologies are agile, device and location independent, easy to maintain, multi-tenet and productive (Chong et al. 2012; López-Nicolás et al. 2008; Sheng et al. 2005). This simplistic view was necessary for a maiden study, as the differentiation of digital technologies would have introduced undue complexity.

The homogeneous selection of organisations in the study sample may have added some bias to the study findings. For example, the inclusion of variables associated with organisational size (e.g. medium-sized organisations), IT maturity, governance and regulations may have provided deeper insights.

The qualitative data sample comprised nine organisations representing seven private sector organisations, one public sector organisation and one not-for-profit organisation. Thus, the results might not be generalizable to other industry segments. Further, the nine organisations represented eight industry sectors and, similarly, the results might not be generalizable to other industry sectors or other organisations in a similar industry sector.

The data collection in the study involved CIOs, CTOs or equivalent senior managers with a maximum of two department managers representing each case organisation. The addition of more department managers representing a broader range of personnel could have improved the findings. However, the selection criteria specifically mentioned that a manager from a department that had initiated an IT-related innovation would be interviewed. All the department managers in each case organisation that fulfilled this criterion were interviewed.

The selection biasness of the sample is acknowledged as a limitation of the study. The purposive sampling method employed in the study selected organisations with ES and digital technologies. The selected organisations are large and resourceful - compared to others. As such, a sample of Small and Medium Enterprises may have different patterns of innovations through an IT portfolio. In spite of such limitations, the notions of orchestration, principals of agile innovation and the extended roles of management for orchestrating IT remain valid.

The researcher conscientiously strived to minimise personal bias. Nevertheless, the researcher's past experience dealing with ES might have impacted on the analysis and interpretation of the research data.

5.3 CONTRIBUTIONS TO THEORY

Even though there are some limitations to this study, the rigor of the qualitative study was achieved through satisfying the following research criteria proposed by Yin (2009) and Sarker and Lee (2003):

i. Internal validity – Pattern matching was used as the analysis method in deduction. The predictions resulted from the two propositions that were challenged and conditionally accepted were matched with empirical patterns to attain internal validity.

ii. Construct validity – The construct validity was attained through collecting data from multiple sources. Multiple interviews were conducted with multiple respondents and further multiple data such as publicly available information about the companies and company documents were also analysed.

iii. Reliability – This was attained through memos/notes that were taken after each interview. Summary tables were created and used a case protocol when conducting interviews.

iv. External validity – This was achieved through enhancing the degree of freedom and using the replication logic. Multiple observations were for used to confirm each prediction. Same propositions were tested in different instances, for example, based on lifecycle phase, lead time and innovation type.

The study offers several contributions to academia in three areas: (i) orchestrating technologies, (ii) agile innovation and (iii) extension of the meta-theory. In addition to these three key contributions, the study extends the IT resource

classification proposed by Nambisan (2013). The dissertation classifies the modern IT portfolio through Nambisan (2013) and identifies how operand and operant resources collectively attain innovation.

5.3.1 Orchestrating Technologies

Before the introduction of ES, organisations used multiple systems to manage their business activities (Swanson 1994). Meyer and Foley Curley (1991) measured the technology complexity that arises through the use of diverse technologies by outlining different systems that are available for integration with an expert system. A collection of multiple systems hinders the organisational performance due to data redundancy issues (Bisbal et al. 1999), difficulties in managing disparate systems (Bingi et al. 1999), poor quality (Holland and Light 1999), high cost (Bisbal et al. 1999), high complexity (Holland and Light 1999), inconsistent processes (Simon 1992) and integration issues (Simon 1992). In contrast to the availability of multiple systems in organisations, ES introduced the process view. ES enables organisations to achieve operational flexibility (Karimi et al. 2007), business process management (Grover and Segars 2005), productivity (Shang and Seddon 2007), profitability (Romero et al. 2010; Staehr et al. 2012) and innovation (Srivardhana and Pawlowski 2007). Even though ES are able to add value for the organisation at the beginning, researchers and practitioners question the long-term contributions of ES to innovation (Kemp and Low 2008; McAfee and Brynjolfsson 2008) and the conventional belief is that ES hinders innovation. The commonly-stated reason for hindering innovation is that ES is innately challenged by its rigidity (Kharabe et al. 2013; Strong and Volkoff 2010). The implementation of ES has often been described as ‘pouring cement’ by academics and practitioners (Davenport 2000b; Kharabe and Lyytinen 2012).

Yet, with the advancement of digital technologies, organisations have begun to integrate these technologies with their ES. To the best of the candidate's knowledge, no prior research has studied this synergistic orchestration of ES and digital technologies or the integration between two types of technologies for enhancing the connectivity between stakeholders such as employees, customers and suppliers.

Prior studies on resource-based view of the organisations (Barney 2001), dynamic capabilities (Adner and Helfat 2003; Teece 1992) configuration theory (Miller 1997; Vorhies and Morgan 2003) and the resource allocation (Sirmon and Hitt 2009; Sirmon et al. 2007) highlight the management of valuable and rare resources. Through the effective management of rare and valuable resources how organisations attain competitive advantage is highly discussed (Barney 2001; Mata et al. 1995; Ray et al. 2005). Yet, ES is a commonly available resource, and these systems are mostly generic and organisations buy off the shelf software (Davenport 1998a; Davenport 2000b). On the other hand, digital technologies are adopted by small and medium companies as well due to their low cost, ease of use, ease of deployment and ease of connectivity (Cearley and Hilgendorf 2014; Weiß and Leimeister 2012). Thus, these two resources cannot be considered as rare resources. Therefore, this study focuses on attaining competitive advantage and innovation through commonly available resources and especially for common organisations doing day to day business as opposed to innovators like Google and Apple.

It is believed that this is the first study to observe how two types of technologies with different roles in attaining innovation (ES and digital technologies) work together to deliver innovation. The study provides an explanation of the role of technology in facilitating innovation. Specifically, research offering empirical

evidence of the role of IT in innovation in common organisations is rare. For example, most past studies have focused on how IT may lead to new patents, products and services (Lyytinen and Rose 2003; Xue et al. 2012) – making innovation seem out of bounds for common organisations. The conceptualisation, derivation and operationalisation of common organisational innovation are a valid contribution of this study. Especially now, when organisations hope to innovate through a selection of technologies, these first insights into how innovation can be attained through multiple technologies will provide a useful foundation.

Based on the primary roles that IT plays in attaining innovation, Nambisan (2013) characterised IT as operand IT and operant IT (as discussed in detail in Chapter 2). Operand IT resources enable innovation whereas operant IT resources trigger innovation. Considering the characteristics of operand IT resources, it is evident that ES act as an operand IT resource enabling innovation. The innate characteristics of ES such as integration, platform nature characterises its role as an operand resource. Digital technologies on the other hand are flexible, easy to deploy and efficient. Considering the innate characteristics of digital technologies they can be viewed as operant IT. The synergistic orchestration of operand and operant resources is discussed in the study. This new orchestration of operand and operant IT in delivering innovation has not been studied previously. The use of operant IT on operand IT can possibly occur in two ways. The operant resources can replace the operand IT resource or operant resource can augment or extend the functionality of the operand tool. The orchestration of operant IT and operand IT resource will depend on the objective of the organisation, the urgency and the resources availability. The interplay between these two IT resources has not been discussed in the prior literature. Therefore, this synergistic interplay between operand and operant

IT resources is an extension to the existing literature and becomes another contribution of the present study.

5.3.2 Agile Innovation

The characterization of agile innovation as a separate process of innovation is a significant finding. The notions of agile innovation provide an alternative approach to the traditional innovations of radical and incremental. Overall, the way in which operand and operant IT resources interact and deliver innovation portrays a new way of how organisations innovate, referred to here as agile innovation. The data collected from all the case organisations endorsed that the innovation attained through the orchestration of ES and digital technologies does not resemble characteristics of radical or incremental innovation (as discussed in detail in Chapter 4). Agile innovation explained a new way of innovating with systems. It was neither radical nor incremental. Agile innovation is defined as "how organisations synergistically orchestrate operand and operant IT resources to innovate, where innovation is defined as production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems." It explains how the interplay between the operand and operant IT resources leads the organisations to innovate. It explains how operand resources give opportunity for operant resources to work synergistically and enable innovation.

Through the interview data, this study describes agile innovation using the following properties derived through an inductive analysis:

1. Agile innovation benefits from a strong and stable technology platform.

2. Agile innovation is independent of the technology sophistication.
3. Agile innovation is triggered by operant technologies.
4. The outcomes of agile innovation are specific and must be attained within a short period.
5. The tolerance of failure in agile innovation is low.
6. Agile innovation is functional-oriented.
7. Agile innovation depends on the effective coordination, configuration and management of operand and operant technologies.
8. Agile innovation can be initiated at grassroots functional levels or at executive levels.

The study's conceptualisation of agile innovation through operand and operant technologies indicates the need for the development of a new management approach that harnesses flexible, participatory and integrating governance practices between functional departments and the IT department. There are several fundamental insights that this research added to the knowledge of innovation. It demonstrated that the notions of innovation in innovation speed and outcomes do not necessarily adhere to the current knowledge of innovation. For example, the study demonstrated that innovation speed is not proportionate to the available IT resources. Similarly, the innovation outcomes are also not proportionate with the level of resources.

Fundamentally, these characteristics differentiate agile innovation from radical and incremental innovations. Agile innovation offers a strategic view of innovation with a balance of evidenced-based, experimental and opportunistic approaches. The narrow, functional focus means that the outcomes of agile innovation can be measurable and the lead time of agile innovation would be short.

Subscribing to Tornatzky and Fleischer (1990) view on innovation outcomes, agile innovation allows organisations to re-structure (or dismantle) operand and operant IT resources if the outcomes are undesirable. Thus, it is anticipated that agile innovation will prevail and will be suited for dynamic environments. An organisation that is in a dynamic environment cannot survive with incremental innovation. An incremental innovation does not change the dominant design; as a result, it is easily imitable. In an advanced technology landscape, the innovation half-life is much shorter. Thus, it is difficult for an organisation to invest in radical innovations that would not last for a considerable amount of time. The flexible nature of the agile innovation process allows organisations to innovate faster and better.

Innovation is not only top-down approach, but can be driven from the operational level. The study acknowledges that this may be unique to IT through its consumerization of IT, but can be extended to general business.

5.3.3 Extension of the Meta-theory

There are multiple theories in IS explaining the importance of managing and configuring IT resources. For example, the resource-based view proposed by Barney (1991), the dynamic capabilities approach proposed by Teece et al. (1997) and the updated configuration theory presented by Vorhies and Morgan (2003) are commonly discussed theories in IS. In this study, the instrumental orchestration theory (Trouche 2004) was employed as a meta-theory to demonstrate how agile innovation can be attained. The concepts such as instrumentation, instrumentalization, instrumental genesis, instrumental orchestration, didactical configuration and exploitation modes were used to explain the whole process of agile innovation. Further, Sirmon et al. (2011, p. 1391) highlight “research suggests that possessing resources alone does not guarantee the development of competitive

advantage; instead, resources must be accumulated, bundled, and leveraged, meaning that the full value of resources for creating competitive advantages is realized only when resources are managed effectively." This highlights the role of the resource orchestrator.

In instrumental orchestration theory, Trouche (2004) explains how an orchestra master leads the orchestra and how he changes the music based on the feedback of the audience. This model was applied to an organisation. As a theoretical extension to the instrumental orchestration theory, this study identified three modes of orchestration, namely, IT-led orchestration, LOB-led orchestration and synchronised orchestration. IT-led orchestration is led by the IT department whereas the LOB-led orchestration is led by a department manager. In synchronised orchestration, both the IT department and LOB managers orchestrate the technologies to attain innovation. These orchestration modes may have generalizable value in the IS and management disciplines.

5.4 CONTRIBUTIONS TO PRACTICE

The wide proliferation of digital technologies arguably provides organisations with an opportunity to engage, synergise, replace and add-value (Nambisan 2013; Yoo et al. 2012; Yoo et al. 2010) to the existing monolithic ES, possibly yielding greater potential to trigger innovation. Yet, empirical evidence on how digital technologies contribute to innovation is scarce. As such, Nambisan (2013) and Nylén and Holmström (2015) identify this area of study as a critical research area for future studies on innovation.

The massive consumerization of IT and the abundance of digital technologies requiring relatively low resource allocations have necessitated a re-thinking of the role of IT and innovation in organisations. The observations in this study yielded the conclusion that organisations are already changing their view of the role of IT in innovation. For example, Gartner (Brinker and McLellan 2014) predicts that by 2017 each salient LOB (i.e. all functional departments, such as marketing) in all major companies will have a designated CTO. Brinker and McLellan (2014, p. 83) point out that Kimberly-Clark had introduced the role of chief marketing technologist (CMT) in order to better deliver functional requirements through the wealth of available technologies. They explain that the main objective of the CMT role is "to create the best technology vision for marketing" and that the CMT will enable departments to campaign for "greater experimentation and more-agile-management of that function's capabilities" as they are "change agents of innovation."

Furthermore, the notions of agile innovation seem to provide an evidence-based approach to allow companies to follow the customer's journey, rather than focusing on business processes. This study highlights that the focus on inward-looking business processes, while necessary to receive a single-view of the

organisation ('keeping the lights on'), does not help organisations to survive in competitive business environments. As demonstrated, agile innovation concepts provide an opportunity for functional departments to be immersed in digital technologies, seeking triggers of innovation. Brinker and McLellan (2014, p. 83) predict that the functional IT head at Kimberly-Clark will harness the maturity of the functional area and possess the ability to experiment with IT in order to create organisational innovation. They highlight that such functional technologists, as the agents of innovation, will be "willing to devote resources much more on digital assets to drive innovation".

In extending the viewpoint expressed above, this study's discussion on orchestration modes provides guidance on how organisations can foster innovation. It outlines the management and structural views on how IT innovations can be initiated, coordinated and managed. The study provides a theory-based, empirically-validated rationale that practitioners can use to introduce semi-autonomous IT decision-making at the LOB, which is then coordinated by the IT department. These insights are particularly useful to LOB managers, as this study substantiates a rationale for them to be given an IT budget and decision-making authority for the purpose of allocating IT resources within their departments.

The notion of agile innovation would be valuable to practitioners in conceptualising the notion the study highlights on how organisations can achieve innovation through IT. In doing so, the study alludes to the important, yet dormant, role of ES in facilitating innovation. Further, it highlights that there is minimal actual risk involved in introducing multiple types of software from multiple vendors to work with a technology platform. Traditionally, CIOs and IT departments are said to be conservative in their views on bringing in multiple technologies, due to the fear of

management complexity. The observations of agile innovation and instrumental orchestration theory in this study highlight that such diversity of applications is beneficial, as long as they are assembled and managed in a coherent fashion.

Further, the study provides a vision of the future IT portfolio in an organisation. Practitioners, particularly senior staff, will benefit from the study's description of the future IT portfolio as an eclectic heterogeneous collection of IT. However, unlike the disparate legacy systems in the past, the new IT portfolio will be integrated with the technological foundations of the ES. For technology vendors, this study provides a vision of their clients' technology landscape. For example, for ES vendors, the study highlights the need for openness to facilitate multiple digital technologies and to identify opportunities to market 'accelerators' as the volume of the data exchange between the platform and the digital technologies increases. Further, the study findings provide a rationale for ES vendors to increase their focus on add-on digital technologies, as the study evidences a hesitation even for the mandatory ES upgrades.

Finally, the study highlights the role of operant digital technologies in triggering innovation. The study shows that organisations could trigger innovation using technologies such as mobile technologies, cloud computing and business intelligence applications that are low risk and low cost. For the astute practitioner, this provides assurance and confidence in trialling new IT products for innovative practices. The figure (Figure 20) summarizes the study outcomes for the practitioners.

1. A stable and open ES acts as a platform to enable innovation. The ES does not need to be optimized, as far as it has consistent data and business rules, it provides a backbone for enabling innovation.

2. Digital technologies inspire creative thinking and triggers innovation. Organisations are able to assess their capacity and capabilities and based on that select a most suitable technology for augmenting a specific business function or a business process.

3. The eco-system members such as customers, suppliers and employees can contribute for innovation and become pollinators in Agile Innovation. As such, their role becomes much more important for the survival in a dynamic market.

4. A defining element of innovation is the IT management structure. Prior research has identified that the organizational design plays a major role in exploiting the IT capabilities for innovation (Boyton et al. 1994; Sambamurthy and Zmud 2000). Specifically, the common three IT governance structures – centralized, decentralized and federal – has their own advantages and disadvantages for attaining innovation and these governance structures determine sustainability of IT based innovations. The analysis showed that successful innovative projects have moved to de-centralized or federated IT management structures, particularly to manage their digital technologies. In some cases, a conscious decision has been made to manage ES data centrally, while providing flexibility to the nodes of operations for digital technology based innovations. Thus, highlighting the need to have more flexible governance structures that favours innovation.

5. Through sensing the market needs, inspiring and ideating organisations could synergistically orchestrate their ES with digital technologies.

6. As these orchestrations are not as complex as ES, organisations are able to trial and implement these innovations within a short period of time.

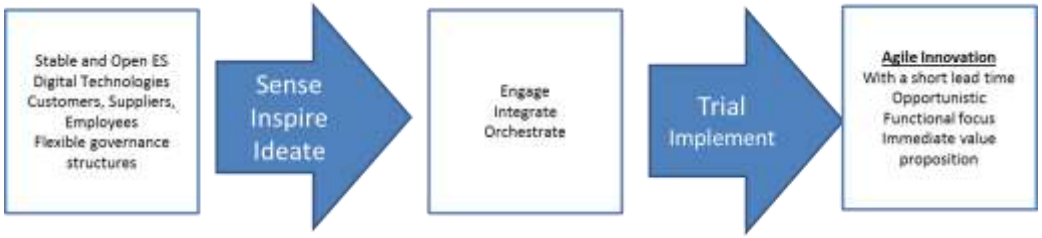

Figure 20: The process of Agile Innovation

5.5 FUTURE STUDY OPPORTUNITIES

Although the findings of this study are promising, further study in at least three areas is necessary to strengthen the notions of agile innovation. First, particular attention must be paid to investigating the outcomes of agile innovation. Future research could identify whether the outcomes of agile innovation are in fact unique and different to any other type of innovation outcome.

Second, investigating how an operant resource becomes an operand resource over time would provide interesting facets of study that will have both practitioner and academic value in relation to resource investment and management. From another viewpoint, this study observed how the role of ES has changed to become a strong enabler as a platform. The role of ES as a trigger of innovation, maturing into an enabler of innovation, is an interesting observation that has the potential to be explored further in future research. For example, it obliges IS researchers to understand IT as a long-term investment with morphing roles, rather than as a sunk cost.

Third, a quantitative study can be employed in future research to understand the optimal orchestration of operand and operant technologies, and how such orchestration would lead to agile innovation. A better examination of organisational/technology maturity and its role in digital technologies (operant resources) and ES (operand resources) and in delivering innovation is an interesting area to study. Relating such contextual variables in a future study would provide unique insights.

The dissertation referred to the collection of technologies such as mobile technologies, cloud computing and analytics as digital technologies. This simplistic

view was taken in order to minimise the complexities that arise from the consideration of multiple technologies. Further research can be initiated to study the innovation attained through ES and individual technology such as mobile technologies, analytics, big data or cloud computing. A natural extension would lead to a deeper understanding of each of the digital technologies (e.g. mobile technologies) to better understand how each technology yields innovation with ES.

A future study could embark on developing a platform index. An index would determine how much of each technology has been employed in the IT portfolio. Such indexes are commonplace in analogous disciplines of economics and finance for understanding risks and returns on investments, and would provide similar value in the IS discipline as well.

Further a future research could focus on the inter-connectedness and contingencies amongst the digital technologies and ES. While the connectivity between mobile technology, cloud computing, in-memory technologies and analytics is obvious and evidently complex, such a study would add further insights into the role of IT in innovation.

The current study provides a useful view of the emerging IT portfolio. In the past, studies have attempted to understand the notion of an IT portfolio as a collection of systems (Weill and Vitale 1999). As such, rarely did studies employ the notion of a portfolio in relation to a collection of different types of technologies. When studying a collection of different types of technologies, inter-dependencies, synergies and connectivity become important. The view presented in this study of digital technologies and ES is a useful initial step towards a greater understanding of a portfolio of multiple technologies. The introduction of digital technologies to the monolithic IT presents the first true view of an IT portfolio. Although the term

"portfolio" has been employed in past IT studies (Myers et al. 1998), it referred specifically to the collection of systems (i.e. payroll system, asset management system, etc.), rather than to the availability of multiple digital options that contemporary companies now have. The current research offers a sense of direction to conceive the role of IT resources in innovation; however, further studies are essential to conceptualise and theoretically explain how an organisation could generate a portfolio of IT to attain innovation. It is argued that the pay-by-consumption SaaS models and the associated affordability will make IT portfolios fluid and flexible, whereby organisations could select and deploy systems reasonably quickly for purposive actions. The practical considerations here relate to how organisations could develop fluid new digital technologies in the current monolithic technology landscape.

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Appendices

APPENDIX A: INTERVIEW PROTOCOL

Deduction Phase

Landscape and Resources

1. Can you describe the current enterprise landscape?
2. What are the main systems that you manage?
    a. Describe the current status of those systems?
    b. What do you use them for? – the purpose
3. Describe main IT projects that you currently manage / initiate / in the pipeline?
4. Do you see any changes in the current technology landscape?
5. Did you rely on your existing resources (i.e. people, knowledge and experience) to introduce such new ideas?
6. What are the advantages and disadvantages you see in introducing these technologies?
7. What are the changes you see in the organisation after introducing these technologies?
8. What are the characteristics that you considered when you introduced these technologies to the organisation?
9. With regard to the time it takes to develop, use and learn what is your viewpoint for each of the technologies you have in your organisation?
10. What is your expectation for each of these technologies? What is the outcome that you expect?

Induction Phase

Note: These questions were modified appropriately for different CIOs depending on the time limitations. Some questions were added later for example, questions related to governance and IT management based on the discussion with prior respondents.

1. Can you describe the current enterprise landscape?
2. What are the main systems that you manage? Describe the current status of those systems? What do you use them for? – The purpose
3. Can you describe the current market?
4. Do you see any changes in the current technology landscape?
5. As the CIO/LOB manager what are your responsibilities to manage the market conditions?
6. Describe your business strategies? How long does these strategies last? If it's short-term why is it so?
7. Describe IT projects that you currently manage / initiate / in the pipeline?
8. What are the objectives of these projects? What areas do you focus to improve your business?
9. What is the timespan of the projects?
10. Confirm whether the project objectives are short / long term
11. Are these projects coming under the corporate strategic plan (long-term plan/IT blue print)?
12. What are the technologies that you used to initiate these projects?
13. What are the advantages and disadvantages you see in introducing these technologies?
14. What are the changes you see in the organization after introducing these technologies?

15. What are the technology characteristics that you considered when you introduced these technologies to the organization?
16. With regard to the time it takes to develop, use and learn what is your viewpoint for each of the technologies you have in your organization?
17. What was/is your expectation for each of these technologies? What is the outcome that you expect?
18. Did you rely on your existing resources (i.e. people, knowledge and experience) to introduce such new ideas?
19. Do these new projects rely on the corporate IT (i.e. your backbone systems)?
20. Do these new systems correspond with your corporate IT / existing systems (i.e. your backbone systems)?
21. Did you require substantial additional resources for these projects?
22. Do you encourage departments / divisions to suggest new technologically driven solutions?
23. What are the changes to the organization that you envisage?
24. Are / did your organizational business processes cope / respond well the changes introduced by the new system?
25. If the solution/s was / were to be successful, how do you describe the advantage that you gain through it? (short/long term gain)
26. When you think about these IT projects what kind of attributes do you think helped you to initiate these projects?
27. Why do you think governance structures are important and what are the governance strategies you used for managing these projects?

28. How do you characterize the risk of these projects? How do you characterize the risk of these technologies?
29. How do you manage the unison between the corporate wide technologies while introducing new projects?
30. What attributes do you see in corporate wide IT systems that helped you to continue these projects?
31. What are the issues you faced when introducing these projects?

APPENDIX B: ETHICS APPROVAL

Dear A/Prof Darshana Sedera and Miss Sachithra Lokuge

Project Title: Continuous innovation in enterprise systems

Ethics Category: Human - Low Risk
Approval Number: 1400000220
Approved Until: 28/07/2017 (subject to receipt of satisfactory progress reports)

We are pleased to advise that your application has been reviewed and confirmed as meeting the requirements of the National Statement on Ethical Conduct in Human Research.

I can therefore confirm that your application is APPROVED.
If you require a formal approval certificate please advise via reply email.

CONDITIONS OF APPROVAL
Please ensure you and all other team members read through and understand all UHREC conditions of approval prior to commencing any data collection:
> Standard: Please see attached or go to
www.research.qut.edu.au/ethics/humans/stdconditions.jsp
> Specific: None apply

Decisions related to low risk ethical review are subject to ratification at the next available UHREC meeting. You will only be contacted again in relation to this matter if UHREC raises any additional questions or concerns.

Whilst the data collection of your project has received QUT ethical clearance, the decision to commence and authority to commence may be dependent on factors beyond the remit of the QUT ethics review process. For example, your research may need ethics clearance from other organisations or permissions from other organisations to access staff. Therefore the proposed data collection should not commence until you have satisfied these requirements.

Please don't hesitate to contact us if you have any queries.

We wish you all the best with your research.

Kind regards

Janette Lamb on behalf of the Chair UHREC Research Ethics Unit | Office of Research | Level 4 88 Musk Avenue, Kelvin Grove | Queensland University of Technology
p: +61 7 3138 5123 | e: ethicscontact@qut.edu.au | w: www.research.qut.edu.au/ethics/

Dear A/Prof Darshana Sedera

Approval #: 1400000220
End Date: 28/07/2017
Project Title: Continuous innovation in enterprise systems

This email is to advise that your variation has been considered by the Chair, University Human Research Ethics Committee. This HREC is constituted and operates in accordance with the National Health and Medical Research Council's (NHMRC) National Statement on Ethical Conduct in Human Research (2007).

Approval has been provided to introduce new survey and additional interview questions.

PLEASE NOTE:
RESEARCH SAFETY -- Ensure any health and safety risks relating to this variation have been appropriately considered, particularly if your project required a Health and Safety Risk Assessment.

CONFLICTS OF INTEREST -- If this variation will introduce any additional perceived or actual conflicts of interest please advise the Research Ethics Unit by return email.

Please don't hesitate to contact us if you have any questions.

Regards

Janette Lamb on behalf of Chair UHREC
Office of Research Ethics & Integrity
Level 4 | 88 Musk Avenue | Kelvin Grove
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e: ethicscontact@qut.edu.au
w: http://www.orei.qut.edu.au

APPENDIX C: PROFILES OF THE CASE ORGANISATIONS

1. LOGISTICS

The LOGISTICS is an Australian logistics company that has operations in 50 countries. It has 7000 employees in Australia and has over 500,000 customers world-wide. LOGISTICS has gained reputation in providing transportation requirements in industry segments of defence, automotive, consumer goods, fresh foods and manufacturing. LOGISTICS has been in business for over 50 years and has now accounted for over 40% of logistics businesses in Australia. LOGISTICS has a substantial investment into assets for transportation. For example, LOGISTICS has 14 million containers world-wide, servicing over 1000 locations world-wide. In 2011, the company makes several strategic acquisitions that make LOGISTICS the largest company in its industry segment in the world. The acquisitions increased the operations in the USA, Mexico and some parts of Europe.

By early-1990s LOGISTICS assessed the need to develop a technology solution that allows total equipment management and single point equipment maintenance. In-house development was abandoned for an integrated SAP solution in 1995. The decision was made to include the SAP's Materials Management, Sales and Distribution, Asset Management and Financials and Controlling to be implemented in 5 countries of core operations: Australia, USA, Mexico, The Netherlands, and New Zealand. Currently, in addition to the five countries, the SAP system is implemented in Canada, South Africa and Singapore.

LOGISTICS employs a centralized global template to manage its SAP system head quartered in Australia. The current CIO has approximately 25 dedicated IT staff in Australia and over 270 IT staff around the world. There are three regional CIOs

for the regions of USA, Europe and Latin America. LOGISTICS recognizes the importance of localization of IT products and encourages country-specific solutions to be developed and adopted.

2. MULTI

MULTI is a multi-national company producing a range of products including chocolates, biscuits, dairy products and a range of health and nutrition products. Currently, there are 10000 employees directly employed at the Oceania and Asian operations in where the case study was conducted. There are 11 major factories and 10 distribution centres and 20 offices across the region in India, China, Indonesia, Sri Lanka, Singapore, Malaysia, Vietnam, Australia and New Zealand. Globally, MULTI employs over 250,000 employees and has operations in 84 countries. The aggressive expansion strategies followed by MULTI in the early 1990s has led to the acquisition of diverse product and service segments, including hotels and hospitals. Still MULTI serves as a daily consumer goods company which as a sales force, largely outsourced through the private distribution centres.

Currently MULTI has over 1000 key product lines. However, in the mid-1990s MULTI possessed nearly 20,000 unique products and services. The diversity of the products led MULTI to face issues with quality assurance, timely development of products and issues pertaining to supply-and-demand management. However, by mid-1990, the company decided to limit the 'localization' of products and only to maintain a set of core products. They highlighted quality control, fierce market competition from local and global competition as the rationale to limit products and services.

In June 1996 MULTI commenced a global enterprise systems implementation replacing their "Dunn-and-Bradstreet" enterprise system. According to the current CIO, the implementation SAP was considered as a tool to deploy global templates that provided tight management control and management structure to receive a single view of the organisation. In June 1999, SAP was implemented across 84 countries. This was, at the time of implementation, considered as one of the largest SAP implementations in the world. The implementation installed SAP's Materials Management, Sales and Distribution, Financials and Controlling modules at MULTI. The current business suite of SAP includes, Business Warehousing, Business Intelligence, In-memory computing, Supply Chain Management and Customer Relationship Management.

The company employs a semi-centralized management approach in managing the SAP system, where the Asia-Pacific management of SAP is facilitated through a group of dedicated staff in Australia. The facility in Australia includes approximately 50 IT staff, led by an experienced CIO. It is noted that each operating country with substantial operations has a CIO that reports to the regional CIO. A dedicated staff of approximately 100 is stationed in Bangalore India for development and maintenance of the SAP system.

3. ENERGY

ENERGY is an Australian company that explores and builds gas fields, produces and sells integrated coal seam gas (CSG) and generates electricity. ENERGY is working in manufacturing CSG since 2000 and they are selling and supplying these commercially since 2004. ENERGY has five fields in the Australia. They are the leading provider of cleaner burning fuels through gas supply for

liquefied natural gas export. This company is owned by a joint venture company between two giant in oil and gas manufacturing.

ENERGY implemented SAP few years ago using the same SAP blue print of the giant company. ENERGY implemented SAP modules such Material Management, Financials, Production Planning and Plant Maintenance as well.

The company employs a semi-centralized management approach in managing the SAP system, where the main controlling of Asia-Pacific region is located in Kuala Lumpur, Malaysia. The IT staff in Australia includes approximately 20 IT staff, led by an experienced CIO.

4. FARM

FARM is Australia's leading farming company producing fresh vegetables all year round. The company is a family owned company founded in the 1950s. Their products are available in Australia as well as around the world through multiple wholesale and retail partners. It has been around nearly 50 years longer than the typical organisation in Australia, and 45 years longer than the average agricultural companies. FARM employs more than 100 people. In Australia, an average company has between 5 and 40 employees, meaning that slightly more people work at FARM than at the average company. FARM invests significantly in the professional development of the organisation and work untiringly to create opportunities for growth in the agricultural sector. They attempt to advance their farming practices through investing in new technologies and encouraging innovation.

FARM commenced their ES implementation replacing their Dunn&Bradstreet system. They introduced SAP as their core system. The implementation installed SAP’s modules such as Materials Management, Sales and Distribution, Financials

and Controlling modules. The current IT portfolio includes, Business Intelligence, analytics and mobile solutions. The company employs a centralized management approach in managing the SAP system, where a group of dedicated IT staff in Australia looks after SAP system. The facility in Australia includes approximately 10 IT staff, led by an experienced CIO.

5. INSURANCE

INSURANCE is one of South Asia's leading providers of life and general insurance solutions. They consist of a team of experienced and dynamic professionals, a strong financial base and trustworthy and leading reinsurance partnerships with highly rated global reinsurers. The company offers a wide range of customised insurance products and services that are of international standards. They reported a growth rate of 20% in combined gross written premium and 31% growth in profit after tax in the last year. Growth was reported from both corporate and retail customer segments, and most classes of general insurance business reported a year on year growth.

INSURANCE has more than 1600 employees that works across the country. INSURANCE has implemented AS400 enterprise system for managing all the core business activities. They employ a centralized management approach in managing the AS400 system. They have more than 10 IT staff led by an experienced CIO. Apart from these, INSURANCE uses mobile technologies and analytics for introducing novel experiences for their customers. Their IT Management systems achieved a significant milestone when it was certified with the prestigious ISO 27001:2005 certification. The ISO 27000 family of standards assists organisations to protect and maintain security of information assets (e.g. business information, customer data, financial information, intellectual property, employee details and

information entrusted by third parties). ISO/IEC 27001 is the best-known standard in the family providing requirements for an Information Security Management System (ISMS). This international standard adopts a process approach for establishing, implementing, operating, monitoring, reviewing, maintaining and improving their ISMS. The ISO 27001 certification recognizes that their IT policies and procedures are in accordance with the highest international standards, and that it ensures confidentiality, integrity, and availability of information assets, systems and infrastructure. Further, the certification recognizes the potential and scope for future expansions and innovations.

6. HEALTH

HEALTH is a not-for-profit organisation started in the early 1950s and has developed into one of Australia's prominent providers of community health and residential aged care, caring for more than 12,000 people every day. This company provides health care for individuals, families and communities across Australia. The company has rapidly expanded and diversified their capabilities to meet the needs of the customers. HEALTH enhanced the services they offered as they increased their customers. The company is committed to offer services across Australian communities irrespective of their class or creed. They have customised services offering model that targets to create and deliver especially designed and personalised solutions that respond to individual and communities. These personalised solutions introduced by HEALTH sets the schedule to manage their resources and strengthen the commitment to innovation and research.

HEALTH has nearly 9,000 employees and more than 2,000 volunteers across the country. They have more than 1,500 vehicles used for taking care of their customers. To manage the employees, volunteers and other assets they have an

Oracle system implemented. This system includes financial modules, Human Resources and Asset Management. They have a separate IT staff dedicated for maintaining these systems and an experienced CIO leads this team. Apart from the Oracle system, they have implemented mobile technologies and analytics solutions for introducing innovative solutions.

7. ROAD

ROAD is a publicly owned company established under the Transport Act. Their purpose is to deliver social, economic and environmental benefits to communities by managing the road network and its use as an integral part of the overall transport system. ROAD's objective is to achieve ongoing reductions in the number and severity of road crashes and to manage the cost of road maintaining, development and assist economic and regional development by managing and improving the effectiveness and efficiency of the road transport system. They build effective, realistic and efficient relationships with all customers by providing them with convenient access to services that meet their needs and deliver cost effective solutions to the community.

They have a planning department for developing both corporate and road system strategies and checks for alignment of enabling strategies developed in other parts of the organisation. Also, their business development departments identifies new ways of doing business, identifies and exploits opportunities to commercialise aspects of existing businesses and, where appropriate, develops and generates new business opportunities to create revenue streams for the organisation. IT is also managed under this division.

The company employs a centralized management approach in managing the Oracle system, where a group of dedicated IT staff in Australia looks after their Oracle system. The facility in Australia includes more than 10 IT staff, led by an experienced CIO.

8. TELECOM

TELECOM is a subsidiary of a giant and it is one of South Asia's largest and fastest growing mobile telecommunications network. The company is also one of the largest listed companies on the stock exchange in terms of market capitalization. TELCOM is at the forefront of innovation in the mobile industry. The company delivers advanced mobile telephony and high speed mobile broadband services to a subscriber base in excess of nearly 8 million customers, via 2.5G and 3G/3.5G and 4G networks. In 2013, the company secured the distinction of becoming the first service provider in South Asia to launch mobile 4G FD-LTE services. The company was also the first service provider in South Asia to launch 3G services in 2006. TELECOM also provides a comprehensive suite of International Roaming Services across a global footprint comprising of more than 200 countries, and operates a wide portfolio of international telecommunication services, including but not limited to retail and wholesale international voice and data services. TELECOM is the first mobile operator in this region to be awarded a Mobile Payments License, based on which it operates mobile money service. TELECOM is an ISO 9001 certified company and has received numerous local and international awards including the National Quality Award, Sri Lanka Business Excellence Award, and 3 successive GSM World Awards.

TELECOM uses SAP and it is currently managed by a dedicated IT staff at the local office led by an experienced CIO. Apart from SAP they also have mobile

technologies and analytics technologies used in their IT portfolio for providing innovative solutions for the customers.

9. DAIRY

DAIRY is a leading producer of dairy products in Australia. It has 2,500 employees and operates as a subsidiary of the global provider of dairy and other food products, which has more than 36,000 employees in 18 countries around the world. The organisation has dairy production facilities in three states in Australia and has operations in Queensland, New South Wales, Victoria and The Western Australia. The nature of the Fast-Moving-Consumer-Good (FMCG) market requires an efficient supply chain that distributes goods across the continent to attain the highest shelf life for their products. DAIRY's major customers include the two biggest shopping chains in Australia. They also provide dairy products in small consignments to the stand-alone shops in any suburb of the four operating states. The wide range of FMCG and the wider network of customers require that DAIRY be receptive to market conditions, environmental factors and to react to them swiftly.

DAIRY implemented SAP in the Australian subsidiary in 2003 and completed the implementation of SAP Materials Management, Sales and Distribution and Financials and Controlling modules in late 2004. Prior to the implementation of SAP, the company included a range of legacy applications that were designed by the head office in Italy and was managed by the staff in Australia.

Four years since the implementation, in 2008, the organisation upgraded their SAP 4.1 system to SAP 4.2. Furthermore, extending the capabilities of the SAP suite of applications, a leading consulting company implemented the SAP's Supply Chain

Management system. This has provided much needed Advance Planning and Optimizing (APO) and Supplier Network Planning (SNP) capabilities to DAIRY.

The ES is currently managed by a dedicated staff at the local office led by an experienced CIO. The CIO has been with the organisation more than 15 years and has the appropriate experience with SAP and the FMCG industry. Currently, there are 15 business analysts, 3 specialized technical staff and 2 helpdesk management staff within the dedicated IT department. In addition, similar number of staff is available in the other three state offices.

APPENDIX D: COMPARISON OF INNOVATION TYPES

The characteristics of incremental innovation and radical innovation are adapted from Latzer (2009). The comparison in the table is not completely based on the induction. Some characteristics of agile innovation are derived from candidate's observation. The table does not assume a continuum. Though the characteristics of innovation stated in a table (Table 9) for ease of understanding, it does not portray agile innovation as the middle ground of radical and incremental innovations.

Table 9: Comparison of innovation types		
Incremental	**Radical**	**Agile Innovation**
Continuous (linear improvement in the value received by customers)	Discontinuous (with or without predecessor; substantial, non-linear improvement)	Ad-hoc
Based on old technology	Based on new technology	Based on both old and new technologies
Dominant design unchanged	Leads to new dominant design	Dominant design augmented
Does not lead to paradigm shift	Can lead to paradigm shift	Opposed to one-view, yet, the fundamentals are not changed. Thus, moderate paradigm shift
Involves low uncertainty	Involves great uncertainty	Moderately uncertain, less impact
Feature improvements	Entire new set of performance features	Extension of the features
Existing organisation and qualifications are sufficient	Need for re-education, new organisation and skills	Considering the qualities of digital technologies, less or no specialized skills required
Result of rational response, of necessity	Attributed to chance, not to necessity; might be influenced by R&D policy	Attributed to agility
Driven by market pull (important in late phase of technology)	Driven by technology push (important in early phase of technology)	Driven by market competition and technology advancements
To achieve economic short-term goals	To achieve economic long-term goals	To achieve quick returns