An Empirical Investigation into the Challenges and Failures of Large-Scale Complex Information Technology Projects

by

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Declaration

I, Meshach Bolutiwi, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Abstract

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Over the past two decades, there have been widespread failures of projects connected to the implementation and delivery of large-scale complex information technology systems (LSCITS) across various industries globally. The high failure rates of large-scale, complex information technology projects (LSCITP) continues to be a topic of central interest in both the academic and professional industries. Consequently, the IT industry is an industry that is now continuously being differentiated by high profile project failures when compared with any other industry.

The objectives of this study are to examine the challenges of LSCITP by undertaking a review of the emblematic syndromes of failures of LSCITP and examining the reasons why LSCITP run into difficulties, why they become challenged and why many eventually fail. Secondly, to determine and analyse the problem areas in LSCITP that contribute significantly to the issues that become inherent in their implementation leading to their poor performance and or eventual failures.

This research was conducted through extensive empirical research. Data on LSCITP from existing literature were analysed. A literature review exercise was carried out to develop the framework that was used by the study to assess the extent of the challenges faced by LSCITP and to identify the causes of poor performance. In-depth examination of relevant case studies on LSCITP was conducted to capture the modern realities of LSCITP. Further research was subsequently carried out through the gathering of data on real-world LSCITP via expert interviews with experienced hands-on practitioners directly and actively involved in the day-to-day management, implementation and delivery of LSCITS and LSCITP.

In summarising the findings, the results identify that the majority of the challenges encountered on LSCITP are connected to human factors which are the results of innumerable failures in implementation and delivery processes, suboptimal management and inadequate governance and leadership structures. These issues are further aggravated by the lack of adequate risk management processes and lack of knowledge integration.

The findings identify that the challenges faced on LSCITP are the collective results from negative impacts experienced from one or more factors across one or more identified LSCITP knowledge areas. Furthermore, these negative impacts experienced were also exacerbated by issues relating to change management, size and scale, extended implementation durations, the urgency of implementation, complex organisational structures, complex project environments and uncontrollable external factors.

Based on the findings from the study, the primary areas that generate challenged outcomes for LSCITP was identified and narrowed down to six highly-critical and nine critical knowledge areas. Furthermore, sixty-six new challenged factors with negative performance impacts on LSCITP were identified including their mapping to related knowledge areas and about forty-three practical recommendations from real-world LSCITP applicable by practitioners and stakeholders to mitigate challenges on ongoing, and future implementations of LSCITP are also presented. The study also provides a conceptual schema that assisted with the representation of the set of challenged factors identified. Finally, the study provides an assessment framework for evaluating the performance of LSCITP to identify challenges, map out challenged factors and obtain a view on implementation progress to support improvements of LSCITP performance.

Keywords: *IT megaprojects, large-scale, complex, information technology, systems, project management, IT project management*

Impact Statement

This study contributes to the body of knowledge within the Information Technology (IT), Information Systems (IS), Software Engineering (SE) and Project Management domains within the context of large-scale project management by providing practical insights along with corresponding solutions to understand and address the set of challenges faced within the domain of Large-Scale Complex IT Projects (LSCITP) and Large Scale Complex IT Systems (LSCITS), particularly focusing on the management, implementation and delivery of LSCITP.

The study investigates LSCITP challenges from a global context and a key objective was to fill a gap in knowledge not covered by existing research into the challenges and failures of LSCITP. In particular, the study uncovers sixty-five new challenged factors across LSCITP implementation areas that are inhibiting the successful implementation of LSCITP and exacerbating their poor performance including the identification of wider implementation areas on LSCITP that also require increased understanding and significant focus by LSCITP stakeholders and practitioners.

Additionally, the study developed and presented a conceptual schema for the identified knowledge areas that was applied to assist the study to identify and better understand the causes of challenges and the determinants of failures of LSCITP. The conceptual framework model developed provides a means to enumerate the knowledge gained in a structure that can improve current understanding and enable possible future expansions via subsequent research. Equally, a challenged assessment framework was developed for evaluating the performance of LSCITP to identify challenges, map out challenged factors and obtain a view on implementation progress to support improvements of LSCITP performance.

The outcomes of the study add significantly to the understanding of how to manage, implement and deliver LSCITP successfully and how to identify and address the challenges that contribute to their poor performance leading to their eventual failures through the identification of relevant knowledge areas and LSCITP challenged factors. The outcomes also help to provide valuable contributions to stakeholders, industry and academic practitioners by helping to increase and gain new understanding and awareness of the causes and the challenges that contribute to poor performance early on and during the implementation and delivery lifecycles of LSCITP.

Furthermore, the study identifies areas for further research that could lead to the development of new and improved implementation, delivery and assurance frameworks, methodologies, tools and techniques aimed at improving the management, implementation and delivery of LSCITP. The identified areas extend to the development of the required metrics around the identified factors that induce failures, help track and manage the potential causes of failures and help improve the understanding of these failure factors and how to eradicate them. The study also helps to improve the understanding of the current capabilities within the IT industry and beyond on the challenges faced in managing, implementing and delivering LSCITP successfully.

The research is one of few studies to perform the empirical investigation into the challenges of LSCITP across both public and private sectors and across various countries globally. One of the key objectives of this study was to involve subject-matter experts who have first-hand knowledge of large-scale complex IT project implementation and delivery based on their experiences and expertise on real-world project environments spanning several industry sectors. The study has therefore provided unique capturable insights into each LSCITP that can be examined.

The continued questions and debate on the poor performance and frequent failures of LSCITP has highlighted the fundamental significance for studies like this one to continue to explore new areas of research and to incorporate and examine multiple perspectives. To that end, this study helps to develop new ways of thinking about the management, implementation and delivery of LSCITP and uncovering new sets of challenges faced.

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List of Abbreviations

The abbreviations of some of the key terms used in this research study are listed in the table below.

Terminology	Description
APM	The Association for Project Management
B2B	Business to Business
BoK	Body of Knowledge
BT	British Telecom
CRM	Customer Relationship Management
CSAF	Challenged Status Assessment Framework
CSF	Critical Success Factors
DMI	Digital Media Initiative
ERP	Enterprise Resource Planning
EU	European Union
ICT	Information and Communications Technology
IS	Information Systems
IT	Information Technology
ITS	Information Technology Systems
LSCEP	Large-Scale Complex Engineering Projects
LSCITP	Large-Scale Complex Information Technology Projects
LSCITS	Large-Scale Complex Information Technology Systems
MIS	Management Information Systems
NAO	National Audit Office
NHS	National Health Service
NpfIT	National Programme for IT
PAC	Public Accounts Committee
PRINCE2	Project in a Controlled Environment
PM	Project Management
PMBoK	Project Management Body of Knowledge
PMO	Project Management Office
PMI	Project Management Institute
RFC	Request for Changes
SAFe	Scaled Agile Framework
SCM	Supply Chain Management
SGI	Standish Group International
SoW	Statement of Work
SPSS	Statistical Package for the Social Science
SRO	Single Responsible Owner
UK	United Kingdom
US	United States
USD	United States Dollars

CHAPTER 1

Introduction

1.1 INTRODUCTION

Technology today is growing at an unprecedented rate; it is evolving at blistering speed, and this is exacerbated by the need for continuous innovation which has never been more important (National Academy of Sciences, 2012; Strawn, 2003). Technology is dramatically changing how we live, work, play and learn, and it is even significantly changing our thought processes (Colbert, Yee and George, 2016; National Academy of Sciences, 2012). It is growing ubiquitous, and this noticeable and significant change has increased the pressure on the technology solutions that are required to help solve today's complex problems, thereby making them more complex than ever before (Mora, *et al.*, 2008).

Advances in technology have also forced a change in society's perception and expectations from technology as well as changes to the Information Technology (IT) industry as a whole (National Academy of Sciences, 2012). As a result, "rapid advancements in ICT have made it possible to conceptualise and implement complex and ambitious projects" (Dwivedi *et al.*, 2014, p.151). These advancements in technology such as advancements in hardware components, memory, storage, processors, and software components such as programming languages, operating systems, databases, etc. (National Academy of Sciences, 2000) including the maturity of ICT elements for example, "mobile computing, wireless networks, web services, grid computing, and virtualization services" (Mora, *et al.*, 2008, p.2), coupled with globalisation and the demands and expectations of society from technology have led to the rise in the size, scale and complexity of IT solutions that can be undertaken as well as those being designed, undertaken and implemented today (Heaton, Skok and Kovela, 2016; Dwivedi *et al.*, 2014). Furthermore, the need to reduce costs, improve competitive performance, improve the quality of products and services offered by organisations both within the public and private sectors has also increased the need for more large-scale complex systems and has led to the rise in significant investments in these complex IT systems (Buhl and Meier, 2011; Aiyer, Rajkumar and Havelka, 2005).

The realisation of these complex technology-oriented systems present challenges from various perspectives including technology, management, systems engineering and from an organisational perspective as highlighted by Mora, *et al.,* (2008) and Heaton, Skok and Kovela (2016). In addition, economic growth and development now rely on the implementation of large-scale complex and innovative technology-oriented systems because these systems help to support mission-critical activities, they help to solve today's complex problems, and they help to meet the challenges of the future (Denker, 2007). "Large complex projects are essential to the development of society" (Morris and Hough, 1993) and are central to its functioning (Denker, 2007), and they are becoming critical societal infrastructures (National Academy of Sciences, 2000). Overall, technology today has become the definitive force that influences economic development.

A knock on effect from the above is that the demand for the implementation of these innovative, high and complex technology-oriented systems and solutions is fast exceeding the ability to implement and deliver them successfully because of the impact rapid technological advancements have on the project management process of large-scale complex IT projects (LSCITP) (Durney and Donnelly, 2013; Mora, *et al.*, 2008). The impact of this rise and increased demand is one of the contributing causes that has led to the high failure rates with LSCITP in the IT industry today (Durney and Donnelly, 2013; Buhl and Meier, 2011; Whittaker, 1999; Willcocks and Griffiths 1994).

Similarly, there are an additional unquestionable set of factors that are also enabling the need for more LSCITP and large-scale complex IT Systems (LSCITS) besides the factors of technological advancements, globalisation and the dependence of society on technology (Chae, 2001). These various factors include the increasing need to transform and support organisational objectives through technology, the need to ensure the long-term viability of an organisation as well as the increase in the levels of IT investments by organisations because of the importance of IT to their continued existence and relevance as highlighted by Fridgen, *et al.* (2014) and Rockart and Crescenzi (1984). These influencing factors also extend into areas such as the growing need for interdependence and integrations with other technology systems, services and platforms (Buhl and Meier, 2011).

The end results of the impact of all these factors are that IT projects of late are now getting bigger and bigger, they now take longer to implement; they are inherently challenging, and they end up being extremely complex (Nelson, 2007). These factors and their impacts lead to challenges, and it means that the failures of LSCITP are increasing significantly as a result.

1.2 MOTIVATION AND CONTEXT

The motivation for this research stems from the increasing and alarming rate of failures of LSCITP failures reported through academic research and industry reports (Hughes, Rana and Simintiras, 2017; Afzal, 2014; Patanakul, 2014; Standish Group, 1994; Patanakul and Omar, 2010; Guah, 2009; Denker, 2007; Gauld, 2007; Charette 2005; Willcocks and Griffiths, 1994) resulting in significant loss of value for stakeholders, significant financial losses, and the loss of benefits realisation as well as the loss of expected economic benefits and on the level of waste being experienced within the IT sector which is beyond alarming. For example, "the cost of project failure in the European Union (EU) was 142 billion Euros in 2004" (McManus and Wood-Harper, 2007, p.38). In the US in 1995, the figure for failed projects was 81 billion dollars (Dalcher, 2003). Additionally, the motivation for this research was also due to the experience of the researcher being involved in the implementation and delivery of LSCITP across several industry domains.

During the last two decades, the number of LSCITP that have failed has risen significantly according to Buhl and Meier’s (2011) and Yeo’s (2002) analysis. Denker (2007) also adds that failures of LSCITP are now a common pattern rather than an exception. The reasons attributed to the failures of LSCITP vary, from reasons to do with technological challenges, management challenges, complexities, internal and external factors within project environments, cost overruns and budget challenges, schedule delays, failures in project management processes, organisational complexity, stakeholder complexity, management failures, extended durations and many more (Patanakul and Omar, 2010; Willcocks and Griffiths, 1994). Grün (2004), for example, state that large-scale IT projects often end in large-scale failures, stumbling from crisis to crisis. Some projects end up being cancelled, some are severely challenged, and some end-up being significantly scaled back from their original requirements. For the LSCITP that survive, the majority of solutions derived out of these projects do not function as expected when eventually delivered. In addition, a significant number of these systems (between five and fifteen percent) are cancelled or abandoned before they are delivered or just after delivery (Charette, 2005). Similarly, Cats-Baril and Thompson (1995) in their research on the management of IT projects in the public sector estimate the number of LSCITP that are cancelled or scrapped to be around twenty percent.

Putting aside the lens of a large-scale complex project for the time being, IT/IS projects, in general, are failing at an alarming and dismal rate (Dalcher, 2003) and according to Nelson (2007), the current IT project failure rates do not look to be decreasing at all. The word *failure* has been associated with IT projects for decades and Glass (2006, p.15), concurs with the above argument by stating that "there are horror stories of colossal IT project failures". Within the IT/Information System (IS) domain, *failure* is now a complex emergent phenomenon. Denker (2007) shares the same views by arguing that "it has been common over the last decade to read stories of IT project failures in both popular press and computing literature" a view also echoed by (Kipp, Riemer and Wiemann, 2008; Aiyer, Rajkumar and Havelka, 2005; Dalcher, 2003). Failures are so common that there is a long historical list of dismal IT projects that have gone wrong in Charette’s (2005) analysis. According to Venugopal (2005).

> "Large IT projects seem especially vulnerable. Whether they are ERP systems, customer relationship management (CRM) or supply chain management (SCM) systems or any similarly complex IT initiative, the scenario of delays, dissatisfied clients and horrendous cost overruns is common" (Venugopal, 2005, p.48).

The increasing need for the implementation of large-scale systems also raises many questions and presents different challenges regarding the right approach and the appropriate methodology to apply in the management, implementation, delivery and assurance of these large-scale and complex systems (Somanchi and Dwivedula, 2010). The general view held within the IT industry based on the large body of existing research carried out to date is that the current failure rates for LSCITP are much higher than they should be (Hughes, Rana and Simintiras, 2017; Charette, 2005).

The high failure rates being experienced within the industry in reference to LSCITP, and IT projects in general, has led several organisations and researchers to conduct studies aimed at understanding the root causes of failures of LSCITP and IT projects (Hughes, Rana and Simintiras, 2017; Afzal, 2014; Patanakul, 2014; Patanakul and Omar, 2010; Mukherjee, 2008; Denker, 2007). The Standish Group International (SGI) is one such organisation and has been known to produce several industry-led comprehensive reports about IT project failures from the year 1994 to date. The results of these studies by the SGI, covering over 50,000 projects, indicate that IT projects, in general, are failing at an alarming rate. According to the results from the initial study conducted by the Standish Group in 1994, only about sixteen percent of IT projects were successful (Al-ahmad, Al-fagih, and Khanfar, 2009 cited in Standish Group, 1994). The definition of success that was applied to these sixteen percent of projects was that the projects concerned were completed on time, within budget and delivered their intended functionalities when completed. A further thirty-two percent of the projects examined in that report were cancelled prior to completion while the remaining fifty-two percent of projects were completed behind schedule, exceeded their original cost estimates and/or encountered various issues during the project lifecycle (The Standish Group, 2014).

The CHAOS reports by the SGI is often used as the starting point of various analysis on the subject of IT project failures in both academic and non-academic contexts (Buhl and Meier, 2011). However, the accuracy of the findings and the methodology applied by the Standish Group have been the subject of various challenges by the academic industry (Gingnell, *et al*., 2014; Buhl and Meier, 2011; Eveleens and Verhoef, 2010; El Emam and Koru, 2008; Sauer, Gemino, and Reich, 2007; Glass, 2006; Jørgensen and Moløkken-Østvold, 2006). The challenges question the methods used by the Standish Group in their studies. The challenges also question the lack of openness about the research methods applied, and they also raise questions regarding the definition of failure that was applied in the analysis of data on failed projects by the Standish Group. In another study conducted by McKinsey & Company in 2012 (Bloch, Blumberg and Laartz, 2012), in partnership with the BT Centre for major programme management at the University of Oxford, large IT projects with budgets exceeding fifteen million dollars were found to exceed their budgets by an average of forty-five percent. The study also showed that the projects concerned fell behind by around seven percent. These projects eventually delivered less functionality (around fifty-six percent) than was originally planned and expected. Various other studies have also been conducted in the United Kingdom, Canada and Australia. For example, a study conducted by the Royal Society of Engineering and British Computer Society in the UK found that around eighty-four percent of IT projects fail (Gauld, 2007). All these various results collectively present a similar pattern, indicating that IT projects suffer from high failure rates and low success rates.

The continued popularity of the results like the CHAOS reports has led to increased research across academia and industry aimed at understanding the true state of IT and large IT projects. In addition, it has also raised concerns that lessons from past failures are not being learned and the knowledge gained from previous implementations are not being understood or applied on new project initiatives (Dwivedi *et al.*, 2015).

The results from recent CHAOS reports produced by the SGI have shown that while the success rates for IT projects have been improving in recent years, the current failure rates are still too high, especially those related to software implementations (Serrador and Pinto, 2015). Moreover, a high percentage of projects are still being severely challenged. Figure 1 below shows the percentages of success, failure and challenged rates of IT projects as analysed by the SGI based on the data it holds on IT project failures between the years 2004 and 2012.

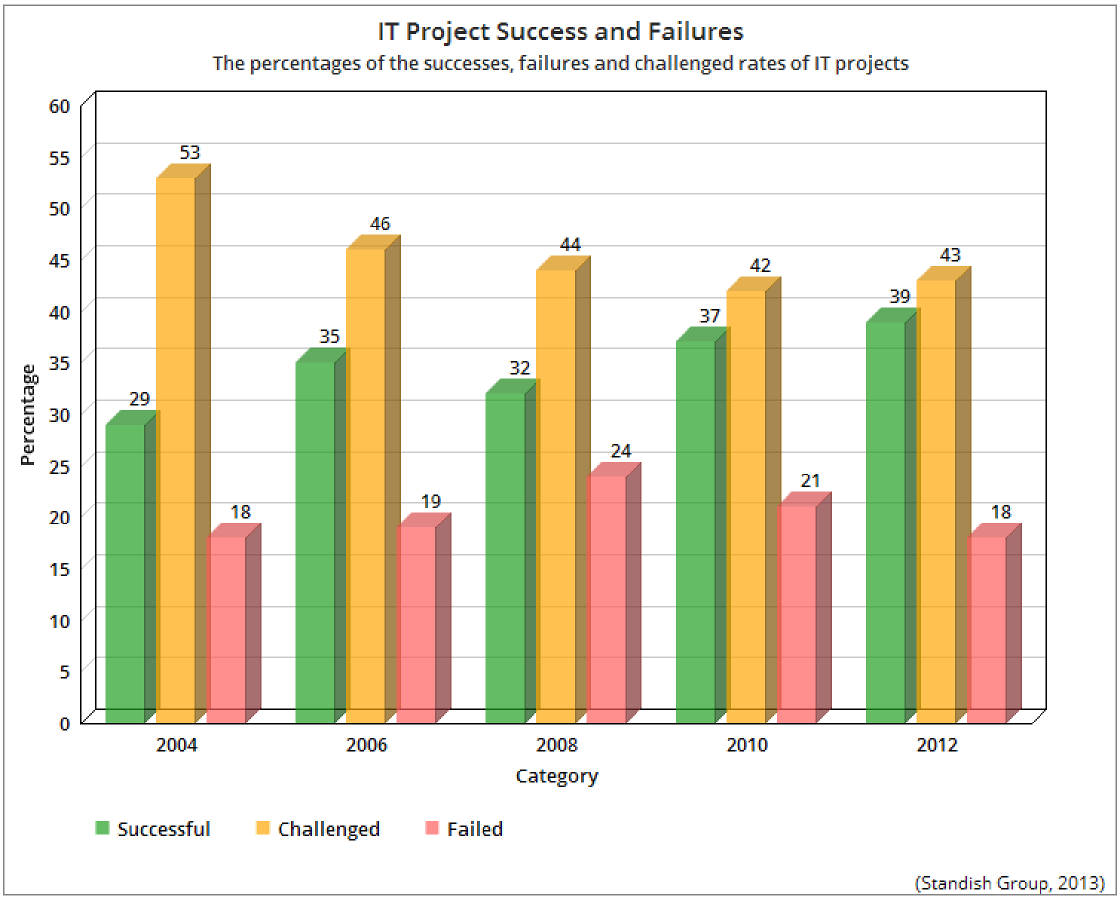


Figure **1**: IT project success and failure results from 2004 - 2012 (Standish Group, 2013).

The issue of large-scale project failures is not confined to the IT industry alone. Other industry domains such as engineering, manufacturing and construction do suffer from large-scale project failures. Failures in engineering projects are not uncommon, and there have been significant construction and engineering failures in recent years (Love *et al*., 2011; Lawrence and Scanlan, 2007). However, despite the shared issue of failures between these industries, LSCITP are much more risky undertakings, with a high percentage of projects suffering more from the common symptoms affecting large-scale and mega projects (Flyvbjerg, 2014).

The IT and Engineering industries face different challenges in relation to the planning, management and implementation of large-scale projects. Every challenge faced presents an entirely different outcome and produces a different level of impact when realised within these industries. However, despite these differences, large-scale engineering projects are still much more successful in comparison to large-scale IT projects of similar size and scale. This gives an indication that there are significant differences and possible influencing factors that affect the way large-scale engineering and construction projects are planned, managed, executed and delivered in comparison to LSCITP.

The consequences of failure are bad for the IT industry as well as being equally bad for the organisations involved in Guah's (2009) view. Moreover, the consequences of failure are bad for society overall because the potential benefits to be gained from such large-scale system implementations cannot be realised. The failure of large-scale projects has significant economic impacts on public and private organisations and can seriously threaten their survival (Buhl and Meier, 2011). For organisations in the private sector, failure of a large-scale project affects the viability and reputation of the organisation (Williams, 2005). Failures lead to financial losses and can potentially result in the collapse of the organisation concerned (Buhl and Meier, 2011). Failures bring about a significant loss of value for stakeholders, business owners and end-users (Rodriguez-Repiso, Setchi and Salmeron, 2007b). For public sector organisations, the failures of large-scale projects lead to a waste of public funds. Such failures damage the public's trust in the ability of the government or public organisations to deliver large-scale public services that are critical and of benefit to society. Overall, the negative outcomes from the failures of LSCITP are bad for the reputation of technology and engineering and the IT industry as a whole (Lawrence and Scanlan, 2007).

Organisations have an incentive to improve the performance of LSCITP. Challenged and distressed projects bring about an increase in working capital and they lead to implementation and delivery delays that in turn constitute an additional financial burden (Iacovou and Dexter, 2004). Challenged and distressed projects also eliminate the expected benefits that will be gained from the implementation of these systems. For example, as Xia and Lee (2004) and Nelson (2005) identified, organisations are currently wasting billions on challenged and failed IT projects. The most important incentive for organisations to improve the performance of LSCITP is because of the economic benefits that will be gained from such improvements. Economic benefits include savings in wasted billions of dollars and the benefits from the realisation of the objectives of the successful implementation and deployment of the large-scale IT systems. Adding to this is the realisation and prevention of lost opportunities.

1.3 PROBLEM STATEMENT

Managing the implementation and delivery of LSCITP is an enduring activity. Project stakeholders and project management teams face many challenges before, during and after the start of a large-scale IT project implementation. In particular, LSCITP creates a set of management challenges and project managers often find it difficult managing large-scale projects due to the sheer size and scale and the level of technological and institutional complexity involved (Patanakul, 2014; Patanakul and Omar, 2010; Kipp, Riemer and Wiemann, 2008). The majority of large-scale IT projects are seen as complex and technically challenging projects, and according to Hass (2009) in describing a complex project,

> "When project managers characterise a project as complex, they usually mean the project is challenging to manage because of size, complicated interactions or uncertainties" (Hass, 2009, no pagination).

Despite adequate and advanced planning, monitoring and management, large-scale projects introduce anticipated and unanticipated challenges. With large-scale projects, because implementations typically span a number of years, the evolving nature of technology coupled with constant changes in business environments and changes in business realities creates several problems and challenges within project environments. In particular, the rapid advancements in technology creates uncertainties for LSCITP (Durney and Donnelly, 2013). According to Xia and Lee (2004), problems include challenges in managing effervescent requirements, challenges in managing estimations and challenges in managing impermanent scope. As a result, the complexities inherent in large-scale projects and the challenges of managing and implementing them are constantly rising (Nelson, 2007).

IT projects, in general, tend to be very complex (Afzal, 2014) and complex systems are more prone to failure (Abbas and Sanavullah, 2008). Furthermore, according to (Patanakul, 2014), the implementation and delivery of LSCITP are more challenging than normal IT projects. A key reason for this challenging nature as Tanaka (2014) explains is because most large-scale projects are initiated to achieve several objectives, and this makes them challenging not just on a single objective front but on different fronts because each objective presents a different perspective by which the success of the system will be measured. More importantly, one of the other major challenges faced by project teams is how to keep on top of the inevitable high volume of changes that will be introduced during a large-scale system implementation's project's life-cycle, how to best anticipate and manage the volatile project environment, including how to constantly adapt to a highly dynamic project environment that IT facilitates. All these challenges must be overcome while keeping the project on track, within budget and within required implementation timeframes. Adding to that is the continuous need to keep on steering the project towards achieving its required objectives as dictated by its stakeholders. An additional challenge includes the need to keep on ensuring that such projects are continuously and strategically aligned with their intended objectives, as well as managing expectations with relevant stakeholders. As Denker (2007) adds, part of this process also includes ensuring a level of consistency between all of the constantly evolving artefacts on an LSCITP. The failure to achieve the above is one of the major reasons why LSCITP become challenged, run into difficulties and many eventually fail.

Various reports have been produced about IT project failures of varying sizes along with reports on the reasons behind those failures. Besides the well-known reports from the Standish Group, other less known reports produced includes the study conducted by OASIG in the United Kingdom in 1995, the study conducted by KPMG in Canada in 1997, as well as the Robbins-Gioia Survey in 2001 (IT Cortex, n.d.). The other notable report was the study conducted by McKinsey & Company in 2012 (Bloch, Blumberg and Laartz, 2012). All these studies focused on the issue of success and failures in small, medium and large-sized enterprise-wide IT projects across different industries and across different countries globally, along with the application of different measurement techniques in the conduct of the analysis. These various reports and studies presented a widespread rate of failure across the IT industry. For example, the Robbins-Gioia Survey reported a failure rate of around 51 percent, the KPMG Canada Survey reported a 61 percent failure rate, the while the OSAIG study revealed a failure rate of around 7 in 10 IT projects.

While these various research studies indicate that a fundamental problem exists with the ability to implement, manage and deliver IT projects and LSCITP in particular, they are not comprehensive enough in their findings, nor do they sufficiently distinguish between normal IT projects and large-scale IT projects as part of the results they provide (with the exception of the McKinsey & Company study in 2012). The majority of the existing research studies place a lot of focus on IT projects in general without much specific focus on LSCITP. In addition, the criteria for success and failure and the criteria for determining the sizes of projects that are applied to the different studies varied significantly per study. However, while these various research studies identify a problem with LSCITP and IT projects in general, and while they point out several causes that lead to failures, there has been no generally agreed on conclusion or consensus as to the real root causes for why LSCITP fail so frequently. Moreover, Mora, *et al.* (2008) identify that there are limited studies on large-scale IT and Information Systems (IS) projects from the private sector. The reason for the lack of sufficient studies in large-scale private-sector IT projects has been blamed on the fact that IT project failures in the private sector are not often visible nor are they often reported by the organisations involved (Glass, 2006).

1.4 SIGNIFICANCE OF RESEARCH

The focus of this research is on examining and understanding the causes of the challenges of LSCITP that leads to their poor performance and eventual failures by examining the challenges inherent in the management, implementation and delivery of LSCITP; and secondly, to determine the key problem areas in LSCITP that hinder success and add to the challenges contributing to their poor performance and eventual failure.

The research seeks to explore the reasons that influence these challenges by looking at and examining areas such as management processes, implementation processes, technology, complexity, success and failure factors, internal and external factors including examining the volatilities in the project environments and well as the project management processes that are applied on these large-scale projects. This research also attempts to look at similar large-scale projects within other related disciplines to see if there are differences or if there are any lessons that can be learned in the way large-scale complex projects are implemented and delivered within these industries. Overall, this research attempts to address the fundamental research problem which focuses on:

> The challenges to the successful delivery of large-scale, complex information technology projects and how can they be avoided, and why do most projects fail to meet their original objectives?

The implementation and delivery of LSCITP are insufficiently understood and are poorly managed (Morris and Hough, 1993) and the continued high-profile IT/IS failures suggests that the lessons learned and knowledge gained from past failures are not being effectively applied in the implementations of new projects and thus highlights the need for continued research on the issue (Dwivedi *et al.*, 2015).

Research on large-scale project failures has been an ongoing activity in the past two decades in Somanchi and Dwivedula’s (2010) view. Research has been conducted over the years on the subject of large-scale IT systems and projects failures (Hughes, Rana and Simintiras, 2017; Patanakul and Omar, 2010; Patanakul, 2014; Whitney and Daniels, 2013; Al-ahmad, Al-fagih and Khanfar, 2009; El Emam, and Koru, 2008; Glass, 2006; Venugopal, 2005; Yeo, 2002; Willcocks, and Griffiths, 1994). However, some of these existing research studies focus heavily on large-scale public sector projects with only a small percentage focusing on IT and IS projects that span other domains and industries (Patanakul and Omar, 2010). In addition, existing research on the subject of IT project failures is often concentrated on the success and failure factors of small-scale or normal sized IT projects with little research of the same nature on projects of significant sizes (Nelson, 2007). Similarly, Patanakul (2014) goes on to explain that the results from the research carried out on non-large-scale IT projects cannot be applied to LSCITP in view of the differences in the size and scale and the level of complexity in these projects. Few studies also provide detailed insights into the challenges of LSCITP including guidance on their effective management, implementation and delivery. Only a handful of studies examine the challenges of

LSCITP and provide insights into their implementation, execution and delivery. Furthermore, the majority of research on large-scale project failures are generally descriptive and do not provide the required tools, processes, methodologies, frameworks or recommendations for improving the implementation, delivery and management of these projects (Kovaka and Fiori, 2005). This study attempts to provide a different perspective and dimension to the challenges of LSCITP with a specific focus on identifying and establishing key knowledge areas and examining and contextualising the inherent factors, their relationships, impacts and outcomes.

More research on LSCITP is required especially because of the significance of these projects since they are fundamentally different to regular IT projects. The ubiquitous and evolving nature of technology has meant that new research is needed more frequently to help address and understand the on-going challenges of LSCITP implementations in line with technology advancements. This is critical because the pervasive nature of technology is now a key determiner of success and one of the biggest factors that have a significant impact on the outcome of an LSCITP implementation.

This research seeks to provide a detailed picture of the causes of failures of LSCITP by examining the factors that influence failures across both the public and private sectors. The research also seeks to increase the focus on large-scale IT project implementations within the private sector as these are often less visible in comparison to large-scale public-sector IT projects.

The outcome of this research should provide significant results and will help contribute to the existing body of knowledge within the domain of LSCITP and Large-Scale Complex IT Systems (LSCITS). The research will also help to provide valuable contributions to both industry and academic practitioners by helping to increase the understanding of the causes and determinants of failures early on and during the implementation cycle so that the required actions can be implemented. Furthermore, the outcome of this research should assist in the understanding of the current capabilities and challenges in managing and delivering LSCITP in the 21st century. One of the key objectives of this research study is to involve participants who are subject matter experts and who are actively and directly involved and have first-hand knowledge of LSCITP implementation and delivery based on their experiences in real-world project environments and across several industry sectors.

The study of LSCITP is important, and the understanding of LSCITS is equally important in order to develop a body of knowledge and to help learn from past mistakes in their implementation and delivery. Conducting these studies leads to substantial learning and allows for the application of the knowledge gained and lessons learned to be applied on future LSCITP implementations, thereby reducing the risks of future failures. Denker (2007) believes in the need to conduct studies aimed at finding the root causes of failures in large-scale IT projects while Lindahl and Rehn (2007) argues that while the failure of projects is an incontestable fact, the failure to study the reasons why they fail is unscientific and illogical. The benefit of studying the failures of LSCITP is that such knowledge will not only be of benefit to the IT industry but will also be of immense benefit to all other industries that undertake the management and implementation of large-scale complex projects and systems.

The failures of large-scale projects increase the need to understand ways of improving their implementation and delivery (Gemino, Reich, and Sauer, 2007; Kovaka and Fiori, 2005). To that end, it is highly important that an extensive analysis of this multifaceted topic be conducted to gain a deeper understanding of the causes of challenges and their implications for the IT industry. This research is, therefore, significant based on the above factors, in that it comprehensively addresses the issues and problems that lie at the causes of the challenges and failures of LSCITP.

It is imperative to identify the causes of the challenges and failures of LSCITP to come up with methods and processes developed through research that can provide a long-lasting solution or help to lower the high failure rates. Analysing failed IT projects provides an opportunity to conduct research aimed at learning more and understanding the causes of failures. Failure to understand the continued reasons behind the high failure rates of LSCITP will have severe consequences for society globally. This is so because, these large-scale systems aided by advancements in technology now sit at the core of how society functions in today's environment, and it has also now become the defacto engine that drives the way that society operates (Denker, 2007).

1.5 RESEARCH AIMS AND OBJECTIVES

This research project seeks to understand the reasons why a high number of LSCITP run into difficulties, end up being severely challenged and many eventually fail. In the pursuit of such understanding, it seeks to understand the differences between large-scale IT projects and similar large-scale projects in other environments such as engineering and construction and perform a comparison of their levels of success and failures. Among the key objectives of this study is to provide information on the key drivers and factors that affect both successful and unsuccessful implementations and delivery of LSCITS and their underlining LSCITP. As noted by Greiman (2014), most of the research carried out on megaprojects tends to focus heavily on their failures and the reasons for failure rather than focusing also on their successful implementation and the benefits the implementations introduce or other implementation outcomes. This research will also explore the subject of complexities inherent in large-scale projects to better understand complexity factors and how these complexity factors impact the successful implementation and delivery of LSCITS within large-scale project environments. The research also hopes to shed light on the management and project management aspects of LSCITP and provide answers as to whether project management or management and governance practices are contributing to the challenges and failures of LSCITP and, if so, to what extent.

The resources for this investigation will be collected through empirical research involving the methodical examination of existing literature. Data will also be gathered through the conduct of relevant case studies and through the conduct of expert interviews on real-world LSCITP. Additionally, the research processes will include the involvement and engagement of key stakeholders, for example, participants with active involvement, engagement and knowledge of large-scale IT project environments as well as relevant stakeholders from within the academic and other relevant sectors. To conclude, this research will explore ways of improving the implementation and delivery of LSCITP and how to steer them towards achieving a more successful outcome. The list below provides the intended scope and objectives that this research is aiming to cover:

- Gain an understanding of the causes of challenges and causes of failures of LSCITP
- Gain an understanding of the set of important critical success and failure factors that contribute to the success or failures of LSCITP
- Understand the reasons for the poor success rates being experienced with LSCITP
- Understand the reasons for complexity inherent with LSCITP and the set of complexity factors
- Understand the differences between large-scale projects in the IT industry and large-scale projects in other similar industries (for example, the construction and engineering industries)
- Understand why LSCITP appear more difficult to manage, implement and deliver
- Understand whether multiple stakeholder views contribute significantly to the challenges being experienced with LSCITP
- Understand whether the project management processes being applied on LSCITP have a negative impact on their outcomes
- Propose a set of recommendations that can be implemented to assist with improving the success rates of LSCITP across implementation areas aided by the development of a methodology or framework that can be used to support the implementation and delivery of LSCITP towards improved outcomes

The answers and the proposed solutions to the above questions will help provide a view as to the real reasons behind the problems and challenges faced by LSCITP. In addition, it will shed significant light and help to provide the answers and solutions required, that will help stakeholders and practitioners globally to be able to manage and deliver LSCITP successfully while meeting all defined success requirements. The hope is that the outcome will contribute to the existing knowledge within this domain and that it will help to advance the domain of large-scale, complex IT systems and project management. Overall, the outcomes will help to develop new ways of thinking about the management, implementation and delivery of LSCITP.

1.6 RESEARCH FOCUS

The literature review is organised into two logical parts starting with (*A*) the challenges of LSCITP and (*B*) the project management perspective. Thus, the starting point and the focus of the study was the management of LSCITP, and consequently, the focus area of the study was the *IT* and *project management* knowledge domains. However, in studying the challenges of LSCITP, it was necessary to explore specific aspects of relevance in other applicable literature beyond the domain of project management and IT to address and acknowledge areas of overlap. The reason is that the study of LSCITP does often extend into different areas of literature and often spans different knowledge domains such as software engineering and information systems. Equally, an added rationale for the need to understand areas of relevance was because of the diversity of the LSCITP examined in the study which originated from different areas of literature.

Specifically, the software engineering domain was identified as an important domain to explore the specific aspects of relevance within the context of projects because of the system implementation projects examined which fall heavily into the software domain or were characterised as large-scale software-oriented project implementations. Thus, the study draws on four relevant areas of literature: *IT*, *IS*, *project management* and *software engineering* in the study of LSCITP. The diagram below provides a view on the positioning of the study within relevant disciplines and domains.

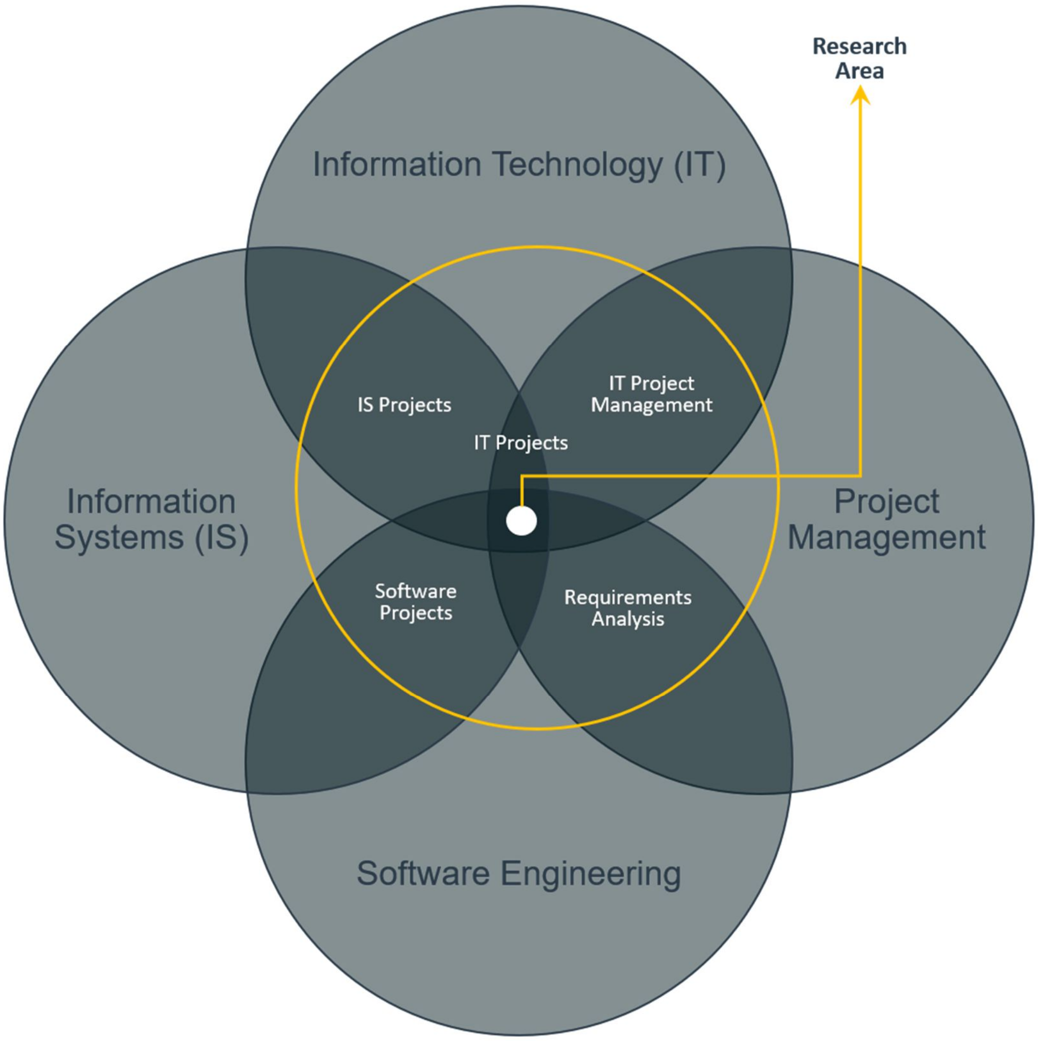


Figure **2**: The diagram showing the positioning of the study.

1.7 THESIS STRUCTURE

This thesis document is apportioned into the following number of chapters and structured as follows:

- **Chapter One** – Introduction
- **Chapter Two** – Literature Review - Part One
- **Chapter Three** – Literature Review – Part Two
- **Chapter Four** – Research Design and Methodology
- **Chapter Five** – The Case Studies
- **Chapter Six** – The Conceptual Domain Model
- **Chapter Seven** – Research Findings
- **Chapter Eight** – The LSCITP Challenged Assessment Framework
- **Chapter Nine** – Discussion
- **Chapter Ten** – Conclusion and Recommendations

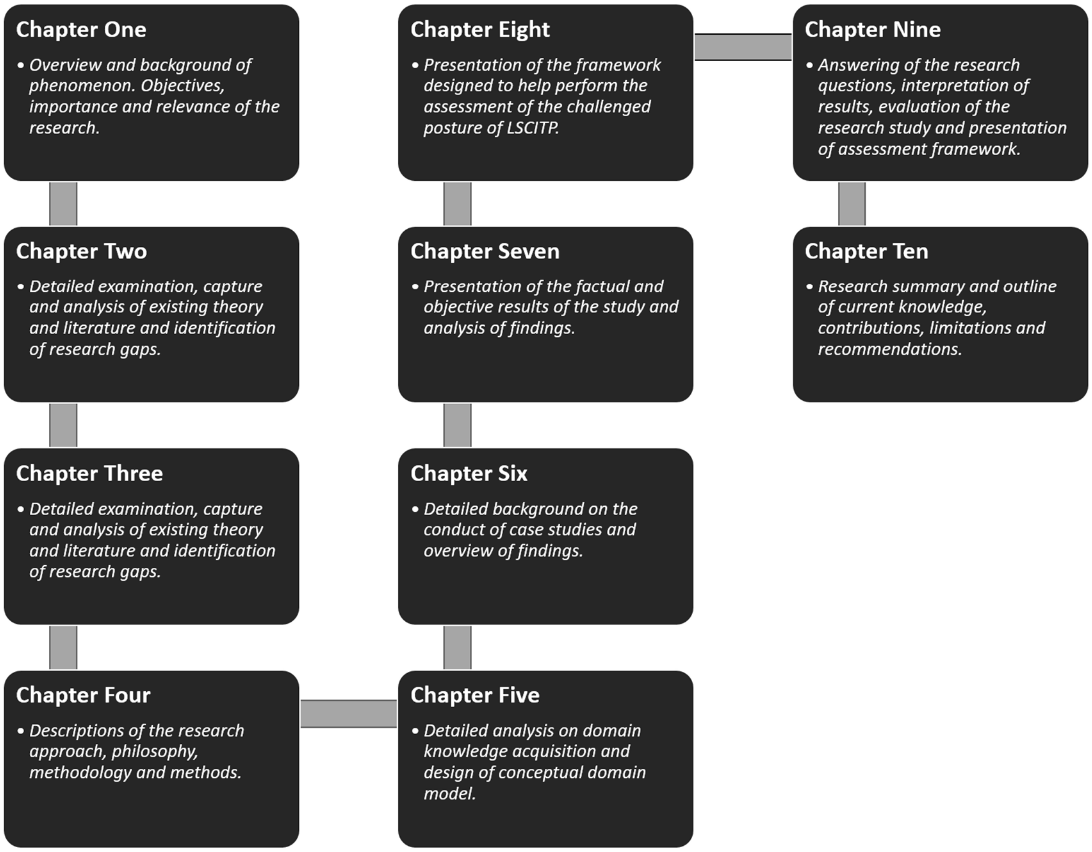


Figure **3**: The structure of the thesis.

Chapter One serves as the introductory chapter for the study where the key objectives of the research and the key questions it attempts to provide answers for are introduced. The chapter contains the introductory paragraph that outlines the challenges with large-scale complex IT projects expressed through the motivation and context and the problem statement. It includes a section on the significance of the research such as the reasons for undertaking the research study. The chapter also lists out the aims and objectives of the research by detailing the specific set of objectives that the research hopes to accomplish. To conclude, the chapter includes a final section highlighting the structure of the thesis.

Chapter Two focuses on the review of literature conducted during the course of the research. It provides a full background and context to the subject of failures of large-scale and complex IT projects. It begins with a definition of large-scale projects that will serve as a guide for the research. The chapter then progresses by fully exploring the issue of large-scale complex IT projects and factors impeding success. Other areas explored include complexities, success and failure factors within large-scale IT project environments, the project management perspective and connections of project management methodologies to the failure of LSCITP. The chapter concludes with the definition of success and failure that the research applies to the conduct of the research.

Chapter Three also forms part two of the literature review exercise conducted and focuses on the project management perspective and the challenges of managing LSCITP within the project management domain by providing an exposition of existing research related to the topic of project management within large-scale project environments. Within this context, this chapter also focuses on understanding the differences between LSCITP and large-scale complex engineering projects (LSCEP), how they are managed and on the understanding of the various outcomes of both projects and why LSCEP appear to be more successful than LSCITP.

Chapter Four focuses on the research philosophy, design and the research methodology that was used for conducting the empirical part of this research study based on the research aims and objectives outlined in Chapter One of this thesis. The research design and methodology also considered the nature of the study and describes the approach to data collection, analysis and validation.

Chapter Five focuses on the conduct of case studies and the analysis and results of the case studies conducted as part of the process of fulfilling the objectives of the research. The case studies section analysed examples of specific LSCITP project failures that fit within the research parameters with a view to understanding the causes of the issues that eventually led to the failures of such projects.

Chapter Six presents the development of a conceptual model for the identification, understanding and evaluation of LSCITP challenged areas that was applied in the study to assist the author to identify and understand the causes of the challenges of LSCITP and resulting knowledge areas. The developed schema helped to categorise and organise the identified factors and to enumerate the knowledge gained into a structure that can enable current understanding and possible future expansions.

Chapter Seven: This chapter focuses on the analysis and interpretation of the data gathered during the course of this study including the presentation of the findings from the analysis of the data.

Chapter Eight: This chapter describes the development of the LSCITP challenged assessment framework designed to support the assessments of LSCITP with the objective of identifying challenged factors, overall challenged posture and supporting the remediation of challenged outcomes.

Chapter Nine: This chapter focuses on the discussions and analysis of the findings from the study presented in chapter seven and discusses the theoretical and practical perspectives and implications.

Chapter Ten: This chapter performs a summary of the results of the research and draws necessary conclusions regarding the challenges of large-scale, complex IT systems and projects. The chapter concludes the research by acknowledging the contributions of the study to the existing body of knowledge, the limitations of the research, providing recommendations, academic implications, business implications, as well as and areas for further research.

This thesis also includes a number of Appendices:

- Appendix A: Research Interview Guide
- Appendix B: Research Interview Instrument
- Appendix C: Evaluation Framework
- Appendix D: LSCITP Management Improvement Recommendations
- References
- Bibliography

CHAPTER 2

Literature Review – LSCITP Challenges

2.1 INTRODUCTION

This part of the literature review chapter of this research study focuses on the review of existing research areas and studies that are of relevance to this study. The objectives of conducting this literature review was to help gain a detailed understanding of the topic under research, to help gain a deep understanding from a theoretical landscape, to find gaps in existing literature and to enable the research to stay in alignment with current developments within the Information Technology (IT) and Information Systems (IS) domain with regards to the study of Large-Scale, Complex IT Projects (LSCITP).

This chapter provides a background on LSCITP; it highlights the *challenges* and causes of *failures* as identified from existing studies. The chapter also offers a definition of *large-scale complex projects* to provide a context by which the objectives of the research will be achieved. Within this context, this chapter provides a view on the different types of LSCITP initiatives that fall within the scope of this research; it highlights examples from around the world on LSCITP that have failed and their different journeys from initiation to eventual failure. The chapter goes on to describe the key reasons why LSCITP end up being severely challenged and fail, and it also provides a view on other causes of failures that impact the implementation, delivery and assurance of large-scale complex IT systems.

2.2 DEFINING LARGE-SCALE COMPLEX INFORMATION TECHNOLOGY PROJECTS

To begin with, this study attempts to define what is meant by a large-scale complex IT project. This definition and understanding is required to provide a context by which the research can be carried out, but more importantly, this definition is required because it also helps to provide a platform for the aims and objectives of the research to be understood and achieved. Kipp, Riemer and Wiemann (2008) argued that to conduct research into LSCITP, the full understanding of their characteristics and particularities are required. The existing definitions of what constitutes a large-scale project within the IT industry, in general, are somewhat ambiguous in Zidane, Johansen and Ekambaram (2013)'s view. The term *large-scale* can mean different things in different contexts. To avoid any ambiguity and to provide some indication of what *large-scale* means within the context of this research, a dictionary definition of *large-scale* is provided below. *Merriam-Webster's* new international dictionary offers a definition of what the term *large-scale* means. According to (Merriam-Webster, 2014) it is something:

> "Large in comparison with others of the same general class. Such as (a) involving great numbers or quantities: having wide scope or extensive proportions. (b) of a map: having a scale (as one inch to a mile) that permits the plotting of much detail with comparatively great exactness" (Merriam-Webster, 2014, no pagination).

The above definitions, when applied within the context of IT projects, means that projects fitting the definitions provided above are large in size and scale. They exhibit attributes that are large in size across all facets of the project. Thus, large-scale IT projects can be initially defined as projects involving the development of complex IT artefacts where every facet of the project is significantly large in size and scale when compared to other projects within the same category. Kipp, Riemer and Wiemann (2008) define LSCITP as mega projects that produce a particular type of artefact from software to IT infrastructures that are significantly large and complex.

Simply understanding the above definition is not sufficient enough to classify a project as *large-scale*. The properties and attributes that help to determine the *large-scale* nature of a project then need to be examined so that a concise picture is painted as to what actually makes a project large-scale. In other words, IT projects fitting the above definitions are deemed large-scale for a number of other reasons besides the generic definitions of a large-scale nature that is applied above. According to Kovaka and Fiori (2005), what makes a project *mega* or *large-scale* is not just down to well-known factors such as the cost of the project, the size, but the combination of a host of other complex characteristics. These complex characteristics include the fact that these projects are often undertaken by multi-organisational enterprises (Flyvbjerg, Bruzelius and Rothengatter, 2003); they contain a certain level of complexity (Philbin, 2008) and are always constrained by time (Grün, 2004). Other complex characteristics include the fact that these projects usually have a higher number of stakeholders, sponsors, clients, owners with differing views and expectations. Additionally, these projects are also highly expensive (for example, they have a high capital cost), they have a longer than normal implementation timeframes, they are often mission critical and are generally technologically challenging to implement (Hassan *et al*, 1999). Projects exhibiting these attributes are also deemed *large-scale* because their size can be quantified.

In addition, projects fitting the *large-scale* definition above tend to run over a longer duration that is usually measured in years, and they are composed of a larger than normal workforce size. Typical LSCITP run for around three years and have a workforce size of over 100 operatives according to Denker (2007) or thousands of workforces often from geographically distributed teams in Tanaka (2014)'s view. The size of the budgets that is allocated to these projects is also very large. For example, in a study by Miller and Lessard (2000) involving large engineering projects, budget allocations in large-scale projects were found to be very large, often starting from between an average of nine hundred and five (905) million dollars to a budget of around one billion dollars (Kovaka and Fiori, 2005).

Moreover, besides the measurement of specific attributes that are used to determine the *large-scale* nature of a project, projects fitting these descriptions are also classed as *large-scale* based on the significant impacts they have when implemented (Zhai, Xin and Cheng, 2009). For example, within a private-sector organisation, these large-scale projects help to transform core business operations, improve performance, increase productivity, and act as the pillar for competitive survival (Dalcher and Genus, 2003) and enables organisations to operate within a global platform. Similarly, in public-sector organisations, these large-scale projects help to improve and transform public services, provide a platform for improved engagement with the population, help to transform and improve government processes, reduce costs as well as improving the quality of services that are delivered to citizens (Gichoya, 2005). Large-scale projects are of strategic and critical importance to the delivery, improvement and efficiency of the quality of services delivered in the public sector (Mora, *et al.*, 2008). Furthermore, these projects have an element of time sensitivity and mission criticality attached to them, and these are attributes that are always synonymous with large-scale project initiatives.

Generally, the common view within the engineering and IT industries (Buhl and Meier, 2011; Kipp, Riemer and Wiemann, 2008; Mora, *et al.*, 2008; Grün, 2004; Miller and Lessard, 2000; National Academy of Sciences, 2000; Hassan *et al*, 1999, Hassan, Maccaffer and Thrope, 1999 cited in Watson 1996) is that large-scale complex projects exhibit the majority of the following attributes:

- They have long duration (greater than two years, and often six years or more)
- They comprise large project teams (more than 200 personnel)
- The projects are often run as an independent entity separate from sponsoring bodies, owners, etc.
- They are technologically challenging and logistically demanding
- They have a large number of organisations responsible and involved in the implementation and delivery of the entire system
- They have a high number of systems and sub-systems, comprising many interrelated processes (typically over 100,000)
- They have a high capital cost and a budget size running into millions of dollars to billions of dollars
- These projects are often overdue before implementation commences and these projects have a sense of urgency attached to them
- They often have the involvement of several key stakeholders

Therefore, it is the combination of the majority of the above factors and attributes that determines the classification of an IT project as a LSCITP. Thus, this study applies the above definition to IT projects for the purposes of achieving the aims and objectives of this research study and to also provide the context by which the research can be carried out.

2.3 UNDERSTANDING LARGE-SCALE COMPLEX IT PROJECTS

Having provided a definition for large-scale IT projects, this study then moves on into gaining an understanding by exploring the history and the particulars of LSCITP. The study examines aspects such as their emergence, the need for LSCITS, their specific attributes, and their applicability, how they are implemented, managed and delivered. It also explores the factors contributing to their challenges and failures and provides examples of notable LSCITP failures and the reasons behind the failures.

The majority of LSCITP fall into the category of what is known as *mega* or *large-scale* projects. Mega projects are huge projects where every facet is significantly large in size, scope, and scale and they have budgets running into hundreds of millions of dollars (Siemiatycki, 2013; Leo, 2010; Al-ahmad, Al-fagih and Khanfar, 2009). As noted by Grün (2004), megaprojects are the giants in the world of projects. Brockmann and Girmscheid (2007) describes them (large-scale projects) as mega projects because they possess the following attributes, a lengthy project duration, they are technically challenging, they have massive budgets, they are mission critical and they are linked to a level of urgency and they have a large number of entities and resources operating within the project environment. Leo (2010) on the other hand, views mega projects as projects that are very large, very complex, associated with high costs and that they are of strategic importance.

The implementations of LSCITS are now a reality and a common undertaking in today's environment across all industry sectors (Chae, 2001). According to (Flyvbjerg, 2014), these megaprojects are the new kid on the block, and they are increasing in size and scale. Large-scale IT projects in particular cost billions (Nelson, 2007; Charette, 2005; Williams, 2005) and the systems implemented out of these projects help to stimulate economic growth and transform lives. These large-scale systems are undertaken as the ideal solution to address the several complex problems and challenges facing society today. Large-scale projects are not just larger versions of their smaller equivalents; they are comprehensively different especially when it comes to certain aspects such as duration, complexity, impact and the number of stakeholders involved (Flyvbjerg, 2014).

The proliferation of LSCITP as a result of the proliferation of LSCITS being implemented is widespread in both the public and private sectors, and they are implemented to support various organisational objectives and goals and also to help bring about improvements in efficiency and effectiveness of business processes across all industry domains (Guah, 2009; Mora, *et al.*, 2008; National Academy of Sciences, 2000) . These large-scale systems are also mission-critical, meaning that the effective functioning of an organisation or public institution is now heavily dependent on their successful implementation and delivery as they now sit at the core of how society functions and operates. LSCITS help to support critical infrastructures and applications used across a range of industry domains that are critical to the functioning of such domains such as telecommunications, transportation, energy, financial services, healthcare, defence, nuclear, utilities, and aviation, automotive, manufacturing and engineering. Such large-scale projects in the public sector contribute immensely to national development (Patanakul, *et al.*, 2016), in the private sector, LSCITP are often the pillar for competitive survival, transforming business operations, increasing productivity and competitiveness and helping to achieve long-term strategic organisational objectives.

LSCITS encompass different technology components and solutions (National Academy of Sciences, 2000). They are more than just a combination of hardware and software systems put together. For example, Mora *et al.* (2008) state that these different technology components that make up a large-scale system range from hardware, software, storage solutions, data, networks, telecommunications, Internet and other digital technologies and infrastructures. These different hardware and software components are required to interact seamlessly together in order to be able to provide the required services and solutions and meet the intended objectives of the end system. Collectively, these large-scale complex systems represent the set of interdependent and interrelated components, systems, and sub-systems that collectively function together as a single large-scale system to meet specific requirements and needs.

LSCITP have a far-reaching impact on an organisation, its processes, and relationships and such impact when positive can completely transform an organisation. Today, the impact of IT is something that is visible right across an entire organisation (Grossman, 2003). The rapid rise and advancements in technology have opened up more avenues for organisations to conduct business, gain competitive advantage, improve business processes, improve efficiency, operate within a global platform and large-scale IT systems are the systems that are capable of supporting these initiatives. Particularly in large organisations, LSCITS are becoming ever so important and critical (Guah, 2009; Ewusi-Mensah, 1997). Equally, the importance of LSCITP also extends far beyond their stakeholders to the environments, organisations, industries and economies that are impacted by the implementation of such initiatives.

The diagram below provides a view of the business areas and business initiatives that organisations today want to address with technology because of constantly changing business environments that are fuelled by rapid technological changes. Organisations are seeking IT solutions to address these key areas and meet any challenges, and LSCITS are pivotal to addressing and satisfying these key objectives. Thus, this demonstrates the importance of Information and Communications Technology (ICT) to an organisation and also demonstrates how ICT is now embedded and highly critical to the continued existence of an organisation (Koh and Maguire, 2009).

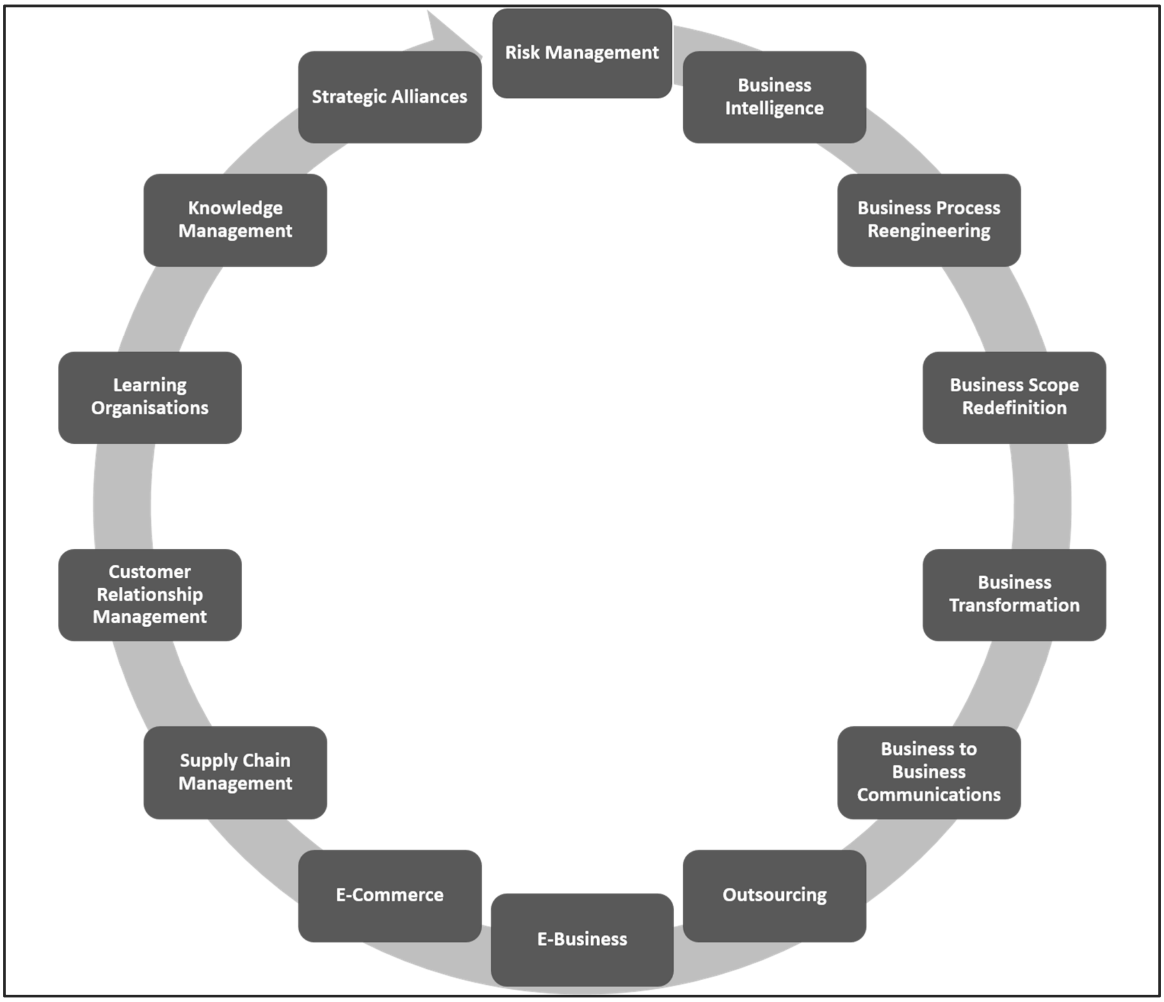


Figure 4: Examples of key areas being aided by the implementation of ICT solutions and services (Adapted from Koh and Maguire, 2009).

The implementation and delivery of these large-scale IT systems are now a common undertaking particularly in large global organisations driven by technology and globalisation and aided by the increasing advancements and capabilities of ICT (Chae, 2001). The same drive for the implementation of LSCITS is also replicated within public-sector organisations driven by similar needs. For organisations in the private sector, LSCITS are built to support mission-critical business processes, business strategies and as a way of gaining competitive advantage. For public-sector organisations, large-scale systems are built to provide a way to offer centralised services and capabilities to support public-sector services to the population and to ensure that the government can serve the population in a more effective and efficient manner. The implementation of LSCITP within an organisation is most often part of wider initiatives and are connected to wider transformation activities that span areas such as organisational change, operational change, technology, infrastructures and information systems (Braa and Rolland, 2000). Today, irrespective of industry sector, technology initiates, enables and facilitates the way society operates and these large-scale complex IT systems that are built are at the heart of these initiatives, and as a result, they are pivotal to the efficient and effective functioning of the modern society (Denker, 2007).

A resulting factor from all of the above is that IT projects being implemented today are not only getting bigger and bigger, but they are equally challenging at the same time as opposed to being smaller and easy (Denker, 2007; National Academy of Sciences, 2000). A result that has meant that numerous projects have had to be cancelled during their implementation stages (Al-ahmad, Al-fagih and Khanfar, 2009). LSCITP are still failing because managing and implementing them is a very complex and challenging process due to a host of reasons (Nelson, 2007; Iacovou and Dexter, 2004). Moreover, in Patanakul (2004)'s argument, they are more challenging to manage and implement compared to small and medium-size IT projects. LSCITP are more complex than similar engineering projects mainly because of key issues such as complexity and invisibility. Similarly, as Humphrey (2005) adds, most LSCITP fail more often compared to normal sized IT projects.

A particular area of concern within the IT industry is regarding the manner at which these large-scale systems are being managed and implemented due to the widespread rates of failures and the low success rates achieved (Al-ahmad, Al-fagih and Khanfar, 2009; Hidding and Nicholas, 2009). The concerns raised relate to whether the project management processes, methodologies and frameworks currently in use are adequate for supporting the successful implementation and delivery of these large-scale projects (He, *et al.*, 2009). For example, Al-ahmad, Al-fagih and Khanfar (2009) have argued that current project management methodologies are often at fault for the challenges and failures in large-scale IT projects.

2.4 THE INCREASING DEMAND FOR LARGE-SCALE COMPLEX IT SYSTEMS

The constant evolution of technology coupled with the increased dependence on technology by society has meant that IT projects being implemented today are increasing in size and scale fueled by the increased demand for innovative technology-oriented solutions (Fridgen, *et al.*, 2014; Buhl and Meier, 2011; National Academy of Sciences, 2009). According to Dwivedi, *et al.*, (2014, p.151), "rapid advancements in ICT have made it possible to conceptualise and implement complex and ambitious projects". A result which means that there are no longer limitations to the size and scale of technology systems that can be implemented today. The knock on effects from the above is that the resulting IT projects are now getting ever more complex and difficult to manage, implement and deliver.

So many factors fuel this rise in demand for modern, inventive, innovative and cutting-edge technology related solutions and services. The biggest of which is through the ever-increasing capabilities that technology offers as well as the increasing needs of society as a whole (Van Marrewijk, A. *et al.*, 2008; Willcocks and Griffiths 1994). Other factors that give rise to LSCITP include the increasing role that technology plays in the transformation and support of organisational objectives, exacerbated by the need for continuous innovation (Rockart and Crescenzi, 1984).

Additionally, the effects of rapid technological advancements have also had an impact on the project management processes of LSCITP, and this impact, in turn, leads to widespread failures (Durney and Donnelly, 2013). The end results of the impact of these factors are that IT projects of late have now become bigger and bigger, they are larger in size and scale than ever before (Denker, 2007), and they now take longer to implement. A result which leaves them being extremely complex, technically challenging, challenging to manage and leads to a failure in delivering expected results or the outright failure of the project. As argued by Al Khouri (2007), the nature, size, and complexity inherent in LSCITP raise the probabilities that these projects are eventually going to fail to achieve their expected objectives.

Typical challenges affecting LSCITP today include technology challenges, complexity challenges, management challenges, budget challenges, and schedule challenges (Hughes, Rana and Simintiras, 2017; Yeo, 2002; Willcocks and Griffiths, 1994). The list also includes social causes, instability and uncertainty challenges. Another challenge facing LSCITP is the complexity of the problem domains that are being addressed (Ewusi-Mensah, 1997). Adding to this list of challenges affecting the management and implementation of LSCITP is the knowledge requirements in managing these projects that are also increasing in line with technology advancements (Al Khouri, 2007). A reason for such challenge is because constant changes to the knowledge requirements add to the complexity challenges on LSCITP. As stated by Al-ahmad, Al-fagih and Khanfar (2009, p.94), the "project management of complex IT projects is challenging, even when measures of success are known and understood". Aside from the above, the presence of other project-related challenges within large-scale project environments has also increased the chances of failures on LSCITP.

The need for LSCITS is undeniable and their relevance unquestionable (Mora, *et al.*, 2008) however, an equally undeniable fact is the need to understand the challenges they face and to provide research that can inform and improve their successful implementation and delivery (Zidane, Johansen and Ekambaram, 2013). According to Hughes, Rana and Simintiras (2017), the number of research on IT/IS projects showing a continued high failure rate suggests that more research is required to develop a deeper and better understanding of the determinants of failure and to identify the causes.

In view of the above, it is highly important that an extensive analysis of this multifaceted topic be conducted to gain a deeper understanding of the causes of failures of LSCITP and the resulting implications for the IT industry.

2.5 TYPES OF LARGE-SCALE COMPLEX IT SYSTEMS

Across all industry sectors, there are various types of LSCITP initiatives involving the development and implementation of various types of LSCITS. These vary from LSCITP involving the development of new LSCITS to address specific business objectives to projects involving the enhancement of existing large-scale systems to introduce new functionalities and also extends to projects involving the customisations of off-the-shelf large-scale enterprise information systems to meet specific requirements. The resulting outputs from the majority of LSCITP are LSCITS.

In both the public and private sectors, examples of these LSCITS include national healthcare IT systems, national pension and welfare IT systems, IT systems for air traffic control (National Academy of Sciences, 2000), IT systems built to support and execute space missions, as well as IT systems built for major defence initiatives on a national level. Kipp, Riemer and Wiemann (2008), for example, describe current examples of LSCITP to include the British NHS IT project (NPfIT), the European Galileo project, and the Australian Custom's Integrated Cargo System (ICS). Mora, *et al.* (2008) describes examples of LSCITP to include "worldwide credit card systems, brokerage financial systems, military defence systems, large ERP systems, governmental tax payment systems, and worldwide e-commerce and B2B supply-chain systems". Other examples include e-

Commerce systems and large-scale infrastructures (National Academy of Sciences, 2000) the British e-Borders Programme, the United States' FBI Virtual Case File (VCF) project and the British National Offender Management Information System (C-NOMIS). Automated supply chain management systems, cloud computing infrastructures, enterprise-wide systems are also examples of LSCITP (Dwivedi *et al.*, 2015).

Similarly, within the private sector Maas (2000), provided examples of LSCITS that includes enterprise resource planning (ERP) systems, customer relationship management (CRM) systems and supply chain management (SCM) systems. Other examples include large IT systems for on-line analytical processing (OLAP) and large data warehouse IT systems used by services running on a software-as-a-service platform (SaaS). The list of LSCITP also includes the development of LSCITS for mission-critical systems such as IT systems to support nuclear-powered plants (Mora, *et al.*, 2008). ERP systems are also part of the largest IT investment initiatives embarked on by large organisations in recent years (Huang, *et al.*, 2004). Morley and Parker (2009) and (Maas, 2000) stated that large enterprises often deploy ERP systems and they are large-scale integrated systems that bring together all of the business activities of an organisation under one single platform. These activities include marketing, sales, finance, customer service, etc. These projects and initiatives are classified as LSCITP because they exhibit specific attributes such as technological complexity; they are very large in size and they are often initiated within a complex project environment (Kipp, Riemer and Wiemann, 2008). ERP systems are large-scale software systems that are technically challenging to implement (Maas, 2000) as they require a heavy customisation and often leads to changes to existing organisational architectures. Additionally, these projects bring about a significant impact on the organisation through changes in business processes, changes in technology and changes to organisational goals and objectives.

As reflected on by the US National Academy of Sciences in their study on the lack of adequate research on IT and LSCITS, LSCITS in general were deemed "*critical infrastructures*" which means that "they are integral to the very functioning of society and its organisations and that their failure would have widespread and immediate consequences" (National Academy of Sciences, 2000, p.101).

2.6 LARGE-SCALE COMPLEX IT PROJECTS: UNDERSTANDING PERSPECTIVES ON SUCCESS AND FAILURE

Within the IS/IT domain, there are different definitions and categories of success and failures in existence that are applied in the definitions of success and failures of IT/IS projects (Hughes, Rana and Simintiras, 2017; Al-ahmad, et al, 2009; Shenhar, *et al.*, 2001; Lyytinen and Hirschheim, 1987).

In Guah's (2009) view, providing an accurate definition of success and failures in relation to IT/IS projects is always challenging for various reasons. In addition, success and failures are ill-defined and highly subjective, and Al-ahmad, *et al.* (2009) in their research on IT project failure root causes expressed the challenges in the definitions of IT/IS projects by concluding that success and failures are complicated and unstructured perceptions that cannot be easily quantified.

To successfully determine what constitutes success and failures within the IS/IT domain, a universally acceptable definition of success and failure is required. This definition can then be applied to support and inform any research process with regards to providing a framework to help understand the causes of failure and determinants of success. Moreover, this definition is required to help provide a benchmark for measuring success and failures of projects within the IT/IS industry and can be applied by stakeholders and practitioners in the assessment and determinations of the outcomes of their LSCITP initiatives.

2.6.1 Existing Definitions of Success

Success of projects within the IT/IS domain has always been generally perceived as the success of a project in delivering on its specified objectives based on the allocated budget, schedule and required functionality (Aiyer, Rajkumar and Havelka, 2005; Atkinson, 1999).

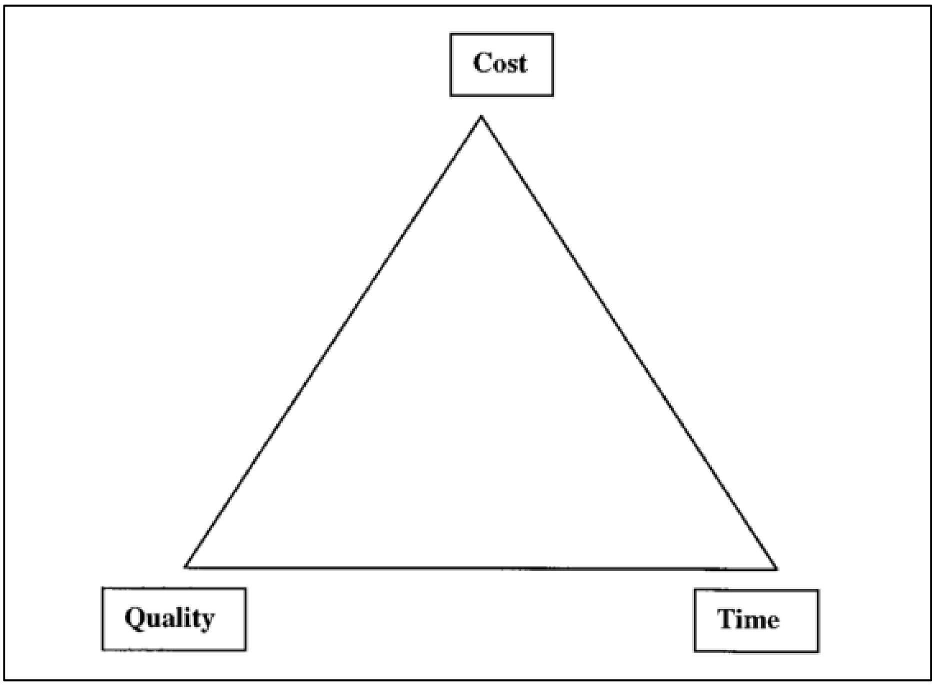


Figure 5: "The Iron Triangle" the common model for measuring project success (Atkinson, 1999).

On the other hand, success has also been viewed more recently as the value derived and the stakeholder satisfaction obtained in a delivered system in meeting specific business needs and providing longer-term benefits even though the objectives of budget, schedule and functionality have not been necessarily met during the implementation of the project (Locatelli, Mancini and Romano, 2013; Atkinson, 1999).

It has been argued that the common criteria for defining IT project success that is widely used in the IT industry which relates to completing projects on time, on budget and meeting required specifications are no longer suitable to be used as a measure of success (Rodriguez-Repiso, Setchi and Salmeron, 2007b; Atkinson, 1999). For example, they argue that meeting design objectives is not necessarily a consideration of success but a contributing factor towards eventual success. Equally, they argue that delivering on time and on budget does not automatically translate to success but rather; it is a key determiner of success. For example, as argued by Shenhar et al. (2001), a challenged project with a record of budget overruns and schedule delays can still recover to become a successful project if it fully satisfies the needs of stakeholders and is fit for purpose.

The challenge with accurately defining success within the IT/IS domain is that "success is a complex concept and its perception is complicated, unstructured and not readily quantifiable" (Rodriguez-Repiso, Setchi and Salmeron, 2007b, p.544). A view shared by Standing *et al.*, (2006, p.1149) who argued that "project success is equally as complex to define as failure". Furthermore, Dalcher (2012) argues that the domain of project management is still struggling to grasp the concept of success in projects.

In addition, individuals and stakeholders within a particular project environment perceive success and failures differently (Hughes, Rana and Simintiras, 2017). Some stakeholders view success as the return on investment minus the cost of implementation and cost of ongoing support and maintenance (Dalcher and Genus, 2003). In addition, given the differences in the size, scale, complexity, purpose and nature of projects, it adds further to the challenges of defining a single measurement view of success (Mir and Pinnington, 2014).

Several models and methods have been proposed aimed at simplifying the understanding, definition and measurement of success in IT projects (Baccarini, 1999). For example, Shenhar, *et al*. (2001) proposes a multidimensional framework for assessing project success by providing different dimensions, perspectives, their meanings and the impact of these on stakeholders based on the nature of the project. Baccarini (1999) proposes a logical framework model for defining project success. According to Shenhar, et al. (2001.), project success can be broken down into four major dimensions which are project efficiency, impact on the customer, direct business and organisational success and preparing for the future. Baccarini (1999) argues that project success is composed of two key areas which are *Project Success* and *Project Management Success*. However, what is clear from the above is that the definition of success is still a challenging concept and how success is measured remains controversial (Buhl and Meier, 2011) and this challenge extends to how to measure it. As Cockcroft (2009, pp.209) puts it, "the success or otherwise of large IS projects is notoriously hard to measure".

2.6.2 Existing Definitions of Failure

Failure within the IT domain has always been perceived as the failure of a project to deliver on its specified objectives based on the allocated budget, schedule and required functionality (Hughes, Rana and Simintiras, 2017). On the other hand, failure has also more recently been viewed as the lack of stakeholder satisfaction in a delivered system with regards to meeting specific needs even though the objectives of budget, schedule and specified functionality have been met in the implementation of the project (Yeo, 2002).

It has also been argued that the common criteria for defining IT/IS project failure is no longer acceptable. For example, Mukherjee (2008) makes reference to a lack of a unified framework to help comprehend the meaning of failures with the IS/IT domain. Lyytinen and Hirschheim (1987), argue that while numerous research exists on the subject of IS/IT failures, the notion of failure itself within the IS/IT context is ill-defined. A view shared by Al-ahmad et al. (2009) who states that the concept of failure has not been explicitly defined and so far, there is no universally accepted definition of failure within the IT/IS domain.

According to Lyytinen and Hirschheim (1987), with regards to IS/IT, failure can be broken down into the major four categories which are *correspondence failure*, *process failure*, *interaction failure* and *expectation failure*. The word failure has different interpretations within different project environments with regards to classifying failed projects, though the widely accepted view of failure in the IT industry is where a project has failed to meet the iron triangle objectives of *cost*, *quality* and *time*. However, failure can also be classified as the lack of stakeholder satisfaction in a system. For example, as argued by Yeo (2002), an abandoned system though fully implemented according to requirements can be deemed to be a failure. In Lindahl and Rehn, (2007)'s argument, they state that a large project that overruns on budget and that faced numerous challenges in its delivery can still be a beneficial project in terms of its outcomes. Thus, they argue that the definition of failure is highly subjective.

While it is evident from literature that failure is a complex and emanating phenomenon within the IT/IS domain in relation to IT projects, there is an additional challenge to define what failure constitutes. An equally challenging aspect is that both success and failure are hard to define within the IS/IT domain (Dwivedi, *et al*., 2014) and the criteria or definitions for success and failure that are applied in the conduct of these various existing research studies on IT project failures are often not clear and exposed to sufficient academic rigour, nor are they openly presented or described in some of the various studies carried out. Additionally, different researchers apply different methods in their analysis of data on successful and failed projects. The lack of consistency in the research approach especially with regards to the definitions of success and failure (Hughes, Rana and Simintiras, 2017) presents a difficulty in understanding the true success and failure rates of IT projects in general.

2.7 THE CHALLENGES OF LARGE-SCALE COMPLEX IT PROJECTS

Across the globe, there are notable examples of challenged LSCITP. As expressed earlier, the challenges leading to the failures of LSCITP bring about severe consequences for all stakeholders involved or connected to the failed project. For example, failures of large-scale IT projects lead to billions of wasted dollars annually as argued by Charette (2005). Across both the public and private sectors, LSCITP are failing far too frequently. LSCITP implemented by public-sector organisations often attract a high profile as a result of the huge public sums and investments applied to them (Kipp, Riemer and Wiemann, 2008). LSCITP also attract a high profile as a result of the impact the systems and technology implemented out of these projects will have on society and the benefits they bring (Zidane, Johansen, and Ekambaram, 2013, Kipp, Riemer and Wiemann, 2008). Generally, LSCITP attracts a high profile mainly due to the increased rate of failures being experienced especially with public sector projects (Brown, 2001).

It has been noted that LSCITP implemented in the private sector do not attract a high profile and attention in comparison with those in the public sector; In Glass (2006)'s argument, this is mainly because the vast amount of failures within the private sector go unreported. However, large-scale IT projects in both sectors suffer the same challenges, difficulties, and experience the same high rate of failures. Regardless of sector, failures of LSCITP severely affect the core business operations of the organisations affected. In Williams (2005), 's argument, failures of LSCITP also lead to financial losses, loss of business, loss of productivity, loss of competitive market share, loss of reputation, etc. for the organisations affected.

The table below lists some of the significant examples of challenged LSCITP implementations from around the world. These specific twelve examples are examples of projects that fit within this research's definition of what constitutes a LSCITP. All projects listed below have IT as a core centrepiece. However, this list is by no means an exhaustive list of all the examples of challenged LSCITP available globally.

#	Country	Project Name	Estimated Cost	Loss Amount	Outcome
1	**United Kingdom**	NHS National Programme for IT (NPfIT)	£11.4 billion	£9.8 billion[1]	Cancelled
2	**United Kingdom**	e-Borders Programme	£1.2 billion	£259.3 million	Cancelled
3	**United States**	Project Everest (Ford Motor Company)	$200 million	$400 million	Cancelled
4	**United Kingdom**	The Libra Project[2]	£146 million	£319 million	Scaled back
5	**United Kingdom**	BBC Digital Media Initiative (DMI)	£81.7 million	£98 million	Cancelled
6	**United States**	21st Century Project (MyCalPAYS)	$373 million	$260 million	Cancelled
7	**Australia**	HealthSMART	$323 million[3]	$556 million[4]	Cancelled
8	**United States**	FBI Virtual Case File (VCF)	$379.8 million	$379.8 million	Cancelled
9	**Canada**	Service Model Transformation (SMT) (Avon Canada)	N/A	$125 million[5]	Cancelled
10	**United Kingdom**	C-NOMIS (The National Offender Management Information System)	£690 million[6]	£155 million	Cancelled
11	**United Kingdom**	Project Jupiter (Centrica PLC)	£ 317 million	£ 183.2 million[7]	Defective
12	**United Kingdom**	ERP Implementation (Avis Europe PLC)	$ 17.7 million	£ 54.5 million	Cancelled

Table **1**: The list of significant LSCITP globally that have been challenged, cancelled and abandoned.

The paragraphs below further explore the projects listed in the table above and provide some background information on these projects, as well as a high-level summary of the overview of

[1] The latest estimated cost forecast of the NPfIT programme by the UK's House of Commons' Committee of Public Accounts (United Kingdom Parliament, 2013).
[2] The Libra contract was modified in 2002 and was significantly scaled down from the original requirements agreed in 1998. The project was not completely cancelled in its entireity.
[3] The Estimated Cost amount stated is in Australian dollars.
[4] The Loss Amount stated is in Australian dollars.
[5] The Loss Amount stated is in Canadian dollars.
[6] The estimated lifetime project cost for the C-NOMIS project.
[7] Estimated losses incurred by Centrica to address the issues and defects in the Jupiter billing system that was delivered by Accenture.

the challenges and the reasons highlighted that led to the abandonment or failures of these projects.

2.7.1 The NHS National Programme for IT (NPfIT)

The NHS's National Programme for IT (NPfIT) project was meant to be one of the world's largest civilian IT system implementation. At the time, it was the largest ever public-sector IT project implementation undertaken in the United Kingdom (UK) (Anderson *et al.*, 2010; Kipp, Riemer and Wiemann, 2008). NPfIT was designed to link, integrate and centralise all of the UK's NHS hospitals and trusts' patient and health information together under one single large-scale, connected IT platform. Amongst the key aims of the system was the provision of centralised information on patient care and to help bring the UK's NHS service into the 21st-century era backed by 21-century technology.

The NPfIT project was deemed to have failed for a variety of reasons. Among the notable reasons given for the NPfIT's failure was that it lacked the right strategy and governance process from the onset and this lack of strategy, governance and control extended to areas such as accountability, management and the effective control of the project. The massive underestimation of the scope and complexity of such a large-scale IT project was also identified as one of its failure factors (Chapman, 2014). The lack of adequate stakeholder engagement (for example the adequate engagement of health trusts, GPs, doctors and other key bodies within the health service) was yet another factor that was identified as one of the reasons that contributed to the NPfIT's demise (Koh and Maguire, 2009).

Other contributing failure factors included the speed at which elements of the project were contracted out to third-party organisations without a complete understanding of the full scope of the entire project and without the completion of a due diligence process.

Failures in the NPfIT's procurement process resulted in IT related issues and challenges during the project's implementation phases. The project also suffered from IT related issues (for example, technology, architectural approach, architectural design, etc.) during the implementation phases and these technology-related issues were contributing factors to the eventual failure of the project. Additionally, the constant changes to the NHS's structure during the life-cycle of the project also had an impact on the project because the project struggled to keep up with the high rate of changes thereby resulting in a negative impact on the NPfIT project. (Brennan, 2007).

The NPfIT project has been described as possibly the most complex and biggest large-scale IT project implementation in the world and the biggest IT project disaster (Nelson, 2007).

2.7.2 The e-Borders Programme (UK Home Office Project)

The e-Borders project was meant to be an electronic IT system designed to help assess and manage travellers coming in and out of the United Kingdom (UK). It was initiated to help place the UK at the forefront of intelligence-led border controls with the application of technology to create a 21st century secure and integrated border. Among the key objectives of the system was the capability to validate travellers' details against specified security databases and help to provide the facilities to electronically collect and transmit passenger information on all individuals entering and leaving the UK.

The e-borders project was deemed to have failed for a variety of reasons. The two major reasons that led to the termination of the project were the poor performance experienced with parts of the system that was already delivered as several quality issues were encountered. The second major reason was regarding the several missed key implementation milestones that were 12 months behind schedule by the project's main contractor Raytheon Systems Limited. Other failure reasons included the poor management and control of the project by the UK Border Agency (UKBA), the government department responsible for the e-Borders project and the failure of the UKBA to learn lessons from similar IT project undertaken in the past. According to the UK Parliament (2010), the report produced by the UK's Home Affairs Committee identified several technology-related issues and challenges that contributed to the failure of the e-Borders project. Issues such as poor requirements analysis, invalid/illegal requirements, poor project management and control and operational difficulties were part of the problems highlighted in the reports produced. The scope of the project was also called into question regarding how realistic it was and whether the requirements for such a large-scale IT system was well understood (Chapman, 2014).

2.7.3 The Everest Project (Procurement System for Ford Motor Company)

In 1999, Ford Motor Company initiated the Everest project that was primarily connected to the implementation of a new large-scale IT eProcurement system to be deployed across the entire organisation and used at its various locations. The Everest implementation was meant to help Ford introduce automation into the entire procurement process and also help to improve existing business processes due to the introduction of new technology (Songini, 2004). The Everest project was also meant to help Ford increase productivity and cut costs by centralising all of its disparate IT procurement systems and creating a single procurement platform.

As common with all large-scale IT projects, the Everest project failed for a variety of reasons. Among the reasons for the failure of the project was the several delays encountered during the implementation of the procurement system due to several missed implementation milestones. Additionally, there were integration challenges with the implementation of the new system as well as with the migration of data from the existing systems (Picchione and Liu, 2007). Other issues related to the poor design of the new system and usability issues were encountered which formed part of the reasons for abandoning the project. Another prominent issue was the constantly rising costs which were escalating rapidly; there was a failure to control costs which rocketed from its original cost estimates of $200 million dollars to about $400 million (English, 2009).

2.7.4 The Libra Project

The Libra project was initiated as a technology solution to help link all magistrate courts in the United Kingdom and provide capabilities for electronic information sharing between the magistrate courts and other law enforcement and criminal justice agencies across the country. The Libra project was initiated due to the inadequacies of the existing IT systems currently being used in the magistrate courts (National Audit Office, 2003).

According to Dalcher and Genus (2003), the Libra project is an example of a high-profile project that suffered from implementation problems. Several factors were responsible for the eventual failure of the Libra project. Among the notable failure factors was the lack of an alignment between the introduction of new technology and the existing business processes of the magistrate courts. This includes the lack of adequate integration of new technology and the goals and objectives of the court's systems as well as the lack of adequate integration with existing processes. Other failure factors include the underestimation of the scope and complexity of the project, a result that meant that the project suffered significant delays which were a contributing factor in its eventual failure. The lack of understanding of the complexity of such a large-scale system implementation, as well as the use of the wrong architecture and integration processes were also factors identified as part of the reasons for the failure of the Libra project (Patanakul and Omar, 2010). Failures were also identified in the procurement process used for the Libra project. Additionally, the department responsible for the implementation of the Libra project failed to learn lessons from previous IT project failures. The Libra project was described as one of the worst IT project disasters and a project that caused a huge embarrassment to the UK government (Denker, 2007).

2.7.5 The BBC's Digital Media Initiative (DMI)

The Digital Media Initiative (DMI) project was a project initiated by the BBC in 2008 to help modernise its production operations and improve creativity and efficiency through the use of modern, innovative and cutting-edge digital production technologies. The DMI project was a technology transformation programme that was meant to transform and digitise the BBC's existing production processes by providing a full integration for video archiving and production amongst others (National Audit Office, 2014).

Notable factors that led to the failure of the BBC's DMI project are identified and noted below. Several factors collectively led to the failure of the project (Glick, 2014; National Audit Office, 2014). According to (Glick, 2014), the lack of adequate stakeholder and end-user engagement and the lack of an alignment between the introduction of new technology versus the existing business processes of the BBC was a constant feature of the failed project. Failures in management along with the poor leadership and governance of the overall project was also identified as one of the DMI's failure factors (National Audit Office, 2014). Additionally, scope creep and constant changes to requirements during the life-cycle of the project also contributed to the failure of the DMI project particularly because the DMI implementation was a very complex system from a technology viewpoint. Inadequate and poor planning, lack of clear requirements definitions, schedule constraints and the lack of full understanding of the scope of the requirements for such a complex system with high risks were some of the other key failure factors identified. There were also challenges for the project from a technology angle mainly to do with the architecture of the system. The DMI project was branded a complete failure by the UK's Public Accounts Committee Chair (UK Parliament, 2014).

2.7.6 The 21st Century Project (MyCalPAYS)

The MyCalPays (now renamed as the 21st Century Project) was a project initiated to provide a new IT payroll system for the state of California in the United States. The objectives of MyCalPays was to provide an IT payroll modernisation system capable of handling the payroll and human resources activities for over 294,000 Californian state employees (IEEE Spectrum, 2013). In addition, the new IT system was meant to improve the management of other payroll related activities such as benefits administration, etc. (California State Controller's Office, 2014). MyCalPays was the largest payroll modernisation project of its kind at the time it was initiated.

Several reasons led to the suspension of the MyCalPAYS project in 2013. Among the reasons attributed to the suspension of the project was that after the delivery of the first (Phase 1) of the project, the delivered system suffered from several significant problems that led to the eventual suspension of the entire project. Among the problems encountered was that the system was unable to function effectively to meet the state's defined payroll requirements. According to California's Legislative Analyst Office (2013), after the first release of the system was delivered, the system was generating problems such as erroneous payroll and pension calculations. The system also produced wrong paycheck deductions. The system also made other erroneous calculations relating to payroll benefits administration. Additionally, the software vendor (SAP) involved in the delivery of the system was struggling to implement the system successfully. The system eventually had to be rolled back and the use of legacy payroll approaches was employed.

California's LAO also cited the lack of expertise and poor project management by SAP as part of the reasons for the termination of the project. The LAO claimed that SAP's project delivery approach was lacking in areas such as planning, change management, quality and in the effective design of the system (IEEE Spectrum, 2013). By the time the project was terminated in 2013, it had incurred costs of around a quarter of a billion dollars and suffered numerous delays.

2.7.7 The HealthSMART Project

The HealthSMART project was imitated in 2003 to help provide a large centralised IT system for the public health services in the state of Victoria in Australia. The new IT system was meant to replace the existing network of disparate health IT systems in use across the different public health establishments in Victoria. In addition, the new IT system was also meant to help provide a modernisation and integration of the new health records system with other health-related systems in the state. Originally intended for completion in 2007, the HealthSMART project suffered from implementation delays, significant cost increases involving an additional $280 million during the course of the project's implementation and it was finally abandoned in 2012.

2.7.8 The FBI's Virtual Case File Project

In 2000, the United States' Federal Bureau of Investigation (FBI) commenced the Virtual Case File (VCF) project, a large-scale software implementation initiative to help introduce automation into the operations of the FBI and provide the capabilities for information sharing, access to information on demand between agents across the United States and information analysis on existing data etc. (Goldstein, 2005). Among the objectives of the system was the introduction of a modernised IT infrastructure along with high-speed networks to help link the various FBI locations with the new systems being implemented (Patanakul, 2014).

The VCF project failed for a variety of reasons. Top in the list of failure factors include the lack of adequate requirements management, the lack of an effective requirements gathering process to gather clear and concise requirements, poor project management, lack of vision by senior stakeholders, unrealistic development schedules and a host of other internal and external factors such as poor planning etc. (Afzal, 2014). Other failure factors attributed to the failure of the VCF project included factors such as the poor and bug-ridden code provided by the application's contractor Science Applications International Corp. (SAIC) (Goldstein, 2005). In addition, the frequent changes to key stakeholders during the project's lifecycle led to problems such as the lack of direction and vision. Additionally, cultural and political issues were also identified as adding to the problems that led to the failure of the VCF project (Laplante, 2014). Afzal (2014) also concluded that the VCF project is considered as one of the notable major IT project failures. According to (Laplante, 2014), the VCF project turned out to be a disaster and a complete failure from all perspectives.

2.7.9 The Service Model Transformation Project (Avon Canada)

The Service Model Transformation (SMT) project was initiated by Avon in 2009 to help the company digitise its consumer experience as well as transform its entire supply chain, improve the procurement process and improve the user experience for its customers amongst other things. The SMT project was based on the implementation of a SAP-based order management system along with other supporting IT systems and applications. The project was cancelled in 2013 due to the negative feedback received from end-users based on the roll-out of the new system in Avon's Canadian business (Securities and Exchange Commission, 2013).

The impact on the outcome of the deployment of the system in Canada was so huge that the planned global roll-out of the new IT system had to be terminated. Among the reasons that led to the termination of the project was that problems were encountered with the real-time ordering and inventory capabilities offered by the new system. Additionally, the user experience was cited as being very poor, and this led to difficulties and complexities in the ordering process rather than the simplification that was expected from the new system. However, some of the vendors involved in the implementation of the system (e.g. SAP) argued that technology was purely not to blame for the termination of the project.

2.7.10 The National Offender Management Information System (C-NOMIS)

The C-NOMIS project was initiated by the United Kingdom's National Offender Management Service (NOMS) in 2004 to help provide the capabilities to track and manage offenders throughout their period of incarceration, probation and rehabilitation. The objectives of the new system were to enable the creation of a single IT system and the use of an integrated approach backed by technology for sharing information, tracking and managing offenders across the prison service in the United Kingdom.

The failure of the C-NOMIS project was down to a number of factors. The National Audit Office (NAO) produced a report on the failed C-NOMIS project and concluded that poor management, oversight and governance from senior management along with the failure to follow standard project management practices were amongst the reasons that led to the failure of the project (National Audit Office, 2009). Other failure factors reported included the fact that the project's technical complexity giving its large-scale nature was not well understood (Patanakul, 2014). According to Dinsmore and Rocha (2012), the C-NOMIS project suffered schedule delays, cost overruns because of the problems and challenges faced.

The C-NOMIS project was already running two years behind schedule at six months to go from its original planned delivery date. Additionally, issues were discovered in the procurement process especially around the way contracts were drawn up, the result of these contract anomalies resulted in difficulties during the project implementation particularly around the ability to bring contractors and suppliers to action. Moreover, the introduction of new technology often forces a change to existing business processes, and the lack of an alignment between the existing business processes of NOMS and the introduction of new technology was also identified as one of the failure factors (Morgan and Dale, 2013).

2.7.11 Project Jupiter by Centrica PLC

Project Jupiter initiated by Centrica PLC in 2002 was meant to be a transformation programme backed by a new IT system to help integrate its Gas and Electricity billing schemes into a single IT system that can support high volumes of billings and billing processes daily. The system was delivered in 2005 and was declared a failure by Centrica PLC as it was unusable and highly defective.

Centrica found the delivered system to be of no use due to the several problems present with the system (English, 2009). One of the many problems cited by Centrica was the fact that the system was unable to process millions of customer bills as expected automatically. According to (Collins, 2009), there were up to eighteen million exception reports generated by the system and manual intervention was required to help resolve these issues before bills could be generated. From a technology perspective, there were several problems with the design and implementation of the system and how the system was integrated. Additionally, the system was reported to be extremely slow and running on inadequate hardware infrastructure.

The consequences of the failure of the Jupiter system led to millions of pounds in losses by Centrica because a large amount of money had to be spent trying to rectify the problems inherent in the system (Charette, 2009). Centrica also suffered losses of its customers who decided to move on to its to competitors as they were unsatisfied with the erroneous bills and the challenges they faced while trying to resolve the billing issues faced.

2.7.12 Avis Europe PLC's ERP Project

Avis Europe PLC initiated the ERP project in 2002; it was meant to be an ERP system implementation that will help improve Avis's business operations globally and increase efficiency through the centralisation of key services and operations and the improvements of existing business processes (Computing, 2004). The ERP system suffered significant delays leading to huge financial losses until its eventual termination in 2004 (Charette, 2005).

Several factors led to the termination of the project. Among these various factors cited was regarding the inadequacies in the design and implementation of the system. The ERP system suffered from significant technical problems and encountered challenges relating to software bugs due to poor code, system integration problems due to lack of interoperability with other legacy systems as well as the poor development quality of the customisations introduced into the system (ComputerWeekly, 2004). In addition, the poor management of the project was cited as also being at fault for the failure of the project. The lack of full stakeholder engagement which in turn led to inadequate requirements definition was also identified as one of the project's failure reasons. Issues such as poor project planning, poor change management processes and the lack of active involvement of key parties were also in the list of factors that contributed to the project's failure (Koh and Maguire, 2009).

All the projects described above across both public and private sectors all exhibit common symptoms such as large size, technological complexity, budget overruns, schedule overruns, poor project management, political complexity, etc.

2.8 THE CAUSES OF CHALLENGES AND SUBSEQUENT FAILURES OF LSCITP

Different research studies have reached different conclusions as to the key causes of LSCITP challenges and failures and according to Al Khouri (2007, p.3), "research to date has found no single explanation for system success or failure". Some researchers attribute the key reasons for LSCITP project failures to be down to the chaos in the process of project implementations and delivery (Abbas and Sanavullah, 2008), others attribute LSCITP failures mainly to technical challenges in relation to size and scale (Philbin, 2008), others emphasise that the high level of complexity inherent is to blame (Patanakul, 2014; Patanakul and Omar, 2010), while others place the blame of LSCITP failures squarely on management and governance challenges (Miller and Hobbs, 2005).

Besides the differences in the key failure reasons, the reasons for LSCITP failures is a view that is shared by the various authors of the existing research that has been carried out so far (Patanakul and Omar, 2010; Al-ahmad, Al-fagih, and Khanfar, 2009; El Emam and Koru, 2008; Lawrence and Scanlan, 2007; Charette, 2005; Yeo, 2002; Murray, 2000; Willcocks and Griffiths, 1994). There is a general consensus that the causes of LSCITP failures are spread out across all the different aspects of the project implementation and delivery processes. According to Lehtinen *et al.*, (2014), Al-ahmad, Al-fagih and Khanfar (2009), these areas include project management, project implementation, project design, and requirements analysis and engineering. Other areas include technology (Nelson, 2007), and the project environment. Brown (2001), on the other hand, suggests that the causes of failures appear to rest on three major factors which are to do with the problems inherent in the software development process, issues relating to management challenges and lack of competencies and lastly, the problems inherent in the processes and procurement methods applied on these projects.

From the analysis of all relevant literature, the factors that influence failures in LSCITP are not limited solely to the size of the project, nor are they limited to the presence of complexities, the high costs involved, nor are they limited to the lengthy implementation durations often associated with such projects. As Buhl and Meier (2011) argue, various factors are responsible for LSCITP failures. The causes of failures in LSCITP are the results of the combination of innovation, technology, complexity, environmental factors, management, cost and human factors. This argument is supported by (Williams, 2005), who notes that the causes of failure of a project are derived from several interrelated sets of factors rather than by a single factor. Philbin (2008) suggests that failures of LSCITP are also influenced by factors such as social causes in addition to technology causes. While Van Marrewijk, A. *et al.* (2008) further strengthen the argument by stating that failures of LSCITP are also characterised and influenced by elements such as instability and uncertainties within the project environments. In particular, large-scale government-related IT projects are affected by social and political factors that affect their successful implementation and delivery in the view of Miller and Hobbs (2005).

Collectively, these various failure factors contribute to what makes LSCITP difficult and challenging to deliver and, as a result, they make such projects very prone to a complete failure. Projects containing the above attributes are bound to fail because, as the size and scale of the project increases, the failure factors are increased and expanded in terms of their impact, and the chances of a successful implementation and delivery decreases in turn. IT projects are difficult to implement and are often a tough undertaking (Al-ahmad, Al-fagih and Khanfar, 2009). These specific attributes inherent in large-scale IT projects is part of what makes them challenging to implement and differentiates them from other engineering projects to a degree. Additionally, these failure factors are often interrelated (Hughes, Rana and Simintiras, 2017), meaning that problems originating from one factor will almost inevitably lead to problems for the other factors. The identified factors also carry a different level of impact and severity, most often, it is the combination of one or more factors that lead to problems of challenges and eventually the failure of a project (Verner, Sampson and Cerpa, 2008; Charette 2005).

Another reason for the failures of LSCITP is because the implementations of these projects are often overdue before they are commenced. This inadvertently reduces the implementation timeframe that is allocated to these projects. The pressures of a reduced implementation time-frame, in turn, has an impact on the outcome of such projects because it forces a tight delivery timescale on LSCITP from the onset (Al-ahmad, Al-fagih and Khanfar, 2009) and it these type of issues that add to the reasons for the increased failure rates being experienced in the IT industry in reference to LSCITP.

The table below shows the failure factors identified so far that have been attributed to LSCITP challenges. These have been aggregated from numerous research literatures on the subject of large-scale complex IT and IS projects (Buhl and Meier, 2011; Nawi, Rahman, and Ibrahim, 2011; Patanakul and Omar, 2010; Schmidt *et al.*, 2001; Al-ahmad, Al-fagih, and Khanfar, 2009; El Emam and Koru, 2008; Lawrence and Scanlan, 2007; Charette, 2005; Yeo, 2002; Murray, 2000; Willcocks and Griffiths, 1994).

Failure Factors	Source/Author
1. The use of new or immature technology 2. High use of disparate technologies 3. Lack of understanding of technology/technology integration 4. Poor system architecture 5. Lack of proper integration and compatibility between new and existing systems 6. Abstract requirements 7. Design errors 8. Poorly defined requirements 9. Poor system architecture 10. Ambiguity in the discernment of requirements and objectives 11. IT supplier problems 12. External pressures 13. Issues with external contractors 14. Changes to key stakeholders and stakeholder conflicts 15. Lack of relevant large-scale project management experience	Buhl and Meier, 2011; Nawi, Rahman, and Ibrahim, 2011; Patanakul and Omar, 2010; Schmidt *et al.*, 2001; Al-ahmad, Al-fagih, and Khanfar, 2009; El Emam and Koru, 2008; Lawrence and Scanlan, 2007; Charette, 2005; Yeo, 2002; Murray, 2000; Willcocks and Griffiths, 1994

16. Poor change management 17. Lack of adaptation to change/technology 18. Lack of proper planning 19. Unrealistic schedules 20. Lack of "end-user" involvement and engagement 21. Poor communication 22. Lack of "single" project owner 23. Lack of adaptive project management processes 24. Lack of a competitive bidding process 25. Failures in the procurement process 26. Poor management of the large numbers of mutually dependent tasks and related activities 27. Significant changes to project scope 28. Inadequate budget and poor budget management 29. Cross-functional and geographically distributed teams 30. Complex interactions 31. Failure to comply with project management standards 32. Human errors 33. Complex requirements 34. Project size 35. Requirements volatility 36. Number of third party/external entities involved 37. Lack of understanding of complexity 38. Shorter implementation time-frames 39. Delays due to external circumstances 40. Inaccurate estimates	

Table **2**: The list of LSCITP failure factors.

Failures of LSCITP bring about severe consequences for the entities and organisations involved. In the private sector, it leads to financial losses, loss of competitive advantage, loss of business opportunities, loss of profitability and loss of productivity (Keil and Montealegre, 2000) and the possible demise of an organisation (Buhl and Meier, 2011). In the public sector, failures lead to a waste of public funds and bring about severe consequences (Kipp, Riemer and Wiemann, 2008). Due to the challenges inherent in managing these large-scale projects, the end result is often that of a failure to achieve set objectives and goals or a complete failure of the project.

2.9 COMPLEXITY AND LARGE-SCALE COMPLEX IT PROJECTS

An examination of the challenges inherent and the reason for failures of LSCITP cannot be fully addressed without examining and understanding the subject of complexities. Understanding project complexity and how such complexity is managed is very important especially in a large-scale project environment (Baccarini, 1996). According to (Brockmann and Girmscheid, 2007), research into complexity in large-scale projects focus too often on the complexity of tasks.

However, there are other angles of complexity that needs to be explored. Besides the focus on task complexity, other complexity categories include social complexity, organisational complexity and cultural complexity.

IT projects of today are becoming increasingly complex (Cristóbal, 2017; Philbin, 2008) and the reasons for the presence of complexities needs to be examined and addressed (Cristóbal, 2017; Haider and Haider, 2012). Addressing complexity is important because according to (Baccarini, 1996), within large-scale project environments, complexity acts as one of the critical project dimensions. Denker (2007, p.559) argues by stating that, "complexity in large-scale IT systems is an area that is insufficiently understood". Complexity is one of the key dimensions that significantly overpowers a project and brings about the introduction of uncertainties and risks and other related elements. Understanding and managing complexity does not eradicate complexity on a project but helps to increase the chances of success for a project by helping to increase the support for the management and understanding of such projects (Bosch-Rekveldt, *et al.*, 2011). As Patanakul (2014) states, the complexity level of a project has now been identified as one of the root causes of problems on LSCITP implementations and one of the reasons why they end up failing.

According to (Vidal and Marle, 2008), "Complexity is everywhere and is continually growing, with an increasing pace". Within the IT projects domain, this is no exception. Complexity is often talked about, and it is now a constant phrase that is being applied continuously to describe challenging and difficult IT projects. However, despite the numerous conversations about complexity, there has not been much of an acceptable or generalised definition of what complexity really means within this context (Cristóbal, 2017; Haider and Haider, 2012; He, *et al.*, 2009; Vidal and Marle, 2008; Sinha *et al.*, 2001).

For this research to understand complexity and identify complexity factors and categories within the context of LSCITP, a definition of what complexity constitutes is required. The reason for the need for clarity as to what complexity means within large-scale project environments is because, the term *complexity* can mean different things within the same domain let alone between different domains (Cristóbal, 2017; Morel and Ramanujam, 1999; Baccarini, 1996). The term complexity is used within the context of large-scale projects without much regard for its significance or what it represents.

To give an example, difficult projects are often misinterpreted as complex projects, but they are not necessarily complex projects. Additionally, complicated projects are also misconstrued as complex projects, but these are also not necessarily complex projects. A complicated or difficult project can be described as projects that are difficult to understand initially due to the presence of a large number of components, systems, sub-systems, dependencies and interdependencies and dynamic interactions, etc. within the project environment, but subsequently easy to understand once the initial difficulty in understanding the system being implemented is overcome. However, complex projects are said to be complex because of the high number of components, systems and sub-systems and the high number of dynamic non-sequential interactions, coupled with dependencies and interdependencies between components etc. present within the project environment that then makes the system difficult to understand, predict and control (Haider and Haider, 2012; Williams, 2005). It is for this reason that a clear distinction and definition needs to be established regarding what complexity really means within LSCITP environments.

Based on the aggregation of several definitions of complexity, along with the dictionary definitions of what complexity constitutes, Baccarini (1996) proposes an appropriate definition of complexity within a project context which refers to complexity as a project that is:

> "consisting of many varied interrelated parts and can be operationalized in terms of differentiation and interdependency" (Baccarini, 1996).

However, Vidal and Marle (2008) have also conducted research to understand project complexity within the domain of project management further. Using and applying various definitions of complexities from related literature, along with their understanding of project complexity from the research they carried out, they propose a definition of project complexity that is defined as such:

> "Project complexity is the property of a project which makes it difficult to understand, foresee and keep under control its overall behaviour, even when given reasonably complete information about the project system. Its drivers are factors related to project size, project variety, project interdependence and project context" (Vidal and Marle, 2008).

This research uses the above definition of complexity as the lens by which it addresses and analyses complexity, complexity factors and the complexity categories they fall under within the context of LSCITP. This includes providing recommendations for managing and dealing with complexities and how to increase the chances of success of large-scale project implementations.

Complexities in LSCITP can be fuelled by different sources (Haider and Haider, 2012; Murray, 2000) or even possibly by a single significant source. Each complexity factor has an influence on a large-scale project resulting in different outcomes. These complexity factors range from requirements complexities, design complexities, complexities in the implementation process, complexities in the project's organisational structure, complexities as a result of a project's domain, and even complexities as a result of economic or market influences (Haider and Haider, 2012; Abbas and Sanavullah, 2008). Xia and Lee (2004) add to the above argument by stating that complexity is the result of several factors including technological and organisational factors as well. In addition, constant changes in requirements and resources over the life-cycle of a project are yet another reason for the introduction of complexity into the project environment (Heaton, Skok and Kovela, 2016).

These various complexity factors identified can be mapped to one or more complexity categories (Vidal and Marle, 2008). For example, in the work of Baccarini (1996), he identifies that technology and organisational complexity are some of the categories containing a set of factors that contribute to a project's overall complexity.

From the extensive literature review conducted on the topic of project complexity, the key complexity factors are identified. This research then produces a table of the project complexity factors identified from several literature sources (Haider and Haider, 2012; Bosch-Rekveldt, *et al.*, 2011; Vidal and Marle, 2008; Xia and Lee, 2004; Murray, 2000; Williams, 1999; Baccarini, 1996). This information is provided in the complexity factors table shown below. Furthermore, each of the complexity categories identified and the relevant key factors among them is then further analysed and discussed in the paragraphs below.

Key Complexity Factors	Source/Authors
1. End-System architecture 2. High number of components 3. Number of component interdependencies and interrelations 4. High number of disparate technologies in Use 5. Lack of technological expertise 6. Flaws/maturity of technology 7. Changes in local and global economy 8. Ecological factors 9. Changes to vendors, partners and third-party Entities 10. The Number of External Parties/Vendors 11. Political Changes 12. Legal Changes 13. The Use of Complex Methodologies and Frameworks 14. The High Volume of Decision Making 15. Design Errors 16. The High Number of Cross-Functional Teams 17. The Large Number of Third-Party Entities	Haider and Haider, 2012; Bosch-Rekveldt, *et al.*, 2011; Vidal and Marle, 2008; Xia and Lee, 2004; Murray, 2000; Williams, 1999; Baccarini, 1996

18. The Shared Decision-Making Process 19. The Project Duration 20. Schedule Dependencies 21. Resources 22. Budget 23. Quality 24. Complex Interactions 25. Changes in Key Project Stakeholders 26. Differences in Stakeholder Views & Expectations 27. Lack of Relevant Experience 28. Abstract/Lack of Clear Requirements 29. Constantly Changing Requirements 30. Complex Requirements 31. Numerous Changes to Project Scope	

Table **3**: List of complexity categories factors identified.

As can be seen from the table above, large-scale projects are complex for a variety of reasons (Abbas and Sanavullah, 2008; Murray, 2000). To begin with, they are complex because they are always connected to the implementation and delivery of complex systems and secondly; they are complex because the purpose and objectives of these large-scale IT systems is to provide a solution to address an existing complex problem. According to Williams (1999), a project implemented to solve a complex problem will normally be tagged as a more complex project. The complexity inherent in most large-scale projects has contributed significantly to the abandonment of such projects, in other cases, it has led to the delivery of solutions that do not meet requirements (Bar-Yam, 2003). Furthermore, the presence of complexity leads to an incomplete understanding of the problem being addressed or the incomplete understanding of the problem domain. The biggest impact of complexity often falls on time and cost to a large-scale project. As stated by Baccarini (1996), complexity not only impacts a project from a time and cost perspective, but it also hinders a project from successfully achieving its goals and objectives because; the presence of complexity complicates the entire process of clearly understanding and mapping out a project's requirements and objectives. The levels of complexity as identified above means that it is almost impossible to successfully implement and deliver LSCITP successfully without adequately addressing these complexity factors.

Another cause of complexity in LSCITP is due to the high number of systems and sub-systems involved within the overall system. These systems and sub-systems normally include a high number of components, and the components, in turn, include interdependencies, etc. This high level of systems, sub-systems, components and interdependencies along with the need to understand the responsibility and relationships between these components are one of the major reasons for the introduction of complexity on large-scale IT system implementations. According to Williams (1999), when interdependencies between the components present within a system are complex, a greater level of complexity is added to the project. Adding to the above, there is also the complexity of the processes, frameworks and methodologies used in these large-scale projects environments as they also introduce another layer of complexity to a large-scale project. To simply put, large-scale projects are complex systems (He, *et al.*, 2009). Because these projects are large-scale, different project management processes, methodologies and frameworks are often sought and used across the various phases of the project implementation. These processes themselves carry some form of complexity to a certain degree. There are other factors that also introduce complexities on large-scale IT projects besides the issue of interdependencies. LSCITS in general often include complex requirements, some with a high degree of challenges and about 90 percent of these requirements are often incomplete when defined. Even in instances where a large percentage of the requirements are complete, they tend to be poorly defined or abstractly defined.

Technology is yet another factor that brings about the introduction of complexity in LSCITP projects. Most large-scale IT systems make use of a host of existing and emerging technologies that have to be integrated and interoperable. This need for integration and interoperability introduces complexity. This complexity is introduced because a high level of risk is created by the need to have all the different technology platforms and systems connected and integrated together as a whole single system using an organised approach in order to function collectively with the goal of meeting specified requirements. Complex systems are rarely designed and implemented by a single entity (Faulconbridge and Ryan, 2003); they are often implemented by a large number of entities working on different parts of the overall system. These separate implementations are then integrated together to produce the intended end-system. In large-scale projects, multiple organisations or teams work concurrently and collectively on the project to achieve intended objectives. This brings about a potential cause for complexity because a change to the deliverables of one team can have a significant impact not only on the team's objectives but have an impact that cuts across the objectives and deliverables of all the other teams involved in the project.

The size of a project is another complexity factor. When projects increase in size, this increase in turn raises the probability of an increase in the errors, issues and problems that can occur in the project (Love *et al.*, 2011). The size of a project can be linked to a level of complexity inherent on such project, as noted by (Vidal and Marle, 2008; Jolivet and Navarre, 1996), the size of a project is one of the factors that introduce complexity. For example, during the life-cycle of a large-scale project, the project size is expected to grow from the initial size estimates. This growth is as a result of all the changes and refinements of requirements that the project goes through to meet the defined end requirements and also for the project to fulfil its required objectives. This constant growth in size intensifies complexity. Apart from having an impact on complexity, this constant growth in size also has an impact on other areas such as budget and duration, etc. Giving an already large size combined with the expected growth in size, it becomes extremely hard to identify all of the relationships, the behaviours and all the dependencies between all of the components within such system. This difficulty in identifying all the possible interdependencies and interrelations brings about the introduction of complexity to the project.

Constant changes to requirements bring about one of the biggest complexity challenges on large-scale projects. In any project environment, changes to requirements are inevitable. However, in large-scale project environments, these inevitable changes are significantly higher in volume due to the size of the project. The effects of this high volume of changes are one that cascades through all parts of the entire project. Changes bring about an impact to a particular part of the project. This change in turn impacts another area of the project and the chain continues in the form of a cascading effect. The number of changes required to a system and the number of other systems that will be affected by such changes are factors of project complexity (Williams, 1999). The end result is that high volume of changes has an impact that cuts right across all facets of the project. This is because, the process of requirements analysis works completely different in large-scale systems compared to normal sized systems. In addition, the process of identifying and documenting the requirements on a large-scale project is always a learning process. This means that requirements are learned over time, they are not known in advance. As progress is being made on a large-scale project implementation, so is the corresponding progress that is being made in the learning of the project's requirements and how they continuously need to be adapted to effectively meet the goals and objectives of the system that is being implemented.

Large-scale systems involve a high number of key stakeholders with different view and expectations or misaligned expectations (Tanaka, 2014). The size of an organisation coupled with the size of the project has an impact on the decision-making process by the stakeholders concerned. This creates a complexity challenge of its own (Buhl and Meier, 2011). Multiple stakeholders have different expectations and views. The stakeholder list on large-scale IT projects are often exhaustive and can include business owners, specific public bodies, organisations, clients, business owners, project teams etc. The number of key stakeholders involved in a project means that complexity is introduced into the project (Williams, 1999). Having multiple stakeholders intensifies complexity in a large-scale project because every stakeholder involved in the project will try to influence the project based on their own objectives and interests.

The size of the project teams involved in a large-scale project implementation is also significantly higher in comparison to normal sized projects. This increase in the size of resources brings about an increase in the volume of interactions required. The high volume of interactions required, coupled with the high number of resources operating within the project environment creates complex interactions. Complex interactions are challenging to manage and control and add to the issues of complexities in these large-scale project environments.

2.10 EXAMINATION OF SUCCESS AND FAILURE FACTORS

As part of the process of investigating the challenges and failures of LSCITP, it is worth examining the critical success and failure factors present within these large-scale project environments that have a significant impact of the outcome of these large-scale projects. Documenting a list of the critical success and failure factors allows for the opportunity to comprehensively assess the factors identified, and to better understand the degree at which each of the factors identified, when not properly addressed, affects the ability to implement and deliver LSCITP successfully. They are called success and failure factors because in simple terms if they are addressed appropriately, a project significantly increases its chances of success. Where they are not addressed appropriately, then a project significantly increases its chances of failure. According to Yeo (2002) and Linberg (1999), these factors below are part of the factors that have been identified as having the ability to significantly increase or decrease the likelihood of success on a project. Various factors are responsible for IT project success and failures with factors having a form of relationship with one another (Lehtinen, *et al.*, 2014), and this is no exception in large-scale IT project environments.

From the extensive literature review conducted, the following factors represent the list of key problems and issues found to be behind the reasons why IT/IS and major IT/IS projects become challenged, why they experience difficulties, end up being complex, and why they eventually fail. These factors are part of the problems that lie at the root causes of IT/IS project failures, and they have been extracted from the analysis of existing research into IT/IS projects of significant sizes across the globe. These existing research cover project failures that have been analysed from 1994 to 2014. The table below lists the key failure factors behind the failures of IT projects in general order by year from the earliest to present.

#	Source/Authors	Country (s)	Year	Causes of Failures

1	(Willcocks and Griffiths, 1994)	Singapore, France, Germany, India, United Kingdom	1994	• Lack of strategic framework, or conflicts over strategy • Lack of organisational adaptation to complement technological change • IT supplier problems and general immaturity of the supply side • Poor management of change, with particular neglect for its implications for organisational and project structure, processes and culture • Too much faith in the "technical fix" • Lack of skills to support implementation
2	(Whittaker, 1999)	Canada	1999	• Poor project planning • A weak business case • Lack of top management support and engagement • Schedule overruns • Use of unproven technology • Poor project estimation and unrealistic schedules • Vendor/Third party commitment issues • Lack of risk management
3	(Murray, 2000)		2000	• Unrealistic project scope given the available resources and project development experience • Improper management of scope creep, the continuous expansion of the project scope • New technology that is critical to the project has not been previously developed • The organisation's issues are not understood • Custom work is needed for the organisation's business activities
4	(Yeo, 2002)	Singapore	2002	• Underestimation of project timeline • Weak definitions of requirements and scope • Inadequate project risk analysis • Ambiguous business needs and unclear vision • Lack user involvement and inputs from the onset • Poor internal communication • Absence of an influential champion and change agent

				• Underestimation of project scope and complexity • Changes in design specifications late the project • Inappropriate choice of software or technology
5	(Charette, 2005)	United Kingdom, United States, Australia	2005	• Unrealistic or unarticulated project goals • Inaccurate estimates of needed resources • Badly defined system requirements • Poor reporting of the project's status • Unmanaged risks • Poor communication among customers, developers, and users • Use of immature technology • Inability to handle the project's complexity • Sloppy development practices • Poor project management • Stakeholder politics • Commercial pressures
6	(Lawrence and Scanlan, 2007)	Global	2007	• Poor initial planning • Lack of clear objectives and deliverables • Lack of understanding of dependencies • Inadequate resource allocation • Poor risk analysis • Poor change management • Lack of "buy-in" from stakeholders • Poor understanding of priorities
7 **8**	(El Emam and Koru, 2008)	Australia, Canada, India, United Kingdom, United States	2008	• Senior management not sufficiently involved • Too many requirements and scope changes • Lack of necessary management skills • Over budget • Lack of necessary technical skills • No more need for the system to be developed • Over schedule • Technology too new; didn't work as expected • Insufficient staff • Critical quality problems with software • End users not sufficiently involved

9	(Schmidt *et al.*, 2001; Al-ahmad, Al-fagih, and Khanfar, 2009)	2009	• Lack of top management commitment to the project • Misunderstanding the user requirements • Not managing change properly • Failure to gain user commitment • Lack of adequate user involvement • Conflict between user departments • Changing scope and objectives • Number of organisational units involved • Failure to manage end-user expectations • Unclear / misunderstood scope and objectives • Improper definitions of roles and responsibilities • Lack of frozen requirements • Introduction of new technology • Lack of effective project management skills • Lack of effective project management methodology • Lack of required team knowledge/skills • Insufficient/inappropriate staffing
10	(Patanakul and Omar, 2010)	2010	• Lack of clear requirements • Lack of stakeholder involvement • Lack of understanding of complexity • Lack of understanding of complexity, architecture and integration • Lack of senior responsible owner and process • Lack of proper process and response plan • Lack of proper process and methodologies, project manager, and competency • Poor perception, relationships, and oversight

Table **4**: The list of IT/IS project failure factors.

Besides the specific factors of LSCITP challenges and failures identified so far, the review of literature also identified other less specific factors. For example, LSCITP are also being challenged and are encountering difficulties due to lack of vision or foresight from key project stakeholders. Similarly, the misalignment of project objectives versus organisational objectives is yet another less common area that has been identified as playing a key part in the challenges of LSCITP.

According to Buhl and Meier (2011), this misalignment in project versus organisational objectives is influenced by factors such as the misalignment between the key stakeholders due to the differences in their goals, objectives and expectations from such projects. Al-ahmad, Al-fagih and Khanfar (2009) for example described the implications of the lack of clear objectives as having an eventual impact of schedule, cost and functionality and any impact to schedule, cost and functionality contributes significantly to a project being in a challenged state. Putting a project in a challenged state increase the chances of that project failing.

The high levels of volatility in the project environment is yet another factor identified as impacting the implementation and successful delivery of LSCITP because within LSCITP environments, the size, scale and complexity inherent means that such projects will inadvertently experience high levels of volatility across all facets of the project. In a study of volatility and its impact of IT projects, Sauer, Gemino and Reich, (2007) identified two types of volatilities, namely *target volatility* and *governance volatility*. Target volatility refers to the numerous unavoidable changes that will come into play during a project's life-cycle that have an impact on the outcome of the project. Governance volatility refers to the numerous changes to stakeholders, project management teams, sponsors and business owners. Such volatility is often not properly anticipated by project management teams, but they have a significant impact on the outcome of such projects.

Among the list of other factors affecting the outcomes of LSCITP are unexpected events such as economic risks that emerge during the implementation phases of a project. Large-scale projects have large budgets and the continued funding of these projects is often connected to economic performance or profitability. Such risks can affect the project's budget and lead to cost overruns or ultimately the termination of a project (Fridgen, *et al.*, 2014).

2.11 SUMMARY

The review of existing literature in this chapter explored the context and subject of IT/IS and LSCITP project failures, examined key areas, defined key terms and identified a number of factors. The study highlighted the importance of understanding the LSCITP context, particularly with regards to understanding the drivers for LSCITP, the need for LSCITP, the types of LSCITP, and the examination of the history of their failures and successes across multiple industry sectors including the effects of the performance and failures of LSCITP on stakeholders.

In digging deeper, the CSFs for IT/IS initiatives were explored, understood and extracted to build a comprehensive list of all identified factors. Equally, the study explored and highlighted the factors behind the challenges and failures of LSCITP and the causes of challenges and failures. Besides the factors presented, other interesting factors were also explored such as the lack of contingency planning and exit strategies, anticipation of unexpected events and major shifts in the expectations of clients and key stakeholders identified as contributory to negative LSCITP outcomes.

The subject of complexity in the context of IT/IS and LSCITP was explored to identify scholarly thinking and define complexity appropriately with regards to LSCITP particularly in the context of the study and identified complexity factors.

The examination of various schools of thought on the definitions of success and failures was carried out to understand and highlight the differences on views and opinions and to formulate a definition of success and failures.

The study highlighted a research gap in the detailed understanding of the specific attributes of the CSFs for IT/IS initiatives with regards to the various underlying causes inherent in those factors. The review also highlighted the lack of detailed research into LSCITP particularly focusing on and examining the challenges being faced by LSCITP.

CHAPTER 3

Literature Review – Project Management

3.1 INTRODUCTION

This part of the literature review focuses on the project management perspective and the challenges of managing large-scale complex IT projects (LSCITP) within the project management domain by providing an exposition of existing research related to the topic of project management within large-scale project environments. Within this context, this chapter also focuses on understanding the differences between LSCITP and large-scale complex engineering projects (LSCEP), how they are managed and also on the understanding of the various outcomes of both projects and why LSCEP appear to be more successful than LSCITP.

3.2 THE PROJECT MANAGEMENT PERSPECTIVE

The project management perspective including the value of project management are a key area in any study on the causes of challenges, and failures of projects and mega projects within any industry domain (Mir and Pinnington, 2014; Zhai, Xin and Cheng, 2009; Müller and Turner, 2007; Thomas and Mullaly, 2007; Williams, 2005; Munns and Bjeirmi, 1996). It is a key area because the role of project management needs to be understood and its relevance elucidated to adequately assess its criticality to project success and outcomes. As Winter, *et al.*, (2006, p.638) notes, project management "is now the dominant model in many organisations for strategy implementation, business transformation, continuous improvement and new product development". This means that projects are not only the mechanisms being used for the activities described above which also includes organisational restructuring, transformation and implementation initiatives and the development of new solutions, products and services but projects are also the mechanisms being used for realising these initiatives (Heaton, Skok and Kovela, 2016) with the objectives of gaining competitive advantage (Grant and Pennypacker, 2006). Bredillet (2008) argues that an understanding of project management as a complex discipline is required and essential because project management in reality deals with managing complexities, uncertainties, and ambiguities and these are attributes that are manifested in large-scale project environments.

The review of existing literature points to a gap in the knowledge requirements for managing large complex projects (He *et al.*, 2009) and researchers within the domain of project management and complexity have called for more studies to help understand how complex projects can be better managed and implemented (He *et al.*, 2009; Williams, 1999). In reference to LSCITP, Kipp, Riemer and Wiemann (2008) argue that the understanding of the particulars of these projects and the effects they have on management, implementation and research is still very limited.

The importance of examining the success and failures of LSCITP from a project management perspective is highly important because too much attention is given to issues such as complexity, technology and innovation in large-scale complex project environments with little attention paid to the project management processes that deal with their management, implementation and delivery (Fan, 2010) including the kwnoledge integration and governance processes required. To better understand a project and its association to project management, the definitions of a project and project management are provided below.

> "A project is a unique, transient endeavour, undertaken to achieve planned objectives, which could be defined in terms of outputs, outcomes or benefits" (APM, 2018).
>
> "Project management is the application of processes, methods, knowledge, skills and experience to achieve the project objectives" (APM, 2018).

From the above definitions, it is clear that there is a distinction between a project and the management of such project. Projects are complex problems that project management is applied on (Munns and Bjeirmi, 1996). Projects are composed of an internal structure that includes elements such as resources, tools, deliverable requirements and many more (Vidal and Marle, 2008) and they use a particular set of methodologies and frameworks to enable the fulfilment of their objectives (Vidal and Marle, 2008). The functions of project management, on the other hand, are to help guide a project to a successful outcome while following a structured process. This is done to ensure that projects are delivered on time, within budget and that such projects achieve their intended objectives and deliver expected results (Guah, 2009). Additionally, the objectives of any project and programme management function that is connected to the delivery of large-scale complex systems should be to help ensure that, the systems are no more complex than they need to be, cost-efficient, simple to implement and that they deliver efficiency, fulfil their objectives and meet the needs of stakeholders.

Within the project management domain, one of the challenges faced by project management teams is how to effectively manage the successful implementation and delivery of LSCITP as they bring about " new challenges in the field of project management" (Guah, 2009, no pagination). In spite of the advances in the project management domain resulting in new methodologies, frameworks, processes and tools, the poor performances being experienced with projects has not improved (Mir and Pinnington, 2014; Venugopal, 2005).

There is no doubt that the management of these large-scale projects presents numerous challenges with varying levels of complexities on different fronts. The definition applied to

LSCITP in *Chapter Two*, *Section 2.3* provides an indication that the management of large-scale projects is a process that comes with significant challenges (Zhai, Xin and Cheng, 2009) especially around the issue of dealing with increased size and scale (Flyvbjerg, 2014) and also in dealing with uncertainties, including political sensitivity and the involvement of multiple stakeholders with diverse views (Patanakul, 2014). Today, modern project management challenges not only include the understanding of complexity and how complexity is managed but extend to areas such as the understanding of human factors, organisational factors, environmental factors, cultural factors and political factors. Challenges also include the understanding of areas such as stakeholder management, legal, social as well as behavioural factors (Goparaju, 2012).

From an IT/IS perspective, the environment in which project management is practised has changed in the past decades (Somanchi and Dwivedula, 2010). At the heart of the requirements to successfully manage the implementation and delivery of LSCITP are knowledge requirements, expertise and significant experience within the domain concerned. Bredillet, (2008) strengthens this argument by highlighting the importance and criticality of knowledge-based management processes within the domain of project management. Similarly, Kipp, Riemer and Wiemann (2008) argue that effectively managing and successfully delivering LSCITP requires a complete and precise understanding of the particulars and characteristics of such projects. In addition, successfully managing and implementing LSCITP means ensuring that these projects are on track and that they remain so throughout the duration of the project. Additionally, it involves ensuring that the projects remain strategically aligned to their mission and objectives, the goals and objectives of the organisation or the business environments to which they are connected.

Rapid advancements in technology also introduce further challenges in the management of large-scale technology projects (Durney and Donnelly, 2013). This is exacerbated by the significance of IT in achieving business goals and the importance of IT to the continued relevance of an organisation and as such requires the creation of project management techniques that are more sophisticated and efficient at addressing these challenges (Tesch, Kloppenborg and Frolick, 2007). Effective project management is heavily linked to the success of large-scale and complex projects, however, as Zhai, Xin and Cheng (2009) argue, there is also a lack of understanding regarding the extent of the value and the impact of project management on large-scale projects.

3.2.1 The Challenges of Managing Large-Scale Complex IT Projects

In the last few decades, projects have become larger and more complex (Williams, 1999) and they are becoming more challenging to manage as a result. The rise in IT project complexity has been linked to the constant advancements of technology, the complexity of technology itself, technical complexity including "cultural, social and organisational factors" (Heaton, Skok and Kovela, 2016, p.295) and also as a result of the increase in the size and scale of IT projects being undertaken. According to Fridgen, *et al.* (2014, p.1), "complexity itself is intensified by dependencies within one or between different projects and processes and is boosted even further by the growing number of large complex IT projects". Technical complexity refers to the combinations of various factors, the first being the huge number of tasks involved, secondly, the level of interdependencies between the various tasks and finally, the uncertainties within the environments in which these tasks are based (Jones and Deckro, 1993). This means that the complexity of a project is reflected in the manageability of the project (Heaton, Skok and Kovela, 2016).

Tanaka (2014), attributes further project management challenges with LSCITP for example, political, economic, social, technological, legal and environmental factors each fuelled by complexity mainly in the hard systems industry. However, these attributes are also synonymous with LSCITP within the IT/IS domain, especially on large-scale public-sector IT projects (Miller and Hobbs, 2005). Adding to that is the challenges of managing the high number of stakeholders involved and the resulting relationships that develop in large-scale IT project environments. Additionally, project management teams today are also faced with the increasing pressure of how to implement and deliver LSCITP on time and within budget while dealing with issues of shrinking budgets and reduced implementation time-frames. These pressures also have an impact on the outcome of a project where they result in a negative impact or outcome.

Furthermore, part of the challenges attributed to large-scale project management today is that in most large-scale project environments, multiple organisations (for example public-sector and private-sector based organisations) are responsible for the implementation and delivery of the different parts of a large-scale system being implemented (Patanakul 2014; Van Marrewijk, *et al*. 2008; Hassan, Maccaffer and Thrope, 1999). Such implementations often involve a host of contractors, suppliers, consultancies and other third-party vendors and organisations all working in tandem on meeting the goals and objectives set by a group of key stakeholders. The presence of a high number of disparate entities working in alliance to achieve the project objectives can be described as a "dynamic social network" (Miller and Hobbs, 2005) or as Xie and Liu (2010), puts it, a "virtual enterprise". The major challenge here is that when a high number of entities are involved, it leads to significant problems and challenges within the "virtual enterprise". Examples of problems include (but are not limited to) issues such as isolated work implementations, lack of collaboration and cohesion, competition between various entities, lack of a standardised approach to implementation and delivery and many more (Heaton, Skok and

Kovela, 2016). Furthermore, these various entities are often too independent in their implementation approach and there tends to be a lack of collaboration and engagement between all the different organisations involved. This includes issues of vested interests (Van Marrewijk, *et al*. 2008).

In addition, every organisation or entity involved in an LSCITP implementation follows a different process in delivering their respective solutions or deliverables. For example, different organisations might follow different project management processes or methodologies that are internal to their respective organisations. While this is not a problem in itself, there is the danger that organisations might be far too disconnected from the overall central project processes of the project being implemented. Central project processes are the governing processes for all the different work streams in a large-scale IT project and a disconnect from a project's central processes could lead to significant problems in a large-scale project environment.

Another management challenge with LSCITP is that when problems are encountered within the project environment, the process of identifying and implementing a resolution to address the issue is quite often complex. For example, issues identified during project implementations will most likely need to pass through a large number of the organisations and entities involved to identify the organisation(s) responsible for dealing with the issue before eventually coming to rest with a single organisation or a number of organisations. In addition, these organisations will often need to work in collaboration to provide a resolution to the problem. Furthermore, problems and issues discovered during the implementation phases take time to resolve, due to the number of entities operating with the project environment. Failures of LSCITP are also caused by the increase in the levels of uncertainty within a project management environment that is increasingly becoming more dynamic (Fridgen, *et al.*, 2014).

Ineffective governance has also been identified as one of the key challenges in large-scale project management. Most large-scale projects lack the appropriate governance structures that should help set-up the framework by which the goals and objectives of the project are to be achieved (Miller and Hobbs, 2005). The lack of an effective governance structure means that a large-scale IT project will lack the pertinent levels of performance oversight including the management of relevant risks. A lack of effective governance results in an impediment to project success (Willcocks and Griffiths, 1994).

More importantly, the poor management of large-scale IT projects has been identified as one of the major challenges and one of the key factors behind the widespread failure rates being experienced within the IT industry. At the core of the issues in most large-scale IT project failures are fundamental mistakes. Poor management refers to fundamental mistakes in project management with issues such as unrealistic timetables, unrealistic objectives, lack of adequate knowledge of the project being implemented, lack of relevant skill sets, lack of cooperation between implementation partners and third-party organisations involved, constant rethinking of requirements, internal politics and many more topping the list of failure causes (Venugopal, 2005). The above arguments are supported by Al-ahmad, Al-fagih and Khanfar (2009) who note that the organisation and the management of large-scale IT projects by organisations is often done in a chaotic and undisciplined fashion. Any shortcomings in any of the areas above will almost certainly result in a negative impact on the project and such an impact could lead to the failure of the management of the project.

Venugopal (2005) identified other project management challenges by arguing that the way the goals and objectives of large-scale IT projects are viewed could be part of the problems that lie at the root cause behind the high rate of failed large-scale IT project implementations. Tanaka (2014), goes on to suggest that research on project management has not been moving at the same speed as the rapid growth being experienced with large-scale projects and technology, and proposes a set of frameworks for effectively managing the implementation and delivery of large complex projects. With regards to the above, Haider and Haider (2012), also agree with Tanaka by expressing the opinion that these constant problems and challenges being experienced with LSCITP means that a new approach to managing and implementing large-scale projects is required.

There are those within the IT industry who hold the belief that the failures of large-scale complex IT projects can be avoided by specifically following existing well-proven project management practices (Denker, 2007), new system architecture models and frameworks or by following specific methodologies targeted at large-scale complex IT systems (Philbin, 2008). Part of the reasons for this belief is that quite often, the failure of projects is down to human involvement. Human involvement encompasses a host of reasons such as the failure to follow proven best practices and proven project management processes and procedures. The view is that if human errors are eliminated then all projects will be successful. Fridgen, *et al*., (2014) argues that IT project failures can be avoided or mitigated when the symptoms of failures are discovered early, and this discovery helps to provide a more insightful management of such projects. Charette (2005) shares similar views by stating that the failures of these system implementations are avoidable and predictable because the causes of failure are known.

All of the above issues and challenges identified have an implication of the successes of LSCITP (Fridgen, *et al.*, 2014). Because of the rapid advancements in technology, the project management domain has to continuously evolve at the rate of the pace of change in technology. Particularly because the rapid advancements in technology create a unique challenge in that it creates a constantly moving target for implementation and delivery teams during the implementation life cycle of LSCITP. Managing technology has now become a critical element for every organisation (Winzker and Pretorius, 2009). Constant changes in technology are inevitable and are predicted to be more intense in the future. Operating within an environment that is witnessing rapid technological advancements will bring about failures (Iansiti, 1995) particularly where knowledge mobilisation efforts lag behind the pace of technology change. For the project management domain, a failure to continue to advance, innovate and adapt to a continuously changing technology domain will result in problems of chaos from a management perspective (Winzker and Pretorius, 2009).

Since LSCITP are critical to organisational goals and objectives, the management and successful delivery of these projects is equally critical (Pennypacker and Grant, 2003). Tesch Kloppenborg and Frolick (2007), goes on to argue that the management of a project is more critical than any other aspect of such project. The conclusion from these various arguments is that the management of LSCITP must be treated with the same level of criticality as the project's organisational goals and objectives.

3.2.2 Limitations of Traditional Project Management Methodologies

Traditional project management processes are being blamed for being responsible for the failures of LSCITP from a project management perspective (He, *et al.*, 2009). The view within the IT industry is that traditional project management methods are too structured in their approach to managing large-scale projects and these processes are unable to adapt to managing projects in the highly dynamic environment that IT requires (He, *et al.*, 2009). According to Fan (2010), the limitations and problems of traditional project management processes and their application to LSCITP are to blame for the failures of these large-scale projects. The same view is shared by Hidding and Nicholas (2009) who in their research attribute the root causes of failures in IT-intensive projects to the traditional project management process. Similarly, Koh and Maguire (2009) noted that the use of these widely recognised project management methodologies (traditional project management processes) within the IT domain has not led to an improvement in the implementation and delivery of projects by highlighting the weaknesses of traditional project management methodologies. Tanaka (2014) goes on to highlight these weaknesses with traditional project management methodologies by listing out the specific issues that make their application to large-scale projects challenging. These issues include scalability, dealing with multiple stakeholders with multiple views, complexity, dealing with constantly evolving technology and dealing with uncertainties and multiple objectives. Managing the high levels of risk associated with large-scale projects is another area that is inadequately addressed by traditional project management processes (Miller and Hobbs, 2005).

In a paper published by Rozenes (2011), the effects of standard project management methodologies on project performance were tested. The findings reveal that project performance improves when non-traditional or systematic approaches are applied to manage projects (Rozenes, 2011).

3.2.3 The Changing Landscape of LSCITP Management

There are several project management bodies of knowledge, standards and methodologies in use today, from publicly available methodologies such as PRojects IN a Controlled Environment (PRINCE2), Project Management Institute's Body of Knowledge (PMBok) (Cooke-Davies, Schlichter and Bredillet, 2001), the APM Body of Knowledge, the International Standard Organisation ISO 21500:2012 standard on project management (International Standards Organisation, 2012) to bespoke methodologies developed and used by large private organisations. These project management methodologies are widely used by organisations of all shapes and sizes and across all industry sectors for the management and delivery of projects to prevent failures and ensure success (Rozenes, 2011; Patel, 2009). Additionally, large organisations also develop enterprise-wise delivery methodologies and project management processes to support project management teams with the aim of successful project delivery. The need for methodologies, especially within the IT/IS domains, is to introduce a level of discipline into the already complex systems development process that is often associated with IT-related projects (Koh and Maguire, 2009).

Over the past few decades, advancements have been made within the domain of project management including greater integration with systems engineering through the introduction of new processes, frameworks, methodologies tools and techniques and enhancements made to existing project management processes (Venugopal, 2005; (Emes, *et al*., 2014; Ewusi-Mensah, 1997; Jolivet and Navarre, 1996). Additionally, the project management sector is constantly working on and actively seeking ways to improve the maturity of the project management processes (Grant and Pennypacker, 2006; Pennypacker and Grant, 2003). Within the IT/IS domain, new methodologies have been developed for managing the implementation and management of

IT and large-scale IT projects. Methodologies such as Agile, Scaled Agile and associated variants are commonly used within the IT domain. One of the core principles of methodologies like Agile is to view organisations and their associated processes as complex adaptive systems that deal with constantly evolving requirements (Venugopal, 2005). However, there have been some doubts as to whether these agile methodologies can be applied effectively on LSCITP. One key argument is that in large-scale project environments, it is impossible to react to every single change due to the size of the implementation at hand. Reaction to changes should rather be targeted at major changes otherwise reacting to every change might have a severe impact on the implementation of the project (Venugopal, 2005).

In the study by Emes, *et al*. (2014), an effort was made to incorporate the set of experiences gained based on the collective knowledge, insights and understanding gained from the successful implementation of space projects into a set of guiding principles in project management and systems engineering that can be applied to the management of projects across other industry sectors. In the study, five key principles were identified that encapsulated the key findings and they reflect a set of generic principles that can be applied to project endeavours in other domains such as IT and systems engineering. The principles are listed and summarised below (Emes, *et al.*, 2014):

- **Principle #1** - Principles govern process - focuses on the facilitation of systems engineering and its management via the development of processes and describes the risks of overdependence on processes including addressing the need for the understanding of the principles that support such processes and the need for principles to be experience driven.

- **Principle #2** - Seek alternative systems perspectives - focuses on the need to explore a wide range of system perspectives, including complexity and the need to understand the connected human factors and the need to gain understandings from solutions to previous endeavours as well as the need to embrace and adapt to changes within a dynamic environment.

- **Principle #3** - Understand the enterprise context - focuses on the need to understand the contextual properties of the environment (e.g. objectives and constraints) that are connected to an undertaking including the understanding of the internal and external environments.

- **Principle #4** - Integrate systems engineering and project management - focuses on the overlay between systems engineering and project management addressing areas such as the need for the cohesiveness of management structures including the need for understanding the differences of methods between engineering and management.

- **Principle #5** - Invest in the early stages of projects - focuses on the need for early investments in the front end of initiatives for example, the proper investment of resources before and during the implementation stages, the sequencing of implementation activities and the decision-making processes early in the implementation lifecycle that is supported by detailed and sufficient information.

The high rate of continued IT related project failures have opened up several angles of debate as to whether existing traditional project management methodologies are best suited for managing the implementation and delivery of projects or whether these project management methodologies offer added value at all (Rozenes, 2011); a more interesting debate was on whether these traditional methodologies are suited to the management and delivery of LSCITP.

3.3 INFORMATION TECHNOLOGY VERSUS ENGINEERING

LSCITP are very similar to other large-scale complex engineering projects (LSCEP). According to (Kipp, Riemer and Wiemann, 2008), LSCITP shares similar characteristics with related LSCEP. Similarities such as size, cost, duration, criticality and impact are just some of the common aspects associated with megaprojects in both domains. According to Dingsøyr *et al.*, (2018, p.491), "large-scale projects or programmes are also fraught with challenges in other industries such as infrastructure, construction, water, and energy". However, some of the challenges faced within these two related industries regarding the management and implementation of large-scale projects differ. LSCITP tend to deal with major challenges from a technology perspective mainly because of the involvement of software while LSCEP tends to deal with engineering-related challenges (Rodriguez-Repiso, Setchi and Salmeron, 2007a; Zwikael and Globerson, 2006).

Examples of LSCEP projects include complex constructions, infrastructures, major civil engineering works, complex buildings, plants, and many more (Hassan, Maccaffer and Thrope, 1999). Examples of LSCITP include national healthcare IT systems, national pension/ welfare IT systems, IT systems built to support space missions, IT systems for air traffic control, IT systems built for major defence initiatives and IT systems (ERP, SCM, etc.) built for large multinational organisations. Other examples include large IT systems for on-line analytical processing (OLAP) and large data warehouse IT systems.

The discipline of software engineering is also very similar to other engineering disciplines, and many of the principles of engineering apply across all similar engineering domains. According to The Free Dictionary (2015), the term engineering is defined as:

> "The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems" (The Free Dictionary, 2015).

With the definition of engineering above, software engineering can thus be defined as:

> "The systematic design and development of software products and the management of the software process (Mills, 1980). Software engineering is said to involve the whole process of software implementation and delivery including hardware and software engineering, systems engineering and systems integration engineering" (Mills, 1980).

Software engineering is applied as a core part of the implementation processes of LSCITS particularly projects involving large complex and challenging software implementations. The primary objectives of software engineering are to ensure the development and implementation of reliable software products that meet specifications, to ensure that software products are developed on time and on budget, etc. (Mills, 1980). The implementation approaches in all engineering disciplines including software engineering are not only similar, but they also include similar sets of engineering principles and practices. However, despite these similarities, there are some aspects of software engineering that are different from other engineering practices. The major difference is in the nature of IT and the newness of the technology itself in comparison to engineering technology. As Rodriguez-Repiso, Setchi and Salmeron (2007a, p.583) put it, "IT projects contain a greater degree of novelty than other engineering projects". These differences warrant a study to understand how these software engineering differences and the degree of difference from other engineering disciplines. Moreover, it also enables a better understanding of the impact these differences have on the implementation outcomes of LSCITS.

3.3.1 Major Differences between LSCITP and LSCEP

Existing research has shown that there are differences in the way projects are planned and executed within the engineering and construction domains when compared with the IT domain. For example, Zwikael and Globerson (2006) through their research on the benchmarking of project planning and success in selected industries identified that the quality of planning is much higher in the engineering and construction industries. Differences have also been identified through research in the levels of expectations from engineering and construction projects when compared with the expectations from similar IT projects. Additionally, engineering projects tend to be more structured; they are mostly visible and operate in less volatile environments than comparable IT projects. These are just some of the several significant differences between engineering and construction projects and IT projects and are explored further below. These differences are possibly behind the reasons why engineering and construction projects are much more successful than similar sized IT projects. However, given how IT is rapidly transforming and changing the dynamics of society, and the ever-increasing reliance on IT, these differences have made IT projects much more liable to issues of risks and failures compared to any of the other industry domains (Yeo, 2002).

Building large-scale and complex IT systems is a very complex engineering process, especially for large-scale IT systems that involve high volumes of software development and the production of IT artefacts. A major cause of this complexity is that most LSCITP have a high percentage of software implementations as part of the core deliverables on such projects (Hewagamage and Hewagamage, 2011; Iacovou and Dexter, 2004). Software and how it is implemented is, therefore, one of the key differentiating factors between large-scale engineering and large-scale IT projects.

Software is a key differentiating factor in LSCITP because of issues such as invisibility, abstractness, complexity, conformity and changeability (Brooks, 1987). Most LSCITS involve heavy software implementations compared to similar engineering and construction projects. They, therefore, inherit some of these characteristics, which ultimately makes software-oriented projects complex and challenging and differentiates them from other engineering projects (Goparaju, 2012). Software by nature is invisible and abstract (Hewagamage and Hewagamage, 2011) and it this issue of invisibility and abstractness that not only forms one of the major differences between engineering/construction projects and large-scale IT projects but it plays a huge part in the eventual outcomes of LSCITP. According to Brooks (1987), the nature of software means that it will always be a challenging process to implement with no silver bullet that can dramatically simplify the process and Abbas and Sanavullah (2008), concur that the software industry has now realised that there is definitely no silver bullet that can guarantee a 100 percent success rate as a result of the nature of software. Adding to that, "despite 50 years of progress, the software industry remains years perhaps decades short of the mature engineering discipline needed to meet the demands of an information-age society" (Gibbs, 1994, p.87). Though this view was expressed over two decades ago, the current view is that the software industry has moved on from the above conclusions with regards to its maturity levels.

Invisibility is an issue for LSCITP because as software is hard to see visually, it becomes hard to measure or size, and, as a result, it becomes hard to monitor visually or control. On the other hand, similar size engineering or construction projects will have development components that are much more visible, for example, where engineering structures can be defined and constructed (i.e. bricks and mortars, pillars, steel beams etc.) and they remain visible throughout the project cycle as the implementation progresses to be measured, sized, visually monitored and controlled etc. As Venugopal (2005) notes, building software differs significantly from building a bridge. Software is much more abstract and, as a result, the concept of visual sizing and implementation visibility does not exist with software. The lack of visibility of software complicates the efforts of sizing, managing, measuring and visually controlling software projects accurately.

Additionally, software artefacts are virtual, and software in itself is not inhibited by physical limitation or restrictions. This leads to the view that the possibilities and opportunities presented by software technology are limitless (Denker, 2007; Brooks, 1987). Such perception often leads to unrealistic expectations or unrealistic project implementations that produce negative outcomes.

The opportunities presented by engineering are often limited by physical constraints and this is yet another major difference between engineering and IT projects (Denker, 2007; Brooks, 1987). Additionally, there is a perception that lines of code in a software program are much riskier than steel and beams in an engineering project.

Another fundamental difference between LSCITP and large-scale engineering and construction projects can be seen from the perspective of scaling. Scaling-up in large-scale engineering and construction projects is usually demonstrated through the expansion in the size of the existing components. This could be achieved, for example, by significantly increasing the size of a building under construction or by adding more physical expansions to an ongoing construction project, or in the example of a bridge construction project, by increasing the length, width, etc. In LSCITS, scaling up takes an entirely different approach. With software, scaling it not necessarily a process that requires an increase in the sizes of existing software components but rather, it is a process that requires an increase in the number of components, systems and sub-systems and an increase in the number of interactions between these disparate components (Brooks, 1987).

Adding to the list of major differences between large-scale engineering and construction projects and LSCITP is the issue of changeability. Software is heavily pressured into changes because software systems are designed to anticipate changing needs. However, engineering and construction projects are not designed as such. Software by nature makes it very easy to introduce changes to the system under development both during and after the conclusion of the development phase (Denker, 2007). In contrast to engineering and construction projects, in most cases changes cannot be easily introduced once construction or implementation has begun. Engineering and construction projects are rarely changed once the development process has begun or when it is completed. Changes to engineering or construction projects where required tend to come in the form of extensions to an existing construction in the case of buildings or the development of new versions of systems that contain the required modifications especially within the manufacturing and automotive industries (Brooks, 1987). As a result, engineering and construction projects do not suffer much from the issue of challenges, difficulties and failures in relation to the introduction of constant changes during the implementation cycles. The changeable nature of software is behind the reasons leading to challenges and eventual failures in LSCITP especially those involving large software implementations (Denker, 2007).

Another major difference between large-scale engineering and large-scale IT projects is in the areas of complexity. Complexity is a challenge to most large-scale projects based on the numerous research carried out on large-scale project complexities (Bosch-Rekveldt, *et al.*, 2011). However, the differences between engineering and IT projects centres on how complexity is measured. While engineering and construction project complexity might normally be measured from the perspective of size and scale, software project complexity is measured by the possible number of states that a software program will go through during its execution life-cycle, rather than by the size of the software code alone (Brown, 2001).

There are other general differences between IT and engineering. These differences relate to how LSCITS are deployed and used in comparison to how LSCECP are deployed and used. For example, software systems can be deployed and used in different environments once implemented (Goparaju, 2012). However, most engineering and construction outputs cannot be reused in this way. While the designs and concepts of both IT and engineering can be reused, only IT outputs can be reused. This factor alone demonstrates the fundamental difference between IT and engineering.

From a project management perspective, research has also shown that there are differences in certain aspects of project management especially the front-end of projects and the overall management of such projects between the engineering and construction industries and the IT industry (Zwikael and Globerson, 2006). These differences also extend to areas such as planning as Zwikael and Globerson (2006), identified that the increased level of quality in the project planning process of engineering and construction projects played a significant role in enabling those projects to reduce cost and prevent schedule overruns.

Furthermore, the professionalism and levels of experience of LSCEP and LSCITP practitioners have been identified as a major difference that also plays a significant part in the understanding of implementation outcomes. For example, the levels of professionalism of LSCITP practitioners was identified as a possible contributory factor to the set of challenges being experienced with the management and implementations of LSCITP this is according to a study by the Royal Academy of Engineering (2004), where the level of professionalism that was observed in the software engineering domain was much lower than that observed in other branches of engineering.

3.4 SUMMARY

The overall review of the extensive body of literature examined the challenges and failures of IT and LSCITP in detail through the examination of various aspects such as the drivers for LSCITP, the examination of specific LSCITP, the different types of LSCITP, the critical success factors, the examination of failed LSCITP, the complexity challenges, the project management processes, the management challenges, and the comparisons of the challenges within the IT/IS domain with similar industry domains such as engineering. The extensive review spanning the domains of IT, IS, software engineering, complex systems, project management and management provided theoretical and empirical evidence and presented opportunities to gain a detailed understanding of the phenomena under study and also helped to identify limitations. The knowledge gained from existing studies has helped to address and close out some of the research objectives mapped out earlier.

To begin with, the review found limited global studies being conducted on LSCITP as part of the efforts to establish a global perspective on the challenges and failures of LSCITP. The available research on LSCITP were largely based on specific contexts for example, they were based on specific geographies, industries and focused on specific LSCITP types.

The examination of the research context provided extensive causes of IT project failures and limited causes of LSCITP failures and the review also identified the extensive set of factors for IT projects and limited sets of factors for LSCITP. As part of the review process, the key factors that are challenging LSCITP were identified however, these were limited due to the number of limited studies carried out which meant that the extensive set of key factors that help to improve or hinder the delivery of LSCITP were unclear. The review also established knowledge areas for large complex projects however, it did not find clear and established critical knowledge areas contextualised for LSCITP. Furthermore, the existing literature provided a broad view of all areas of large complex project management that were also deemed applicable to LSCITP. The review also identified several views and reasons on the value drivers for LSCITP but could not establish the set of specific reasons for the value delivery failures of LSCITP. In understanding the application of existing project management methodologies and their impacts on LSCITP outcomes, the review identified gaps on whether the use of specific project management frameworks and methodologies could be used to prevent or improve the challenges of LSCITP, address complexities and assess their specific contributions to improving LSCITP outcomes.

Finally, the review provided extensive and detailed outcomes on large-scale projects, the study identified the lack of detailed similar corresponding research into LSCITP specifically and particularly those centred on LSCITP successes. The majority of existing studies focused heavily on LSCITP failures. Thus, the gap highlighted included the need for further studies aimed at addressing both LSCITP success and failures collectively. Furthermore, the review identified that the domain of LSCITP is rapidly changing and the challenges and failures increasing furthermore as a result, to that end, the gaps identified coupled with the dynamic and rapidly changing nature of the LSCITP domain indicates that this remains an area for future research to address existing, ongoing and future challenges.

From the volume of reports and the existing research studies examined on the topic of technology project failures, it is clear that a fundamental problem exists regarding the ability to manage, implement and deliver LSCITP successfully. The conclusions from these various studies and reports all produce similar results that indicate that the failure rate of large-scale IT projects is still very high in comparison to the success rates. These results also indicate that more and more large-scale projects run into difficulties and are severely challenged. The majority of these existing studies focus heavily on identifying the problems connected with the failures of these projects but with very little focus on providing solutions and recommendations to mitigate these problems. Furthermore, the domain of project management is seen in some of the reports to be inadequate at managing and controlling the complexities and dealing with all of the challenges inherent in the implementation and delivery of LSCITP (Somanchi and Dwivedula, 2010; McManus and Wood-Harper, 2007).

CHAPTER 4

Research Design and Methodology

4.1 INTRODUCTION

This chapter focuses on the research philosophy, design and the methodology that was used for conducting the empirical part of this research study based on the research aims and objectives outlined in *Chapter One*. This chapter explains the research methodology, the methods, approaches and procedures applied and how the research was carried out. The chapter includes the reasons behind the selection of the research methodology, the data gathering processes used as well as the processes used to analyse and interpret the data gathered.

4.2 RESEARCH AIMS

Any research project to be carried out requires a methodological direction with regards to the proposed research design and research methods based on the goals and objectives of the research study. Before touching on the research methodology, it is worth revisiting the aims and objectives of the study to ensure that they are well understood. As Toledo-Pereyra (2012) states, understanding the questions posed by a research is critical in order to determine the critical parameters that should be added to the research design process.

The objectives of this study are to examine the challenges and factors that influence the failures of LSCITP by undertaking a review of the emblematic syndromes of failures of LSCITP and examining the reasons why LSCITP run into difficulties, why they become challenged and why many eventually fail. The principal objective is to understand why the majority of LSCITP become challenged, why they encounter difficulties and why most fail to achieve their intended objectives and eventually fail to deliver value for their stakeholders. The research objective also includes understanding the key factors responsible that hinder successful outcomes for LSCITP and to be able to compare the results obtained from the study with findings from a theoretical perspective.

4.3 RESEARCH QUESTIONS

The understandings gained from the review of existing literature and the gaps identified helped to refine and shape the formulation of the research question. The detailed and methodical review of existing literature helps to understand existing research within the area of study, helps to further refine the research questions and research objectives, helps to identify gaps in existing literature and also helps to identify recommendations for further research including helping to gain knowledge on research approaches and strategies (Saunders, Lewis and Thornhill, 2009; Gall, Gall and Borg, 2006).

Based on the research gaps identified and the research problem, the primary research question that this study looks to answer is:

> *What are the challenges to the successful delivery of LSCITP, how can they be avoided, and why do most projects fail to meet their original objectives?*

In light of the research question posed above, the following sub-research questions were developed, and they assisted in guiding the study towards addressing the fundamental research question raised:

Sub-RQ1: *What are the key factors that help to improve or hinder the management, implementation and delivery of LSCITP?*

Sub-RQ2: *What are the challenged knowledge areas on LSCITP that stakeholders and practitioners need to be aware of?*

Sub-RQ3: *Why do the majority of LSCITP fail to meet their original objectives?*

Sub-RQ4: *Do specific project management methodologies and their application to the management, implementation and delivery of LSCITP help to improve the successful outcomes of LSCITP?*

Answering these questions will require the detailed examination and analysis of several LSCITP. The questions posed by this research will be addressed through the conduct of the case studies and through the analysis of the data gathered from the expert interviews on real-world LSCITP.

The detailed understanding of the aims and objectives of the research based on the activities carried out in the preceding chapters of this study helped to lay a solid basis for which the data gathering aspect of the study was conducted effectively and efficiently. In Toledo-Pereyra's (2012) view, a good research strategy helps to pave the way for the collection of accurate data that is required for a study. The understanding of the research objectives also helped to put in place an effective data collection strategy which was achieved through a thorough understanding of the makeup and the depths of the problem under study aided by the critical analysis of relevant literature and other research activities that were carried out in the preceding phases of this research project.

To successfully explore and understand the challenges and failures of LSCITP, it is extremely important to explore and understand the complex relationships between large variable sets. From the extensive literature review conducted, it was evident that to adequately address and answer the questions posed by the research, multiple methods of data gathering will be required spanning a large variable set. In addition, as part of the research strategy process, an analysis was performed to establish whether the study is predominantly quantitative or qualitative in nature. LSCITP are by nature complex projects and any attempt at understanding the challenges they face that lead to their eventual failure requires a rich data set that allows for a thorough analysis and deeper-level understanding of the various factors at play that affects and prevents them from achieving a more successful outcome. Analysing and understanding such factors requires several methods of data capture from different data sources including the study of the phenomenon in a real-life environment.

The diagram below shows the structure of the design of this research study.

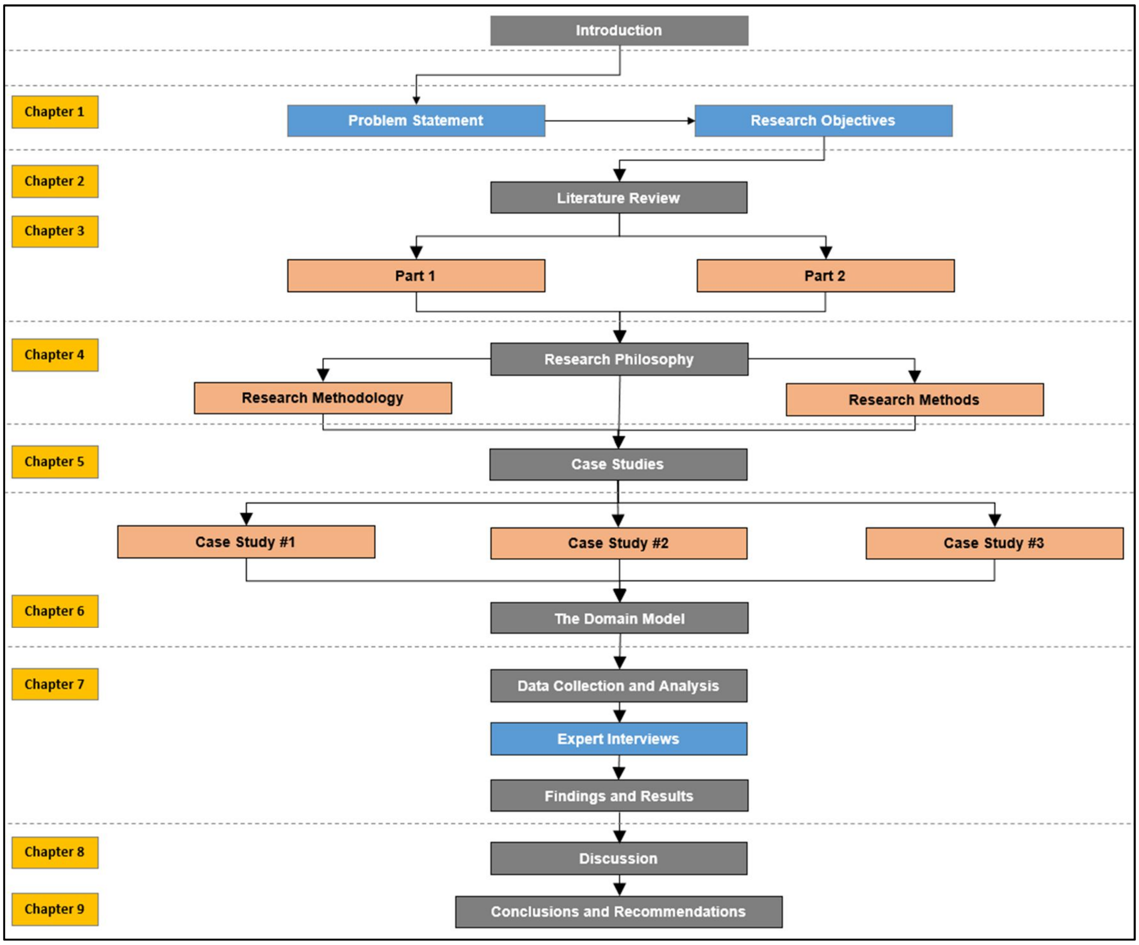


Figure **6**: The overview and structure of the research study (Source, Author).

4.4 RESEARCH PHILOSOPHY

Research philosophy refers to the development of knowledge and the nature of that knowledge (Saunders, Lewis and Thornhill, 2009). In a research study, before focusing on the research strategy and design it is important to focus on the research philosophy as a first step so that the appropriate research paradigm can be selected and applied (Wong, 2014; Eriksson and

Kovalainen, 2011; Guba and Lincoln, 1994). This is because the adopted research philosophy includes critical assumptions that includes the belief system, and these subsequently impacts the research design and methods used in a study as they are closely linked together (Eriksson and Kovalainen, 2011; Saunders, Lewis and Thornhill, 2009). Furthermore, the selection of a research philosophy is also dependent on the nature of the research questions being addressed by a study (Saunders, Lewis and Thornhill, 2009).

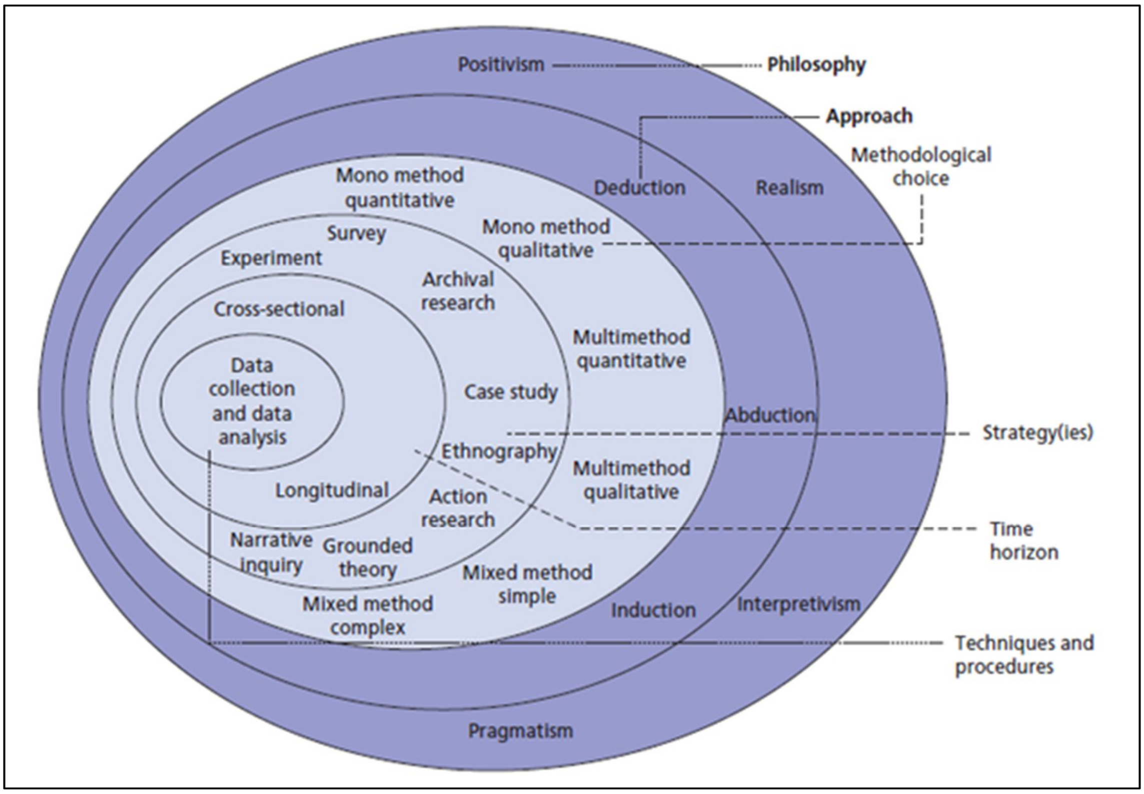


Figure 7: The research onion studied to understand research philosophies and approaches (Saunders, Lewis and Thornhill, 2009).

A research paradigm is defined as "the basic belief system or worldview that guides the investigator not only in choices of method but in ontologically and epistemologically fundamental ways" (Guba and Lincoln, 1994, p.105). The research paradigm refers to "a way of examining social phenomena from which particular understandings of these phenomena can be gained and explanations attempted" (Saunders, Lewis and Thornhill, 2009, p.118). Research paradigms are essentially conceptual frameworks within which research is carried out (Healy and Perry, 2000).

As part of the research process, a key required step is the selection of the research paradigm to be applied (Wong, 2013) as they help to guide the research process. There are four dominant scientific research paradigms in existence that could be applied to aid a research process and they are *positivism*, *constructivism*, *critical theory* and *realism* (Wong, 2013; Healy and Perry, 2000) or *positivism*, *realism*, *interpretivism* and *pragmatism* (Wong, 2014; Saunders, Lewis and Thornhill, 2009). In addition, these paradigms are defined by the following elements *ontology*, *epistemology* and *methodology* (Wong, 2013; Eriksson and Kovalainen, 2011; Healy and Perry, 2000). These specific attributes provide a view of how knowledge is viewed, the perception of the researcher in relation to the knowledge and the methodology or approach by which the knowledge is subsequently uncovered or discovered.

According to Wong (2014), the majority of these paradigms centre on qualitative and quantitative approaches. This research study is based on the *interpretivism* paradigm. According to Eriksson and Kovalainen (2011, no pagination), the interpretivism position is focused on "how people, as individuals or as a group, interpret and understand social events and settings". Studies based on this philosophical position are more focused on human actions, furthermore, preconceptions are used to assist with the research process and such process involves the interactions of the researcher with the human subjects (Walsham, 1995). Interpretivism is also amongst the common research frameworks applied by researches within the IT/IS domain in the study of system failures (Goldkuhl, 2012; Mukherjee, 2008; Walsham, 1995) though other philosophical paradigms such as critical realism and positivism are also being used (Wynn and Williams, 2012).

The reasons for the selection and use of the interpretivism paradigm as the preferred paradigm includes the fact that the study is primarily focused on increasing the understanding of a particular phenomenon within a specific setting. In the context of this study, the objective of this study is to examine the challenges and factors that influence the failures of LSCITP by undertaking a review of the emblematic syndromes of failures of LSCITP and examining the reasons why LSCITP become challenged and why many eventually fail. In addition, the study seeks to examine the challenges of LSCITP against the knowledge, opinions and insights of LSCITP practitioners and experts, thus, requiring their views, perspectives, opinions and judgement on the subject matter. To that end, a qualitative research approach that has a philosophical basis primarily in the interpretivism paradigm is deemed suitable for the study. The study's objectives align principally with the philosophical beliefs that underlines the interpretivism paradigm. Furthermore, within the IT/IS domain there have been arguments made (Goldkuhl, 2012) that the interpretivism and pragmatism paradigms are suitable research paradigms to support research within the IT/IS domain and have been widely used in previous research studies on IT/IS failures (Goldkuhl, 2012; Mukherjee, 2008).

4.5 RESEARCH DESIGN

The research design provides the necessary strategy for a research study. A research design encapsulates the processes for data collection, analysis, interpretation and presentation (Wong, 2014; Saunders, Lewis and Thornhill, 2009) and according to Cantrell (2011), it provides a view of how the set of required activities will help to provide the required answers to the research questions. In Hammond and Wellington (2103)'s view, research design is the process of turning a research study into a manageable project. There are several research design processes in existence and the selection and application of the appropriate research methodology is a critical and fundamental part of any research study (Panacek and Thomoson, 1995). Selecting the appropriate research design not only aids the research process but rather as noted by Hedrick, Bickman, and Rog, (1993), it is crucial because of the effect the design has on the credibility, usefulness and feasibility of a study. According to Toledo-Pereyra (2012), once the aims and objectives and the questions to be addressed in a study have been outlined and understood, the research design then represents a crucial step in how the research study is organised and planned. Another equally important aspect is the philosophical perspective. A research design provides a plan on how to move off from the starting point to the end point of a study and as argued by Bahna and Conrad (2009), it is the starting point and fundamental part of any research process.

It is also worth pointing out that there are significant differences between the research methodology and the research method. The research methodology focuses on the logical structure of research study which includes the definition of the various components of the study, including the research questions, the analysis process as well as the verification and validation methods to be applied amongst others while the research method focuses on the data collection approach and the analysis of the data gathered (Saunders, Lewis and Thornhill, 2009). In short, methodology deals with the kind of data that is to be collected while method deals with how the data is to be collected (Hammond and Wellington, 2013).

The selection and application of a research methodology have implications on the results obtained and on the analysis of such results. The selection of the right research method will enable a study to gather the data that is required to answer the fundamental questions posed by the research. More importantly, the selection of a research method has to be appropriate and suitable based on the nature of the research questions being addressed by the study. Moreover, finally, a thorough description of the methodology and design strategy applied in a study is crucial to be able to validate the outcomes of the research. This process also helps to support the research outcomes by making sure that a research is reputable, unambiguous and coherent (Glanville, 1999).

According to Saunders, Lewis and Thornhill, (2009), the choice of the right design is always down to the research questions being answered. Therefore, the selection of the research methods for this study was primarily driven by the nature of the questions being addressed by the study as well as other considerations such as the phenomena under study, the type of data to be gathered through an assessment of the quantitative or qualitative nature of the study, including the availability of the data to be gathered and the availability of required resources.

In light of the above, this study makes use of the descriptive research design. Descriptive studies help to provide an accurate and realistic view of the phenomena being studied. Descriptive research designs help to provide the how, when and why answers about a phenomenon (Burns and Grove, 2005). In this research context, the use of the descriptive research design is to help provide an accurate and a more complete view of the challenges and failures of LSCITP, the factors influencing failures and why LSCITP fail far too often.

4.6 DATA COLLECTION

Data represent the raw materials in a research project, and such data needs to be gathered and extracted from a subject so that it can be analysed, interpreted and refined to produce relevant outcomes and reach required conclusions (Walliman, 2006). Aided by the research questions, this study makes use of different methods for data collection for example, through the use of interviews and case studies. This use of multiple data gathering methods allowed the study to build on similar research from other authors who have studied the phenomenon in question.

Based on the above, the study's data gathering objectives was achieved using the following data gathering processes:

1. Interviews conducted with selected professionals within the various industries who are actively involved in the implementation and delivery of large and large-scale and complex IT projects and systems. The objective of the interviews was to obtain the perspectives and document the insights and experiences of these professionals with regards to the factors contributing to successes, challenges and failures of large-scale and complex IT projects that they have been personally involved with.
2. Case studies and detailed analysis conducted on selected projects that fit with the research objectives and that satisfy the criteria of being a large-scale complex IT project. The goal of the case studies was to provide a more detailed analysis of the factors involved in the challenges and failures encountered in LSCITP environments. Selected projects were identified and analysed to explore the causes of challenges and failures in LSCITP.

The approach to each of the various data gathering methods listed above are described in detail in the sections below.

4.6.1 The Case Studies

A case study is a means of studying a phenomenon within its context with data gathered from a variety of sources involving the application of several data gathering methods (Baxter and Jack, 2008) or as Eisenhardt (1989) describes it, it is a research strategy that is used to understand the flux within a specific environment. Case studies can comprise the use of a single case study or multiple case studies and as part of any research process, with the objective of realising different objectives. Equally, the selection of the right case study approach will have a compelling impact on the efficacy of the research study. For the purposes of this study, the use of case studies is used to help gain a detailed insight, to understand and to help describe the challenges and failures of LSCITP within a real-world context.

There are several types of case studies in existence and in Yin (2003)'s view, they fit within one of the following categories *exploratory*, *explanatory* and *descriptive*. The type of case study employed in this study is a *descriptive* case study. A descriptive case study is applied in a study when describing a phenomenon within the context of its real-life environment (Yin, 2003).

As part of the data-gathering activities for this study, case studies were conducted on selected LSCITP that fit within the objectives of the research study. The primary objectives of using case studies are to ensure that the subject matter at hand is adequately explored thereby providing a detailed contextual analysis of the multiple aspects of the phenomenon, their relationships as well as ensuring that the phenomenon is fully understood. Case studies as a qualitative research method are used as a means of studying a phenomenon within its context using various data sources (Baxter and Jack, 2008). Case studies are relevant depending on the type of research being carried out and in Yin's (2003) view, a case study approach is advised when a research is trying to answer the 'how' and 'why' questions regarding a phenomenon including when the researcher cannot influence or manipulate the conduct of the participants involved in the study. Additionally, Yin (2003) states that the considerations for the use of a case study to understand a phenomenon also includes instances when research is trying to understand contextual conditions due to the relevance of the contextual condition to the phenomenon. The use of the case study approach will enable this study to gain a detailed level of insight and obtain answers to the questions posed by the research using a scientific approach.

Though there have been criticisms regarding the use of case studies as they are not so easy to generalise from and or having the tendency for bias by researchers (Runeson and Höst, 2009; Gable, 1994), the use of case studies for research purposes is increasing especially within the information technology domain. In a study by Hamilton and Ives (1982) carried out to understand the common research strategies used in management information systems (MIS) research, the study found that case studies are the most commonly employed method for empirical research with the MIS domain. The benefits of conducting case studies are that it provides the opportunity to undertake a detailed analysis of a particular phenomenon and enables a study to dive deep into the complexity of the phenomenon as opposed to skimming over the critical elements of the phenomenon.

The case studies analysed in this study have been selected to help provide an understanding of the real-world examples of the challenges encountered in LSCITP environments. While the use of case studies has its benefits, there are certain drawbacks one of which relates to setting appropriate boundaries which as Baxter and Susan (2008) explains, refers to the use of case studies by researchers who attempt to answer an overly broad research question or research topics that have numerous objectives that cannot be understood by a single study. The challenges with case studies also extend to the fact that cases investigated are often not a good representation of the wider population and the results obtained cannot be used as a generalisation (Gable, 1994). Though, as argued by Larsson (1993), the limitations or challenges around the use of case studies can be overcome by employing the case survey methodology.

In summary, the objectives of conducting case studies in this research study are to enable the in-depth analysis of specific cases into detail thereby providing knowledge and learning that theories can be developed from subsequently.

4.6.2 The Expert Interviews

An interview research instrument was developed in the form of a semi-structured questionnaire that was used during the interview segment of the data gathering activities for the study. Interviews are an excellent way to gather valid and reliable data for a study to answer the research questions posed and to meet the research objectives (Saunders, Lewis and Thornhill, 2009). The use of structured interviews was ideal due to the complex nature of some of the questions in the interview. The interview questions were focused on examining LSCITP from different viewpoints and in particular, addressing the research objectives by examining the challenges of LSCITP and the reasons why they fail far too often as well as the factors that influence such failures through various parameters. According to Marshall (2014), interviews can be structured to some degree. One form of structured interviews is where the researcher completes the survey instrument (for instance, a questionnaire instrument) rather than the interviewee during the interview. And as noted by Fowler (2009), this is not an uncommon practice. In addition, the logic behind structuring the interviews is to enable the researcher to impose a set of criteria on the data that is being gathered (Marshall, 2014).

The interview instrument (*Appendix B*) was made up of open-ended and closed-ended questions focusing on the key variables that are being assessed with regards to the context of the research. The closed-ended questions provided the opportunity to gather factual data (quantitative data) while the open-ended questions provided the opportunity to obtain a more in-depth information (qualitative data) on specific questions based on the views and experiences of the interviewees and to pick up any comments that are not covered by the pre-defined list of questions. The open-ended questions provided further discussions and further development of the phenomena being investigated thereby opening up further conversations and lines of thought with the participants. The closed-ended questions also helped the researcher to ensure that vital and essential topics were not overlooked. The mix of open and closed-ended questions was preferred to have a quantitative and qualitative analysis while at the same time being able to capture a rich data set on the phenomenon from an interview setting and to be able to explore specific questions further. A total of 33 questions made up the interview instrument broken down into the various relevant sections.

The following LSCITP areas were examined as part of the interview process with participants with the objective of obtaining a comprehensive viewpoint from the practitioners:

- The overview and background of the specific LSCITP in context
    - Perceptions of LSCITP
- Factors contributing to LSCITP challenges
    - Discussions on the challenges faced and an evaluation of the key areas based on the evaluation criteria
    - The negative and positive impacts of the factors experienced
- The performance of the LSCITP through the implementation lifecycle phases looking at areas such as
    - Budget performance
    - Schedule performance
    - Technical performance
    - Quality performance
- The complexity of the LSCITP looking at areas including
    - The technical complexity
    - The management complexity
- The management, execution, implementation and delivery of the LSCITP
    - The management of the LSCITP

  - The leadership and governance of the LSCITP
- The outcomes and results of the LSCITP in context
  - The benefits to be realised from the LSCIP implementation

The research study attempts to find out the knowledge, opinions and insights of LSCITP practitioners and experts about the underlying causes of challenges and failures in LSCITP. Thus, this requires the views, perspectives, opinions and judgement of these individuals on the subject matter. As a result, face-to-face and in-depth interviews were then conducted with identified professionals both within and outside of the IT industry. Interview participants were identified from various organisations globally such as technology and management consulting firms, engineering and IT outsourcing firms, financial services organisations that are undertaking the implementations of LSCITP. Interviewing multiple participants across several organisations afforded the study the opportunity to obtain critical data that eliminates any potential bias. The focus of the interviews was on ensuring the high quality of data that is gathered rather than on the number of interviews conducted.

Conducting a set of face-to-face interviews with a wide range of stakeholders allowed the study to gather significant data from the identified stakeholders who are dispersed across multiple programme roles and possess in-depth knowledge and involvement in several LSCITP of different size, scale and complexity thereby ensuring the gathering of data from different perspectives. The interviews were conducted with the use of standardised questions for each participant in the interview process. The objective of the face-to-face interviews was to gather data on the insights, knowledge, perspectives and experiences from the research participants regarding their practical experiences in relation to the challenges and failures of LSCITP and LSCITS that they have been involved with and to study the outcomes of the data gathered. Moreover, the study was also interested in the insights and experiences of these participants, particularly with regards to how they think about the challenges of LSCITP in an approach that is distinct from existing methods.

As part of the process of identifying suitable interviewees, the basis for the selection of interviewees was that at a minimum all interviewees must satisfy the following conditions:

- Hold a senior level role within a LSCITP that they are involved with or have been involved in and are actively participating in the implementation and delivery of such projects.
- Have five or more years of experience working with large-scale IT and complex projects in general.

- Have significant experience of LSCITP environments and experience in implementing and delivering large IT projects in general.

Participants meeting the above criteria were contacted in advance to secure their co-operation and participation in the interview process for the study. Additionally, the participant selection process also took into account the role profiles of the participants so as to ensure that a diverse set of participants with different roles and responsibilities across an LSCITP were interviewed thereby ensuring that the contributions of the participants were not restricted to a particular role area. According to Helen (1993), the population being studied must be accurately specified and described and the participants should possess the required information that can be explicated to the researcher.

The interviews were scheduled to run for between sixty and ninety minutes. The interview instrument was interviewer-administered, and the interview process followed a set process with the same list of questions provided to all participants. However, there were opportunities during the interview sessions where some of the answers provided could be elaborated upon. In addition to the use of the interview instrument, and interview materials, notes were taken of each interview to track and record the key points raised during the discussions. The notes helped to seek clarifications on answers provided by the participants and also to interrogate and pry out further questions from the participants.

A total of fifty-six expert interviews were carried out between July 2016 and May 2018. During the interview process, the roles and responsibilities played by each participant on their specific LSCITP were clarified prior to the commencement of the data capture exercise. During the interviews, the study participants described their experiences, perceptions, their interpretations of reality as well as their insights on the challenges faced during the LSCITP implementations including discussions on what they felt were ways and methods of improving the implementation, delivery and assurance of LSCITP during the project/programme lifecycles. The interview discussions also extended to areas such as the critical success factors, the experiences around the use of methodologies, frameworks, tools and techniques, problems encountered, project concerns and on other factors not initially considered by the researcher. Some informal conversations and post-interview discussions were also carried out with participants which helped to inform and improve the understanding of the interview processes, the research questions and the projects in context.

The data gathered from the interview process was recorded during the sessions via the interview instrument developed for subsequent analysis by the researcher. This process allowed the researcher to gain a comprehensive interpretation and understanding of the data captured and in particular to help reduce the risk of errors.

In conducting the interviews, steps were taken to ensure the anonymity of the participants and to ensure the confidentiality of the projects being discussed where requested. Anonymity was granted to the participants to ensure that accurate data can be captured without bias and also to ensure that the participants were not hesitant to provide information on their perceptions about the state of the LSCITP they were involved in particular where such participants held a significant level of responsibility on such project. The reason was to reduce participant bias, as participants might feel more comfortable providing accurate and honest answers if the data being gathered does not identify them in any particular way, shape or form.

4.7 DATA ANALYSIS

From a data analysis viewpoint, this study makes use of qualitative and quantitative research methods as part of the data collection process and as part of the overall research design. Qualitative methods refer to data gathering with the focus on understanding behaviours from the perspective of the researcher about phenomena using observations, interviews, case studies and other methods to obtain a comprehensive view or description of the phenomena under study. Data analysis is performed based on the descriptive information gathered that are non-statistical in nature and reported through descriptive analysis (Saunders, Lewis and Thornhill, 2009). Quantitative methods refer to data gathering with the focus on uncovering specific facts about the phenomena under study through the measurements of the specific symptoms exhibited by the phenomena under study to extract and produce results that can be generalised (Saunders, Lewis and Thornhill, 2009). Data analysis is performed based on measurable variables that can be categorised into units of measurements using statistical methods and reported through statistical analysis. According to Wang *et al* (2013), quantitative methods provide the capability to draw probable inferences regarding a population and outside of the limits of the sample being analysed. In Wang *et al* (2013, p.1)'s view, "quantitative methods provide powerful tools for establishing truths about the objective reality at an estimated level of precision and with a specified level of confidence". Walliman (2006) describes the two different data collection methods below

> “Quantitative techniques rely on collecting data that is numerically based and amenable to such analytical methods as statistical correlations, often in relation to hypothesis testing” (Walliman, 2006, pp. 37-50).

> "Qualitative techniques rely more on language and the interpretation of its meaning, so data collection methods tend to involve close human involvement and a creative process of theory development rather than testing". (Walliman, 2006, pp. 37-50).

Using the quantitative and qualitative means of data gathering will enable the study to obtain a comprehensive picture of the reasons behind the challenges and failures of LSCITP as well as the reasons why they fail far too frequently. Gathering data from multiple sources is beneficial to a research study because of the added level of accuracy that is introduced with the use of such approach according to Baxter and Jack (2008).

Additionally, the use of the different means of data collection afforded the study the opportunity to utilise a process of methodology triangulation. Methodology triangulation refers to the process whereby multiple methods (for example quantitative and qualitative) are applied to the data gathering process during the conduct of a study. Morse (1991, p.120) defines methodological triangulation as "the use of at least two methods, usually qualitative and quantitative, to address the same research problem". This process is normally achieved through the use of quantitative and qualitative data instruments, for example, surveys, case studies and interviews, etc (Saunders, Lewis and Thornhill, 2009). Triangulation offers many benefits with the key benefit being the ability to use the results from the different data sources independently or in combination to address the questions posed by a research study. It also enables a study to obtain different viewpoints on the phenomenon that is being studied and to decrease any potential disadvantage that might arise from the use of a single data collection method. Additionally, using triangulation helps to guarantee the findings from a study as it can be used as a way of demonstrating or ensuring the validity of the research methods applied in a study.

The objective of the use of multiple data sources is not simply to obtain multiple conclusions of the same phenomenon under study but rather, an opportunity to obtain a much clearer understanding of a phenomenon and its associated relationships (Wynn and Williams, 2012). In particular, this research makes use of simultaneous triangulation. As stated by Morse (1991) simultaneous triangulation refers to the utilisation of both quantitative and qualitative methods independently at the same time in a study but with limited interaction between both data sets during the data gathering process however, the outcomes from both methods complement each other at the end of the study.

Both quantitative and qualitative approaches were selected to perform the analysis of the different sets of data (qualitative and quantitative) that was gathered during the study. According to (Guba and Lincoln, 1994), qualitative and quantitative methods can be applied within any selected research paradigm. The case studies conducted provided the opportunity to gather a rich set of qualitative data while the use of the semi-structured interviews provided the opportunity to gather both qualitative and quantitative data so that qualitative and quantitative analysis can be carried out on the assembled data.

4.7.1 Qualitative Data Analysis

The qualitative data gathered was analysed through the application of qualitative analysis processes (content analysis, narrative analysis, discourse analysis) and coding techniques where required to identify specific themes, categorise, summarise and transform the data gathered to draw relevant conclusions. The qualitative data analysis covers both the data gathered from the case studies and the non-numerical data gathered from the expert interviews. Furthermore, the conceptual model and framework essentially acted as a framework that helped to organise the qualitative data gathered across the case studies and expert interviews. The analysis of the data followed the approach and structure below:

- Data Familiarisation
- Data Transcription
- Data Organisation/Indexing
- Data Coding (where relevant)
- Data Validation
- Data Summarisation

4.7.2 Quantitative Data Analysis

Quantitative analysis methods were applied to the closed questions in the interview instrument as the data gathered were numerical in nature and can be quantified. The use of statistics helps to provide the mechanisms and techniques that are required for describing and analysing the data gathered about phenomena through the use of descriptive statistics. Descriptive statistics help to analyse and present data in an easily understandable structure by providing a much easier approach to the interpretation of data in order to, for example, identify patterns in the data etc. According to Fisher and Marshall (2009), descriptive statistics are useful to help "organise, present and analyse data" using an effective and meaningful approach. Data for descriptive statistics are often represented using tables, graphs and charts. The reason for the application of a statistical method of analysis was to support the study as part of the efforts to address the research question on understanding the challenges of LSCITP.

CHAPTER 5

Case Studies

5.1 INTRODUCTION

This chapter provides a detailed background on the case studies conducted during the course of this research study as part of the data gathering processes employed to help underpin the validity of this study and to assist with gaining a detailed understanding of the challenges and failures of large-scale complex IT projects (LSCITP).

The approach employed in the selection of the case studies is explained. The type of case study conducted and how the resulting data was analysed including the summary of the findings derived from each case study is also provided. The case study segment of this study is built around three real-world LSCITP.

A detailed analysis of the case study approach that was applied to this exercise is described extensively in *Chapter Four* (*Research Design and Methodology*).

5.2 THE CASE STUDIES

The objectives of the conduct of the case studies is firstly to assist with the fulfilment of the overall research objectives to examine the challenges and factors that influence the failures of LSCITP by undertaking a review of the emblematic syndromes of failures of LSCITP and examining the reasons why LSCITP run into difficulties, why they become challenged and why many eventually fail. Secondly, examining the case studies helps determine and analyse the critical problem areas in LSCITP that hinder success and contribute to challenges that become inherent in their implementation and delivery leading to their poor performance or eventual failures.

The case study approach centres on the examination, identification and understanding of the areas within LSCITP that significantly impact the implementation and delivery based on the knowledge gained from the literature review. The examination of the selected LSCITP seeks to understand their challenges and to discover the underlying causes of such challenges as well as to understand how these challenges can be addressed and mitigated on future LSCITP implementations.

5.3 CASE STUDY SELECTION

In selecting the LSCITP to be examined primarily based on their relevance to the research study, a set of other important factors was also considered. The factors include whether the cases selected provide a proper embodiment of the population they are connected to. Other factors considered included the industry sector and size of the organisations involved, the location of the organisations, the nature of the projects, the importance and relevance of the projects to their respective organisations as well as the wider impacts that will be generated or realised from these projects when implemented and delivered.

The use of multiple case studies was designed to help explore the research questions across three different LSCITP with the aim of obtaining perspectives from real projects and to help understand and add rigour to the research and to be able to validate the findings and outcomes. The multiple cases studied also provided an opportunity for the research to adequately examine the challenges of LSCITP and to explore the negative impacts contributing to challenged and failure outcomes. The opportunity provided also include the possibility to collate the findings from the different cases to help shape the research questions and add to the further research to be conducted through the expert interviews. The data for each of the case studies were gathered from secondary data sources, such as journal articles, media publications, audit reports and project documentation.

The research question including the sub-questions derived guided the conduct of the case study exercise including the data gathering and collection processes and helped to determine the boundaries of the case study process with regards to its scope.

The approach used for the case studies involved the gathering of relevant qualitative data primarily from published secondary data sources (for example, journal articles, conference papers, books, magazines, newspapers, official government publications, web articles, and industry studies) on each of the cases being examined. As a way to assure the validity and reliability of the data gathered, multiple data sources were used and analysed. In determining the outcomes and conclusions from each case analysed, the data gathered was examined to establish the specific properties about the phenomenon being examined. Any correlations between the identified case properties are also then analysed in detail to establish the key facts about the phenomenon being studied and to build a view of the causes and effects on the phenomenon. The key facts within the context of this case study are to determine the causes of challenges and factors influencing failures in LSCITP.

Based on the selection criteria explained above, the following high-profile LSCITP were identified and selected for in-depth case study analysis from the available list of suitable projects.

Number	Project Name	Description	Country	Estimated Cost

Project #1	**NPfIT**	The UK's National Programme for IT	United Kingdom	**£11.4 billion**
Project #2	**DMI**	The BBC's Digital Media Initiative	United Kingdom	**£81.7 million**
Project #3	**e-Borders**	The UK Home Office's e-Borders Programme	United Kingdom	**£1.2 billion**

Table **5**: The list of LSCITP examined as part of the case study exercise carried out.

Each of the cases examined follow a similar pattern, the studies start with a background and description of the specific project and the context in which the programme was initiated, the objectives and problems the project aimed to address and the values to be realised from the implementation of the project. The context is important, particularly when examining the various projects to understand and assess their outcomes and performance against their set objectives. The studies then focus on the detailed examination of the cases, the findings derived from the study and an explanation of the outcomes of the findings.

5.4 CASE STUDY 1 - THE NATIONAL PROGRAMME FOR IT (NPFIT)

This section presents the case study of the National Programme for IT (NPfIT) project. The NPfIT was a large-scale IT project implementation that was undertaken by the National Health Service (NHS) in the United Kingdom in 2002 with the objectives of modernising the NHS through the introduction of 21st century technology into the operations and processes of the NHS to improve patient care, improve the quality of the services being provided by the NHS and to provide a centralised and integrated online electronic health records database (Department of Health, 2002).

Part of the objectives of the NPfIT included the need to modernise and transform the NHS and centralise healthcare services and patient records. The NPfIT programme, in summary, had three key component parts as part of its proposed implementation:

1. PAS (Patient Administration System)
2. PACS (Picture Archiving and Communications Systems)
3. Choose and Book (Electronic Booking and Prescription Service)

The project was planned during a ten-year implementation span, and the original schedule for the NPfIT project was stated for seven years with a target completion date set for December 2010 (Brennan, 2007). At the core of the objectives of the NPfIT was to put in place a technology solution that would help connect over 330 various health organisations in England, for example, General Practitioners (GPs), Community and Mental Health organisations and other Care organisations together to achieve the 21st century technology vision defined for the NHS and to empower patients with increased choice (Cabinet Office, 2011; Coiera, 2007; Hendy *et al.*, 2005).

The proposed architecture that was required to achieve the objectives of the NPfIT is presented in Figure 6 below.

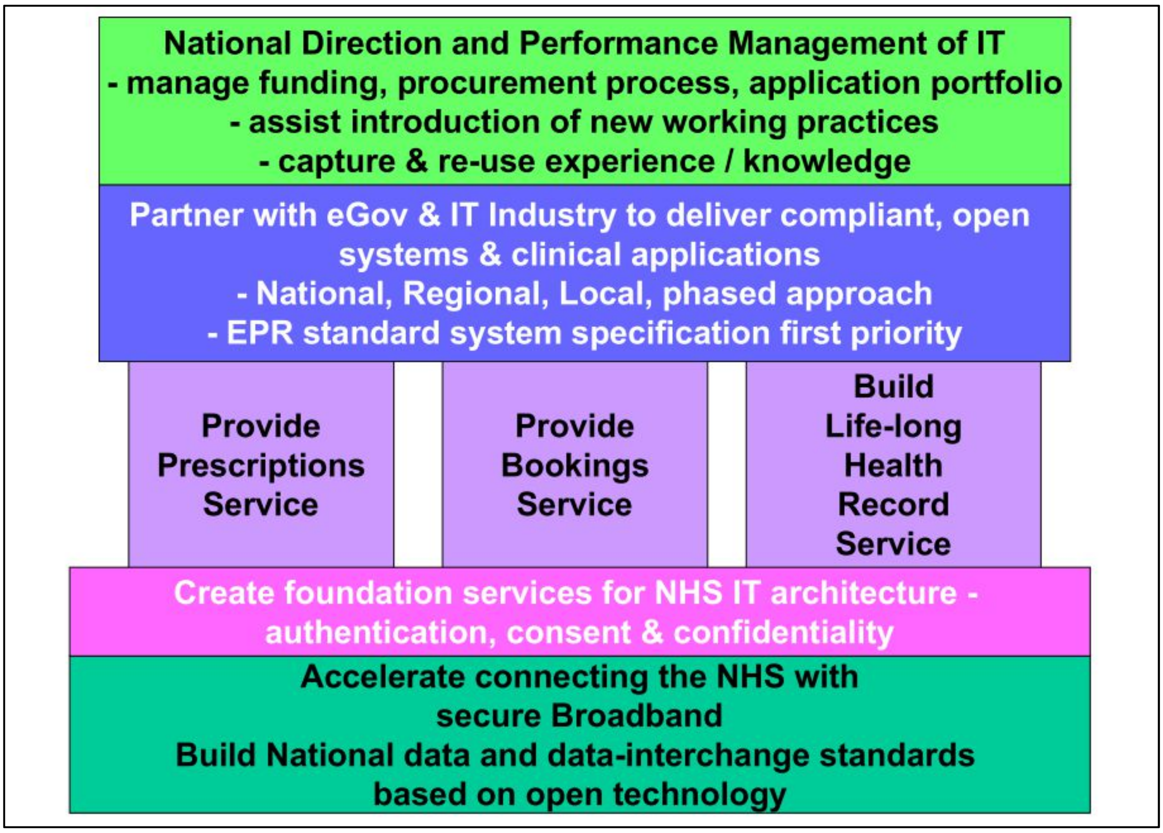


Figure 8: The proposed NPfIT architecture (Source: Department of Health, 2002).

The NPfIT was strategically placed as a long-term transformational programme that was meant to transform NHS working practices aided by 21st-century technology (Currie and Finnegan, 2016).

5.4.1 NPfIT: Case Study Objectives

The objectives of this case study were to understand and assess the challenges faced in the management, implementation and delivery of the NPfIT that contributed to its eventual failure. In conducting the case study on the NPfIT, the following documents were examined:

- The United Kingdom's National Audit Office (NAO) reports
- The United Kingdom's Public Accounts Committee (PAC) reports
- The United Kingdom's Major Projects Authority (MPA) Programme Assessment Review (PAR) reports
- Academic Journals

- Newspaper Articles
- Online News Media Articles

The reason behind the selection of the NPfIT as a case to explore was that it is as at present the largest ever IT-oriented project undertaking in the public sector (Brennan, 2007; Clegg and Shepherd, 2007; Bryant, 2005) and thus fits the criteria required for this study.

5.4.2 NPfIT: Summary of Findings

The table below presents the set of issues identified that was encountered from the analysis of the implementation of the NPfIT programme. The findings detailed and identified below have been extracted from all the relevant literature sources examined and analysed during the study (Currie and Finnegan, 2016; Cabinet Office, 2011; Brennan, 2007; Clegg and Shepherd, 2007; Coiera, 2007; Bryant, 2005; Hendy, *et al.*, 2005).

No.	NPfIT – The Significant Issues Identified
1	The lack of co-operation amongst the various Trusts and health organisations involved in the NPfIT which had an impact on procurements and contracts for the NPfIT during the implementation lifecycle.
2	The failure by the Department of Health and responsible Senior Management teams to recognise and address the fact that the NPfIT as a programme was more than just an IT programme, rather, that it was a transformational programme that will have an extensive impact on the NHS as an organisation and also have an impact on the existing business processes within the organisation that spans far beyond IT.
3	The poor negotiation of contracts with the various contractors (e.g. the vendors and other third-parties) involved with the implementation and delivery of the NPfIT programme by the Health Department.
4	The failure to ensure that end-users (e.g. NHS Trusts, GPs, and other health organisations) were fully engaged in the implementation process in order to obtain their buy-in into the wider objectives of the systems and solutions being implemented and delivered through the NPfIT.
5	The failure to adequately manage and engage the various stakeholders involved in the NPfIT by the programme's management teams through an established and meticulous engagement management approach.
6	The failure by the Health Department and responsible stakeholders to adequately understand the complexity of the NPfIT programme.
7	The failure by the Health Department in understanding the complexity and enormity of the various component tasks involved during the NPfIT's implementation.
8	The lack of in-depth extensive IT knowledge and significant expertise on the part of the Health Department and the contractors and third-parties engaged to implement a complex technology-driven system such as the NPfIT.
9	The failure to successfully architect and design an appropriate non-centralised technology solution that takes into account the needs and requirements of all the different stakeholders (e.g. NHS Trusts, GPs, and other health organisations) involved and their different goals and objectives from the NPfIT deliverables.
10	The lack of adequate due diligence conducted by the Health Department in the award of contracts to contractors (e.g. vendors and third-parties) during the initial phases of the NPfIT.

11	The failure of the responsible stakeholders and senior management teams to set aside a budget for the ongoing running costs of the NPfIT programme.
12	The failure to provide a cost-benefit assessment of the NPfIT programme at different milestones during the implementation lifecycle as well as regular ongoing cost-benefit assessments throughout the implementation phase of the programme.
13	The unreliable software was delivered during the NPfIT's implementation that failed to meet specified requirements resulting in system functionality issues.
14	The constant departures of senior responsible owners, key senior management personnel and senior leadership teams that resulted in negative impacts on the effective governance and management of the NPfIT during its implementation.
15	The constant changes in the leadership structures of the governing and responsible bodies of the NPfIT due to political reasons.
16	The delays caused to the NPfIT programme as a result of key supplier departures and departures of sub-contractors of suppliers (e.g. Accenture and Fujitsu) quitting the NPfIT programme in the early implementation stages.
17	The changes in government during the lifecycle of the NPfIT.
18	The lack of an exit strategy for the NPfIT programme.
19	The inherent cultural issues within the Health Department that had a negative impact on the NPfIT due to the lack of processes in place to address and deal with concerns and warning signals raised during the implementation cycle.
20	The lack of understanding of the business impacts of IT by the Health Department as a result of the NPfIT implementation.
21	The weak and ineffective management and oversight of the NPfIT by the Health Department and other responsible management teams.
22	The poor communication between the NPfIT management teams, NHS Trusts, Service Providers and other connected health organisations involved in the NPfIT programme during the implementation phases.
23	The failure by the Health Department and the NPfIT management teams to continually assess the progress of the NPfIT programme with a realistic timetable.

24	The failure in managing the adoption of the new systems being delivered with different NHS trusts involved in the programme.
25	The lack of relevant engagement and collaboration between the NPfIT programme, the various project management teams and the NHS Trusts.
26	The high-level specifications produced that was conducted with a broad range of stakeholders that lacked the required detailed-level specifications and links to the detailed requirement stakeholders and owners.
27	The key decisions being undertaken during the early stages of the programme that lacked the required end-user inputs as a result of the "top-down" management approach taken.
28	The involvement of the required end-users at the wrong stages of the programme after key programme decisions had been made and key contractual processes had been established or began.
30	The lack of the systematic monitoring and control of the ongoing expenditure on the programme.
31	The delivery delays encountered on the NPfIT that resulted in increased costs to local and NHS Trusts as a result of the need to renew existing systems or upgrade and adapt existing systems to meet the requirements of the solutions being delivered.

Table **6**: The list of significant issues identified in the analysis of the NPfIT programme (Source: Author).

5.4.3 The Challenges of the NPfIT

The analysis of the NPfIT programme identified a list of factors encountered during the programme's implementation and delivery lifecycle that collectively resulted in negative performance outcomes which ultimately resulted in the failure of the programme. This section provides a summary narrative analysis on some of the key issues encountered that was identified in the preceding section above.

Using the outputs from the literature review exercise to provide a basis for analysis and assessment, numerous factors were identified from the findings detailed above. Some of the factors appeared to be more significant than the others. Based on the analysis, the frequent and prominent factors identified are re-listed below to align with findings from literature:

- lack of adequate effective governance structures;
- lack of effective project management;
- lack of clearly articulated and validated goals and objectives;
- failures of contract management processes with vendors and suppliers
- lack of adequate stakeholder and end-user involvement and engagement;
- lack of the understanding of complexity and enormity of the deliverables of large, complex IT projects;
- lack of required knowledge and expertise in technology and managing large-scale technology projects;
- lack of technological know-how in architecture and solution design of complex systems and solutions;
- lack of proper procurement processes with vendors and suppliers
- failures in budget management processes;
- failures in benefits and value realisation processes and ongoing- value and benefits assessments processes;
- poor quality implementation and solution delivery;
- resource volatility, high staff turnover of senior and project team personnel;
- loss of key suppliers during programme implementation and delivery;
- political instability and political and external influences;
- lack of effective change management processes and failures of anticipating organisational change;
- lack of understanding of technology and impacts on business process and organisational culture;
- lack of strategic direction and management of the programme objectives and deliverables;

- lack of sustained single responsible ownership, senior management ownership and leadership;
- high-level requirements and specifications
- significant delays in schedule and delivery milestones

These identified issues can be traced to significant failings in implementation and delivery processes from both the client (the Home Office) and the vendors involved with the programme. Some of the above findings are explained and discussed below.

Amongst the critical issues that contributed to the overall failure of the NPfIT was the significant failings by the leadership and senior management teams that were responsible for managing and steering the NPfIT towards achieving its defined objectives. In the management of the programme, the Department of Health had the overall management responsibility for the programme, however, various bodies were setup to manage the implementation and delivery of the NPfIT during its lifecycle. Initially, a body the NHS Information Authority had been setup the deliver the NPfIT programme. However, in 2005, the NHS IA was later scrapped and replaced with a new body Connecting for Health (NHS CfH) (Clegg and Shepherd, 2007).

Other contributing factors were as a result of the significant scope of the programme, the NPfIT was composed of a set of national and local projects (Department of Health, 2002) with implementation activities split across different geographical regions (Clegg and Shepherd), 2007). Bryant (2005) and Clegg and Shepherd (2007) argued that the NPfIT was quite possibly the largest and most complex IT project undertaken in history. To put the scope into context, the NPfIT was not a single program implementation but rather, it was a collection of various major programmes made up of different work streams, with different components parts, various dependencies and interdependencies and with different timescales and different objectives (Cabinet Office, 2011).

The high-level of technical complexity as a result of the introduction of new technology and the complex levels of integrations required across the existing infrastructures within the national health care system was also another factor in the negative impacts that contributed to the outcome of the programme. The UK's National Health Service (NHS) is a complex organisation in itself and according to Brennan (2007), the scale of the NPfIT programme was so large that it was unprecedented in the history of the UK's public sector. The management complexity as a result of the inadequate management structures put in place and the constant changes to the management structures during the implementation and delivery phases also contributed to the list of failure factors.

The constant changes to the organisational structures of the NHS and changes to the organisations responsible for delivering the NPfIT programme during its lifecycle were identified as key contributors to the issues regarding the inadequate management and oversight of the NPfIT (Brennan, 2007) a result that contributed to its eventual failure. As highlighted by Currie and Finnegan (2016), the NHS as an organisation went through a constant restructuring process, and some structural changes saw Strategic Health Authorities (SHAs) being reduced from 28 to 10. These structural changes had a significant impact on the major projects being implemented to transform the operations of the NHS including the NPfIT.

The frequently changing political environment was also another contributing factor to the set of challenges faced as the NPfIT programme was operating in a constantly changing political climate (Mark, 2007). Projects like the NPfIT are known to be socially and politically complex (Cockcroft, 2009) as they are undertaken by government departments and are exposed to a high degree of political influence. The social and political complexity is also drawn from the fact that the implementation of these systems involves a variety of stakeholders who have different objectives and interests in the outcome of the project. In addition, these projects are often undertaken on a national scale and they present significant challenges, as a result, challenges that require a restructuring of the organisations involved including a restructuring of their existing business processes in order for the challenges to be overcome (Cockcroft, 2009).

In 2011, the Major Projects Authority (MPA) conducted a review called the "Major Projects Authority Programme Assessment Review (PAR)" into the NPfIT programme and provided a detailed analysis of the findings from its review. The objectives of the MPA's review into the NPfIT was to provide the reasons for the failure of the NPfIT to help improve the delivery and assurance of major technology projects undertaken by government agencies and to help guarantee a more successful outcome for these projects. A key finding from the MPA's analysis was that the NPfIT was challenged from the onset by virtue of the fact that it was defined, described, viewed and perceived by the Department of Health as purely an IT implementation programme which was a massive mistake that would later contribute significantly to the programme’s demise.

The analysis also identified that a heavy focus was placed on IT while other significant areas of the NHS were overlooked or not afforded the same level of focus such as the resulting changes that are required to the existing business processes and the existing working practices of the NHS and the various health organisations involved and affected by the implementation of the programme. According to Currie and Finnegan (2016), the NPfIT wasn’t simply about implementing a large-scale complex IT system, it was more of a long-term transformational programme touching on areas far beyond IT within the entire NHS. The changes brought about by the introduction of modern technology solutions also brings about a disruptive change into their connected business environments and associated business processes (Currie and Finnegan, 2016). When such changes are not managed adequately, they hinder the implementation, introduction and adoption of such new technology solutions. In the case of the NPfIT, the introduction of new and modern 21st-century technology solutions via the NPfIT meant that a change to the current working practices of GPs, health care practitioners and other concerned health organisations was inevitable. Changes to the existing business processes within the NHS was also inevitable including the need for new business processes to support the overall NPfIT objectives. According to Umble, *et al.*, (2003.), the existing business processes of an organisation are often not in harmony with the introduction of a new technology solution including harmony between existing systems and the new systems realised from such large-scale technology introduction. Regardless of the benefits to be realised by the introduction and adoption of a new technology solution, it inevitably introduces a change to an organisation's strategy, existing business processes, working practices including changes to the culture of an organisation. When existing business processes are changed or new business processes are introduced as a result of the adoption of new technology, it results in the inevitable impact on an organisation including impacts to culture, processes, policies and its people (Umble, *et al.*, 2003). In the case of the NPfIT, the lack of the management of such change later provided a barrier to adoption of the NPfIT solutions in the various connected health organisations.

The failure to recognise that projects of this nature are strategic and not just an IT implementation is a critical issue in large-scale public-sector IT projects and an issue that was encountered in the NPfIT.

5.4.4 NPfIT: Conclusion

To conclude, the complexity of the NPfIT, coupled with the complexity of the organisation (the NHS), and the political and social complexity within and outside of the NPfIT's project environment meant that the NPfIT was always going to be a challenging undertaking from the onset. The NPfIT as a large-scale IT programme is not unique in this regard, as can be seen from the other case studies examined during the course of this study. Similar large-scale IT-oriented projects have also suffered the same fate and are beset by the same set of challenges. In reality, challenges on projects of this nature are almost inevitable, cost overruns, changes to scope and changes to the schedule are also part of the inevitable challenges faced.

The need for modern technology solutions and systems like the NPfIT is undeniable, the benefits they provide is unquestionable, and the impact and benefits they provide are far-reaching. The eventual cost of the failure of the NPfIT to the UK taxpayers is still unknown; this is as a result of the ongoing legal disputes with various contractors who have had their contracts terminated and the continued cost being incurred through the ongoing component parts of the programme that are still being implemented and delivered. According to the Cabinet Office (2011), the actual spend on the NPfIT as at the end of March 2011 stood at £6.46 billion pounds with a newly revised forecast to complete the programme estimated as at 2011 to be £11.4 billion pounds.

In spite of the overall outcome of the NPfIT programme being classified as a failure, it has to be noted that there are component parts of the programme that have been delivered and are operational and in use, and these various component parts are deemed to have met the needs for which they were developed (Cabinet Office. 2011). The UK's House of Commons' Committee of Public Accounts did acknowledge that there were parts of the dismantled NPfIT programme which had been successful having been placed under a different management and accountability structure. However, the key elements of the NPfIT programme encountered difficulties and suffered significant delays resulting in the programme being cancelled in September 2011 after the report of a review into the NPfIT programme by the United Kingdom's Cabinet Office's Major Projects Authority (MPA) (United Kingdom Parliament, 2013; Gov.UK, 2011).

5.5 CASE STUDY 2 – THE BBC DIGITAL MEDIA INITIATIVE (DMI)

This section presents the case study of the BBC's Digital Media Initiative (DMI) programme. The British Broadcasting Corporation (BBC)'s in 2008 embarked on a new project labelled the Digital Media Initiative (DMI) with the objectives of introducing a flexible and multi-platform digital technology solution that will enable the BBC to be at the forefront of the changes in digital content production and consumption to meet the demands of the 21st century (House of Commons Committee of Public Accounts, 2014, National Audit Office, 2014; House of Commons Committee of Public Accounts, 2011). The BBC is the United Kingdom's public-service broadcaster.

The overall objectives of the DMI were to help transform the infrastructure and production operations of the BBC through the introduction of digital technology to facilitate a synergetic and a multiplatform production process. The primary goal was to facilitate easy access to archived information thereby providing a more collaborative platform and easy access to the required media by staff members regardless of the location of access. Amongst the other objectives was to help introduce an improved level of efficiency in the media production activities right across the

BBC as well as replacing disparate legacy systems that were in use (National Audit Office, 2014; PricewaterhouseCoopers, 2013, House of Commons Committee of Public Accounts, 2011).

The overall DMI solution was planned for delivery in May 2009 with initial rollouts planned to commence in November 2008.

5.5.1 DMI: Case Study Objectives

The objectives of this case study were to understand and assess the challenges faced the management, implementation and delivery of the DMI that contributed to the poor performance and its eventual failure. In conducting the DMI case study, the following sources of information were analysed and examined:

- The United Kingdom's National Audit Office (NAO) reports
- The United Kingdom's Public Accounts Committee (PAC) reports
- Academic Journals
- Newspaper Articles
- Online News Media Articles

5.5.2 DMI: Summary of Findings

The table below presents the set of issues encountered during the implementation and delivery of the DMI programme as analysed and extracted from the various information sources examined. The issues list presented below provides the required insight in helping to gain an understanding of the key factors responsible for the failure of the DMI programme. The findings identified and detailed below have been extracted from all the relevant literature sources examined and analysed during the case study analysis (Glick, 2014; House of Commons Committee of Public Accounts, 2014; National Audit Office, 2014; Accenture, 2013; PricewaterhouseCoopers, 2013; House of Commons Committee of Public Accounts, 2011).

No.	DMI – The Significant Issues Identified
1	The lack of periodic reviews of the DMI's business case as a long-term, large-scale technology-enabled transformation programme while taking into account the changes in technology, changes in business processes and the potential impact of potential changes on costs as well as the impacts on the business case and the BBC.
2	The constant changes to the requirements by the business (e.g. the BBC Production Team) which resulted in significant requirements volatility resulting in a cascading effect on the features already implemented and those currently under implementation which meant that those features had to be redesigned and implemented thus creating some further impacts on budget, scope and schedule.
3	The lack of engagement between the technology teams and the business (end-users) during the key stages of the DMI's implementation and delivery including, the lack of business direction as part of the engagement process to aid and support the adoption of the intended and delivered technology solution.
4	The lack of understanding of the impact and changes required to the BBC's existing business processes by the business teams as a result of the implementation and deployment of the new technology solution.
5	The lack of relevant and sufficient depth of technical expertise by the BBC on the technological aspects of the solution being implemented including the failure by the BBC to undertake a detailed independent assessment of the proposed technology solution's architecture and design and assess for suitability.
6	The lack of the required level of competency and experience to undertake, manage, implement and deliver a large-scale, complex IT project such as the DMI within the BBC.
7	The lack of adequate high-level knowledge of the technology solution being introduced into the business by the senior management teams and stakeholders and the wider impacts on the introduction of such large-scale technology change project on the organisation (BBC).
8	The lack of training and consultancy for the BBC's senior management teams to acquire the required high-level technical knowledge on the technology solution being introduced to the business through the DMI implementation so they are able to understand and interpret the information provided to support improved and informed decision making.
9	The lack of the required in-depth knowledge of the internal workings, structure and internal operations of the BBC by the Vendor (Siemens) which was responsible for delivering an innovative, challenging, complex and technology-led transformation programme that has a significant impact on the existing operations and business processes of the BBC.
10	The lack of a senior programme leader with a significant track record and expertise of implementing and delivering large-scale, complex IT systems and projects such as the DMI.
11	The issues encountered with the Vendor (Siemens) particularly around the lack of understanding of the DMI solution and other challenges resulting in a 21 months delay to the overall DMI project's schedule.

12	The significant delays to the overall programme schedule due to elements of some of the delivered components' functionality not meeting user expectations coupled with technical issues resulting in the lack of confidence from the business as to the reliability of some of the delivered DMI solution in meeting their business needs.
13	The significant number of changes to the DMI project's scope at key stages of the project's implementation resulting in significant work and rework efforts to be undertaken by the development teams.
14	The lack of understanding of the nature of technology required and the subsequent lack of understanding of the overall complexity of the DMI project by the organisation.
15	The lack of understanding of the wider impacts the DMI as a technology-enabled business transformation programme would have on the BBC and in particular, the impacts on the existing business processes and operations of the BBC as a result of the DMI's introduction.
16	The lack of a Single Responsible Owner (SRO) from a business point of view with the required experience, sole management ownership, authority and responsibility for the overall DMI programme and for driving the programme through to meeting its objectives.
17	The lack of strong senior management oversight of the DMI programme by the responsible BBC senior management teams.
18	The lack of efforts by the BBC's DMI senior management teams to introduce initiatives aimed at educating the various business teams on the impacts of the DMI solution and the resulting impact on existing business processes of the BBC.
19	The lack of action taken by the BBC's senior management teams on repeated warnings raised by the DMI's Programme Management Office (PMO) teams on the DMI's project Amber and Red risks statues. Furthermore, the failure of the senior management team to respond to and address warning signs presented to it about the challenges of the DMI programme.
20	The lack of the ineffective and unsuitable governance structure that was established for the DMI programme along with the failure to ensure that the governance structure took into account the nature and complexity of the project being implemented.
21	The award of a complex multi-million-pound contract requiring a high-level of significant technological innovation to a single vendor without a tender process and without open competition from other potential suitable and capable vendors.
22	The ineffective management structure that was put in place for the DMI programme that lacked the presence of an executive steering committee which was meant to provide full management oversight and direction of the programme as well as the opportunity to challenge the progress being made.
23	The failure of the DMI's senior management teams to adequately and continuously monitor and challenge the progress and performance of the DMI during its implementation and delivery lifecycle.

24	The lack of a regular project review and feedback sessions between IT and the business at key stages of the DMI's implementation that would have provided regular feedback and helped to ensure that the development efforts are constantly in line with business and end-user expectations and requirements.
25	The lack of a clear, transparent and formalised reporting process for the DMI programme that would have allowed senior executives to monitor the progress of the DMI's implementation against the target plan, schedule, budget, and to continually assess the progress being made against the expected benefits to support their decision-making process.
26	The failure to ensure an effective and efficient risk management process was in place and executed regularly for the DMI project along with the failure to ensure that the various risk and assurance processes that were carried out were formalised, consistent, non ad-hoc and integrated.
27	The nature and setup of the fixed-price contract that was signed by the BBC with the vendor (Siemens) such that all the risks and low-level management of the program's implementation and delivery was passed on to the vendor with the BBC having a hands-off approach which meant that the BBC did not have the required adequate visibility on the implementation and delivery until it was too late and was unable to manage the risks it faced effectively.
28	The constant changes to the delivery priorities and project's roadmap resulting in significant impact on the overall DMI implementation and delivery schedule and timelines.
29	The lack of frequent progress reports to all relevant stakeholders on the overall progress of the DMI programme against the defined timescales, budget and outcomes by the programme management teams which led to inaccurate visibility and reporting of the programme's status to the senior stakeholders and prevented the relevant stakeholders from making the required executive decisions to address potential issues encountered.
30	The poor technology solutions delivered via the various component parts of the programme that was more deficient that the existing technology solutions in place and with increased running costs.

Table **7**: The list of significant issues identified in the analysis of the DMI programme (Source Author).

5.5.3 The Challenges of the DMI

The analysis of the DMI programme identified the set of challenges encountered during the programme's implementation and delivery that resulted in negative impacts and contributed to the eventual failure of the programme. This section provides a summary analysis on some of the key issues encountered that was identified in the preceding section above.

Using the outputs from the literature review exercise to provide a basis, numerous factors were identified from the findings detailed above. Some of the factors appeared to be more significant than the others. Based on the analysis, the frequent and prominent factors identified are re-summarised below to align with findings from literature:

- lack of a regularly validated and reviewed business case
- lack of stable and valid business requirements
- unclear business goals and objectives
- significant volatility in delivery objectives and project's implementation roadmap
- lack of adequate engagement across various business functions and with end-users and third-parties
- lack of technical expertise and competency for complex solution delivery
- lack of the understanding of the impacts of new technology on existing business processes
- poor vendor management processes
- significant schedule delays (based on numerous factors)
- lack of understanding and management of priorities
- lack of adequate scope management
- lack of the understanding of complexity of technology and complexity of implementation
- lack of a single responsible owner
- lack of independent technical assurance on technology solution design and architecture
- lack of a robust programme and project management process
- lack of adequate and effective governance structures
- poor procurement and contract management processes with third-parties
- lack of effective monitoring and collaboration between the business and the third-party supplier
- lack of adequate and effective monitoring and control of implementation and delivery across project lifecycle

- lack of effective risk management processes and formalised approach to risk management
- lack of required training and knowledge and expertise in technology solution design and complexity
- poor quality technology solution delivery

Some of the factors identified above are summarised and discussed below. In reviewing the set of issues identified above, amongst the set of challenges encountered was the lack of senior management support and engagement throughout the key phases of the DMI project including the lack of an effective governance structure, issues with requirements volatility, the lack of understanding of the scale of the solution being implemented, the lack of an effective monitoring and control process as well the lack of an effective as risk reporting and assurance processes (PricewaterhouseCoopers, 2013). Amongst the outcomes identified in the review carried out by the PwC was the lack of adequate governance and risk management processes as well as the lack of strong senior management oversight of the DMI programme at all levels (PricewaterhouseCoopers, 2013).

In 2008, the BBC awarded Siemens Information Solutions and Services (SIS) group the contract to design and implement a digital technology solution for the DMI with an estimated delivery date of May 2009 (IEEE Spectrum, 2013; House of Commons Committee of Public Accounts, 2011). Siemens was an existing BBC technology partner at the time. According to a report by the IEEE Spectrum (IEEE Spectrum, 2013), no component of the DMI was ready for delivery by Siemens as of February 2009. Additionally, the NAO report also noted that Siemens had failed to deliver against the agreed project milestones (House of Commons Committee of Public Accounts, 2011). The BBC eventually cancelled its contract with Siemens in September 2009 (National Audit Office, 2014). Upon the termination of the DMI contract with Siemens, the BBC decided to bring the project in-house under its management with a new target delivery date of February 2011 (National Audit Office, 2014; House of Commons Committee of Public Accounts, 2011).

To better understand the reasons behind the failure of the DMI programme, the BBC Trust appointed Pricewaterhouse Coopers (PwC) to conduct an assessment and produce a report that seeks to outline the reasons for the failure of the DMI programme. The report was conducted to focus on how the DMI project was managed, governed, and the processes that was put in place on the project's reporting including the financial management, risk management and project management processes. The report produced a list of significant failings by the BBC in its handling of the DMI programme. At a high-level, the following areas were identified: lack of an effective governance structure, lack of formal project risk reporting processes, heavy focus on technology without a focus on the wider impacts and implications of such technology, lack of a periodic review of the DMI's business case and the lack of an effective risk management processes put in place. According to the PAC chair Margaret Hodge who presided over the hearing on the BBC DMI's failure, she noted that the failures of the DMI project went right to the very top of the management levels at the BBC. As a result, the BBC was not able to steer the project towards a more successful outcome (National Audit Office, 2014). The assessments also revealed that some of the BBC's senior management team did not have an adequate technical understanding of the DMI project and as a result, they were unable to challenge or adequately monitor its progress (National Audit Office, 2014; House of Commons Committee of Public Accounts, 2011).

Furthermore, one of the major reasons attributed to the failure and subsequent cancellation of the DMI project according to the BBC's Chief Technology Officer (CTO) at the time (John Linwood) was as a result of the constant changes to the requirements by one of the key business units at the BBC (the Production Business Unit) (House of Commons Committee of Public Accounts, 2011). The constant volatility in the project's requirements resulted in a cascading effect on the features already implemented and those currently under implementation resulting in these features having to be redesigned and re-implemented. A process which had a resulting knock-on effect on the budget, scope and schedule of the project.

Across all the data sources examined on the DMI, a key recurring theme was on the lack of adequate engagement particularly between the implementation teams, vendors and the business teams (the production teams in particular). This lack of adequate engagement led to various challenges during implementation. One of such challenges was the constant and significant changes to the business direction, requirements and changes in expected behaviour of delivered components by the business including the change of direction from the business on the agreed use of the agile methodology in the implementation and delivery of the project. Such frequent changes by the business across functionality, requirements and approach were down to the lack of management direction and clarity from the business on requirements. These constant changes resulted in impacts of delivery timelines, schedule and costs.

The DMI project was subsequently scrapped by the BBC in May 2013. The total cost of the failure of the DMI was estimated to be around £98.4 million.

5.5.4 DMI: Summary of Findings

From the various reports produced on the failure of the DMI project by the NAO, the PAC and PwC, a lot of focus was placed on the BBC and its handling and management of the DMI project, however, there was no sufficient focus placed on the measurement and assessment of the third-parties connected and involved in the implementation and delivery of the DMI project and other areas of the project. The BBC's failings were made apparent, however, the analysis into the possible failings by vendors was not investigated or provided.

The successful implementation of the DMI would have provided the BBC with increased efficiencies, in costs, time and creativity. Also, the DMI would have helped to transform the infrastructure and production operations of the BBC through the introduction of digital technology and would have helped to achieve its vision for a holistic digital transformation of the organisation as part of the long-term strategic objectives.

Though the DMI project has been scrapped as a whole, there were components parts of the overall solution delivered as part of the implementation process that are of use and will be retained for example, the Fabric Archive Database that allows end-users to search and obtain access to relevant media (Accenture, 2013).

5.6 CASE STUDY 3 – THE E-BORDERS PROGRAMME

This section presents the case study of the United Kingdom (UK) Home Office e-Borders programme. The e-Borders programme was a large-scale IT programme initiative that was kicked off by the UK's Home Office Department in 2003 with the objectives of introducing an advanced border control and information technology-enabled security solution that will help to improve the tracking and management of individuals moving through the UK borders (Alami 2016; National Audit Office, 2015; Vine, 2013). The implementation of the e-Borders programme was originally planned for completion in 2011.

The eventual capabilities to be delivered by the e-Borders programme will, in summary, enable the UK's Home Office department to track and conduct the relevant checks necessary on individuals prior to their arrival in the UK. The implementation of the programme requires travel operators to collect and transmit passenger and travel information electronically on every passenger entering and leaving the UK across all entry ports and airports (Dibb *et al.*, 2014). The objective was to collect Advance Passenger Information (API) on all inbound and outbound travel across all entry ports (for example, airports, seaports and trains) in and out of the UK to enable the relevant authorities to track, analyse and manage the exclusions of certain individuals that are deemed a threat or pose a risk to the UK and to leverage the technology capabilities being implemented to provide a more improved and effective border control (National Audit Office, 2015; Vine, 2013). The e-Borders system was meant to replace the existing solution in use by the Home Office that that only allowed for checks on individuals to be carried out only when they have arrived in the UK.

A pilot programme was implemented in 2004 by the Home Office called "Project Semaphore" to test the idea of the e-Borders initiative prior to the award of the main e-Borders contract. The outcomes of the pilot programme for "Project Semaphore" was deemed successful and the Home Office eventually awarded the contract to implement and deliver the e-Borders programme to Raytheon Systems Limited (RSL) in 2006 (National Audit Office, 2015; Vine, 2013).

The original contract for the e-Borders programme with RSL was cancelled in July 2010. The Home Office subsequently contracted Serco and IBM as suppliers after the termination of the contract with Raytheon (Alami, 2016). The revamped e-Borders programme initiated through a series of replacement programmes is now set to be delivered with a new target date currently set for some time in 2019, eight years behind the original schedule.

5.6.1 E-Borders: Case Study Objectives

The objectives of this case study were to understand and assess the challenges faced in the management, implementation and delivery of the e-Borders project that contributed to its eventual failure. In conducting the case study, the following secondary information sources and documents were analysed and examined:

- The United Kingdom's National Audit Office (NAO) reports
- The United Kingdom's Public Accounts Committee (PAC) reports
- Academic Journals
- Newspaper articles

5.6.2 E-Borders: Case Study Findings

The findings from the detailed analysis of the e-Borders programme are presented in the table below. These set of issues have been extracted from the relevant information sources examined and analysed during the analysis of the programme (Alami, 2016; House of Commons Committee of Public Accounts, 2016; National Audit Office, 2015; Dibb et al., 2014; Vine, 2013).

No.	e-Borders – Significant Issues identified
1	The failure by the Home Office to perform a detailed assessment of its ambitions with the e-Borders programme through a realistic lens while taking into account external factors and internal and external dependencies that could potentially hinder those ambitions.
2	The unrealistic business case that was put together by the Home Office for the e-Borders programme coupled with the unrealistic expectations set as a result and the constant changes to the business case by the Home Office that hampered the vendor (Raytheon Systems Limited) in meeting its objectives and resulted in significant delays to the project's overall schedule, subsequent poor performance and including the eventual termination of the e-Borders contract.
3	The failure by the Home Office to conduct a detailed low-level requirements analysis of the e-Borders deliverables prior to the agreement, awarding and signing of the e-Borders contract with the supplier (Raytheon Systems Limited) that would have ensured that both parties had a detailed low-level understanding of the scale, scope and the detailed view of the expected deliverables and outcomes from the e-Borders implementation.
4	The failure to by the Home Office to recognise that due to the complex nature of the e-Borders programme, the requirements and needs for the e-Borders programme are bound to evolve and change during the project's implementation and delivery lifecycle, especially as the programme's implementation, was planned to span several years. This includes the failures by the Home Office to build in the required mechanisms into the programme's contracts with the vendor to make allowances for such changes in requirements and offer the required flexibility for potential future changes to the programme's requirements, deliverables or outcomes.
5	The lack of understanding of the detailed system integration and API requirements for subsystems and components, etc. that was required by the external parties (i.e. the rail, airline and ferry and other transport operators) who have to integrate and upgrade their existing disparate IT systems to be compatible with the interface requirements of the new e-Borders solution being implemented by the Home Office.
6	The agreement and signoff of contracts between the Home Office and the vendor (Raytheon Systems Limited) that was based purely on high-level requirements leading to subsequent disputes between the vendor and the Home Office and different interpretations of the specified requirements by both parties.
7	The requirement on the vendor (Raytheon Systems Limited) to implement the required e-Borders solution on a fixed-price contract and on a fixed delivery timescale while having to deal with constantly evolving requirements by the Home Office which ultimately had an impact on the scope and defined timescales of the e-Borders project and had an impact on the vendor being able to deliver against the specified objectives.
8	The lack of clarity on the integration requirements and timescales for integration required by a large number of external parties (e.g. rail, maritime, air and other transport operators) who were required to amend their existing systems in order to be able to integrate with the e-Borders solution to provide the required data by the Home Office on passengers.

9	The lack of adequate internal and external stakeholder engagement (i.e. rail, maritime, air and transport operators) throughout the key phases of the programme's implementation lifecycle.
10	The failure to thoroughly investigate and understand from the onset the magnitude of the impact that the new e-Borders technology solution being implemented will have on the existing business processes of the Home Office and other connected government departments as well as on the existing business processes of the external stakeholders involved (rail, airline and ferry operators) and the level of change management processes required.
11	The unrealistic implementation plans and delivery timeframes that were defined for the e-Borders programme by the Home Office and the resulting impact on the planning due to the lack of a consistent strategy.
12	The unrealistic, overly ambitious and unachievable implementation plans brought about by the lack of a dependency analysis and assessments conducted to determine the impact of internal and external dependencies prior to setting the implementation scope and objectives of the e-Borders programme.
13	The significant delays to the programme as a result of legal disputes with the vendor (Raytheon Systems Limited).
14	The failure by the Home Office to manage the impact caused to external stakeholders (rail, airline and ferry operators) by the failure of the supplier (Raytheon Systems Limited) to provide multiple technology interfaces of integration to deal with the high number of disparate technology systems in use by these external stakeholders that are required to be integrated with the e-Borders solution resulting in a delay to the overall implementation schedule.
15	The failure to conduct an assessment or take into account the existing technology solutions of the various external parties involved that will be required to integrate with the e-Borders solution in order to provide a choice of multiple integration interfaces.
16	The failure to fully understand and adequately manage the potential impact the new technology solution being implemented will have on the existing business processes of all connected external stakeholders who all have disparate technology solutions.
17	The failure by the Home Office's senior management teams responsible for the e-Borders programme to take the warnings and concerns raised by various assessment reports conducted into the state of the programme highlighting fundamental problems in its management and delivery seriously and the failure by the leadership team to adequately address those concerns.
18	The lack of a consistent strategy by the Home Office that ties in with the vision and objectives set out for the e-Borders programme.
19	The constant changes in the e-Borders programme's senior management and leadership teams resulting in an impact on its effective governance and management.
20	The lack of an effective governance setup for the programme that is in alignment with the chosen implementation and delivery method.

21	The constant changes in key members of staff and management and leadership teams resulting in a lack of leadership and ownership during the key phases of the project.
22	The high turnover of permanent and non-permanent staff including members of the senior leadership teams and the failure to retain expertise and key knowledgeable staff during key project phases resulting in schedule delays, frequent transfer of knowledge and constant changes to strategy and scope as a result of departures of leadership personnel during the implementation period which ultimately resulted in the lack of responsibility and accountability for the respective key project phases and the inability to hold the responsible individuals to account during these key project phases.
23	The lack of action taken by the Home Office's senior management teams on the repeated warnings raised by the e-Borders project teams regarding the potential challenges being faced by the project that could cause significant impacts.
24	The lack of senior-level programme oversight and progress monitoring across all the key milestones of the e-Borders project.
25	The complacency of the Home Office with regards to the effective monitoring and management of the progress being made on the e-Borders programme implementation.
26	The lack of adequate stakeholder and expectations management particularly in relation to the external parties involved throughout the key phases of the e-Borders programme's implementation.
27	The failure on the part of the vendor (Raytheon Systems Limited) in providing appropriate visibility to the Home Office on the risks it faced during the project's implementation which was the direct result of the Home Office's commercial strategy that imposed a fixed price and fixed schedule contract and agreement while providing continually changing requirements.
28	The lack of reflection of the department's lack of proven track record and expertise of managing and delivery projects of such nature in the revised schedule of the programme when the implementation of the project was moved in-house.
29	The poor programme and project management on the part of the Home Office's responsible senior management and programme management teams connected to the e-Borders project.
30	The lack of regular periodic project reviews and accurate progress reports that should have facilitated a more effective, improved and informed decision making by the senior management teams on the e-Borders project.
31	The lack of the effective management of all the numerous external stakeholders involved in the project due to the large-scale nature of the programme and the resulting number of increased stakeholders.
32	The imbalance between the objectives of the Home Office and the interests and commercial obligations of the firms impacted by the implementation of the e-Borders programme.

Table **8**: The list of significant issues identified in the analysis of the e-Borders programme (Source: Author).

5.6.3 The Challenges of the E-Borders

The analysis of the e-Borders programme identified a list of challenges that was encountered during the programme's implementation and delivery that contributed to the poor performance experiences and the eventual failure of the programme. This section provides a summary analysis on some of the key issues encountered that was identified in the preceding section above.

Using the outputs from the literature review exercises to a basis for assessment, numerous factors were identified from the findings detailed above. Some of the factors appeared to be more significant than the others. Based on the analysis, the frequent and prominent factors identified are re-summarised below to align with findings from literature:

- lack of regularly validated and reviewed business case;
- lack of detailed business requirements;
- poor requirements analysis and solution definition
- lack of effective change management processes;
- lack of technical know-how and understanding
- poor contract management
- lack of adequate end-user involvement and engagement
- unrealistic planning
- schedule delays
- poor project management
- lack of adequate and ongoing risk assessment
- poor governance structures and oversight
- resource volatility
- lack of adequate monitoring and control
- lack of relevant management and implementation expertise

In assessing the outcomes above, the e-Borders programme failed because of significant difficulties and challenges during its implementation and delivery cycle that can be linked to failures at both the client (the Home Office) and the vendor (RSL).

From the analysis carried out on the e-Borders programme, the implementation ran into difficulties from the outset (Dibb *et al*., 2014). As a result of the challenges encountered with the initial e-Borders programme's implementation, the Home Office terminated its initial contract with Raytheon Systems Limited (RSL) in 2010 as a result of what it claims were failures by RSL in meeting the specified project milestones (Vine, 2013). The Home Office decided on a new approach to realise the overall objectives of the e-Borders programme by initiating a series of successor programmes between 2010 and 2015.

A key factor that led to the e-Borders programme being challenged and significantly behind schedule was due to the cancellation of the contract with the key vendor RSL (House of Commons Committee of Public Accounts, 2016). According to the NAO findings in its report, some of the functionalities delivered during the revised implementation approach were subsequently impaired due to the lack of modern IT systems that are required to support the effective functioning of the functionalities delivered. As a result of the delays and failures in the initial e-Borders programme, additional costs had to be spent in upgrading and modernising legacy systems to support the functionalities being delivered by the successor programmes (National Audit Office, 2015). As at 2015, the legacy systems are still be used as a result of the challenges with the project. The target date of 2007 set for decommissioning all legacy systems was never met (National Audit Office, 2015).

Another contributing factor to the failure of the e-Borders programme was the constant departures of key members of staff during the implementation and delivery phase of the programme. The issue of personnel departures was identified as a key problem area that subsequently resulted in challenges to resourcing and created significant gaps in capability. The challenges on personnel introduced significant delays to the implementation cycle of the programme. For example, according to the House of Commons Committee of Public Accounts report, there were eight different programme directors during the key phases of the e-Borders programme implementation (House of Commons Committee of Public Accounts, 2016). These constant changes to members of staff at both senior, mid-level and junior levels had significant impacts on the outcome of the project as the volatility of personnel lead to significant delays and lack of ownership of the various programme components that they oversaw. A knock-on impact from the constant changes to personnel meant that key business decisions, strategic approaches and key conversations had to be repeated with the relevant stakeholders with every major departure in personnel. In addition, the constant changes to personnel led to constant changes in strategy and approach as different individuals brought about their own approach and strategy to the various programme components. These constant changes in personnel also lead to the lack of accountability and the ability to hold key individuals responsible and accountable for issues that went wrong with the implementation. Finally, these constant changes in personnel lead to numerous handover programmes and thus impacted the specified implementation and delivery timescales.

According to the UK's House of Commons Committee of Public Account's assessment of the programme, the e-Borders and the successor programmes is projected to fall behind its initial delivery schedule by around eight years and will cost over £1 billion pounds in total (House of Commons Committee of Public Accounts, 2016). Alami (2006, p.66), in his study of the failures of the e-Borders programme, concluded that “the failure of the e-Borders case was due to suboptimal management, adverse ecosystem conditions combined with poor risk management, and multiple failures in execution”.

5.6.4 E-Borders: Conclusion

Though the various reports by the NAO, the PAC and the Independent Chief Inspector of Borders and Immigration all recognised that the e-Borders programme did deliver some value and improved functionality from the component parts that were implemented and delivered, the reports concluded that the key objectives and the vision defined for the e-Borders programme have not been met. The reports also concluded that based on the objectives set out in the original vision of the programme, the programme has failed to deliver to such vision (National Audit Office, 2015; Vine, 2013). Particularly, as identified by Vine, (2013) in his independent assessment and subsequent report on the e-Borders program, as at 2013, the e-Borders programme is yet to deliver on the key benefits for which it was initiated.

The revamped e-Borders programme is now expected to be delivered in 2019 as a result of the overhaul of the programme. The change in schedule is expected to add a further investment cost of more than £275 million pounds to the initial budgeted cost of the programme. According to the National Audit Office (2015), as at 2015, a total amount of £830 million pounds has been spent so far on the e-Borders programme during the period beginning April 2006 to March 2015.

CHAPTER 6

The Conceptual Domain Model

6.1 INTRODUCTION

This chapter provides a detailed background on the approach taken with regards to the development of a conceptual domain model to help model the knowledge gathered about the Large-Scale Complex IT Projects (LSCITP) challenges based on the findings from the review of literature and the case studies conducted and to identify knowledge areas and connected factors and provide a categorisation of the factors identified from the literature review exercise and the case studies that are impacting the successful management, implementation of IT and LSCITP. The sections that follow below details the steps taken and the process used for acquiring the required domain knowledge to underpin the development of the conceptual domain model and for representing such knowledge gained in a formalised structure.

6.2 DEVELOPING THE CONCEPTUAL DOMAIN MODEL

As part of the objectives of this study, a conceptual modelling approach is applied to assist with the effective discovery, establishment and understanding of the static and dynamic elements and to interpret the informal descriptions of the LSCITP problem domain (for example, through the identification of the entities, concepts, relationships, dependencies and processes) into a conceptual domain model as part of the research objectives of identifying and understanding the challenges of LSCITP and the reasons why they fail far too often.

The research activities carried out in the preceding chapters of this study have allowed for the acquisition of extensive domain knowledge including the identification of the key influencing success and failure factors that are connected to LSCITP and IT/IS projects in general. The acquisition of the required knowledge to underpin the development of the domain model was the starting point in the domain modelling exercise carried out. Building the conceptual model required a prior detailed and comprehensive knowledge and understanding of the LSCITP domain. As Olivé (2007) argues with regards to conceptual modelling, "it is not possible to have concrete knowledge about a domain without a prior general knowledge about that domain". This knowledge gained and acquired is then represented through the use of a conceptual domain model to firstly, assist with the identification of the various entities operating within a LSCITP environment and their associated relationships, secondly, to identify and model the required knowledge areas for LSCITP from the knowledge gained, to capture generic concepts and relationships of the LSCITP challenged domain and finally, to assist with the specification of the acquired knowledge in a format that facilitates understanding, future expansion and possible application through a visual representation of the identified knowledge areas, associated relationships and connected factors.

A domain model represents a conceptual and logical model of a problem domain and is also often referred to as conceptual models. The use of conceptual models is particularly prevalent within the IT/IS domain (Wand and Weber, 2002). Conceptual models form the basis for formalised ontology (Tanriöver and Bilgen, 2011) and they are used to represent an application domain (Everman and Wand, 2009). According to Evermann and Wand (2005), "conceptual models are descriptions of the organisational context for which a system is developed, and are used to help to understand this context." Creating conceptual modelling is fundamental particularly in areas with complex real-world problems (Reinhartz-Berger and Sturm, 2008). Brambilla, Cabot and Wimmer (2012) strengthen the argument on the significance of models by explaining that models have long been applied in several scientific contexts as they are of central importance to understanding a particular domain area.

A conceptual domain model depicts the various attributes connected to a problem domain in the real world as a set of domain objects that are required to collaborate together including the depiction of their relationships, attributes, roles, data, connected processes, responsibilities constraints and interactions and how they reflect the problem domain being addressed to achieve the desired outcome (Brambilla, Cabot and Wimmer, 2012; Tanriöver and Bilgen, 2011; Larman, 1998). Domain models are created after an understanding of the requirements of a system (Everman and Wand, 2009) that are often captured through the requirements gathering process using various methods (for example, user stories, use cases and many more). In summary, a domain model represents a methodical knowledge of the problem being addressed as it provides the full set of information required to address the problem.

Within the IT/IS domain, the use of domain modelling is central to the design, implementation and delivery of software as domain models are often used to relieve the complexity of software (Evans, 2003; Wand and Weber, 2002; Larman, 1998). Software engineering tools and techniques are increasingly being applied in complex project environments in order to apply system based methods to the implementation process (Locatelli, Mancini and Romano, 2013). The idea behind the application of the domain modelling principles in identifying, mapping and interpreting the informal descriptions the LSCITP problem domain is to apply the combination of formal methods, experienced-based techniques, best practices and the fundamental principles of software engineering that are used to understand, implement and decompose complexity in complex systems in the understanding of LSCITP which are complex projects themselves. In summary, the application of domain modelling principles in this context is used to derive the conceptual schema for the LSCITP challenged domain. Additionally, the use of domain modelling also helps to acquire an overall view of the set of corresponding entities, their relationships, attributes, roles, operations, connected processes, responsibilities, constraints and interactions within the LSCITP problem domain.

In the context of this study, the use of a domain model is focused on the domain-related aspects of domain modelling rather than the system engineering-related aspects. The use of a domain model provides a way not only to represent the LSCITP problem domain and to gain a deeper understanding of the LSCITP environment but also as a way to reflect the understanding of the problem domain being addressed. Overall, the application of domain modelling concepts in this study is to help:

1. Understand and categorise the failure factors for LSCITP
2. Understand the success factors for LSCITP
3. Develop a domain model with identified knowledge areas to represent the knowledge acquired on LSCITP failure factors
4. Derive the conceptual schema (the domain categories) to understand the factors identified, their categorisation and relationships
5. Evaluate the effectiveness of the use of the domain model in understanding the challenges of LSCITP and examining the causes that lead to failures

6.3 PERFORMING DOMAIN ANALYSIS

Domain analysis is the process that is used "to identify and document common and variable characteristics of systems in a specific domain" (Lisboa, et al, 2010) or as Ferre and Vegas (1999, p.1) defines it, domain analysis is used to "identify, organise and model knowledge about the solution of a class of problems". Building a conceptual model requires a thorough process to collect, organise, categorise and analyse several sources of information about the different areas of a domain (Lisboa, *et al*, 2010) and the development of an appropriate domain model requires an appropriate analysis process that details the set of activities required which includes domain scoping, data collection, data analysis, data classification and evaluation (Lisboa, et al, 2010, cited in Arango, 1994, pp.17–49) in order to produce the required domain model.

The source of knowledge for creating the domain model in this study is based on the extensive review of literature and the case studies conducted that extensively captures the LSCITP problem domain along with the analysis of the extensive list of critical success and failure factors which also formed part of the knowledge gathering process to build and evaluate the domain model.

So far from the existing literature, there is no coherent model identified that depicts the LSCITP problem environment and the connected processes or which models the concepts within the LSCITP domain. Additionally, the literature review identified the lack of a domain model to conceptualise the challenges of LSCITP.

6.3.1 Acquiring the Domain Knowledge

Within the IT/IS domain, achieving a successful outcome for an IT project is often said to be down to a set of important factors that are deemed to be the key enablers for success. These several factors impact the degree of success on a project (Müller and Jugdev, 2012). When these set of factors are understood and applied, they help towards the achievement of a successful outcome on a project (Rockart and Crescenzi, 1984) and when they are not effectively understood and applied, they can contribute towards the failure of a project (Hidding and Nicholas, 2009).

The high failure rate being experienced with IT projects and LSCITP has led to increased research and analysis being conducted across both the academic and industry sectors on successful and non-successful IT projects alike. The objectives of these are to help identify the set of important critical factors for IT projects that can be effectively applied during their implementation with the ultimate goal of preventing failures and increasing success rates (Doherty, Ashurst and Peppard, 2012; Müller and Jugdev, 2012; Fan, 2010; Hidding and Nicholas, 2009; Fortune and White, 2006). The objectives also include the need to identify, analyse and understand the potential threats to success and effectively mitigate these threats so that the chances of success can be increased significantly (Schmidt, *et al.*, 2001).

From the pool of existing research carried out to date, a set of factors have been identified as being connected to the success or failure of an IT project. The identified factors are often referred to collectively as *Critical Success Factors (CSF)*, *Success Factors* and *Failure Factors*. As defined by Rockart and Crescenzi (1984) and Rockart (1979), CSFs are those specific vital areas that need to be focused on, with the achievement of successful performance on these critical areas in turn leading to success in achieving defined objectives. Put simply, CSFs are defined as the set of criteria that must be achieved in order for a particular IT-project implementation to achieve a successful outcome (Rodriguez-Repiso, Setchi and Salmeron, 2007b; Sherry and Corbett, 2007). Their presence increases the likelihood of success while their absence increases the likelihood of failure (Hidding and Nicholas, 2009).

The subject of CSF was explored in a study by Rockart (1979) to understand the various methods of providing the information needs of senior executives and stakeholders with regards to supporting improved decision making. Rockart described four of the approaches in use at the time which were the "by-product technique", the "null approach", the "key indicator system", and the "total study process" (Rockart, 1979). These methods provided various approaches to the establishment of senior management information requirements however, these approaches were also without their challenges and shortcomings in spite of the various merits they provide Rockart noted problems for example, the usefulness of the data presented (the by-product technique), the informal approach and the possibility of missing out vital information (the null approach), the possibility of overload of unnecessary non-targeted information (the key indicator approach) and the possibility of bias (the total study process approach).

Putting the above methods in context, with the introduction of the CSF method Rockart (1979) highlighted the high effectiveness of the use of CSF in helping with assessing and understanding senior management's information needs and the achievement of organisational goals and objectives. In Rockart's view and based on his examination of relevant literature, CSFs should be tailored and adapted to each stakeholders' needs and should also be tailored to an organisation. Rockert's argument is since there are several internal and external factors that can lead to the need for differing CSF within organisations particularly when the issue of strategic objectives is factored in.

In determining the CSF, the identification process would be performed on the back of a two or three stage process with senior management stakeholders to facilitate the capture of goals and the subsequent discussion of the CSF that help to underpin the defined goals. The end objective being the need to derive the actual CSF that reflects the real hard and soft information needs and areas for senior management to focus on with detailed attention. To sum up, senior stakeholders need to define specific and tailored CSF that is tied to a period or goal in context.

Various theoretical, empirical, case studies, practical research and other forms of research studies have been carried out to identify the set of factors that can increase the likelihood of success on IT projects across various dimensions and covering different projects categories (Hughes, Rana and Simintiras, 2017; Hidding and Nicholas, 2009; Fortune and White, 2006). In addition, several methodologies, frameworks and models have also been developed from existing research into IT/IS project success and failures to assist in the identification, categorisation, ranking and prioritisation of these critical factors. The idea is to allow project stakeholders to identify, understand and address these critical factors as a matter of priority in their pursuit of project success. The three most common methodologies developed are Analytic Hierarchy Process (AHP), Critical Success Chains (CSC) and Fuzzy Cognitive Maps (FCM) (Rodriguez-Repiso, Setchi and Salmeron, 2007b). Moreover, amongst the objectives of such studies and the development of such methodologies and frameworks is to establish a connection between the successful outcome of a project and the influences contributed by the relevant factors in that process and to identify the relationships between them if any.

While there have been several studies carried out that identify the critical factors for IT projects, other studies (Hughes, Rana, and Simintiras, 2017) have identified the need for further research to help identify more critical factors for IT projects using new frameworks or approaches. Rodriguez-Repiso, Setchi and Salmeron (2007b) argue that current research methodologies and frameworks that are used to identify and classify the indicators of success or failures in IT projects have certain limitations that must be overcome with the use of new frameworks to help identify the true critical factors on IT projects. Despite the extensive research to date on IT/IS project success and failures and the exhaustive list of critical factors presented, Hughes, Rana and Simintiras (2017) argue that there are still gaps in the body of existing knowledge specifically with regards to the understanding new factors and the contributions they add as well as their influence on project outcomes. Doherty, Ashurst and Peppard (2012) argue that a detailed explanation and understanding of critical factors are required so that their application to prevent failures can be more effective. In a related argument, Fortune and White (2006) presented a systems-based model of addressing and overcoming the limitations of CSFs. Salmeron and Herrero (2005), in their study on using an AHP-based methodology to rank critical success factors of IS project also argued that some literature studies on CSFs lack the required technical rigour to underpin their validity.

The high rate of failures of IT projects and LSCITP has led to an increase not only in the need to understand these critical factors better but to also understand the effects of their application on IT projects with the objectives of measuring their effects on reducing the likelihood of failures and increasing the success rates (Fan, 2010). Dwivedi, *et al*. (2014) highlighted the need for such further research to explore areas currently unexplored and to explore these issues from multiple perspectives. These critical factors ultimately represent the set of factors by which the success of a project is being assessed and determined (Goparaju, 2012). Additionally, these critical factors vary with regards to their significance and importance in the context of ensuring a more successful outcome for an IT project and to avoid known issues that lead to failures. According to Bergeron and Begin (1989), the approach of identifying and applying critical factors has been applied to other industry sectors with successful outcomes. The objectives of identifying and analysing critical factors from an IT project context is so that they can be understood and applied to increase the likelihood of success and also to help to achieve a successful implementation and delivery outcome for such projects.

The comprehensive literature review exercise carried out in *Chapters Two* and *Three,* and the case studies conducted in *Chapter Five* has helped to identify an exhaustive list of various success and failure factors for IT projects of various dimensions spanning several research studies into IT/IS project success and failures. A total of twenty-seven research articles were identified and analysed to extract the set of factors from existing literature that investigate critical success factors, success factors and failure factors in IT projects through content analysis. A systematic in-depth review of this existing relevant literature was carried out. These existing research studies examined cover the identification and examination of success and failure factors on IT projects across multiple industry sectors and were based on a combination of several data gathering methods and research techniques with some studies providing an exhaustive list and ranking of the factors. The approach to gathering the list of factors was based on the thorough examination of relevant literature and by conducting a critical review of IT project success and failure literature and taking a look at the most cited factors and formulating a view of the key factors and reasons that cause failures in those projects. From the set of literature articles analysed, fifty-one different failure factors were identified, and 36 success factors were also identified.

Identifying and compiling the set of success and failure factors proved challenging because of the different interpretations, wordings and meanings assigned to the individual factors from the different research studies examined. Though several relevant studies provide a list of success and failure factors, there are variations in their scope and objectives (Belassi and Tukel, 1996). In identifying the set of key factors, the focus was placed on the meaning and understanding of a factor rather than purely on the words used to describe the factor in the literature.

The list of the various success and failure factors identified and extracted from the literature exercise is documented in the tables below.

#	Failure Factors	Source/Author
1	Poor and ineffective change management	Hughes, Rana and Simintiras, 2017 Patel, 2009 Abbas and Sanavullah, 2008 Schmidt, et al., 2001 Gauld, 2006 Willcocks and Griffiths, 1994
2	Lack of responsiveness and resistance to change	Hughes, Rana and Simintiras, 2017 Patel, 2009 Gauld, 2006
3	Lack of appropriate functional requirements	Hughes, Rana and Simintiras, 2017 Abbas and Sanavullah, 2008 Attarzadeh and Siew, 2008 Verner, Sampson and Cerpa, 2008 Nelson, 2007 Gauld, 2006
4	Requirements volatility	Hughes, Rana and Simintiras, 2017 Alfaadel, Alawairdhi and Al-zyoud, 2012 Hidding and Nicholas, 2009 Patel, 2009 Abbas and Sanavullah, 2008 Schmidt, et al., 2001
5	Poor project management	Hughes, Rana and Simintiras, 2017 Alfaadel, Alawairdhi and Al-zyoud, 2012 Abbas and Sanavullah, 2008 Verner, Sampson and Cerpa, 2008

		Ewusi-Mensah, 1997
6	Lack of clearly defined goals and objectives or business case	Hughes, Rana and Simintiras, 2017 Alfaadel, Alawairdhi and Al-zyoud, 2012 Abbas and Sanavullah, 2008 Verner, Sampson and Cerpa, 2008 Hidding and Nicholas, 2009 Gauld, 2006 Schmidt, et al., 2001 Ewusi-Mensah, 1997
7	Lack of clearly defined business case	Hughes, Rana and Simintiras, 2017 Verner, Sampson and Cerpa, 2008
8	Poor project management processes	Verner, Sampson and Cerpa, 2008 Nelson, 2007
9	Inappropriate delivery methodology	Verner, Sampson and Cerpa, 2008
10	Use of unsuitable software development methodologies	Hidding and Nicholas, 2009 Verner, Sampson and Cerpa, 2008
11	Budget management failings and costing issues	Abbas and Sanavullah, 2008 Attarzadeh and Siew, 2008 Verner, Sampson and Cerpa, 2008
12	Poor planning and lack of adequate planning	Hughes, Rana and Simintiras, 2017 Alfaadel, Alawairdhi and Al-zyoud, 2012 Abbas and Sanavullah, 2008 Attarzadeh and Siew, 2008 Nelson, 2007 Verner, Sampson and Cerpa, 2008 Linberg, 1999
13	Insufficient staffing	Patel, 2009

		Abbas and Sanavullah, 2008 Attarzadeh and Siew, 2008 Verner, Sampson and Cerpa, 2008 Schmidt, et al., 2001 Linberg, 1999
14	Poor communication	Alfaadel, Alawairdhi and Al-zyoud, 2012 Abbas and Sanavullah, 2008 Verner, Sampson and Cerpa, 2008
15	Lack of technical know-how, skills and required domain knowledge	Patel, 2009 Abbas and Sanavullah, 2008 Verner, Sampson and Cerpa, 2008 Schmidt, et al., 2001 Ewusi-Mensah, 1997
16	Poor risk management	Hughes, Rana and Simintiras, 2017 Abbas and Sanavullah, 2008 Verner, Sampson and Cerpa, 2008 Nelson, 2007
17	Lack of user involvement and commitment	Schmidt, et al., 2001 Abbas and Sanavullah, 2008 Attarzadeh and Siew, 2008 Verner, Sampson and Cerpa, 2008
18	Lack of adequate user engagement	Alfaadel, Alawairdhi and Al-zyoud, 2012 Abbas and Sanavullah, 2008 Verner, Sampson and Cerpa, 2008 Gauld, 2006 Schmidt, et al., 2001
19	Lack of effective client consultation	Hughes, Rana and Simintiras, 2017 Hidding and Nicholas, 2009

		Verner, Sampson and Cerpa, 2008
20	Use of inappropriate technology	Buhl and Meier, 2011 Abbas and Sanavullah, 2008 Verner, Sampson and Cerpa, 2008 Ewusi-Mensah, 1997
21	Unsuitable political environment	Verner, Sampson and Cerpa, 2008
22	External factors	Verner, Sampson and Cerpa, 2008
23	Quality assurance issues	Verner, Sampson and Cerpa, 2008 Nelson, 2007
24	Lack of top management commitment and support	Hughes, Rana and Simintiras, 2017 Alfaadel, Alawairdhi and Al-zyoud, 2012 Abbas and Sanavullah, 2008 Verner, Sampson and Cerpa, 2008 Nelson, 2007 Schmidt, et al., 2001 Ewusi-Mensah, 1997
25	Lack of leadership/effective leadership	Abbas and Sanavullah, 2008 Verner, Sampson and Cerpa, 2008 Gauld, 2006
26	Business process re-engineering	Verner, Sampson and Cerpa, 2008 Gauld, 2006
27	Internal and project team conflicts	Alfaadel, Alawairdhi and Al-zyoud, 2012 Verner, Sampson and Cerpa, 2008 Nelson, 2007 Schmidt, et al., 2001 Linberg, 1999
28	Suitability of technology/technical framework	Abbas and Sanavullah, 2008 Gauld, 2006

		Schmidt, et al., 2001
29	Resource volatility	Hughes, Rana and Simintiras, 2017 Nelson, 2007 Gauld, 2006
30	Dependence on third-parties/contractors/consultants/suppliers	Gauld, 2006
31	Multiple stakeholder views	Buhl and Meier, 2011 Gauld, 2006
32	Political environment	Buhl and Meier, 2011 Abbas and Sanavullah, 2008 Nelson, 2007 Gauld, 2006
33	Misunderstanding of the requirements	Schmidt, et al., 2001
34	Changing scope and objectives	Alfaadel, Alawairdhi and Al-zyoud, 2012 Patel, 2009 Nelson, 2007 Schmidt, et al., 2001
35	The large number of external parties involved	Schmidt, et al., 2001
36	Lack of expectations management and unrealistic expectations	Abbas and Sanavullah, 2008 Nelson, 2007 Schmidt, et al., 2001
37	Lack of effective project management methodology	Abbas and Sanavullah, 2008 Schmidt, et al., 2001
38	Inappropriate staffing	Abbas and Sanavullah, 2008 Schmidt, et al., 2001
39	Large-scale and complex nature	Hughes, Rana and Simintiras, 2017
40	Lack of post-implementation process	Hughes, Rana and Simintiras, 2017
41	Poor project team	Abbas and Sanavullah, 2008

		Ewusi-Mensah, 1997
42	Escalating project costs	Ewusi-Mensah, 1997
43	Schedule problems and unrealistic timeframes	Alfaadel, Alawairdhi and Al-zyoud, 2012 Abbas and Sanavullah, 2008 Nelson, 2007
44	Lack of resources	Abbas and Sanavullah, 2008 Nelson, 2007
45	Poor estimation	Nelson, 2007
46	Poor stakeholder management	Nelson, 2007
47	Failures by external contractors and third-parties	Nelson, 2007
48	Lack of alignment of technology implementation with business objectives	Buhl and Meier, 2011
49	Lack of strategic framework, or conflicts over strategy	Willcocks and Griffiths, 1994
50	Lack of organisational adaptation to complement technological change	Willcocks and Griffiths, 1994
51	IT supplier problems and general immaturity of the supply side	Willcocks and Griffiths, 1994

Table **9**: The list of failure factors for IT projects extracted from the examined literature.

The list of the various success factors identified and extracted from the literature exercise is documented in the table below.

#	Success Factors	Source/Author
1	Top management commitment and support	Ahmad, Haleem, and Syed Ali, 2013; Hidding and Nicholas, 2009 Sherry and Corbett, 2007 Cottrell and Rapley, 1991 Pinto and Slevin, 1987
2	Project management and organisation	Ahmad, Haleem, and Syed Ali, 2013;

		Hidding and Nicholas, 2009
3	Training and education	Ahmad, Haleem, and Syed Ali, 2013; Holodnik-Janczura and Lerka, 2010 Sherry and Corbett, 2007
4	Effective communication, communication plans and communication planning	Ahmad, Haleem, and Syed Ali, 2013; Holodnik-Janczura and Lerka, 2010 Hidding and Nicholas, 2009 Sherry and Corbett, 2007 Pinto and Slevin, 1987
5	Change management	Ahmad, Haleem, and Syed Ali, 2013; Sherry and Corbett, 2007
6	Vision and planning	Ahmad, Haleem, and Syed Ali, 2013; Sherry and Corbett, 2007
7	Competent and effective project teams	Ahmad, Haleem, and Syed Ali, 2013; Sherry and Corbett, 2007 Pinto and Slevin, 1987
8	Vendors and vendor relationships	Ahmad, Haleem, and Syed Ali, 2013;
9	Technology and use of appropriate technology	Ahmad, Haleem, and Syed Ali, 2013; Hidding and Nicholas, 2009 Sherry and Corbett, 2007 Cottrell and Rapley, 1991
10	Technical infrastructure	Ahmad, Haleem, and Syed Ali, 2013; Sherry and Corbett, 2007
11	Clearly defined business goals and objectives	Ahmad, Haleem, and Syed Ali, 2013; Hidding and Nicholas, 2009 Cottrell and Rapley, 1991 Pinto and Slevin, 1987
12	Planning	Ahmad, Haleem, and Syed Ali, 2013;

		Hidding and Nicholas, 2009 Sherry and Corbett, 2007 Pinto and Slevin, 1987
13	Project management	Ahmad, Haleem, and Syed Ali, 2013; Holodnik-Janczura and Lerka, 2010 Sherry and Corbett, 2007 Cottrell and Rapley, 1991
14	Managing cultural and organisational change	Ahmad, Haleem, and Syed Ali, 2013; Sherry and Corbett, 2007 Cottrell and Rapley, 1991
15	Managing expectations	Ahmad, Haleem, and Syed Ali, 2013;
16	Budget	Ahmad, Haleem, and Syed Ali, 2013; Sherry and Corbett, 2007
17	Effective management	Ahmad, Haleem, and Syed Ali, 2013;
18	Interdepartmental cooperation	Ahmad, Haleem, and Syed Ali, 2013;
19	Vendor selection	Ahmad, Haleem, and Syed Ali, 2013; Sherry and Corbett, 2007
20	Project leadership	Holodnik-Janczura and Lerka, 2010 Hidding and Nicholas, 2009 Pinto and Slevin, 1987
21	Managing scope	Hidding and Nicholas, 2009
22	Skills and expertise	Holodnik-Janczura and Lerka, 2010 Hidding and Nicholas, 2009 Cottrell and Rapley, 1991
23	User involvement and engagement	Holodnik-Janczura and Lerka, 2010 Hidding and Nicholas, 2009 Sherry and Corbett, 2007
24	Risk management	Hidding and Nicholas, 2009

25	External factors management	Hidding and Nicholas, 2009 Sherry and Corbett, 2007
26	Single responsible owner/project champion	Holodnik-Janczura and Lerka, 2010 Sherry and Corbett, 2007
27	Effective decision making	Sherry and Corbett, 2007
28	Synergetic project teams	Sherry and Corbett, 2007
29	Legacy technology assessment	Sherry and Corbett, 2007
30	Relationship management	Sherry and Corbett, 2007 Pinto and Slevin, 1987
31	Post-implementation management	Sherry and Corbett, 2007 Cottrell and Rapley, 1991
32	Data management	Holodnik-Janczura and Lerka, 2010 Cottrell and Rapley, 1991
33	Adequate resources & resourcing	Holodnik-Janczura and Lerka, 2010 Pinto and Slevin, 1987
34	Appointment of a steering committee	Holodnik-Janczura and Lerka, 2010
35	Clearly defined and detailed requirements	Holodnik-Janczura and Lerka, 2010
36	Business process re-engineering	Holodnik-Janczura and Lerka, 2010

Table **10**: The list of success factors for IT projects extracted from the examined literature.

The combined list of success and failure factors identified above along with the literature review exercise carried out in the study in *Chapters Two* and *Three* and the case studies carried out in *Chapter Four* provided the set of input variables that was required as part of the development of the domain model to describe the LSCITP problem domain and the various entity objects, the relationships between them, attributes, roles, operations, connected processes, responsibilities, constraints and interactions.

6.3.2 Identifying the LSCITP Challenged Domain Entities

A scope was defined for the creation of the domain model, the scope covers the entire LSCITP problem domain identified through the existing research work carried out in Chapters two, three and five as highlighted above. The objectives of defining the scope are to set the context and boundary by which the domain modelling exercise can be performed and to effectively allow for an approach for the knowledge gained to be accurately represented and for the resulting model to be developed and validated.

The entities listed below were derived through the application of object-oriented principles on the data derived from the domain knowledge acquisition exercise through the use of category lists and the identifications of nouns and phrases by explicating the terms obtained from the knowledge acquisition exercise to identify the possible entity classes, their relationships, attributes, roles, operations, connected processes, responsibilities, constraints and interactions as well as the classifications of the objects into specific entities and relationship types.

The list of the identified entities is represented in the table below.

#	Term	#	Term	#	Term
1	Technology	2	Business Case	3	Complexity
4	Support	5	Organisation	6	Goal
7	Management	8	Stakeholder	9	Risk Management
10	Requirement	11	Engagement	12	Scope
13	Knowledge	14	User Involvement	15	Project Manager
16	End-User	17	Expertise	18	Project Team
19	Schedule	20	Senior Management	21	Framework
22	Leadership	23	Methodology	24	Objective
25	Business Process	26	Communication	27	Skill
28	Budget	29	Planning	30	Training
31	Cost	32	Resource	33	Change Management

34	Business Owner	35	Third-Party	36	Monitor
37	Control	38	Mission	39	Risk
38	Governance	39	Change	40	Experience
41	Procurement	42	Contract	43	Quality
44	Process	45	Client	46	Contract
47	Project	48	System		

Table **11**: The list of identified LSCITP problem domain entities explicated from existing literature.

In identifying and deriving the eventual challenged knowledge areas for the domain model, a category list was developed to help identify key conceptual classes based on for example, processes, procedures, designs, specifications, descriptions, documentations, events, roles, organisations, and reports analysed from the data acquired through the domain knowledge exercise. Moreover, the identification of nouns and phrases in the descriptions of the data derived also supported the above efforts to identify the domain classes required to model the "challenged" problem domain. Furthermore, associations between the domain classes identified were also mapped and used to record the logical connections and meaningful relationships and dependencies between domain objects that are critical in assimilating the conceptual model. The associations mapped in the model indicate structural relationships between the connected objects and signifies the existence of operational dependencies and functionality and data sharing between the operations in one knowledge area and the connected knowledge areas.

The category list derived is presented in the figure below.

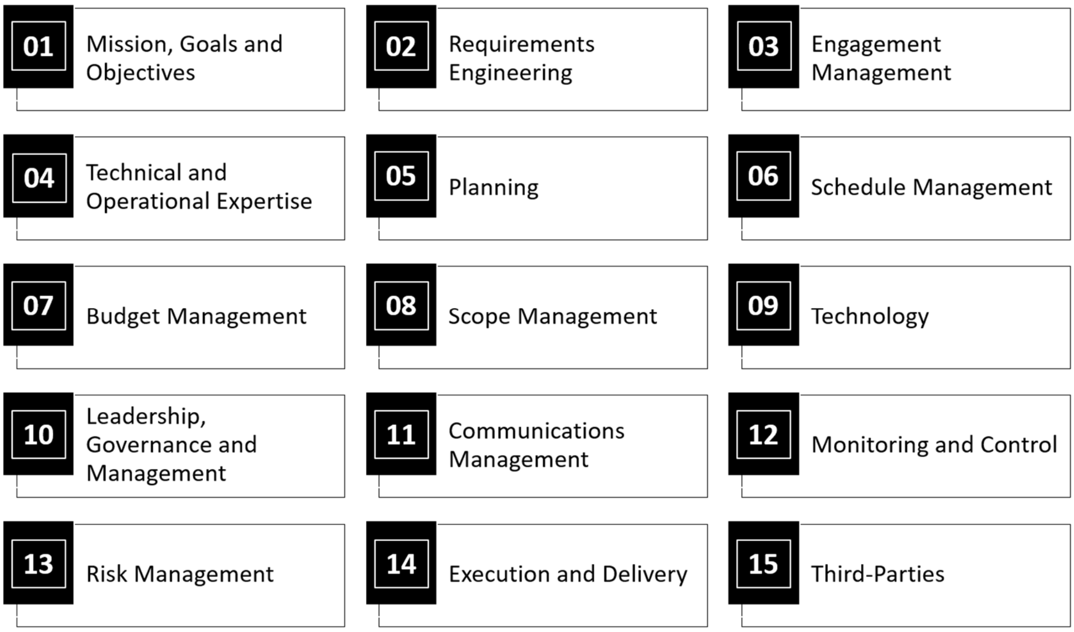


Figure **9**: The list of “challenged” problem domain entities identified from the domain analysis exercise.

The detailed understanding of the identified entities along with the domain analysis performed to identify challenged knowledge areas was a key part of the objectives in the efforts to understand the challenges, causes, effects and the resulting impacts of outcomes on LSCITP.

6.3.3 Developing the Conceptual Schema

The domain model was developed and designed using the "Unified Modelling Language" (UML). Different languages and tools are used for the development of a conceptual model, and UML is one such language used to develop and represent conceptual models (Evermann and Wand, 2005). Within the software engineering domain, UML is often used as the standard conceptual modelling language to help describe domain models, particularly through its object-oriented language and approach. UML is a formal modelling language that is used to model the requirements, design and development of software systems (Reinhartz-Berger and Sturm, 2008; Fowler and Scott, 1999). Additionally, UML contains the required notations for expressing and creating various design diagrams to help visualise requirements, ideas and analyse requirements and for describing the structural and dynamic aspects of a system (Brambilla, Cabot and Wimmer, 2012). In this modelling exercise, UML class diagrams have been used to provide the central building block for the model. UML class diagrams are used to model the domain entities and represents the concepts in the domain being examined. Class diagrams describe the static structure of a system by depicting the classes contained within the system, their attributes and the relationships amongst them (Fowler and Scott, 1999). The classes contained in the model have been designed with the lowest level of detail by removing the attributes and operations and only keeping the class names and the high-level notations.

6.3.4 The LSCITP Challenged UML Domain Model

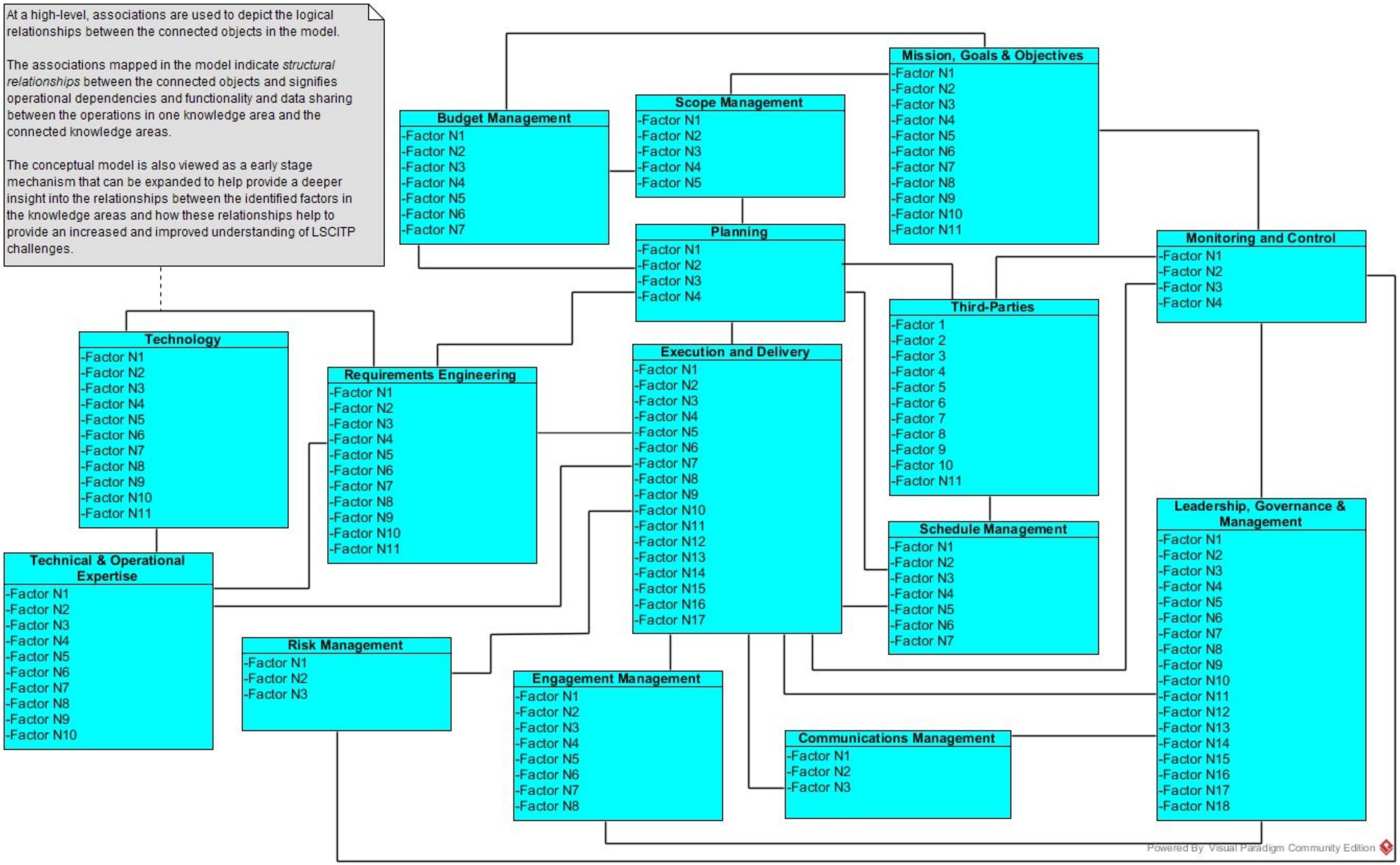
The domain model presented below describes the problem domains of real-world LSCITP through the conceptual model that captures the entities, objects, concepts, processes, relationships within the domain. In the developed model, the following relationships are shown:

- Entities – the set of objects (classes) participating within the model
- Relationships – the set of relationships identified within the domain model

Mapping out the challenges inherent in the management, implementation, and delivery of LSCITP requires a good domain model that reflects deep insights into the problem domain. Based on the domain analysis carried out, the modelling process was modelled to focus on the areas that are connected to the challenges of LSCITP. This problem domain model focuses on the entities and their relationships, attributes, roles, operations, connected processes, constraints and interactions showing dependencies, interdependencies and relationships and interactions between the identified domain areas. However, the classes contained within this model are shown with the lowest level of detail by removing the attributes and operations and only keeping the class names and the high-level notations.

The LSCITP critical knowledge area domain model UML class diagram is represented in the figure below.

Figure **10**: The LSCITP challenged domain model (Source: Author).


At a high-level, associations are used to depict the logical relationships between the connected objects in the model.
The associations mapped in the model indicate *structural relationships* between the connected objects and signifies operational dependencies and functionality and data sharing between the operations in one knowledge area and the connected knowledge areas.
The conceptual model is also viewed as a early stage mechanism that can be expanded to help provide a deeper insight into the relationships between the identified factors in the knowledge areas and how these relationships help to provide an increased and improved understanding of LSCITP challenges.
Budget Management
-Factor N1 -Factor N2 -Factor N3 -Factor N4 -Factor N5 -Factor N6 -Factor N7
Scope Management
-Factor N1 -Factor N2 -Factor N3 -Factor N4 -Factor N5
Mission, Goals & Objectives
-Factor N1 -Factor N2 -Factor N3 -Factor N4 -Factor N5 -Factor N6 -Factor N7 -Factor N8 -Factor N9 -Factor N10 -Factor N11
Planning
-Factor N1 -Factor N2 -Factor N3 -Factor N4
Monitoring and Control
-Factor N1 -Factor N2 -Factor N3 -Factor N4
Third-Parties
-Factor 1 -Factor 2 -Factor 3 -Factor 4 -Factor 5 -Factor 6 -Factor 7 -Factor 8 -Factor 9 -Factor 10 -Factor N11
Technology
-Factor N1 -Factor N2 -Factor N3 -Factor N4 -Factor N5 -Factor N6 -Factor N7 -Factor N8 -Factor N9 -Factor N10 -Factor N11
Requirements Engineering
-Factor N1 -Factor N2 -Factor N3 -Factor N4 -Factor N5 -Factor N6 -Factor N7 -Factor N8 -Factor N9 -Factor N10 -Factor N11
Execution and Delivery
-Factor N1 -Factor N2 -Factor N3 -Factor N4 -Factor N5 -Factor N6 -Factor N7 -Factor N8 -Factor N9 -Factor N10 -Factor N11 -Factor N12 -Factor N13 -Factor N14 -Factor N15 -Factor N16 -Factor N17
Schedule Management
-Factor N1 -Factor N2 -Factor N3 -Factor N4 -Factor N5 -Factor N6 -Factor N7
Leadership, Governance & Management
-Factor N1 -Factor N2 -Factor N3 -Factor N4 -Factor N5 -Factor N6 -Factor N7 -Factor N8 -Factor N9 -Factor N10 -Factor N11 -Factor N12 -Factor N13 -Factor N14 -Factor N15 -Factor N16 -Factor N17 -Factor N18
Technical & Operational Expertise
-Factor N1 -Factor N2 -Factor N3 -Factor N4 -Factor N5 -Factor N6 -Factor N7 -Factor N8 -Factor N9 -Factor N10
Risk Management
-Factor N1 -Factor N2 -Factor N3
Engagement Management
-Factor N1 -Factor N2 -Factor N3 -Factor N4 -Factor N5 -Factor N6 -Factor N7 -Factor N8
Communications Management
-Factor N1 -Factor N2 -Factor N3
Powered By Visual Paradigm Community Edition

6.3.5 Categorising the Failure Factors

In developing the domain model and in categorising the failure factors into applicable knowledge areas, the factors identified from the data gathered across the literature and the case studies were grouped together to produce a master list of factors. Following the development of the domain model, these factors were then assembled together and mapped to the various related categories in the schema and are referred to as the "evaluation criteria" or the "conceptual schema". The domain model produced effectively provides a means of analysing and categorising the factors identified under knowledge areas as part of the development of the conceptual schema. The outcomes of the mapping and categorisation are presented in the table below.

Domain Categories	Identified Factors	Source	
		Literature	Case Study
Mission, Goals and Objectives	Lack of clearly defined goals and objectives or business case	x	x
	Lack of clearly defined business case	x	x
	Lack of regularly validated and reviewed business case		x
	Unclear business goals and objectives		x
	Significant volatility in delivery objectives and project's implementation roadmap		x
	Lack of clearly articulated and validated goals and objectives		x
	Failures in benefits and value realisation processes and ongoing value and benefits assessments		x
	High-level business cases defined with missing low-level details		x
	Lack of adequate definition and regular updates to low-level objectives and business cases		x
	Lack of clarity on expected short and long-term benefits realisation		x
	Lack of adequate understanding of business cases and adequate dissemination of business case across project organisational structures		x
Requirements Engineering	Lack of appropriate functional requirements	x	x
	Requirements volatility	x	
	Business process re-engineering	x	
	Misunderstanding of the requirements	x	x
	Complex requirements	x	
	Abstract requirements	x	

	Lack of detailed business requirements		x
	Poor requirements analysis and definition		x
	High-level requirements and specifications		x
	Lack of stable and valid business requirements		x
	Conflicting business requirements		x
Engagement Management	Lack of user involvement and commitment	x	
	Lack of adequate user engagement	x	
	Lack of effective client consultation	x	
	Lack of top management commitment and support	x	
	Lack of "end-user" involvement and engagement	x	x
	Lack of adequate stakeholder and end-user involvement and engagement		x
	Lack of adequate engagement across various business functions and with end-users and third-parties		x
	Lack of a methodical and coherent approach to engagement management		x
Technical and Operational Expertise	Lack of technical know-how, skills and required domain knowledge	x	x
	Quality assurance issues	x	
	Lack of relevant large-scale project management experience	x	
	Lack of understanding of complexity	x	
	Lack of technical expertise and competency for complex solution delivery		x
	Lack of relevant management experience and implementation expertise		x
	Lack of technological know-how in architecture and solution design of complex systems and solutions		x
	Lack of required knowledge and expertise of technology and managing large-scale technology projects		x
	Lack of required training and knowledge and expertise on technology solution design and complexity		x
	Lack of assessment on organisational and technical capacity		x
Planning	Poor planning	x	
	Lack of adequate planning	x	
	Inaccurate estimates	x	
	Unrealistic planning		x
	Poor estimation	x	

Schedule Management	Schedule problems and unrealistic timeframes	x	
	Unrealistic schedules	x	
	Shorter implementation time-frames	x	
	Schedule delays		x
	Significant delays in schedule and delivery milestones		x
	Lack of understanding and management of priorities		x
Budget Management	Budget management failings and costing issues	x	
	Escalating project costs	x	
	Budget constraints	x	
	Failures in budget management processes		x
	Financial mismanagement		x
	Lack of regular lifecycle assessments of estimated costs vs actual costs		x
	Lack of continuous monitoring and reporting of the impact of changes and decisions on costs		x
Scope Management	Changing scope and objectives	x	
	Significant changes to project scope	x	
	Lack of adequate scope management		x
	Lack of clarity in overall scope during implementation stages		x
	Volatile implementation scope		x
Technology	Use of inappropriate technology	x	
	Use of new or immature technology	x	
	Suitability of technology/technical framework	x	
	Lack of alignment of technology implementation with business objectives	x	
	High use of disparate technologies	x	
	Poor systems architecture	x	
	Design errors	x	
	Poor system architecture	x	
	Lack of the understanding of the impacts of new technology on existing business processes		x
	Lack of proper integration and compatibility between new and existing systems	x	
	Technical obsolescence		x
Leadership, Governance and Management	Lack of leadership/effective leadership	x	
	Lack of strategic direction and management of the programme objectives and deliverables;		x
	Poor and ineffective change management	x	

	Lack of responsiveness and resistance to change	x	
	Multiple stakeholder views	x	
	Political environment	x	
	Lack of expectations management and unrealistic expectations	x	
	Lack of resources	x	
	Changes to key stakeholders and stakeholder conflicts	x	
	Lack of "single" project owner	x	
	Lack of adequate an effective/poor governance structures		x
	Poor governance structures and oversight		x
	Lack of a single responsible owner (SRO)		x
	Lack of sustained single responsible ownership, senior management ownership and leadership;		x
	Lack of independent technical assurance on technology solution design and architecture		x
	Lack of a robust programme and project management process		x
	Lack of effective accountability structures		x
	Lack of senior stakeholders with significant technical and technology expertise		x
Communications Management	Poor communication	x	x
	Lack of effective communication		x
	Complex interactions		x
Monitoring and Control	Lack of adequate monitoring and control	x	x
	Lack of adequate and effective monitoring and control of implementation and delivery across project lifecycle		x
	Lack of effective monitoring and collaboration between the business and the third-party supplier		x
	Lack of regular assessments of the implementation and delivery progress across the implementation lifecycle		x
Risk Management	Poor risk management	x	
	Lack of adequate and ongoing risk assessment		x
	Lack of effective risk management processes and formalised approach to risk management		x
Execution and Delivery	Poor project management	x	x
	Poor project management processes	x	x

	Lack of an adaptive project management processes	x	
	Inappropriate delivery methodology	x	
	Use of unsuitable software development methodologies	x	
	Insufficient staffing	x	
	Internal and project team conflicts	x	
	The large number of external parties involved	x	
	Lack of effective project management methodology	x	
	Resource volatility	x	x
	High staff turnover of senior and project team personnel		x
	Inappropriate staffing	x	
	Poor stakeholder management	x	
	Poor project team	x	
	Human errors	x	
	Large-scale and complex nature	x	
	Cross-functional and geographically distributed teams	x	
Third-Party Management	Dependence on third-parties/contractors/consultants/suppliers	x	
	Failures by external contractors and third-parties	x	
	Loss of key suppliers during programme implementation and delivery		x
	IT supplier problems	x	x
	Lack of proper procurement processes with vendors and suppliers		x
	Number of third party/external entities involved	x	
	Lack of a competitive bidding process	x	x
	Failures in the procurement process	x	x
	Poor contract management		x
	Poor vendor management processes		x
	Lack of a clear statement of obligations on all suppliers engaged and between suppliers		x

Table **12**: The LSCITP conceptual model and associated factors.

Other issues identified that did not fit with the conceptual schema defined are listed in the table below.

Domain Categories	**Identified Factors**	**Source**	
		Literature	Case Study

Other	External Pressures	x	x
	Market and competitive pressures		x
	Unsuitable political environment	x	x
	Political instability and political and external influences		x
	External factors	x	x
	Poor change management	x	x
	Lack of effective change management processes		x
	Lack of adaptation to change/technology	x	x

Table **13**: The LSCITP conceptual model and associated factors.

From the conceptual schema presented, the knowledge areas are interrelated which means that factors in a particular domain can have a negative impact on a related knowledge area and the combination of factors with negative outcomes across several domain groups can lead to challenges and could lead to the failure of any connected LSCITP. Moreover, the conceptual schema also helps LSCITP stakeholders to obtain an improved understanding of the relationships and interrelationships between the domain categories and their associated factors.

The domain model exercise carried out led to the development of what can be deemed to be a proposed "framework" that can help grasp the challenges of LSCITP and also as a means to explore the different perspectives of LSCITP further. The identification of the knowledge areas containing the set of identified related factors would enable a better evaluation of LSCITP with a view to understanding their challenges and outcomes. These knowledge areas essentially form the primary risk areas for LSCITP. As such, it will enable LSCITP stakeholders and practitioners to obtain a detailed understanding of the critical aspects that are important to achieving a successful outcome. The overall objectives of the conceptual schema are to assist with the efforts to obtain a detailed understanding of the challenges of LSCITP and to identify and understand the causes of such challenges that lead to poor performance and subsequent failures.

The conceptual schema will assist with the identification of the specific areas on LSCITP that need to be addressed along with the set of containing factors that have been identified to be contributors to the causes of the challenges in LSCITP that influence failures. The conceptual framework provides a grouping of the failure factors identified and can be used to identify their possible effects and outcomes on LSCITP performance. The schema can also be used to perform an assessment of LSCITP against the identified factors and an assessment of the state of an LSCITP with a view to improve their performance and help to reduce potential failures. Having a detailed understanding of such focus areas would necessitate the need for the set of required actions in the management, implementation and delivery of LSCITP to provide stakeholders and practitioners with an informed and improved understanding on the required decision-making processes.

The use of such "framework" would be beneficial to stakeholders of LSCITP and IT projects in general and represents key knowledge areas in the context of the challenges of LSCITP and in understanding the reasons while they fail far too often.

6.4 REVIEWING THE DOMAIN MODEL

As part of the efforts to provide a validation for the developed domain model, a testing process was carried to ensure that the developed domain model is a complete and accurate representation of the knowledge acquired on the challenges of LSCITP as well as to ensure correctness, consistency, and completeness. The model was provided to participants for review and feedback as part of the data collection testing process of the external data gathering segment of the study. The feedback received during this process was reviewed and incorporated to update the design of the developed model prior to the outputs of the model being used as part of the interview process of the study.

The outcome of this testing process helped to identify the need for a strong focus on other key areas of LSCITP that were identified during the literature review exercises and case studies but where a particularly strong focus had not been placed on these areas previously. For example, the topics of change management and third-parties were two major themes that were identified previously but were not originally a key focal point in the initial design of the model performed. However, as the research activities progressed and based on the feedback received, these areas were identified as an important area to include in the focus on LSCITP challenges and were subsequently address during the interview process.

6.5 BENEFITS OF THE DOMAIN MODEL

The developed conceptual model along with the embedded factors can be applied by practitioners implementing LSCITP to help increase the understanding and awareness of the critical knowledge areas within LSCITP and their associated factors. Each of the knowledge areas identified represents critical areas for LSCITP stakeholders and practitioners to understand the challenges and issues inherent and evaluate and address these in the context of their LSCITP engagements to support the achievement of successful outcomes. The development of the conceptual model to capture LSCITP problem areas, the set of critical factors contained, their relationships and dependencies and how the model can be applied to support the management, implementation and delivery of LSCITP helps to not only highlight the critical areas of challenges that influence failures of LSCITP but it also helps to demonstrate how LSCITP can be better managed to reduce and mitigate inherent challenges and help to reduce current failure rates thereby steering LSCITP towards a more successful outcome.

The core value provided by the model when combined with the associated factor mapping table lies in the representation of the comprehensive set of factors identified, their mapping to related knowledge areas, their relationships and dependencies and the overall holistic representation provided as a result. An added objective of the model is to support improved decision making by stakeholders and practitioners and to help visualise and relate concepts within the LSCITP problem domain. In essence, it provides a conceptual schema of the important abstractions including the representation of the domain knowledge gained and the information content of the problem domain analysed. A model-driven implementation can be an instrumental concept for LSCITP and can be extremely useful to help address the issues of complexity, challenges and failures and help to influence and provide support for a more successful outcome for large-scale IT projects.

Finally, the conceptual model complements the objectives of this study as it helps to not only to capture and visualise the knowledge of LSCITP challenges as well as the knowledge of the problems and challenges and causes of failures of LSCITP but also to support the development of an assessment framework. They allow LSCITP stakeholders to recognise the key areas within an LSCITP that require strong levels of governance and management and helps them to help identify the areas that required a strong focus particularly during the implementation and delivery lifecycle of these projects.

CHAPTER 7

Research Findings

7.1 INTRODUCTION

The previous chapters defined the philosophical and methodological groundwork for this study. This chapter presents the findings from the data gathering activities carried out and the results obtained. It provides the analysis and the integration of the findings across the data gathering mechanisms employed for this study and presents the overall results. This chapter aims to report the quantitative and qualitative analyses and the results obtained. The chapter begins with an overview of the research data gathered and moves on to the analysis of the data along with the provision of answers to the research questions, and the results obtained post analysis.

The analysis and results presented in this chapter covers all of the research objectives, and the results obtained was able to provide answers to the research question posed on identifying and examining the challenges of LSCITP Furthermore, the analysis also covered determining and analysing the critical problem areas in LSCITP that hinder success and contribute to challenges that become inherent in their implementation and delivery leading to their poor performance and eventual failures. Moreover, it also includes the understanding of the recommendations obtained that can help to improve the implementation, delivery and assurance of LSCITP including an understanding of the project management methodologies and their application to the implementation and delivery of LSCITP and any potential impacts.

7.2 THE DATA GATHERED

The data gathered for this study provided a strong foundation for the understanding of all of the objectives being addressed by this study and in providing the required answers to the research questions posed. The analysis of the data gathered included the examination of the research question and the sub-questions derived. The data gathering process had provided the opportunity to gain unique insights into each LSCITP under examination that can be captured. Amongst the objectives of the data gathering exercise through the expert interviews and the case studies was to examine the challenges of LSCITP further and to validate the findings from the outcomes of the case studies. Such approach not only enabled the ability to capture the necessary static data but also the opportunity to obtain a detailed description, explanation and an understanding of the set of activities and actions undertaken to address the challenges faced with LSCITP. Additionally, the nature of the data gathering process also enabled the opportunity to tailor and adapt the process to the nature of the LSCITP in context.

From the data gathered, the findings are broken down and presented as follows. To begin with, the findings from the case studies are discussed, the interview results obtained are also analysed, the participants to the data gathering exercises are also discussed, the connected LSCITP are then examined and analysed further to understand why they ran into difficulties and ended up being severely challenged and also the reasons why some of them failed. The process also includes the analysis of the factors influencing such failures through the examination and analysis of the various project factors, and finally, various aspects of the LSCITP in the study such as the project background, project outcomes, project performance and the project results are also analysed within the context of the project outcomes. The goal was to ensure that a detailed analysis of every facet of the projects is conducted in order to provide an accurate picture as to the reasons for the challenges leading to the subsequent failures of LSCITP.

In addition to the data gathered on challenged LSCITP, this study also gathered data on successful LSCITP. The objective was to study both *successful* and *failed* LSCITP and then perform a comparison of the outcomes and identify the determinants of success and failures. In doing so, the study compares the results from *successful* and *unsuccessful* LSCITP using the same assessment criteria to identify any differences between successful and unsuccessful LSCITP and the reasons for such differences.

For the purposes of this study, the word *project* is used to describe both the implementation of large-scale complex projects or programmes correspondingly.

Data was gathered and analysed on 37 *challenged* and 19 *successful* projects. Prior to the data gathering process, the study had defined *successful* and *challenged* LSCITP as part of the data gathering process as explained in section 7.3 below.

The definition of success and failures from the perspectives of the study was done to not only guide the study in its quest to understand different LSCITP implementation outcomes but also to prevent any possible bias by participants on the perception of success or failures of their projects particularly on the projects where they had an active role or involvement in.

In addition, since the study focuses specifically on LSCITP across several industry domains globally that fits within the criteria and objectives for this research study the study only assessed projects that have a minimum starting budget of five million dollars United States Dollars (USD).

The 37 *Challenged* LSCITP examined in the study had a combined approximate budget of over 1.75 billion dollars. The 19 *Successful* LSCITP examined in the study had a combined approximate budget of over 690 million dollars.

No.	Project Budget *Challenged LSCITP*	Total	
		Projects	Percent
1	LSCITP with budgets of about **5** Million	**14**	**37.8%**
2	LSCITP with budgets of about **10** Million	**7**	**18.9%**
3	LSCITP with budgets of about **15** Million	**1**	**2.7%**
4	LSCITP with budgets of about **25** Million	**6**	**16.2%**
5	LSCITP with budgets of about **50** Million	**3**	**8.1%**
6	LSCITP with budgets of about **100** Million	**3**	**8.1%**
7	LSCITP with budgets of more than **100** Million	**2**	**5.4%**
8	LSCITP with budgets of more than **800** Million	**1**	**2.7%**
Total		**37**	**100.0%**

Table **14**: The breakdown of the budgeted costs of the challenged LSCITP examined.

No.	Project Budget *Successful LSCITP*	Total	
		Projects	Percent
1	LSCITP with budgets of about **5** Million	**1**	**5.3%**
2	LSCITP with budgets of about **10** Million	**3**	**15.8%**
3	LSCITP with budgets of about **15** Million	**2**	**10.5%**
4	LSCITP with budgets of about **25** Million	**9**	**47.4%**
5	LSCITP with budgets of about **100** Million	**1**	**5.3%**
6	LSCITP with budgets of more than **100** Million	**1**	**5.3%**
7	LSCITP with budgets of about **200** Million	**1**	**5.3%**
8	LSCITP where approximate budgets could not be determined	**1**	**5.3%**
Total		**19**	**100.0%**

Table **15**: The breakdown of the budgeted costs of the successful LSCITP examined.

Overall, the combined budgets of all the LSCITP examined in the study was over 2.44 billion dollars.

Furthermore, the data gathering process also included a geographic span of LSCITP from across 11 countries. In total, 56 LSCITP was examined in this study from the perspectives of various core project stakeholders across various industries who are actively involved and engaged and having the primary first-hand knowledge, expertise and experience in these LSCITP environments.

The interview instruments used by participants in this study is attached in *Appendix A, B and C* of this thesis document.

7.2.1 The Expert Interviews

The interview process spanned several organisations globally, and across several industry sectors and as a result it helped to ensure that there was no bias or that the data set gathered might be heavily focused on a specific industry sector or organisation. The interviews also spanned various user roles within the LSCITP project environments and hence helped to ensure that the insights, perspectives and views obtained on the LSCITP examined were reflective of the current state of the challenges impacting LSCITP. By interviewing individuals across several organisations and across several industry sectors, it provided the study with a rich data set that captures the views, insights, experiences and outcomes from a myriad of perspectives, contexts and environments.

The questioning and discussions with participants resulted in detailed assessments and evaluations across all LSCITP areas identified in the conceptual framework and those provided by participants, including recommendations provided by participants on addressing specific issues encountered within specific LSCITP areas with regards to mitigating the challenges and reducing risks and improving LSCITP performance and outcomes. In summary, the discussions touched on the experiences, expertise, knowledge, insights and opinions of the interviewees in the context of understanding the challenges that they experienced during their LSCITP implementations. Through their significant years of experience, participants interviewed had built out tremendous insights into the implementation and delivery of LSCITP, and this enabled the discussions to cover a wide range of significant areas on LSCITP. As part of the interview process, participants were strongly encouraged to provide accurate and detailed information and the importance of obtaining sincere and accurate information was pointed out and reiterated.

The summary of the project interviews carried out on challenged LSCITP is presented in the table below.

Project No.	Role/Function	Industry/Sector	Approximate Budget
No.1	Programme Manager	Internet/Online Technology	5 Million
No.2	Programme Manager	Real Estate	5 Million
No.3	Team Lead/Business Analyst	Finance / Banking / Insurance	50 Million
No.4	Programme Manager	Manufacturing	25 Million
No.5	Project Manager	Finance / Banking / Insurance	5 Million
No.6	Programme Manager	Transportation / Distribution	> 100 Million
No.7	Manager	Retail	10 Million
No.8	Programme Manager	Telecommunications	10 Million
No.9	Programme Manager	Finance / Banking / Insurance	5 Million
No.10	Consultant	Finance / Banking / Insurance	5 Million
No.11	Programme Manager	Finance / Banking / Insurance	5 Million
No.12	Project Manager	Finance / Banking / Insurance	25 Million
No.13	Manager	Retail	5 Million
No.14	Programme Manager	Transportation / Distribution	10 Million
No.15	Project Manager	Telecommunications	5 Million
No.16	Delivery Director	Healthcare / Medical	25 Million
No.17	Manager	Telecommunications	5 Million
No.18	Manager	Construction	10 Million
No.19	Programme Manager	Manufacturing	100 Million

No.20	Team Lead	Education	5 Million
No.21	Manager	Finance / Banking / Insurance	5 Million
No.22	Consultant	Finance / Banking / Insurance	5 Million
No.23	Consultant	Government / Military	5 Million
No.24	Systems Engineering Lead	Government / Military	10 Million
No.25	Systems Engineering Lead	Government / Military	5 Million
No.26	Consultant	Government / Military	50 Million
No.27	Programme Manager	Manufacturing	10 Million
No.28	Senior Business Analyst	Transportation / Distribution	10 Million
No.29	Business Analyst/Senior Business Analyst	Government / Military	> 100 Million
No.30	Consultant	Education	100 Million
No.31	Delivery Lead	Finance / Banking / Insurance	15 Million
No.32	Senior Manager	Finance / Banking / Insurance	50 Million
No.33	Business Analyst/Senior Business Analyst	Finance / Banking / Insurance	25 Million
No.34	Manager	Transportation / Distribution	100 Million
No.35	Programme Manager	Transportation / Distribution	> 800 Million
No.36	Programme Manager	Finance / Banking / Insurance	25 Million
No.37	Programme Director	Media / Printing / Publishing	25 Million

Table **16**: The breakdown of the interviews conducted on challenged LSCITP.

Additionally, the summary of the project interviews carried out on successful LSCITP is presented in the table below.

Project No.	**Role/Function**	**Industry/Sector**	**Approximate Budget**
No.1	Programme Manager	Healthcare / Medical	10 Million
No.2	Project Manager	Retail	25 Million
No.3	Project Manager	Non-Profit	5 Million
No.4	Technical Lead	Government / Military	25 Million
No.5	Team Manager	Utilities	25 Million
No.6	Project Manager/Assignment Manager	Government / Military	100 Million
No.7	Programme Coordinator	Finance / Banking / Insurance	> 100 Million
No.8	Delivery Consultant	(Anonymous)	15 Million
No.9	Programme Manager	(Anonymous)	15 Million
No.10	Executive	Aerospace / Aviation / Automotive	25 Million
No.11	Delivery Consultant	Computers (Hardware, Desktop Software)	Unspecified
No.12	Programme Manager	Government / Military	25 Million
No.13	Consultant	Government / Military	10 Million
No.14	Programme Manager	Finance / Banking / Insurance	25 Million
No.15	Senior Executive	Finance / Banking / Insurance	25 Million
No.16	Project Manager	Government / Military	25 Million
No.17	Project Manager	Retail	10 Million

No.18	Director	Finance / Banking / Insurance	200 Million
No.19	Programme Manager	Finance / Banking / Insurance	25 Million

Table **17**: The breakdown of the interviews carried out on successful LSCITP.

Participants had been involved in multiple IT/IS and LSCITP project implementations and delivery and they were able to identify from the set of successful and challenged LSCITP to review and discuss. The start of the interview process included an introduction, overview, and an explanation of the purpose, scope and objectives of the research study being conducted. The privacy requirements were also provided to participants and obligations to agree to any confidentiality requests made by the participants in respect of any information shared along with an assurance provided by the researcher regarding the purposes, use and disclosure of any data collected during the interview process.

Detailed information about the interview processes, questions and procedures can be found in *Chapter Four* section 4.4.2 and *Appendix A*, *B* and *C* of this thesis document.

7.2.2 Industry Sectors and Industry Types Examined

In the quest to address the research objectives and questions posed, this study analyses the views and perspectives of experienced individuals directly involved in the implementation and delivery of LSCITP and also assesses the realities within LSCITP environments as well as LSCITP outcomes across several industry sectors. The engagement of professionals and experts with hands-on experience, first-hand knowledge and adequate exposure to LSCITP environments including their implementation and delivery and participants with a significant level of experience within the IT/IS project domain across a wide variety of industries was a key objective defined for this study.

The participants in the expert interviews and the connected LSCITP examined came from both the public and private industry sectors, this was part of the objectives of the study to capture data from participants across sectors and across a broad section of industries and across different LSCITP implementations. The majority (59%) of the LSCITP in the study originated from the private sector, while 41 percent of the projects examined came from the public sector. The summary of the sector breakdown is presented in the table below.

No.	Public and Private Industry Sectors	Total	
		Projects	Percent
1	Private sector LSCITP	**33**	**59%**
2	Public sector LSCITP	**23**	**41%**
Total		**56**	**100.0%**

Table **18**: The breakdown of the industry sector of the projects examined in the study.

The projects examined also originated from various industry sectors, with the largest percentage coming from the *Finance/Banking/Insurance* industry sector with 32.4 percent. This reflects the principal sector where the majority of the LSCITP in this study was undertaken. Projects examined also originated from other major industry sectors, for example, the *Government and Military* sector accounted for 13.5 percent of the LSCITP examined, *Transportation and Distribution* also provided 13.5 percent, the *Telecommunications* with 8.1 percent, and *Manufacturing* with 8.1 percent was amongst the other sectors represented.

The results of the analysis of the projects examined in the study broken down by industry sectors is shown in the table below.

No.	Industry Sectors	Number	Percent
1	Construction / Home Improvement	1	1.7%
2	Aerospace / Aviation / Automotive	1	1.7%
3	Education	2	3.5%
4	Finance / Banking / Insurance	17	30.3%
5	Government / Military	10	17.8%
6	Healthcare / Medical	2	3.5%
7	Internet	1	1.7%
8	Manufacturing	3	5.3%
9	Media / Printing / Publishing	1	1.7%
10	Real Estate	1	1.7%
11	Retail	4	7.1%
12	Telecommunications	3	5.3%
13	Non-Profit	1	1.7%
14	Transportation / Distribution	5	8.9%
15	Utilities	1	1.7%
16	Computers (Hardware, Desktop Software)	1	1.7%
17	Not specified	2	3.5%
Total		**56**	**100%**

Table **19**: The breakdown of the examined LSCITP by industry sectors.

The results above show that the set of LSCITP analysed in this study span multiple industry sectors and therefore the results provide a good reflection and indication of the common outcomes of LSCITP that can be applied to other industry sectors not represented here where the implementation and delivery of LSCITP are being undertaken. Additionally, the above results show a wide range of industry sectors being represented and therefore avoids any possible bias with regards to a specific focus being placed on a particular industry sector.

7.2.3 Participants, Roles and Experience

As part of the interview process, before the commencement of the interviews, participants were asked to reconfirm and provide an overview of their background covering areas such as years of experience, professional history, industry sector background, and the level of experience of involvement in LSCITP. Discussing this information was vital and ensured that the participants could be re-validated against the initial selection criteria that were used to identify the selected participants. Obtaining participants roles also allowed the researcher to look at the seniority of participants and in particular, their roles within the projects being explored and also provides the appropriate premise for concluding that the participants have sufficient experience and expertise and are familiar with the domain of IT/IS and LSCITP equally. Furthermore, this process also ensured that the selected participants were an integral part of the projects being examined and hold the required knowledge in the specific areas being investigated and help to contribute to the validity of the answers and discussions provided by participants.

The roles and levels of experience of the participants and their level of involvement with the respective projects were also discussed and analysed. As part of the study, participants were asked to specify their roles on the connected projects from a pre-defined list of project-related roles in the associated IT/IS projects that they were interviewed on. 30.3 percent of participants held programme management level roles as part of their involvement in the projects being analysed with other project-related roles varying from project managers 14.2 percent. Consultants represented 10.7 percent of the projects. The objective of this exercise was to ensure that participants held key roles within the projects being analysed and examined and are therefore best placed to provide an in-depth analysis and first-hand knowledge of the state of the projects concerned and any challenges faced within such project environments. Additionally, the objective was to help validate the quality of the data gathered for the study.

The results of the analysis of the roles of participants are shown in the table below.

No.	Participants Roles	Number	Percent
1	Business Analyst/Senior Business Analyst	**3**	**5.3%**
2	Consultant	**6**	**10.7%**
3	Programme Director/Delivery Director	**2**	**3.5%**
4	Manager	**6**	**10.7%**
5	Systems Engineering Lead	**2**	**3.5%**
6	Programme Manager	**17**	**30.3%**
7	Project Manager	**8**	**14.2%**
8	Senior Manager	**1**	**1.7%**
9	Team Lead	**2**	**3.5%**
10	Team Lead/Business Analyst	**1**	**1.7%**
11	Delivery Lead	**1**	**1.7%**
12	Director	**1**	**1.7%**
13	Senior Executive	**2**	**3.5%**
14	Programme Coordinator	**1**	**1.7%**

15	Technical Lead	**1**	**1.7%**
16	Other	**2**	**3.5%**
Total		**56**	**100%**

Table **20**: The breakdown of respondent's roles in the examined LSCITP.

As can be seen from the above results, participant's roles were varied within the structures of the projects they were involved in and with participants interviewed having a mixture of technical, management and leadership roles and responsibilities.

7.2.4 The Different Types of LSCITP Examined

To understand why a large percentage of LSCITP are challenged and run into difficulties leading to their poor performance and eventual failure, it is essential to understand the different types of LSCITP implementations including projects with a significant element of IT/IS. In conducting the data gathering process, participants were engaged and asked to discuss, specify and describe the nature of the projects they were being interviewed on. The objective of this part of the study was to gather data that can help to determine whether specific categories of LSCITP were more likely to run into difficulties, become challenged, fail or succeed than other categories of LSCITP. The table below shows the list representing the various types of LSCITP analysed in this study.

No.	LSCITP Types	Count
1	IT Infrastructure Projects	23
2	Software Development/Product Development Projects	23
3	Enterprise Resource Planning (ERP) System Projects	7
4	Management Information Systems (MIS) Projects	6
5	IT Integration Projects	26
6	IT Services (ITS) Projects	9
7	Application Development Projects	5
8	Application/Infrastructure Migration Projects	1
9	Cyber Security Program Projects	1
10	Data Archiving and Storage (Unstructured Data) Projects	1
11	Data Compliance Programme Projects	1
12	Data Migration Projects	1
13	Public Digital Services (e.g. National ID Cards) Projects	1
14	Custom Technology Implementation Projects	1
15	Records Management Systems Projects	1
16	Financial (e.g. Trading Systems Replacement) Projects	1
17	Application Packaging and Deployment Projects	1
18	Enterprise PLM Projects	1
19	Privacy Compliance Program Projects	2
20	Enterprise Web Development Projects	1

Table **21**: The various types of LSCITP analysed in the study across both challenged and successful LSCITP.

As can be seen from the above table, the projects examined were sufficiently diverse with regards to the industry domains covered, including the business domains involved and the nature of the projects. From the analysis of the data gathered, IT Integration, IT Infrastructure and Software Implementation projects make up a significant proportion of the LSCITP examined. More importantly, the range of projects types examined above reflects the typical project undertakings within the IT domain that fits with the types of projects the study sought to explore and also these types of projects provide a rich set of the various attributes being explored and examined such as size and scale, complexities, increased budgets, and other related attributes.

The above results help to improve the understanding that the majority of LSCITP are not simply large development-related project initiative but rather, they are often the combination of multiple initiatives that are composed of various implementation workstreams and sub-projects that collectively help to achieve the target objectives.

7.2.5 Geographical Coverage of LSCITP Implementations

One of the objectives of this research was to conduct a global study where possible that reflects the challenges being faced with LSCITP globally. After the 24-month period of data collection and once the data gathered had been refined to fit with the requirements of the study, a mini-directory was established that consisted of 56 LSCITP globally that was then broken down by project outcomes for example, *Successful* and *Challenged*.

The LSCITP examined were implemented in 6 different geographical locations, covering fourteen countries. The table below provides the summary of the number of LSCITP examined by geographical locations.

No.	LSCITP Implementation Locations	Total	
		Projects	Percent
1	Australia	6	10.7%
2	Austria	1	1.7%
3	Brazil	1	1.7%
4	Canada	2	3.5%
5	France	1	1.7%
6	India	2	3.5%
7	Netherlands	2	3.5%
8	Saudi Arabia	1	1.7%
9	South Korea	1	1.7%
10	Spain	1	1.7%
11	Sweden	1	1.7%
12	Switzerland	1	1.7%
14	United Kingdom	29	51.7%
14	United States	7	12.5%

Total	**56**	**100.0%**

Table **22**: The number of LSCITP examined broken down by geographical locations.

As can be seen from the data presented above, the largest share of the LSCITP examined in the study about 51.7 percent was implemented in the United Kingdom. The United States and Australia with 12.5 and 10.7 percent are second and third in the list. As is evident from the results above, the LSCITP analysed originate from multiple countries, therefore, fulfilling one of the study's primary objectives which were to conduct a global study into LSCITP.

7.2.6 LSCITP Implementation Durations

In the analysis of the data gathered, the implementation durations of LSCITP were also identified and analysed across both successful and challenged projects to help improve the understanding of how long LSCITP take to implement and deliver from the commencement of their implementation to their end state. From the projects examined, the typical implementation durations ranged from between one to over six years.

The results of the LSCITP implementation durations is presented in the table below.

No.	LSCITP Implementation Durations	Total	
		Projects	Percent
1	LSCITP with durations less than **1 Year**	2	3.5%
2	LSCITP with durations of around **1 Year**	14	25.0%
3	LSCITP with durations of around **2 Years**	18	32.1%
4	LSCITP with durations of around **3 Years**	10	17.8%
5	LSCITP with durations of around **4 Years**	3	5.3%
6	LSCITP with durations of around **5 Years**	3	5.3%
7	LSCITP with durations of around **6 Years**	1	1.7%
8	LSCITP with durations of over **6 Years**	3	5.3%
9	LSCITP where durations could not be determined	2	3.5%
Total		**56**	**100.0%**

Table **23**: The breakdown of the implementation durations of LSCITP examined in the study.

7.3 DEFINING SUCCESSFUL AND CHALLENGED LSCITP

For the purposes of understanding the success and challenged outcomes of LSCITP, this study after the careful examination of existing literature on the perceptions and existing definitions of success, challenged and including failure definitions and the difficulties inherent with the existing perceptions had defined a view of success, challenged and abandoned statuses that was applied to the study and in the examination of applicable LSCITP to help provide a view of what success and challenged LSCITP constitutes.

During the data gathering process the study defined the three status categories that it sought to gather data on (*successful*, *challenged* and *abandoned)*. The definitions for each category are provided below:

Successful LSCITP were viewed as projects that have met their defined success criteria and defined objectives and have been completed on schedule, completed on budget and have met specified requirements including the objectives of the projects being achieved and the projects meeting the minimum criteria of satisfaction of the stakeholders concerned. This definition also includes projects meeting the defined success criteria described above but also projects that experienced minimal delays to schedule, minimal increase in scope and minimal budget overruns with minimal changes to outcomes but still managed to achieve their intended outcomes and met the majority of their required objectives.

Challenged LSCITP (for example, challenged and abandoned projects) were viewed as projects that have failed to meet their defined success criteria and defined objectives, significantly overran on budget, and have either been delivered significantly behind schedule or have been partially delivered. This definition also includes projects that have had to be scaled back from their original objectives.

Abandoned LSCITP are viewed as projects that meet the definition of challenged above and includes projects that have failed to deliver a solution or required outputs as a result of being severely challenged that they have been unable to meet defined objectives or have been cancelled or abandoned.

The initial reasoning behind the separate categories particularly for challenged and abandoned projects was to see whether additional valuable information could be obtained if a larger data set could be gathered in order to support future analysis work to be carried out that would be a value add on the back of the study.

For the purposes of the study, the challenged and abandoned LSCITP categories were grouped together and referred to as "challenged" LSCITP. The reason for the grouping is because based on the definitions provided for each of the categories the abandoned projects were a type of challenged projects. The outcome of the grouping resulted in two final LSCITP categories for subsequent analysis (1) Challenged LSCITP and (2) Successful LSCITP. The summary of the data obtained, and the grouping is displayed in Table 26 in *Chapter Seven*, *Section 7.5.1* below.

7.4 THE CASE STUDY FINDINGS

The outcomes from each of the cases described and examined in *Chapter Five* illustrate the set of challenges that were inherent in each of the LSCITP examined during their implementation and delivery phases. The outcomes that emerged from each individual LSCITP was also examined across all of the cases to establish their broader relevance and identify possible limitations.

In summarising the findings across the LSCITP examined, various challenged factors were identified based on the analysis carried out which identified the specific set of factors that influenced the poor performance on these projects. The analysis showed that the challenges faced by these projects were heavily linked to issues at both the front-end and within the implementation and delivery phases. The findings also showed that these programmes were mainly operating in highly complex and dynamic project environments with high levels of technical, management, political and social complexities that were exacerbated by deep-rooted structural, cultural challenges that were preponderant by numerous failures in implementation and execution processes, poor management and subpar project management aided by the absence of required project assurance processes. Furthermore, the analysis also identified that the poor performance of the projects was also down to systematic problems as a result of the nature of the projects mainly down to factors such as the size, scale, extended duration, and the level of complexity, the nature of the technology being implemented and internal and external factors.

From the review of existing literature carried out, the list of factors that impact IT projects and LSCITP negatively leading to poor performance and subsequent failures was identified. This list comprises 51 factors including those from the case study. The factors identified from the analysis of the case studies were cross-checked against the set identified from literature to identify similarities and frequency of occurrence. In *Chapter Five*, a domain model was developed to establish LSCITP problem knowledge areas and to provide a categorisation of the identified factors into the conceptual model, the model also helps LSCITP stakeholders to recognise the key areas within LSCITP that require strong levels of governance, management, oversight and increased focus. The resultant model helped to identify a set of factors grouped together under fifteen knowledge areas each of which focuses on an essential area of LSCITP implementation and delivery. The knowledge areas then formed the evaluation criteria by which the results obtained were further analysed to gain a deeper understanding of why they happened, how they happened and any other vital outcomes for further investigation.

7.4.1 The Challenges and Failures of the LSCITP Cases Examined

The analysis of the outcomes of the projects examined in the case studies is summarised in the sections that follow below.

7.4.1.1 Mission, Goals and Objectives

On mission, goals and objectives, various issues were identified regarding the documented business cases for the projects with some business cases missing the required low-level details that were required to link back to the implementation deliverables for verification and validation. There was also the lack of adequate definition and updates to the documentation of the low-level details of the goals and objectives including the short and long-term strategic needs for the projects particularly around how the intended objectives tie-in with the strategic direction of the organisations involved in implementing them. Additional issues include the lack of clarity on how the expected short and long-term benefits are to be realised and measured and the estimation of the value to be generated throughout the project's implementation life-cycle. These numerous business case related issues prevented the ability to monitor the impact of the deliverables and changes to the scope of the projects against the required objectives in light of the progress being made. It also prevented obtaining the clarity on how the fulfilment of the business cases defined will lead to the implementation of the intended strategy and objective for the organisations involved.

Additionally, the high-level "business cases" provided were not adequately understood and were not well disseminated across the lower levels of the organisational structures of these projects. These issues also extended to the lack of consistency in the articulation of the business case as it shifts in line with changes to the defined objectives and organisational strategy of the organisations involved. Furthermore, there was the lack of regular revision and revalidation of the strategic organisational and programme needs and objectives being carried out in line with changing realities on the projects and in line with the changing needs of the multiple stakeholders and end-users involved and their differing needs and expectations causing a misalignment between project goals and objectives and the longer term strategy of the organisations involved. There was also the failure to regularly assess the projects during crucial implementation stages and phases on whether they continue to provide value for money against intended outcomes and measurements against outcomes achieved to date as part of value realisation processes.

7.4.1.2 Requirements Engineering

The analysis identified that there were significant problems with the requirements elicitation process of the projects, particularly as they relate to the implementation of critical, large-scale complex systems and solutions. In most cases, the requirements elicitation process failed to cover the entire lifecycle of the requirements needs of these programmes at the onset and also failed to account for and provide accommodation for the inevitable changes in business realities. The failure to recognise that end-user needs and requirements are subject to change during the implementation phase particularly as more clarity is obtained about the capabilities and intended functionalities and outcomes given the nature and scope of the projects where detailed requirements will be lacking and unclear and the failure to build in the required capabilities in the implementation process to react to and address such changing priorities and requirements was one of the issues faced. This was coupled with the lack of adequate involvement and engagement of the end-users and key stakeholders as part of the requirements elicitation process. These challenges around requirements engineering contributed to poor, inadequate, inaccurate and missing requirements resulting in the implementation of the programme's objectives with conflicting requirements. In most cases, the traceability of requirements was challenging, and this contributed to an overall lack of clarity including the provision of abstract requirements that created paralysing gaps in interpretation for the implementation teams.

7.4.1.3 Engagement Management

Another outcome identified that was common across the LSCITP cases was that the involvement and engagement of key stakeholders and end-users were lacking and not adequate enough to address the evolving stakeholder needs particularly as the projects required the involvement and engagement of multiple stakeholders with differing needs and expectations from the outcomes of the implementations. In some cases, the lack of a methodical and coherent approach to the management and engagement of stakeholders throughout the project's implementation lifecycle was identified. This lack of adequate stakeholder involvement and engagement resulted in deliverables that were not adequately aligned with the needs of the respective stakeholders.

7.4.1.4 Technical and Operational Expertise

The analysis identified that there was a lack of the required technical and operational expertise in specific areas to undertake the implementation and delivery of large-scale, complex IT programmes within the senior management and core program implementation teams. Equally, senior management teams demonstrated a lack of understanding of the technology and the complexity of the projects in their decision-making processes. In instances where the organisations lacked the technical know-how, there was the failure to seek appropriate external expertise including the lack of assurance by subject matter experts on technical framework and technology solutions proposed. Organisational and technical capacity was another issue that was identified as contributing to the challenges faced on these projects. Some of the organisations involved did not have the full set of resources with the appropriate skills and experiences to manage, implement and deliver an LSCITP successfully.

The lack of technical and operational expertise and technical and organisational capacity meant that implementation and delivery issues were not managed and addressed appropriately as they surfaced, and this contributed to the chaos experienced in the implementation process contributing to the poor performance of the projects.

7.4.1.5 Technology

The analysis identified several technological challenges during the implementation phases particularly focused on technological challenges that were not foreseen or adequately understood during the commencement of these projects. In addition, the delays encountered during the implementation process led to technical obsolescence as a result of the fast-changing pace of technology. For most of the programmes, the defined technical solutions did not move in line with the changing realities and shifting priorities of the projects. In addition, the programmes suffered from the delivery of component parts of the intended solutions that had no lasting economic value and will have to be replaced or improved resulting in increased running costs.

7.4.1.6 Scope Management

The projects suffered from a lack of clarity in overall scope particularly on scope definition, validation and control resulting in incomplete and inadequate scope while the implementation stages were progressing. This had an impact on the programme deliverables. As LSCITP, these projects are subject to substantial uncertainties, and the examination of these projects showed the absence of the required processes and procedures to anticipate and respond to potential changes in scope and underlying realities. Additionally, the high levels of volatility in scope and requirements connected to the failure of the adequate engagement of key stakeholders and end-users in shaping and defining detailed, realistic requirements for implementation was yet another issue identified in the scope element of these projects. Furthermore, the unmanaged changes in scope lead to cost overruns and schedule delays.

7.4.1.7 Leadership and Governance and Management

Poor governance structures were identified as one of the factors resulting in significant challenges on the projects. This is because of the failure to ensure that adequate and effective governance and accountability structure was established to help underpin the management of the programmes and also assist with the effective review and monitoring process and equally to support the key stakeholders with informed decision-making. This includes the lack of alignment of authority and responsibility in the management and governance structures between all the relevant parties involved in the implementation and delivery process. The analysis also identified the lack of effective leadership, senior management commitment, support and engagement throughout the implementation lifecycles. These failures in governance and management resulted in the lack of clear accountability and responsibility processes across the management structures of these projects. They also appeared to have had a fundamental impact on the management and strategic direction of these programmes. Furthermore, the management structures in place heavily reflected senior stakeholders with portfolio, change, programme and stakeholder management expertise, however, the programmes failed to reflect senior management stakeholders with significant technical and technology expertise.

In reviewing the findings from the LSCITP examined, several failures in implementation and execution along with poor management and subpar project management was identified. Amongst the findings was that there was a failure by the management teams of the various projects to anticipate, recognise, prepare and undertake the required actions and corrective measures to address problems and issues promptly when they arose. During the course of the implementation, the day-to-day management of the implementation and delivery covering specific vital areas (for example, planning, scope, schedule, requirements, end-user engagement, communication, etc.) lacked the required level of robustness leading to implementation challenges and particularly, the lack of direction and clarity that was required by the implementation teams.

Human resource management was another issue identified from the analysis that had a significant impact on the outcomes of these projects. These issues were mainly focused on the high rates of staff turnover that led to constant struggles to ramp up on full manpower required. The impacts associated with high staff turnover levels caused sententious disruptions to the implementation process notably on the efficiency and effectiveness of the implementations being carried out and on the constant loss of accumulated experience. For example, the constant departures across all levels of the projects meant that the projects experienced a considerable loss of acquired knowledge. The issue of continually changing resources particularly that of the senior management teams including changes of ownership responsibility at the board levels affected the projects' objectives as new senior management resources brought in different visions, objectives, and approaches of addressing the ongoing implementation and also a new interpretation of the objectives thereby leading to an impact on the implementation and delivery of the overall objectives. The volatility in senior management personnel also affected the governance of the projects due to the fact that senior members of staff were not staying long enough in their respective roles to take accountability and responsibilities for their actions on the projects.

The underestimation of the complexity of the overall solution being delivered was another issue identified. The failure by the senior responsible stakeholders in adequately understanding the complexity of the implementations lead to the challenges in other areas such as the resulting underestimation of budgets and schedule and the underestimation of the impact of changes in scope on the overall programmes.

7.4.1.8 Budget Management

The examination of these projects also identified that the projects suffered from financial mismanagement which contributed to the overall outcome of the projects. The issues around financial mismanagement include the failures in performing regular full life cycle assessments of the estimated costs vs actual costs of the programmes in line with the changing realities being encountered. For example, budgets were exceeded due to several factors such as changes in scope as a result of changes in requirements, changes in resourcing, changes in the costs of technology components, rework and late deliverables and equally there was a lack of adequate control on budgets including regular monitoring and reporting of the impacts of changes to the projects on costs and how they are managed in line with the approved budgets coupled with a poor and fragmented cost control and cost containment processes.

7.4.1.9 Schedule Management

The lack of appropriate schedule management of these projects led to missed deadlines and milestones, the delivery of requirements with reduced functionality from initial specified requirements coupled with the absence of recovery plans for addressing and managing challenges and issues experienced with missed deadlines.

7.4.1.10 Planning

The planning processes on these projects failed to anticipate or incorporate regular re-planning particularly taking into account the internal and external factors that were forcing a change to the defined programme schedules.

7.4.1.11 Monitoring and Control

Another outcome was the lack of an effective monitoring, control and review processes being carried out on the programmes to perform regular health checks and to track the overall implementation and delivery progress being made towards the defined goals and objectives and against implementation schedules and also to rethink and reshape the projects objectives in line with changing dynamic realities. This includes the failure by the responsible stakeholders and senior management teams to perform regular assessments of the implementation and delivery progress across the different delivery teams and across the different implementation phases within the established delivery functions to perform an assessment of effectiveness, performance and governance. These monitoring and control issues also extended to the lack of the monitoring of the various component parts of the solutions being developed and on the management of the programmes despite the fact that the programmes were exhibiting the classic warning signs and symptoms of challenges. In some cases, the senior management teams overlooked the problems and symptoms being reported by the programme implementation teams and project management office. Such monitoring and control failures prevented ongoing monitoring of overall programme health, benefits monitoring and assessments, the measurement of progress against changing realities, specific performance measurements and the reporting and visibility of the programme realities to the key stakeholders and the senior management teams throughout the implementation and delivery process. These issues overall prevented the accurate measurement and understanding of progress achieved on these projects.

7.4.1.12 Communications Management

Another issue identified from the analysis of the projects was the lack of adequate and regular communications throughout the implementation lifecycles and across all the different tiers of the projects. This includes the lack of effective communication spanning internal and external parties across the project spectrum that covers sponsors, business owners, stakeholders, project teams, third-parties (vendors, suppliers, consultancies and contractors) and other required stakeholders. Moreover, the issues identified in communication also extends to the lack of establishment of clear communication channels. The establishment of clear communication channels would have provided the opportunity... and ensure that across all levels of the programmes, that the same vision, mission and objectives are shared. This was influenced by the lack of key stakeholder involvement and engagement.

7.4.1.13 Execution and Delivery

The findings identified multiple failures in implementation processes leading to poor execution and delivery outcomes of the various component parts of these programmes.

7.4.1.14 Risk Management

The lack of adequate risk management and risk analysis was also identified in the review of these programmes. This includes lack of adequate processes on the identification of risks, quantification and qualification of project risks and on the risk response and mitigation processes.

7.4.1.15 Third-Party Management

A common issue identified was that the selection of the implementation partners in a few cases did not go through a rigorous selection process prior to the selection of the suppliers. Additionally, other issues that caused an impact on the implementation processes of the projects was that of supplier volatility. Over the course of the implementations, key suppliers departed or had their contracts terminated for various reasons. The termination of contracts brought knock-on effects from subsequent contract disputes that arose with contract cancellations occasionally bringing in an additional financial burden. The knock-on impacts extended to the need to replace departed suppliers resulting in delays to the overall implementation schedules. Issues relating to the procurement process and subsequently the poor contract management with suppliers was also identified. These issues range from the lack of a clear statement of obligations between all the suppliers involved and the organisations involved. The issues also extend to the lack of a systematic process to track and manage suppliers to meet their required obligations with regards to deliverables, track timelines, track and manage delays and increase in costs.

7.4.2 Other Observations

Other identified issues related to the intense focus that was placed on the front-end of contracts with the suppliers involved and the lack of the same level of focus post-award of contracts across the contract lifecycle, particularly during the implementation phases. Furthermore, issues regarding the technical and operational effectiveness of the suppliers involved were also identified.

The issues identified above had an impact on the overall outcomes and performance of the projects examined as they resulted in adverse impacts on the implementation and delivery processes. These resulting impacts on the implementation and delivery process resulted in the poor execution of the required objectives and led to a constant struggle to perpetuate the implementation and delivery which ultimately resulted in the eventual failure and abandonment of the programmes. It was the combination of the several challenges encountered that ultimately induced the failures of the projects. A contributory factor in the failures of these projects was that the challenges faced were magnified as a result of the extensive scope, scale and the duration of these projects.

7.4.2.1 Change Management

The failures in managing organisational change particularly cultural issues inherent in the relevant organisations as a result of the lack of understanding of the impacts from the implementation and adoption of new technology on the organisation were identified as part of the list of significant issues faced in the implementation of these programmes. Amongst the organisational issues identified was the lack of perception of the organisational transformation changes required as well as the impacts on the existing business processes in the affected organisations. These issues extended to failures in managing and responding to the changing aspects of the organisations such as changes to organisational objectives, changes to existing business processes, changes to the physical and logical environments and changes to the management structures while the project implementation phase was in progress. The lack of anticipation of change while taking into account the complexity of the organisation (for example, the complexity of the existing structures and processes) and the lack of the implementation of required change management processes contributed to the failure of the projects.

7.4.2.2 External Factors

Social and political factors were also identified as having a significant impact on the outcomes of the cases reviewed. These political and social influence was as a result of changes to the political ecosystem connected to these projects such as changes in political parties in government (public sector projects) and changes in the governing structures (private sector projects). These political and social realities led to challenges such as instability, changes in objectives and unnecessary demands expectations including excessive media and public scrutiny.

7.4.3 The Summary Results

The table below provides a cross summary of the identified challenges that contributed to the challenges and failures of the three LSCITP examined. The high, medium and low scores applied to the cross summary of the findings across each factor area for each project that is used in the table below are applied in the relative term to call out each of the factors' relative influence within project case examined.

No.	Knowledge Areas	NPfIT	DMI	e-Borders
1	Mission, Goals and Objectives	M	H	H
2	Requirements Engineering	H	H	H
3	Engagement Management	M	H	H
4	Technology	H	H	H
5	Scope Management	M	M	L
6	Leadership, Governance and Management	H	H	H

7	Budget Management	H	H	H
8	Schedule Management	M	M	M
9	Planning	L	L	L
10	Technical and Operational Expertise	M	H	M
11	Monitoring and Control	M	H	M
12	Communications Management	M	M	L
13	Execution and Delivery	H	H	H
14	Risk Management	H	H	H
15	Third-Party Management	M	H	M

Table **24**: The summary of the findings from the cases analysed and the impact scores.

The results of the other factors identified as part of the case analysis are displayed below.

	Factors	NPfIT	DMI	e-Borders
1	Change Management	H	H	H
2	External Factors	M	L	L

Table **25**: The summary of the other findings from the cases analysed and the impact scores.

From the analysis above, the outcomes identified that these projects through large-scale and complex in nature, were very different, they were different with regards to their goals and objectives, different with regards to the implementation processes and procedures applied and particularly different with regards to the industry setting. However, the negative factors that influenced the failures of these projects were very much alike.

7.4.4 Case Study Conclusions

The three case studies conducted (NPfIT, DMI and e-Borders) offered valuable insights as to the set of challenges faced, how they manifest and also how they contribute to their poor performance as there was sufficient data from the secondary data sources analysed that allowed the study to be able to address a key part of the research's objectives. The conduct of the case studies helped to identify the factors and challenges inherent and also helped to gain an in-depth understanding about the factors and how they give rise to challenges on LSCITP leading to negative performance impacts.

Beyond the identification of the set of challenges faced in LSCITP, the findings identify that lessons still need to be learned on LSCITP with regards to their effective management, governance and oversight and how they are implemented and delivered. Lessons also need to be learned on understanding and identifying the broader impacts of implementing LSCITP on the existing business processes of the organisations affected and on the culture in place prior to the commencement of the implementation of such projects. The study also identified that the changing culture of an organisation needs to be assessed for impacts on the implementation and delivery of an LSCITP.

Furthermore, the case studies also identified that lessons need to be learned on ensuring that top-level engagement and management support is present, effective, continuous and consistent throughout the implementation and delivery lifecycle of these projects. According to McManus and Wood-Harper (2007, p.38), "management issues accounted for about 65% of the factors that were identified with failed projects". These factors covers areas such as the lack of strong leadership, the lack of adequate stakeholder engagement, the lack of stakeholder management, the lack of an effective risk management, the lack of top-management support, the lack of adequate planning and estimation and the lack of relevant skills, knowledge and competency (McManus and Wood-Harper, 2007).

Lessons have also been identified on the need to ensure that an effective governance framework is established and put in place to govern all programme decisions, to set expectations, to define roles and responsibilities, to provide accountability and transparency and to define the expected outcomes and value realisation. More importantly, lessons need to be learned on the fact that projects of this nature are highly strategic or tactical and are more than just an IT project undertaking but rather, that they are projects with significant impacts and consequences that cut right across all areas of an organisation.

Programmes such as the NPfIT, DMI and the e-Borders are more likely to run into significant challenges and may eventually fail because of their large scale and complex nature and because of the complex environments they have to operate in. Modern-day realities and advancements in technology mean that LSCITP like the examples in this study are an absolute necessity and will continue to be implemented. Therefore, the key challenge at hand is on understanding and implementing the necessary frameworks, processes and procedures that are required to help improve their implementation and delivery and increase success rates to enable LSCITP to achieve their intended objectives as well as deliver value for their stakeholders. Simply knowing the causes of challenges and failure and how to prevent failure is insufficient without having an understanding of the critical set of actions required to implement, prevent or limit such failures including implementing the required programme tracking and measurement and assurance mechanisms to manage and prevent the possibility of such failures early on in the implementation cycle.

The results from the case studies will allow LSCITP stakeholders to understand the set of pitfalls from past projects, understand the most common pitfalls, identify patterns of failures, understand the evaluation dimensions for the LSCITP and gain a comprehensive understanding of how these issues impact LSCITP outcomes to prevent a repetition on future LSCITP undertakings. Furthermore, it will help to develop the required metrics around the identified factors that induce failures, help track and manage the potential causes of failures and to help improve the understanding of these failure factors and how to eradicate them.

7.5 THE EXPERT INTERVIEWS FINDINGS

The study aimed, through the data gathering process to identify, understand and gain a detailed insight into the set of factors that cause challenges on LSCITP causing negative impacts and leading to their poor performance and possible failures and to provide the mitigating solutions. The breakdown of the results from the analysis of the data gathered is described in the subsequent sections below. The structured results of the interviews were analysed, and the unstructured results coded and qualitatively analysed with the objective of understanding the results and obtaining detailed insights into the relevant factors being investigated.

7.5.1 LSCITP Implementation Outcomes

This section provides the analysis of the findings with regards to the current outcomes of LSCITP based on the data gathered for the study. The project outcomes from the data gathered during the study are analysed and examined based on the three key project outcomes that participants categorised their projects as falling into (for example, successfully completed, challenged and failed/abandoned). The definitions of *successfully completed*, *challenged* and *failed/abandoned* as applied in the study were provided to participants, and they were asked to assess the outcomes of their projects in one of these three categories. The objective of this section of the study is to understand and analyse the current success and failure rates of LSCITP globally and to understand the factors responsible for the success, challenges and failures as well as the levels of impact the specified factors have in determining a project's overall outcome. In addition, another objective was to challenge the results from existing studies on the success and failure rates of IT projects in general to (or "intending to") providing a more accurate and up to date picture on whether LSCITP outcomes are improving, remain static or taking a turn for the worse.

From the analysis of the data gathered, the results show that 53.5 percent of projects analysed were identified as *Challenged*. A further 12.5 percent of projects examined fell into the *Abandoned/Failed* category while a further 34.0 percent of projects were identified as being *Successful*. The results of the LSCITP outcomes from the study is presented in the table below.

No.	Overall LSCITP Outcomes	Total

			Projects	Percent
1	Successful LSCITP		19	34.0%
2	Challenged LSCITP	Challenged	30	53.5%
		Abandoned	7	12.5%
Total			56	100%

Table **26**: The breakdown of the successful and challenged outcomes of the projects examined in the study.

From the above results, it can be seen to be evident that LSCITP implementations are still being challenged. This opens up the debate on the need to understand the challenges of LSCITP further and identify the underlying causes or key set of factors that induce such failures and poor performance. The key objective lies in understanding what makes LSCITP inherently challenged and to analyse the factors responsible for influencing such challenged statuses and adverse outcomes.

7.5.2 The Challenges to the Successful Delivery of LSCITP

This section provides the analysis of the findings as part of the efforts to identify and examine the challenges and the factors that influence the failures of LSCITP through a review of the emblematic syndromes of failures of LSCITP. Additionally, in this part of the analysis, the relationship between the identified key knowledge areas and their impacts on LSCITP outcomes was also investigated. This section of the findings aims to answer the primary research question

> *What are the challenges to the successful delivery of LSCITP, how can they be avoided, and why do most projects fail to meet their original objectives?*

The factors that significantly contribute to IT/IS project failure were identified from the extensive review of literature carried out into IT/IS and LSCITP failures and on the LSCITP case studies carried out in this study. The list comprises 51 factors. These factors were categorised into fifteen knowledge areas based on their relevance to the respective areas, the relationships and interrelationships between the categories were also established via the domain model exercise carried out as fully detailed and described in *Chapter Five*. The set of factors contained within these evaluation dimensions (also termed knowledge areas) constitute an integral part of any IT/IS and LSCITP implementation, they are considered as part of the most important attributes that have a significant impact on project outcomes as analysed in the following studies (Patanakul and Omar, 2010; Al-ahmad, Al-fagih, and Khanfar, 2009; El Emam and Koru, 2008; Lawrence and Scanlan, 2007; Charette, 2005; Yeo, 2002; Schmidt *et al*., 2001; Murray, 2000; Whittaker, 1999; Willcocks and Griffiths, 1994).

The summary of the knowledge areas being examined as specified in the evaluation criteria is listed below. The full details of the evaluation criteria and the list of specific factors contained can be found in *Chapter Six, Section 6.3.5*.

Figure **11**: The list of key evaluation dimensions used to analyse the LSCITP as identified through the review of literature, the case studies and modelling exercise performed.

During the interview sessions, the evaluation criteria and conceptual schema formed some of the input materials for the sessions. In this part of the study, the factors contained within each of the evaluation criteria were discussed, analysed and evaluated by participants to assess their impact on all areas of the specific LSCITP in context including their overall impacts on eventual outcomes along with comments and views from participants that highlights the fundamental characteristics of the factors explored. More importantly, the interview process also sought to identify new factors previously undiscovered within specific knowledge areas defined in the conceptual schema that is also having an impact on LSCITP performance.

This section of the analysis addresses two of the sub-questions of the research question posed below which focus on the identification of the causes of challenges that act as the determinants of failures:

Sub-RQ1: *What are the key factors that help to improve or hinder the management, implementation and delivery of LSCITP?*

Sub-RQ2: *What are the challenged knowledge areas on LSCITP that stakeholders and practitioners need to be aware of?*

Overall, the end-goal for the study and analysis of these factors was to help gain an improved understanding of the causes of the challenges being experienced and the resulting effects and impacts that the factors have on the implementation and delivery of LSCITP as well as on their outcomes. Positive and negative statements were presented for each evaluation criteria and participants who categorised their projects as challenged or abandoned were asked to assess the various factors defined within the conceptual schema and provide a degree of assessment and agreement based on the performances of each of the factors within their LSCITP and the degree to which the factors had a positive or negative effect to the outcomes experienced for their LSCITP.

Participants were also asked to describe the nature of the LSCITP being examined to help establish a solid context by which the question and answer sessions can be conducted. Having established some initial context about the LSCITP under examination, the discussions with the participants then shifted to the detailed examination of the various aspects of the LSCITP. The questions on the evaluation criteria in the interviews were coded to a 5-point Likert scale. The responses to the performance of the factors collectively were used to rank the dimensions on a scale of 1 - 5 with 1 representing a strong disagreement and 5 representing a strong agreement. The responses were ranked as follows:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Neither Agree nor Disagree
- 4 = Agree
- 5 = Strongly Agree

By categorising and summing up the positive and negative scores that participants assigned to each of the evaluation criteria in relation to their LSCITP and the subsequent outcomes of such projects, it provided the opportunity to assess the factors contained and understand the impact they have overall on LSCITP outcomes. In addition, it also allows for the identification of the specific factors where the majority of participants have reported as significantly contributing to the set of challenges being experienced for LSCITP. A result which means that comparisons can then be made between these factors and also, comparisons can also be made amongst the same set of factors within the context of successful and challenged LSCITP outcomes.

The fifteen knowledge areas that make up the evaluation criteria (the conceptual schema) that was derived from the review of literature along with the additional new themes identified through the data gathering processes are discussed, analysed and evaluated in the sections that follow below with regards to their impact and significance on LSCITP outcomes.

The impact rating that was applied for each outcome area is determined by participants based on the factual discussions held. The table below provides a definition of each of the impact outcomes.

Impact	Description
Positive	The experience of the factors encountered for this knowledge area during the LSCITP resulted in significant positive contributions to overall project outcomes.
Neutral	I am unable to determine whether the experience of the factors encountered for this knowledge area during the LSCITP contributed positively or negatively to overall project outcomes.
Negative	The experience of the factors encountered for this knowledge area during the LSCITP implementation resulted in significant negative contributions to overall project outcomes.

Table **27**: The definitions of the impact factors used for assessing the evaluation areas.

The sub-sections below focus on the results of the data gathering on each of the knowledge areas identified. As part of addressing the research question posed. The experiences of participants on the challenges experienced with regards to the various factors contained within specific knowledge areas were sought. The process also sought to identify other issues and challenges encountered during the implementation and delivery process that are yet to be identified from prior research along with the consequences of these issues and the resulting impacts on the projects in context. Additionally, where participants provided a view of recommendations or the solutions applied to address any of the challenges faced, these were also described and documented in the explanation of the results for the respective sub-sections below.

7.5.2.1 Mission, Goals and Objectives

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the Mission, Goals and Objectives knowledge area for both *challenged* and *successful* LSCITP.

Mission, Goals and Objectives	Impacts		
	Positive	Neutral	Negative
Challenged LSCITP	**28**	**4**	**5**
Percentage	**75.7%**	**10.8%**	**13.5%**
Successful LSCITP	**19**	**0**	**0**
Percentage	**100.0%**	**0.0%**	**0.0%**

The results of the discussions and analysis of the *Mission, Goals and Objectives* category on the LSCITP examined initially addressing the factors listed below in addition to any new factors identified and the resulting contributions to the overall outcomes of the projects: • Clearly defined goals and objectives • Clearly articulated and validated goals and objectives • Regularly validated and reviewed goals and objectives • Documented business goals and objectives • Levels of volatility in delivery objectives and implementation roadmap • Benefits and value realisation processes and ongoing value and benefits assessments • Clarity of expectations

Table **28**: The results of the analysis of the factors of the Mission, Goals and Objectives knowledge area on the challenged and successful LSCITP.

Overall, twenty-eight of the challenged LSCITP examined felt that the Mission, Goals and Objectives area and the resulting outputs (for example, the business cases, objectives, scope, timeframes, benefits, costs, value proposition, resourcing, anticipated support and implementation responsibilities) were adequately defined, documented and was well understood with minimal challenges experienced that led to any significant negative impacts of the outcomes of the specific area and on the overall outcome of the projects.

However, nine of the challenged LSCITP examined identified specific issues and challenges being encountered with regards to the Mission, Goals and Objectives aspects of their implementations. Some of the issues already identified in the evaluation criteria were also highlighted by participants as part of the set of issues encountered and experienced. These existing issues were discussed in the context of the projects being examined. Furthermore, additional issues were also identified by participants. Amongst the additional issues faced includes:

- The difficulties in obtaining a consistent view from key stakeholders on how the defined goals and objectives for the LSCITP translate to success and what the measures of success were. Including how success was to be measured and how it was to be realised. These challenges were apparent through the lack of a value measurement plan established that should provide the definitions of key performance indicators (KPIs) and other required metrics to help determine the success parameters required in achieving the defined mission, goals and objectives and the business case for the LSCITP

- The challenges experienced with some senior stakeholders and business owners being unclear about the specifics of the mission, goals and objectives and the long-term strategic objectives of the LSCITP that was defined. The lack of detailed understanding by responsible stakeholders meant that they were unable to provide consistency of guidance and clarity from the top levels of management down to the affected entities, interested parties, the implementation and delivery teams involved including the third-parties involved within the scope of the entire implementation process

- The lack of regular reviews and refinement of the goals and objectives during the implementation stages to take into account any significant changes introduced or realised since the start of the implementation process. These challenges were highlighted particularly for significant changes in business objectives, significant changes to the implementation scope, changes to the existing value proposition, changes in expected outcomes, changes in planned timeframes and changes to key stakeholders and sponsors including changes in the leadership and governance structures. These issues were also coupled with the lack of adequate steps being taken to ensure that stakeholder agreements and alignment were obtained on such refinements and that the refinements continue to tie in with the overall organisational goals and objectives whilst taking into context the performance and progress achieved and the solutions that have been developed and implemented to date
- The challenges experiences with the mission, goals and objectives and the resulting business cases that were on occasions missing the required level of detail. These challenges were expressed particularly around areas such as a sufficiently detailed high-level specifications document containing detailed, validated and substantiated objectives and a documented detailed scope of implementation, the expected outcomes and the measures for success. The issues raised also includes the fact that there were often gaps in the statement of work (SoW) along with gaps in key expected timescales and milestones, gaps in scope, gaps in delivery responsibilities, gaps in resourcing requirements, gaps in initial cost estimates and budget requirements, gaps in high-level implementation plans and timeframes. In addition, the lack of definitions of constraints, the lack of the lists of key dependencies particularly on related ongoing initiatives with possible significant impacts and the set of pre-identified barriers to successful implementation were further issues highlighted

For example, on some of the challenged LSCITP, participants discussed the issues that they felt contributed negatively to the outcomes of their implementations. For example, a participant expressed the views below:

> *There was the lack of prompt action by the key stakeholders and business sponsors on our digital transformation programme to perform a timely review, approval and confirmation of the direction of the transformation initiatives in light of the significant changes made to the business objectives by the various business areas as part of the initial assessment exercise and the proof of concept conducted. The issues extend in particular to their failure to provide timely confirmation that the modified objectives and business cases where still in line with the overall organisational strategic objectives and direction and that the changes made continues to meet their expectations on projected costs and value. Implementation schedules were significantly impacted as a result of approval and confirmation delays.*

Overall, for the majority of LSCITP examined, the Mission, Goals and Objectives aspects reflected a positive outcome. Participants, in general, expressed the significance and the importance of having a detailed business case to help perform an analysis of anticipated costs, the expected benefits, to understand the value drivers, the value propositions and to provide a confirmation and validations of defined business goals and objectives. Thus helping to prepare for and address potential implementation issues that might arise such as the inevitable changes in scope, stakeholder misalignments, resourcing constraints, consistency of deliverables, clarity of expectations and the setting of implementation priorities and any resulting schedule implications.

Some participants suggested that as part of ensuring a positive outcome on the mission, goals and objectives area, specific processes and specific metrics should be defined to assist with the measurement of the business case during implementation and to ensure that stakeholder agreement and alignment is sought on the revised business case. Additionally, the process should help to continually track and monitor for changes in value forecasts as a result of any resulting changes in business objectives, scope, stakeholders, stakeholder expectations, governance structures, sponsors, end clients and end-users. More importantly, participants emphasised the importance of implementing LSCITP initiatives through the lens of the overall mission, goals and objectives defined for such projects that express up to date reality.

Given the constant changes in business realities and the evolving nature of technology, some of the affected participants suggested a way to mitigate the set of the specific issues faced with regards to the mission, goals and objectives aspects of LSCITP is to undertake a review of a LSCITP objectives regularly including assessing the value drivers, the value proposition, vision, strategy, anticipated benefits and costs, as well as performing business objective assessments and technical feasibility assessments to identify any material changes and any deviations from defined objectives whilst taking into account the scale and nature of the implementation being undertaken. Others instead suggested the need to review business cases on a quarterly basis as part of the implementation activities, while some suggested a review should be conducted ideally at least semi-annually at a minimum for a large and complex programme. Collectively, participants particularly those who experienced negative outcomes felt that undertaking regular reviews will enable the shaping of the implementation and delivery agenda to align with organisational and end-user needs and contribute to the control and improvement of other key implementation aspects such as planning, schedule, budget, spend and engagement.

In summary, participants were of the opinion that the goals and objectives and the business cases while being defined, documented both quantitatively and qualitatively, detailed and robust enough and regularly updated at a minimum must also have significant measurable and trackable outcomes.

7.5.2.2 Requirements Engineering

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the *Requirement Engineering* knowledge area on the *challenged* and *successful* LSCITP examined.

Requirements Engineering	Impacts		
	Positive	Neutral	Negative
Challenged LSCITP	12	5	20
Percentage	32.4%	13.5%	54.0%
Successful LSCITP	17	1	1
Percentage	89.4%	5.3%	5.3%

The results of the analysis of the *Requirements Engineering* category for the LSCITP examined initially addressing the factors listed below in addition to new factors that were identified and the resulting impacts on the outcomes of the projects:

- Appropriate functional requirements
- Requirements volatility
- Business process re-engineering
- Understanding of the requirements
- Complex requirements
- Abstract requirements
- Detailed business requirements and specifications
- Requirements analysis and definition
- High-level and low-level requirements and specifications
- Stable and valid business requirements

Table **29**: The results of the analysis of the Requirements Engineering knowledge area on challenged and successful LSCITP.

In summarising the results presented above, twelve of the challenged LSCITP examined felt that there were no significant challenges faced on requirements engineering that resulted in any significant negative impacts on the overall outcomes of their implementations. However, twenty of the challenged LSCITP examined identified specific requirements engineering challenges experienced as the primary catalyst for the resulting set of challenges experienced and for the resulting poor performance of the projects overall. Participants identified several factors already identified in the evaluation criteria, these existing factors were analysed and discussed. In addition, new factors were also sought and identified and amongst the requirements engineering challenges experienced and highlighted by participants include:

- The lack of a well-established and continuous process of requirements engineering particularly around validation and verification throughout the implementation lifecycle of the projects to take into account the challenges being faced on elicitation due to the complexity of the problems being addressed and on the ongoing tracing and tracking of requirements back to the defined objectives and business case

- The lack of clear, concise and ambiguous requirements combined with the lack of stable implementation scope and stable requirements to undertake technical designs, solution architecture, prototyping and subsequent developments and testing with
- The constant changes to requirements by the stakeholders, clients and business owners on demand and the resulting inconsistencies that were occurring in the revised requirements as a result to the defined plans, the technical work elements, the solution architectures, the delivered components, contractual obligations on third-parties, including the changes on existing requirements gathered and those already implemented
- The impact of the continually changing requirements creating resulting inconsistencies in other dependent projects as part of the overall programme implementation where applicable
- The lack of the use of an established or effective formal requirements management approach on projects which contributed to the set of challenges faced such as the missing of requirements, the late delivery of some requirements and the increases in the cost of implementation of some requirements due to requirements management issues and the constant re-baselining of the impacted implementation tasks, activities and deliverables.
- The lack of the application of well-established configuration management processes on LSCITP implementations to help organise, manage and control changes within the project environment specifically changes connected to systems and technology platforms and solutions that are being developed and implemented

In discussions with participants, the need to apply a formalised process or method for requirements facilitation, elicitation and documentation was raised. The majority of participants believed that use of a good and effective requirements engineering process will help to overcome some of the challenges identified particularly helping to tackle issues such as the management, control and governance of the determination, elicitation and validation processes for requirements including helping with the baseline management, managing and validating requirements changes, addressing requirements volatility, and improving traceability and alignment with implementation objectives and the wider project and business objectives. The benefits of a good requirements engineering approach were highlighted as a significant value that will ultimately contribute to the improvement of other implementation areas such as budget management, schedule management, cost management, quality and technical performance management. As suggested by a participant,

> *Changes to requirements are inevitable during the extended implementation life-cycle of an LSCITP due to several factors such as changes in organisational priorities, changes in business environments, changes in strategic and tactical objectives, legal and regulatory compliance changes, competitiveness, external pressures, and operational issues and that implementation objectives need to adjust and adapt to reflect these changes with a matter of urgency.*

Furthermore, as part of the discussions on the challenges faced around requirements engineering, participants expressed how in some situations, senior level stakeholders and sponsors agreed high-level programme goals and objectives and high-level strategic requirements and engaged potential contractual partners in contractual strategic discussions and negotiations without adequate consultation and engagement with the various dependent business units and departments within the organisations to adequately understand and elicit their detailed real business needs and current challenges being experienced.

Participants felt that more low-level engagement of all connected business areas and required stakeholders needed to be performed prior to any high-level strategic decisions and directions being made because such steps would help to ensure that the goals and objectives and strategic directions defined for the initiatives being proposed accurately reflect the challenges faced and thereby lead to a better understanding including the ability to put together detailed low-level requirements that can be addressed and implemented into a future technology solution.

Additionally, amongst the challenges faced on requirements was that critical request for changes (RFC) was being presented by the business and approved by stakeholders very late into the implementation phases particularly close to go-live which as a result impacted on the operational readiness plans and risks and security of the technology solutions being implemented. This result impacted the stability of the implementation process.

Furthermore, participants felt that managing requirement changes both minor and major and the resulting impacts it creates during the implementation process, particularly for component parts of the solutions that are already developed or implemented and those that were mid-way through the development stages, was amongst the biggest set of implementation challenges faced.

Moreover, the fact that such implementation challenges faced led to significant rework of implemented and ongoing component parts and also led to cost increases and schedule delays as a result of the rework activities being undertaken and the increased technical complexity, highlights the need to not only have a formalised process for requirements management but also the need to review the business cases regularly and agree changing objectives with stakeholders. The collective shared view was that requirements completeness supports design readiness and this, in turn, supports the implementation and delivery readiness and subsequent implementation processes.

Overall, the requirements engineering analysis identified that the requirements management process is a critical element of success particularly for complex technology implementations that often span multiple implementation teams, multiple implementing organisations that are often spread across various geographical locations with implementations and solutions delivered incrementally across various disparate technology components and platforms.

7.5.2.3 Engagement Management

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the Engagement Management knowledge area for the *challenged* and *successful* LSCITP examined.

Engagement Management	Impacts		
	Positive	**Neutral**	**Negative**
Challenged LSCITP	**16**	**1**	**20**
Percentage	**43.2%**	**2.7%**	**54.1%**
Successful LSCITP	**15**	**3**	**1**
Percentage	**78.9%**	**15.8%**	**5.3%**
The results of the analysis of the *Engagement* area of the LSCITP examined initially addressing the factors listed below in addition to new factors identified and the resulting impacts on the outcome of the projects: • User involvement and commitment • Adequate end-user engagement • Effective client consultation • Top management commitment, engagement and support • Levels of end-user involvement and engagement • Adequate stakeholder involvement and engagement • Adequate engagement across business functions and third-parties			

Table **30**: The results of the analysis of the Engagement Management knowledge area on challenged and successful LSCITP.

The section below describes the overall outcomes of the discussions and analysis of the above knowledge area for the challenged and successful LSCITP examined. In summarising the results presented above, twenty-one of the challenged and successful LSCITP examined identified significant challenges around the stakeholders, user involvement and engagement areas of their implementations that they felt contributed negatively to the overall outcomes experienced for their projects. The majority of the factors contained in the evaluation criteria provided were identified. Furthermore, additional issues were raised and amongst the additional issues identified and discussed includes challenges such as:

- The lack of adequate monitoring of stakeholder expectations over the entire LSCITP implementation lifecycle particularly for those very large and distributed complex programmes
- The failure to adequately identify all relevant stakeholders across all the stakeholder groups connected to the projects including identifying and mapping out key stakeholders and gauging and assessing their levels of interest in the undertaking and throughout the key phases of the implementation lifecycle

- The lack of full engagement and understanding of stakeholder objectives, goals and expectations and priorities
- The failure to identify and understand ongoing stakeholder concerns throughout the project's implementation lifecycles
- The lack of understanding and assessment of stakeholder expectations in the context of the implementation scope, delivery and project objectives and outcomes
- Lack of assessments and understanding conflicts in stakeholder goals, objectives and expectations in the context of the project's objectives, goals and implementation deliverables
- The lack of the monitoring of stakeholder behaviours, engagement and commitment levels during the implementation lifecycle
- The lack of adequate stakeholder engagement with the business areas and end-users that are significantly impacted by the technology solutions being implemented and the resulting change processes required

The lack of the monitoring of stakeholder behaviours, engagement and commitment levels during the implementation lifecycle was identified by two participants as significant challenges that arose that caused negative impacts with regards to engagement related aspects of their LSCITP implementations. The participants suggested that stakeholder behaviours should have been monitored throughout the period of the implementation stages to address issues such as the changes over time in stakeholder behaviours and how these changes impact against expected commitment levels that have been defined and expected from the stakeholders. As suggested by a participant,

> *The changes in stakeholder behaviours during the implementation stages should have been tracked across each of the critical implementation cycles to assess, understand and measure their levels of commitment, understanding and their acceptance of the progress on the implementation process, deliverables and subsequent outcomes. Such process would have allowed for the opportunity to ensure engagement levels remain continuous, help to provide valuable feedback to the implementation and delivery teams and other stakeholders involved, and also ensured that the required actions from these stakeholders are sought and are received promptly when sought.*

Participants discussed the critical importance of increasing the current levels of stakeholders and end-user engagement and the need for effective and improved engagement management in achieving successful LSCITP outcomes. In their views, improving the engagement levels of senior stakeholders, end-users and other connected and interested parties within the implementation and delivery process not only helps to improve their engagement levels but that it also helps to ensure their alignment, commitment, understanding, acceptance and required contributions to the implementation process. Other suggestions include the need for a strategy for effective engagement management to be established to govern and guide the engagement and relationship process of LSCITP.

A shared perception by some participants was that sufficient levels of engagements were not being carried out as required at a level that is suitable enough for the nature of LSCITP with business functions, end-users and other interested parties to undertake regular reviews of the proposed solutions for reasonability especially considering the solution architectures, technical and operational designs and intended system functionality being proposed. The need for regular reviews was identified as being required to support the comprehension and utilisation of the technology solutions developed by end-users when eventually delivered. The opportunity provided through this process also allows the implementation teams to utilise the outputs from the engagement sessions and feasibility analysis sessions to link back to the identified requirements to identify any missing gaps and for validation and verification purposes as well as to support the validation against the business case.

The lack of committed and influential stakeholders and sponsors was a key area of challenge to some of the projects examined as they were unable to seamlessly execute and deliver on all of the objectives in the scope of the implementation. Additionally, the lack of adequate engagement between all interested parties meant that critical and updated requirements were not manifested in the end solution that was delivered as expressed by participants.

Overall in summarising the discussions on *Engagement Management*, participants highlighted the importance of having the right levels of senior-level stakeholder support in the form of influential stakeholders and sponsors and to secure their committed engagements and to understand the available levels of such support in advance. In addition, the emphasis on engagement was also highlighted as being critical in supporting the enhanced alignment between stakeholders, business owners, clients, vendors, the implementation and delivery teams and end users and other interested parties.

7.5.2.4 Technical and Operational Expertise

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the *Technical and Operational Expertise* knowledge area for the *challenged* and *successful* LSCITP examined.

Technical and Operational Expertise	Impact		
	Positive	Neutral	Negative
Challenged LSCITP	**18**	**6**	**13**
Percentage	**48.6%**	**16.2%**	**35.1%**

Successful LSCITP	17	2	0
Percentage	**89.4%**	**10.5%**	**5.3%**

The results of the discussions and analysis of the *Technical and Operational Expertise* knowledge area of the LSCITP examined initially addressing the areas listed below in addition to new factors identified and the resulting contributions to the outcome of the projects:

- Technical know-how, skills and required domain knowledge
- Quality assurance issues
- Relevant large-scale project management experience
- Understanding of complexity
- Technical expertise and competency for complex solution delivery
- Management experience and implementation expertise
- Technological know-how in architecture and solution design of complex systems and solutions
- Knowledge and expertise in technology and managing large-scale technology projects
- Training and knowledge mobilisation and expertise in technology solution design and complexity

Table **31**: The results of the analysis of the Technical and Operational Expertise knowledge area on challenged and successful LSCITP.

In summary, thirteen of the challenged LSCITP examined highlighted challenges being experienced on technical and operational expertise across the various parts of their project implementations. In discussing these challenges experiences, the following issues were highlighted particularly because participants felt that they contributed negatively to the outcomes of their projects. For example, participants identified issues such as:

- The failure to engage external organisations to help perform a verification and validation of the proposed technical architectures and technical solution designs for these large-scale complex initiatives prior and during the implementation phases because of the complexity of the projects and the lack of sufficient internal technical expertise available. This was particularly relevant in scenarios where the implementation and delivery were being managed internally within the organisations and where the lack of technical skills and experiences was a highlighted issue

- The non-usage of external organisations to conduct an assessment of project progress during key delivery milestones or project implementation phases to assess current performance against defined objectives and also to perform a benefits assessment where significant challenges have been reported and where the successful implementation of the project was reported to be at significant risk

- The management failures where senior resources with significant domain experience and expertise in the implementation of LSCITP and specifically within the specified industry domain have not been brought on early in the implementation and delivery cycle to help shape the project's implementation and delivery roadmap from the onset

On technical implementation skills, participants alluded to the lack of availability of technical delivery skills and expertise that is required to drive the LSCITP implementation progress through the different development phases right up to the delivery of viable solutions. Some participants specifically argued that the delivery leads must be technical experts in the specific domains relating to the implementation projects that they manage.

Overall in summarising the discussions, participants identified and highlighted the importance of having the appropriate levels of LSCITP implementation and delivery skills and abilities including significant experience and expertise as part of the implementation and delivery efforts within the project environment. They felt that in their experience, the presence of appropriate levels of operational and technical expertise had a significant positive impact on the outcome of their projects and was essential to driving for success. This was particularly prominent where the projects in context involved the use of new and evolving technology. Citing specific scenarios, participants felt that having resources with the appropriate level of skills, abilities, experience and expertise embedded within key project roles and, having highly experienced technology domain experts across key implementation functions within the project environment specific to the technological domain of the project helped to avoid some of the typical implementation challenges they faced in the implementation and delivery cycles of these projects.

Significant experience and expertise in the theoretical and practical aspects of LSCITP management, implementation and delivery were perceived by most participants in their experiences as a significant critical success factor for LSCITP success outcomes. The majority of participants believed that implementation heads particularly those in roles such as programme managers/project managers/heads of delivery/delivery directors/delivery leads and other lead roles on LSCITP implementations need to possess significant experience, expertise, knowledge and skills that spans beyond programme and project management and delivery knowledge into other significant areas such as possessing skills and understanding and experience of technology, business and organisational change, change management, transformation and enablement, leadership, and communications management. These set of skills were seen by participants as being vital to the effective management, implementation and delivery of LSCITP.

7.5.2.5 Planning

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the *Planning* knowledge area for the *challenged* and *successful* LSCITP examined.

Planning	Impact		
	Positive	Neutral	Negative
Challenged LSCITP	**9**	**4**	**24**
Percentage	**24.3%**	**10.8%**	**64.8%**

Successful LSCITP	**12**	**6**	**1**
Percentage	**63.1%**	**31.6%**	**5.3%**
The results of the analysis of the *Planning* aspects on the LSCITP examined initially addressing the factors listed below in addition to new factors identified for the projects examined and the resulting contributions to the outcome of the projects: • Planning • Estimation			

Table **32**: The results of the analysis of the Planning knowledge area on challenged and successful LSCITP.

The discussions on planning examined the planning aspects of the projects including the on-going development and update of the project plans and addressing aspects such as whether the plans were detailed and realistic enough and whether the plans reflected both the high and low-level details covering every aspect of the implementation and required deliverables. In summarising the results presented above, twenty-four of the challenged LSCITP examined and one of the successful LSCITP identified planning challenges that contributed negatively to the performance of their projects. Participants discussed various LSCITP planning aspects and indicated that overall there was insufficient planning and poor management of the planning processes and that the on-going development and maintenance of the various planning aspects of the projects were not well managed. For example, most participants felt that though the planning aspects reflected high and low-level plans with key milestones, gateways and deliverables identified, they felt that plans on occasions were not properly baselined and that progress against plans was not being tracked effectively. The inefficient processes around planning meant that slippages and deviations from the plans were not being identified or detected very early on and that meant that any resulting issues were not adequately managed promptly.

In summarising the above findings, the results indicate that the challenges faced on the planning aspects were mainly as a result of the set of challenges experienced within other knowledge areas primarily on requirements engineering, scope management and leadership, governance and management. Participants on the challenged LSCITP examined expressed the fact that though the management of the planning process was appropriate in most cases, the lack of stable and valid requirements and the constant changes in specified or defined requirements coupled with the constant changes to scope and the lack of timely decision making and approval from stakeholders and sponsors meant that the planning for the implementation of the various component parts of the entire implementation was a challenging process from the onset. For example, participants felt that they were unable to establish and clear implementation roadmap and as a result, the planning for various aspects of the implementation such as work streams implementation planning, planning for key implementation milestones, dependency planning, release planning and delivery planning were severely impacted. In addition, the planning challenges experienced extended to other planning related issues such as challenges with the sequencing of implementations, resourcing challenges and optimism bias in the estimations processes. These planning issues participants felt led to continuous re-planning exercises in order to accommodate and take into account the changes occurring to the implementation objectives.

Aside from the planning challenges brought on by the challenges experienced in other LSCITP knowledge areas, some participants felt that the implementation and delivery planning aspects of their LSCITP could be further improved as there were inefficiencies with specific aspects of the planning process. For example, some participants expressed the fact that re-planning activities were not adequately planned for and anticipated as a result of the volatility synonymous with LSCITP and occasionally, there was the lack of a formal effort estimation process applied and the lack of validation of estimates.

7.5.2.6 Schedule Management

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the *Schedule Management* knowledge area for the *challenged* and *successful* LSCITP examined.

Schedule Management	Impact		
	Positive	Neutral	Negative
Challenged LSCITP	**11**	**5**	**21**
Percentage	**29.7%**	**13.5%**	**56.7%**
Successful LSCITP	**15**	**3**	**1**
Percentage	**78.9%**	**15.8%**	**5.3%**

The results of the analysis of the *Schedule Management* knowledge area for the LSCITP examined initially addressing the factors listed below in addition to new factors identified and the resulting contributions to the outcome of the projects:

- Poor estimation processes
- Schedule problems and unrealistic timeframes
- Unrealistic schedules
- Shorter implementation time-frames
- Schedule delays
- Significant delays in schedule and delivery milestones
- Understanding and management of priorities

Table 33: The results of the analysis of the Schedule Management knowledge area for challenged and successful LSCITP.

The section below describes the overall outcomes of the discussions and analysis of the above knowledge area for the challenged LSCITP examined. Twenty-one of the challenged LSCITP examined highlighted challenges being experienced around schedule management across the various phases of their LSCITP implementations. Participants identified specific issues that they felt contributed negatively to the overall outcomes of their projects. For example, issues identified include:

- The lack of understanding of interdependencies between various programs being undertaking concurrently by the client and this lack of understanding meant that the interfaces between the various programs could not be sufficiently managed where overlap or integration was required leading to significant schedule delays as a result
- The aggressive and unrealistic timescales given to implementation teams to achieve unrealistic expectations while having to deal with constrained budgets, resources, and having to implement demanding technology solutions coupled with the lack of clarity on expected outcomes and client and stakeholder limitations
- The lack of regular schedule analysis in line with implementation progress to provide and produce long, medium and short-term schedule forecasts

Furthermore, other issues raised include working and engaging with new suppliers, implementation and technology partners which were identified as issues that contributed to implementation schedule delays. Some participants highlighted the fact that working with new partners and understanding their ways of working and engagement models where a suitable working arrangement has not been established lead to delays which exceeded initially planned estimates for such collaborations and engagements. Moreover, another challenging aspect in the management of the schedules of LSCITP as experienced by participants was the challenges of working with and implementing new technology solutions, particularly where practitioners and implementation teams lacked prior experience with the implementation of such technologies. The challenges of implementing new technology solutions were seen to prove disruptive to defined implementation schedules. In addition, optimistic estimates based on similar experiences were applied resulting in longer implementation timeframes.

Participants also expressed the view that quite often implementation teams were being tangled in the politics inherent within the project environments rather than being untangled and having the freedom to focus on and drive through with their required implementations and deliverables.

In addition, other schedule issues reported related to participants noting that on occasions the delivery teams had to put in a significant amount of additional work hours to help meet specified timeframes and avoid slippages of key milestones and deliverables which was attributed to issues in planning and changes in scope and a set of internal factors.

7.5.2.7 Budget Management

This section focuses on the results of the discussions on *Budget Management*. As part of answering the research question posed, the experiences of participants on the challenges encountered with regards to budget management was sought. The process also sought to identify other budget issues encountered that are yet unknown from prior research along with the consequences of the issues encountered and the resulting impacts on the project in context. Additionally, where participants provided a view of the required solutions to address the challenges faced, these were also described and documented in the explanation of the results below.

The table below shows the comparison of the overall outcomes of the impacts of the knowledge area on the outcomes for both challenged and successful LSCITP.

Budget Management	Impacts		
	Positive	Neutral	Negative
Challenged LSCITP	**15**	**9**	**13**
Percentage	**40.5%**	**24.3%**	**35.1%**
Successful LSCITP	**13**	**3**	**3**
Percentage	**68.4%**	**15.8%**	**15.8%**

The results of the analysis of the *Budget Management* knowledge area for the LSCITP examined initially addressing the factors listed below in addition to new factors identified and the resulting contributions to the outcome of the projects:

- Budget management failings and costing issues
- Escalating project costs
- Budget constraints
- Failures in budget management processes

Table **34**: The results of the analysis of the Budget Management factor for challenged and successful LSCITP.

For *Budget Management*, there was not many differences between the set of factors identified through the existing literature and the set of challenges faced by participants on their projects. However, about twenty-eight of the projects examined across both the challenged and successful projects expressed some of the budget management challenges that they encountered. These challenges focused primarily on the cost management processes, identified issues expressed included:

- The lack of adequate and ongoing monitoring of cost forecasts, actual costs and spend and the lack of regular continued updates to forecasts throughout the implementation process
- The aptness of the initial cost assumptions and estimates made against the eventual costs and spend incurred

7.5.2.8 Scope Management

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the *Scope Management* knowledge area for the *challenged* and *successful* LSCITP examined.

Scope Management	Impacts		
	Positive	Neutral	Negative
Challenged LSCITP	**17**	**5**	**15**
Percentage	**45.9%**	**13.5%**	**40.5%**
Successful LSCITP	**16**	**1**	**2**
Percentage	**84.2%**	**5.3**	**10.5%**
The results of the analysis of the *Scope Management* knowledge area for the LSCITP examined initially addressing the factors listed below in addition to new factors identified and the resulting contributions to the outcome of the projects: • Changing scope and objectives • Significant changes to project scope • Lack of adequate scope management			

Table **35**: The results of the analysis of the Scope Management factor.

In summarising the outcomes of the analysis above, seventeen of the challenged LSCITP examined felt that overall, the scope management aspects were effectively managed and controlled and the outcomes were positive to the projects with some challenges encountered however these did not have a major impact. However, fifteen of the challenged projects examined identified major scope management challenges that contributed negatively to the outcomes on their projects. Amongst the set of additional scope challenges expressed by participants of these projects include:

- The lack of effective management and control of the project's scope and requirements
- The lack of the application of formalised and rigorous change control processes that led to significant implementation challenges resulting in technical changes in the ongoing implementation of component parts of the delivery, schedule delays, increased scope, contractual changes, poor quality and increases in budgeted costs as a result
- The inability to baseline the implementation scope during key milestone cycles due to constant changes
- The high-levels of changes introduced to the implementation scope by stakeholders and the resulting issues faced in the translation of the added scope into detailed requirements
- The continuous issues faced with the mapping of changes in scope to high-level requirements and the business case established through every significant change cycle introduced
- The challenges with implementing and putting in place a formalised change control process to control, and re-baseline the implementation scope due to significant volatility and lack of control around scope changes

- The inconsistencies between requirements, the changes in requirements and the defined implementation scope and project objectives
- The challenges around analysing and assessing the impact of required changes on the project and defined objectives

7.5.7.9 Technology

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the *Technology* knowledge area for the *challenged* and *successful* LSCITP examined.

Technology	**Impacts**		
	Positive	**Neutral**	**Negative**
Challenged LSCITP	**17**	**4**	**16**
Percentage	**45.9%**	**10.8%**	**43.2%**
Successful LSCITP	**11**	**6**	**2**
Percentage	**57.9%**	**31.6%**	**10.5%**

The results of the analysis of the *Technology* knowledge area for the LSCITP examined initially addressing the factors listed below in addition to new factors identified and the resulting contributions to the outcome of the projects:

- Use of inappropriate technology
- Use of new or immature technology
- Suitability of technology/technical framework
- Lack of alignment of technology implementation with business objectives
- High use of disparate technologies
- Poor system architecture
- Design errors
- Poor system architecture
- Lack of the understanding of the impacts of new technology on existing business processes
- Lack of proper integration and compatibility between new and existing systems

Table **36**: The results of the analysis of the Technology factor on challenged LSCITP.

In summarising the results presented above, seventeen of the project examined felt that overall the technology aspects of the project implementation resulted in a positive impact on the project outcome despite encountering technology issues and challenges. However, sixteen of the projects examined identified major technology-related challenges that contributed negatively to the outcomes experienced for their projects. Existing technology factors identified through existing literature and the case studies were covered. Additional issues experienced was sought and the set of additional technology challenges expressed by participants of the sixteen projects included:

- The lack of understanding of interface and integration requirements between the new systems being developed, legacy systems and the interface and integration requirements of dependent external organisations

- In some instances, the technology solutions being developed could not be rolled out to end-users within the business due to operational issues as a result of incompatible interfaces to interact with the technology and the lack of operational readiness measures to adapt existing business processes to fit with the new solutions implemented
- Poor solution architectures and complex integration requirements with new and existing disparate technology systems
- Over customisation of off commercial off the shelf (COTS) software platforms used where applicable, that stretched the boundaries of these platforms which effectively rendered the platforms unfit for purpose as a result of the over customisations due to ever-changing business requirements
- The lack of technical feasibility assessments being carried out mainly for implementation areas with high levels of complexity, utilising new technology solutions and platforms and where prior experience with such technologies within the organisation and implementation teams is relatively low
- The lack of adequate planning for go-live and operational readiness of the new services and solutions being delivered by the implementations. The insufficient capacity planning for the operational services, failures of the operational service due to increased and unanticipated usage

Some participants also noted that poor quality and technical performance was an issue that was high on the list of issues faced on their projects particularly on the issues of technical defects. On specific projects, some of the technical component solutions delivered contained high-levels of technical defects which remained unresolved as at the operational deployment of the solutions which in turn hampered the operational use of the delivered solutions and associated underlying services. Some participants also attributed the use of immature technologies as the primary cause of the challenged outcome of their projects.

Additionally, as part of the understating and assessment of technology-related factors, the technical complexity of the challenged LSCITP being examined was also assessed and measured based on a four-level category scale of low, medium, high, and very high to help improve the understanding of the impacts of technical complexities on LSCITP outcomes. The technical complexity provides a measure of the project's internal workings. Participants were asked to discuss and describe the levels of technical complexity experienced covering areas not limited to the number of disparate technologies involved, the number of technical interfaces implemented or supported, the number of technology components developed, the use of modern, unproven or cutting-edge technologies, the number of internal and external interdependencies including interdependencies between components, systems and sub-systems, and processes and legacy systems, data migrations. Furthermore, the analysis of technical complexity includes the number of application technologies being implemented and the number of third-party vendors involved. The results of the assessment of the technical complexities of the projects are presented in the table below.

No.	Technical Complexity	Projects	Percent
1	LSCITP where technical complexities could not be fully determined	2	5.4%
2	LSCITP with high levels of complexity	16	43.2%
3	LSCITP with low levels of complexity	2	5.4%
4	LSCITP with medium levels of complexity	12	32.4%
5	LSCITP with very high levels of complexity	5	13.5%
Total		**37**	**100.0%**

Table **37**: The results of the assessment of the levels of technical complexities on the challenged LSCITP examined.

As can be seen from the analysis on technical complexity, the projects examined showed a large proportion of the projects have been classed as having medium, high and very high levels of complexity.

7.5.7.10 Leadership, Governance and Management

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the *Leadership, Governance and Management* knowledge area for the *challenged* and *successful* LSCITP examined.

Leadership, Governance and Management	Impacts		
	Positive	Neutral	Negative
Challenged LSCITP	**12**	**8**	**17**
Percentage	**32.4%**	**21.6%**	**45.9%**
Successful LSCITP	**17**	**1**	**1**
Percentage	**89.4%**	**5.3%**	**5.3%**

The results of the analysis of the *Leadership, Governance and Management* knowledge area for the LSCITP examined initially addressing the factors listed below in addition to new factors identified and the resulting contributions to the outcome of the projects:

- Leadership/effective leadership
- Strategic direction and management of the programme objectives and deliverables;
- Change management
- Responsiveness and resistance to change
- Multiple stakeholder views
- Political environment
- Expectations management and unrealistic expectations
- Resources
- Changes to key stakeholders and stakeholder conflicts
- "Single" project owner
- Adequate and effective governance structures
- Governance structures and oversight

• Single responsible owner (SRO) • Sustained single responsible ownership, senior management ownership and leadership; • Independent technical assurance on technology solution design and architecture • Robust programme and project management process

Table **38**: The results of the analysis of the Leadership, Governance and Management factor on challenged LSCITP.

In summarising the results presented above, seventeen of the projects examined explicitly identified specific challenges around the leadership, governance and management on their projects that contributed negatively to the outcomes of the projects. A set of common issues based on existing factors presented were identified. Amongst the additional issues discussed not covered in the list of existing factors includes challenges such as:

- The established governance forums that often lack the adequate representation from all relevant stakeholders, business areas, clients and third-parties on a consistent basis
- The reduced and inadequate levels of challenge from senior stakeholders and the inadequate levels of scrutiny placed on project areas reported by the project and delivery teams as challenging such as: risks and issues, required actions, required support and also on the set of required standards, policies and procedures being followed as part of the implementation process
- The occasional failure to establish and implement an effective governance plan and the failure to leverage, operationalise and fully implement such established governance plans where they are established
- The lack of regular and ongoing monitoring of stakeholders and changes in stakeholders and changes in governance structures that impacted the projects and also impacted the existing governance structures established as a result of the resulting changes
- The high levels of stakeholder volatility leading to challenges on projects as participants expressed the fact that significant governance changes resulted in a delay to decision making and a slowdown of governance processes resulting in an inevitable delay to the project's implementation processes
- The expectation of failure by senior stakeholders at the onset of the implementation of LSCITP. Some participants felt that this default mindset meant that stakeholders were already anticipating failures and were implementing cautious strategies from the onset to mitigate the consequences of failures. Most participants felt that while these mitigation strategies were not necessarily a bad thing, they impeded the implementation process significantly
- The lack of adequate and prompt decision making by stakeholders and lack of agreements between stakeholders including the occasional lack of clarity of execution particularly on LSCITP where the decision-making processes can be enormously complex, involving a chain of interactions, communications and decisions between stakeholders, business areas, project teams, third-parties, suppliers and end-users which some participants felt was often not forthcoming from the stakeholders

- The lack of awareness of the complexity of the technical solution architecture and design connected to the various parts of the implementation by members of steering groups, senior management and key stakeholders that would have helped to support effective decision-making
- A few participants highlighted the fact that some stakeholders and business owners were inexperienced with regards to their specific roles and responsibilities and as a result, they lacked the appropriate level of experience and expertise to make necessary decisive decisions when required. Participants felt that the lack of decisive or prompt decision making led to significant delays and missed deadlines while clarifications, guidance and future directions were being sought
- Several participants also highlighted the lack of a Single Responsible Owner (SRO) for their LSCITP. They expressed the fact that giving the large-scale nature of these undertakings, owners were varied across several entities, business areas, business units, clients and projects and as a result, decision-making process and oversight and accountability processes became challenging
- Participants also noted that far too often the majority of stakeholders have a default mindset whereby they view the implementation of LSCITP purely from a technological perspective and do not sufficiently consider other perspectives nor present a holistic strategical view that embeds the organisational, cultural or operational context at the core of the implementation and delivery process
- Some participants noted that operating in an LSCITP project environment that has complex governance structures led to challenges in prompt decision making and adding to that, the constant need to navigate the complex decision-making processes exacerbated the program's schedule and estimated timeframes and resulted in cost increases as a result of repetitious process cycles being undertaken
- The lack of the implications for late IT/IS projects was another issue that was raised. Participants felt that when compared to other related projects, for example, regulatory change projects that there was the lack of any resulting implications for IT/IS if the implementation fell behind schedule. When compared with regulatory change projects where the implications are known

The need for a single SRO for large-scale complex initiatives was regularly highlighted given that these initiatives are often composed on several program workstreams. As discussed by a participant:

> *The lack of an SRO appointed for our Technology Transformation Programme (TTP) to help lead, develop, maintain and disseminate the vision and strategy of the programme to all required stakeholders across all multiple projects operating within the programme and, across all dependent projects was a failure in my view. Owners across the projects though they worked in collaboration with other projects and were engaged by the programme leadership teams, the lack of an SRO meant that the engagement levels throughout the implementation span of the programme was inefficient and inadequate.*

Participants expressed the fact that regardless of the large-scale nature of an initiative, ideally, an SRO should be mandated to have overall responsibility and accountability for the implementation and delivery of the entire undertaking. Furthermore, participants felt that an appointed SRO should not only ensure the continued viability of the programme and the defined objectives but should be also responsible for ensuring the realisation of the benefits for the programme.

Furthermore, some participants felt that the departures of key members of their implementation teams caused disruptions and delays on their defined schedules and on the governance and accountability aspects of the projects. In particular, affected participants felt that the loss of senior members of the project teams brought about the loss of acquired knowledge and the constant realignment and changes in strategic management and implementation directions which severely affected the team synergy and the quality and technical performance of their implementation and deliverables. Resource volatility issues extended to delays scheduling as a result of new resources being transitioned and integrated into their new roles. Due to the typical extended implementation durations of LSCITP, interviewees felt that leadership and senior management teams should plan for and anticipate the possible departures of key members of the implementation teams particularly those of the senior teams in senior roles and build in the mitigating solutions such as succession planning into the overall project governance, management and implementation structures for LSCITP.

The need to apply established processes and procedures was another topic that surfaced during the discussions. For example, a participant described their experiences of decision making during their project implementation and indicated that:

> *Guiding principles were not established as a basis for decision making at the steering committee sessions and at the project management office levels of the implementation particularly during the mobilisation and early phases of the project. The lack of appropriate processes established and integrated into the implementation process from the onset meant that ad-hoc processes were used on decision making, and this resulted in the lack of timely decision making, the lack of clarity on responsibilities with regards to authority and accountability. The absence of a defined process meant the implementation schedule was significantly impacted.*

Several interviewees also expressed the need for the strong and engagement-driven level of leadership signifying the importance and stressing that they viewed that has been vital to the viability of the LSCITP. For example, participants reflected the lack of strong leadership in governance, management, sponsorship, and ownership leading to challenges around the short-term effectiveness of the implementation and delivery process which in turn led to issues such as the delays to the verification and validation of the scope of work, delays to the defined schedule right from the component parts of the deliverables through to the key delivery milestones thereby resulting to overall schedule delays for the projects. Also, the lack of strong and engagement-driven level of leadership affected the strategic direction of the projects leading to frequent changes in objectives and scope which in turn gave rise to increases in costs because of the impacts on schedule and scope. Also, poor technical performance and quality of end deliverables are also some of the outcomes emanating from the governance challenges faced.

Multiple stakeholder views and conflicts in stakeholders was another issue raised by participants as a common occurrence on LSCITP. In the case of a specific project examined, issues with multiple stakeholder views completely exhausted its entire contingency schedule. As described by a participant.

> *The entire project's contingency was exhausted by delays in top-level decision making. The decision-making process for the project involved thirteen stakeholders with differing views, perspectives and expectations. The project's budget was exceeded significantly as a result of the decision by the stakeholders to keep the various implementation teams and associated workstreams together while they were waiting to agree collectively and figure out how to proceed and to decide on the next steps for the project. Such delays led to significant cost overruns and schedule delays that eventually resulted in the decision to terminate the project.*

Additionally, as part of the assessment of the *Leadership, Governance and Management* of LSCITP, the management complexities of the challenged LSCITP was also assessed and examined based on a five-level category scale to help improve the understanding of the impacts of complex management and governance processes on LSCITP outcomes. The management complexity provides a measure of the project's internal management and governance structures and covers areas such as the organisational and business areas of the projects including organisation size, team size, management structure, number of entities involved, and the number of interested parties as well as the number of vendors, suppliers, contractors and other organisations involved. The discussions also extended to the project environments, internal politics, conflicts and other issues experienced. Participants were asked to discuss and describe the levels of management complexity experienced based on the areas described above.

The results of the examination of management complexities are presented in the table below.

No	LSCITP Management Complexities	Projects	Percent
1	Number of LSCITP where the levels of management complexities could not be determined	**2**	**5.4%**
2	Number of LSCITP with **High** levels of management complexity	**13**	**35.1%**
3	Number of LSCITP with **Low** levels of complexity	**4**	**10.8%**
4	Number of LSCITP with **Medium** levels of complexity	**11**	**29.7%**
5	Number of LSCITP with **Very High** levels of complexity	**7**	**18.9%**
Total		**37**	**100.0%**

Table **39**: The results of the assessment of the levels of management complexities for challenged LSCITP.

As can be seen from the results above on the assessment of management complexity, the majority of the projects examined fell into three complexity categories (Medium, High and Very High) and therefore fulfils one of the objectives of the study which aims to understand complex structures of large-scale, complex technology projects. Only a small subset of projects was categorised as falling into the low complexity category.

In addition, some participants identified that quite often the delivery responsibility for the component parts of an LSCITP initiative is seen as a responsibility that belongs solely to the accountable senior stakeholders, owners and sponsors. However, participants argued that delivery responsibility including the accountability for the value realisation from the implementations of these component parts of the LSCITP implementation should be rolled down through the various ownership and responsibility structures of the organisation involved. They felt that rolling down the delivery responsibility and value accountability will ensure that these areas are vigorously managed throughout the implementation process and through each implementation phases. Such a process does not remove the need for overall accountability and responsibility, however, it ensures a more low-level management and oversight of deliverables and value realisation.

In summarising the overall outcomes, participant's views were that the nature of LSCITP necessitates a robust and effective governance structure, expeditious management with adequate and effective oversight and management of all the several cross-functional teams and processes involved in the implementation and delivery process. Participants felt that an effective governance structure brings about an effective and adequate oversight of the LSCITP implementations. It also brings about the establishment of governance standards, the required levels of transparency and accountability including objectivity and responsiveness and ultimately to manage potential issues and address external factors.

7.5.7.11 Communications Management

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the *Communications Management* knowledge area for the *challenged* and *successful* LSCITP examined.

Participants were asked to discuss the communications management aspects of the projects in context using the evaluation criteria as a guide, and various areas were discussed and analysed with regards to, for example, the levels of communication, how it was managed, the challenges faced and how the issues faced where applicable were addressed and mitigated.

Communications Management	**Impacts**		
	Positive	**Neutral**	**Negative**
Challenged LSCITP	**16**	**6**	**15**
Percentage	**43.2%**	**16.2%**	**40.5%**
Successful LSCITP	**15**	**3**	**1**
Percentage	**78.9%**	**15.8%**	**5.3%**
The results of the analysis of the *Communications Management* aspects for the LSCITP examined on the LSCITP examined initially addressing the factors listed below in addition to new factors identified and the resulting contributions to the outcome of the projects: • Communications • Levels of communications • Complex interactions • Cross-functional communication challenges			

Table **40**: The results of the analysis of the Communications Management factor on challenged LSCITP.

In summarising the results presented above, sixteen of the projects examined felt that the communications management aspects were managed effectively and overall contributed positively to the outcomes of their projects though they also identified issues encountered however, the majority of participants felt that these were sufficiently managed and addressed with no significant negative impacts. However, fifteen projects identified specific challenges and issues on their projects around communications management that they felt contributed negatively to the outcomes experienced for their projects. The common issues identified through existing literature and the case studies were discussed, and additional new issues identified were captured. The new additional issues discussed include the challenges and issues such as:

- The failure of the project management teams to provide the senior stakeholders with the required accurate project performance and project status information that would enable senior stakeholders to manage progress effectively understand realistic statuses, judge outcomes, manage risks and provide the required inputs to other management, implementation and support processes
- The increasing need to manage and orchestrate high-volume, dynamic communications and interactions with various stakeholders, business areas and internal entities within the LSCITP ecosystem as well as with external entities which proved challenging for implementation teams
- The failures by senior management teams and stakeholders to process and assimilate project communications and feedback provided timely
- The use of poor communications mediums as the primary source of communications throughout the implementation and delivery cycle (for example, electronic mails were

being used as the primary medium to deliver and communicate project updates and feedback)

- The lack of transparency in certain areas particularly to do with reporting to senior stakeholders, lack of objectivity and combined with the lack of frequent updates and an open line of communication established within the project environments was also identified by some participants as contributory factors as part of the communication issues faced
- The lack of visibility of issues to senior stakeholders and responsible individuals particularly to do with issues within the implementation process that could have a significant impact on expected outcomes and results

Other participants identified that the ability to maintain and provide regular clear, unambiguous communications across all the varied structures of their projects was difficult mainly because their projects were made up of a diverse set of teams working in various geographical locations with multiple stakeholders, business owners and third-parties etc. involved. Communication issues experienced stem from both miscommunication and the lack of adequate, regular, timely, concise and transparent communication across the upper, middle and lower tiers of the project structures.

In addressing the issue of effective communication and reporting and providing the appropriate level of visibility to the senior stakeholders. Some participants alluded to the process involving the use of bespoke assessment and evaluation frameworks in the form of surveys and structured interviews that was applied regularly during the implementation phases of their projects to gather, assess, monitor and provide visibility and systematic reporting on the progress being made towards implementation objectives. This process involved quantitative and qualitative data gathering and analysis in the form of regular surveys and interviews of key members of the implementation and delivery teams to gather their individual insights and perspectives and through the setup of regular open-forum feedback, working sessions to obtain collective feedback. The key objective was to gather data across several project reporting categories covering areas such as implementation progress, performance, budget vs costs, achievements to date, issues and concerns, levels of confidence, current realities and expectations, operational challenges and other reportable issues to support a more informed decision-making process by the relevant stakeholders.

Others suggested the use of improved top-down and bottom-up communication processes particularly during the implementation phases supported through the use of new tools of communication that can be tracked and measured for effectiveness and engagement.

The majority of participants concluded that the gathering and prompt reporting on implementation progress, findings, issues, concerns and outcomes to senior stakeholders during the implementation phases provides significant driving force for visibility, learning and understanding and for the required decision-making processes that helps to address implementation issues and concerns promptly and appropriately thereby helping to increase the likelihood of success of a LSCITP. Some participants also expressed the fact that the size and complexity of the project being implemented should always be a determining factor to assess the level of additional reporting and communication that is required.

7.5.7.12 Monitoring and Control

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the *Monitoring and Control* knowledge area for the *challenged* and *successful* LSCITP examined.

Monitoring and Control	Impacts		
	Positive	Neutral	Negative
Challenged LSCITP	**18**	**8**	**9**
Percentage	**48.6%**	**21.6%**	**24.3%**
Successful LSCITP	**16**	**1**	**2**
Percentage	**84.2%**	**5.3%**	**15.8%**

The results of the discussions and analysis of the *Monitoring and Control* knowledge area for the LSCITP examined initially addressing the factors listed in the evaluation criteria summarised in the list below and the resulting contributions to the outcome of the projects:

- Monitoring and control
- Adequate and effective monitoring and control of implementation and delivery across the project lifecycle
- Effective monitoring and collaboration between the business, entities and third-parties involved

Table **41**: The results of the analysis of the Monitoring and Control factor for challenged and successful LSCITP.

Eighteen of the projects examined reported an overall positive impact on their projects arising from the effective monitoring and control processes carried out on their projects. However, nine projects reported negative outcomes on the monitoring and control aspects of their implementations that they felt contributed negatively to the resulting outcomes of their projects. Participants on the nine projects that reported negative outcomes highlighted the following issues:

- The lack of regular and consistent attendance by specific members of the steering, executive committee groups, sponsors and responsible stakeholders in the programme/project checkpoint meetings and required workshop sessions which meant that the successful oversight, management, steer and direction required from these stakeholders to support the implementation process was challenging at limited on occasions
- The failure by the key program stakeholders, sponsors and owners to regularly monitor the speed of implementation and the progress being achieved towards the defined objectives in each program delivery phases. Participants were of the opinion the lack of regular key stakeholder monitoring and control meant that they were not able to influence and drive the implementation and delivery agenda as required. Some of the participants also felt that the monitoring processes were often done on an infrequent basis and not frequent nor formalised enough to be able to address issues and problems as the surfaced

Amongst the objectives and benefits suggested by some participants on monitoring and control was on implementation stakeholders to regularly identify and monitor actual project status, project and implementation performance, issues and challenges, risks, expected outcomes, results and benefits and the various change processes connected to the embedding of delivered outputs into the organisation and applicable environments and to communicate such performance outputs to key stakeholders. For example, a participant drew on the experience gained from their LSCITP implementation about monitoring and control where

> *A project monitoring database was established for the duration of the programme implementation and the database was being populated in real-time with ad-hoc, daily and weekly status updates and key reports and metrics across all programme implementation workstreams. The process meant that key stakeholders had a real-time visibility into the reality of the various programme workstreams and the overall programme and were able to monitor their implementation progress and identify any significant challenges and exceptions as they arose. The significant value provided by this approach meant that critical issues and challenges were assessed promptly to establish if further actions and inputs were required from the connected stakeholders. The participant felt that this process ensured that the appropriate level of ongoing engagement, oversight, management and control was maintained and sustained.*

The majority of participants suggested that a well-defined and industry standard process is required to support the enhanced monitoring of LSCITP undertakings. The enhanced monitoring processes will offer support for the regular measurement, assessment and reporting of the LSCITP performance based on specifically defined Large Project Performance Indicators (LPPI) unique to the project in context and generic to LSCITP. They suggested that the LPPI indicators should focus on key areas such as cost, spend, scope, schedule, operational performance, value realisation and technical quality and technical performance.

Some participants stressed the importance of the ongoing assessment of an organisation delivering a LSCITP to ensure that the projects and the various component parts of the implementation and delivery are being implemented, managed and delivered according to the defined principles on governance, management, goals and objectives, technical and operational expertise and execution and delivery by the stakeholders.

7.5.7.13 Risk Management

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the *Risk Management* knowledge area for the *challenged* and *successful* LSCITP examined.

Risk Management	Impacts		
	Positive	Neutral	Negative
Challenged LSCITP	**12**	**11**	**14**
Percentage	**32.4%**	**29.7%**	**37.8%**
Successful LSCITP	**16**	**2**	**1**
Percentage	**84.2%**	**10.5%**	**5.3%**
The results of the analysis of the *Risk Management* knowledge area for the LSCITP examined initially addressing the factors listed below in addition to new factors identified and the resulting contributions to the outcome of the projects: • Risk management • Adequate and ongoing risk assessments • Effective risk management processes • A formalised approach to risk management			

Table **42**: The results of the analysis of the Risk Management factor for LSCITP.

In summarising the results presented above, fourteen of the projects examined identified significant challenges around risk management in their projects that resulted in negative contributions to the outcomes experienced for their projects as a result. Amongst the additional risk issues not covered in existing risk factors discussed include:

- The lack of regularly documented comprehensive risk management plans, contingency planning, risk response strategies and the conduct of regular and periodic risk reviews including the ongoing and proactive monitoring of risks during each stage of the implementation and delivery processes and during critical implementation milestones
- The lack of detailed checklists for large-scale complex IT project risks to act as a source of possible risks to consider and the lack of the regular documentation, update and review of the risk logs and risk registers by the project management teams
- The fact that most risk management activities in their experiences were often more of a tick box exercise. For example, where risks are documented in the risk logs, there was no regular follow-up actions to address the risks raised, to determine the realisation of any of the risks documented and also there was no regular follow-up actions to implement appropriate controls to address, mitigate or respond to the set of risks that

were realised. There was a lack of consistent approach to risk management and it was often viewed as an after task

- The lack of iterative risk identification and management processes with the appropriate set of risk response strategies throughout the implementation lifecycle of the projects coupled with the lack of periodic reviews of risks

Other participants discussed the lack of a systematic approach to the risk management of their projects specifically around the organisation and repeatable approach to understanding the dynamics of the complex environments the projects were operating in and in particular the constantly changing environments in order to help identify the scenarios and situations that could give rise to risks that may impact the performance of the projects and impacts on meeting its objectives. Others argued that the periodic reviews of the risk management plans established were not frequently conducted. In other scenarios, risk mitigation plans were not developed and sufficiently maintained, and risk processes were not being incorporated into the implementation and delivery cycles of the undertakings. For example, as one participant indicated:

> *The issues that we experienced during the implementation process on the project was handled reactively as disruptive events rather than proactively via appropriate risk management processes and there were no effective processes established to help to anticipate risks and issues.*

Other participants highlighted the strong focus that was placed on the identification and assessment of internal risks and the lack of the same focus being placed on external risks. In addition, the lack of the identification of external risk factors particularly around areas such as financial markets, political background, technology evolvement, third-parties was part of the experienced failings on risk management.

Furthermore, other risk issues identified by some participants related to the lack of the cross-comparison of risks amongst related workstreams or projects in the programme (where applicable on specific projects) and against past similar projects within the specific environments including the lack of engagement with external risk expertise particularly for large complex technology-led projects. Some participants also expressed challenges around the ability to determine and identify internal and external risks; they felt that internal risks were often identified, however, external risks were often ignored or not afforded the same level of criticality as internal risks.

LSCITP are complex undertakings, they are highly dynamic in nature, and they present varying levels of risks during the implementation and delivery life-cycle. Risk management is viewed as an important element of achieving a successful outcome for LSCITP and is backed up by prior research looking into risks and large-scale IT initiatives that have identified the lack of effective risk management and its corresponding impacts of IT/IS project outcomes (Schmidt et al., 2001; Willcocks and Griffiths, 1994).

7.5.7.14 Execution and Delivery

The table below shows the results and the outcomes of the discussions and assessment of the impacts of the factors within the *Execution and Delivery* knowledge area for the *challenged* and *successful* LSCITP examined.

Execution and Delivery	Impacts		
	Positive	Neutral	Negative
Challenged LSCITP	**16**	**6**	**15**
Percentage	**43.2%**	**16.2%**	**40.5%**
Successful LSCITP	**19**	**0**	**0**
Percentage	**100%**	**0.0%**	**0.0%**

The results of the discussions and analysis of the *Execution and Delivery* knowledge area for the LSCITP examined initially addressing the factors listed below in addition to new factors identified and the resulting contributions to the outcome of the projects:

- Project management
- Project management processes
- Delivery methodology
- Software development methodologies
- Resourcing
- Project teams and conflicts
- External parties
- Project management methodology
- Resource volatility
- Stakeholder management
- Human errors
- Cross-functional and geographically distributed teams

Table **43**: The results of the analysis of the Execution and Delivery factor on challenged and successful LSCITP.

In summarising the outcomes of the analysis of the results above, about half (sixteen) of the challenged LSCITP examined felt that the execution and delivery processes for their projects were satisfactory and contributed to a positive outcome for the projects with minimal challenges experienced. However, the other half (about fifteen) of the projects expressed the challenges faced and the contributions to the negative outcomes that resulted for their projects. Six of the projects examined could not determine whether the execution and delivery process contributed positively or negatively to the outcomes of the projects.

- The commercial and economic pressures placed on the implementation teams to deliver results which meant that on occasions, standard project management processes and procedures were not followed effectively

- The lack of focus, steer and formalisation of project meetings was an issue that some participants experienced significant challenges with. For example, participants felt that quite often, critical project issues are not sufficiently covered or addressed at all in the timeframes allocated to the project, status and steering committee meetings due to deviations on the agenda, deviations from the topics of discussions and due to excessive time spent focusing on other areas of discussions during these meetings. These issues participants felt was aided by the lack of formalisation and strong steer by the project leadership and management teams during these steering sessions
- The lack of regular attendance by key members of the steering groups, business owners, key stakeholders and other required participants during regular sessions meant that progress meetings where more challenging as absent participants meant that such meetings could not be sufficiently steered with regards to the agenda and objectives due to the lack of adequate representation of all required stakeholders
- Issues with the effectiveness of the meetings and workshops facilitators particularly regarding their effectiveness in addressing areas of their roles and responsibilities such as effectively facilitating discussions around project issues and risks, challenging points of discussions during workshops, meetings and engagement sessions, managing and tracking required actions and follow up updates, and ensuring that decision-making areas are provided to the responsible stakeholders
- The occasional lack of clarity on responsibilities with regards to authority and accountability on decision making coupled with the lack of timely decision making including the scope of the decision makings and the lack of clarity on the required inputs into the decision-making process
- The lack of available and suitable expert resources and specific subject matter experts across business and technology domains when specifically required during the implementation process coupled with the lack of timely access to the appropriate business and technology expertise where available within the project environment during the implementation process
- The lack of the use of program management technology tools to drive the management and implementation of LSCITP was a recurring issue discussed by participants

Other outcomes from the discussions on the execution and delivery were on the implementation durations of LSCITP. Some participants argued their projects significantly ran over an extended implementation period and that a rethink of the lengths and durations of LSCITP needs to be considered as they need to be reduced as a result of the pace of change that is particularly accelerated within the IT industry. For example, they suggested the breakdown of projects scheduled to run over 3 years into smaller scale projects so that they are not severely affected by the accelerated pace of change within the IT industry. As indicated by a participant

> *The major IT project implementations being undertaken by our organisation are increasingly being challenged from the onset prior to their implementation being underway as a result of the increasing demands to deliver more in scope, contend with shorter implementation timeframes, reduced budgets, and a reduction in implementation resources whilst making use of fast-moving modern technologies solutions to undertake the implementation of such ambitious complex projects.*

The majority of participants also expressed the increasing need to support the delivery and assurance of major IT projects through the use of agile delivery methods to help improve their performance and outcomes. Participants discussed the chaos experienced with traditional project management processes when applied to LSCITP, this view was born out of the discussions on the suitability and application of the implementation and delivery processes applied to the implementation of these projects. Some participants discussed the need for the use of more agile oriented methodologies in the implementations of their LSCITP and discussed the benefits on the use of such methodologies particularly the ability to organise and break down complex programme components or work into smaller more manageable units for implementation and delivery.

The delivery of LSCITP based on defined schedules and on defined budgets have long been used as a measure of success however, some participants felt that value realisation is perhaps a better measure as it is the ultimate objective from the implementation and delivery of LSCITP initiatives and therefore should be used as the ultimate measure of success.

7.5.7.15 Third-Parties and Suppliers

The section below describes the outcomes of the discussions and analysis of the above knowledge area for the challenged LSCITP examined. Not all the LSCITP examined involved the significant involvement or engagement of third-parties. However, for the projects that did, partitions were able to provide a view of some of the challenges encountered that they felt contributed to the negative performances and outcomes for such projects.

Amongst the key discussion points to emerge were the challenges experienced around the use of fixed-price contracts with third-parties (for example, vendors, suppliers, consultancies, external agencies and contractors) engaged on their project implementations. Participants highlighted and discussed the risks posed through the use of fixed-priced contracts which was being used to effectively move the risks from clients to the third-parties. Such challenges encountered include regular ongoing disputes with third-parties on requirements and scope of work, legal challenges between clients and third-parties on contract terms and possible contract breaches, poor quality outputs and deliverables from third-parties due to lower costs options pursued by providers, occasional disagreements on responsibilities and obligations, breakdown of relationships and engagements with third-parties, management overhead and analysis of numerous change requests and significant increases in costs as a result of the frequent changes to the scope of work and implementation timeframes by clients and the renegotiation of contracts.

Vendor incompetence was also another topic that emerged that some participants discussed. For example, as described by a participant,

> *A major issue in the implementation of our enterprise-wide ERP transformation programme was that both the vendor and the vendor's implementation and integration partners exhibited high levels of technical incompetence. The vendor implemented and deployed the ERP modules and accompanying functionality that were incompatible with the requirements specified including the deployment of ERP modules and features that were out of scope. Due to poor vendor management processes and failures in the testing and operational acceptances processes, the ERP solution was not fit for purpose when utilised on launch day as a result of the unspecified functionality delivered that conflicted with specified functionality. The end-users ran into operational and usability issues. The cost of remodifying the defective ERP solution delivered to fit with the specified requirements and objectives ended up costing more than half of the cost of the original implementation.*

Furthermore, some participants discussed experiencing challenges around the nature of the relationships that were forged with third-parties engaged in their projects. They felt that strength of the relationships and the collaborations between the project teams and third-parties were particularly weak and on occasions lacked any formalised structure leading to poor relationships and lack of collaborative and constructive working arrangements between internal and external implementation teams and third-parties. Some participants felt that the lack of a formalised structure governing client, third-party and vendor relationships led to occasional disagreements in client and third-party responsibilities particularly when significant issues arose. In their experiences, collaborative and collective progression with the overall implementation objectives became incredibly challenging.

Several participants also identified other issues such as the selection of third-parties with selection decisions driven primarily by costs rather than longer-term strategic fit, value for money, the fitness of purpose and the suitability to the delivery of requirements and objectives. Others raised the issue with regards to the lack of regular senior-level engagement with third-parties and suppliers during the implementation stages of these projects.

On some of the successful projects, participants discussed the productive and healthy relationships established with the suppliers engaged in the implementation as a contributory factor in helping to meet the challenging schedules. The health of the relationships forged with suppliers extended to areas such as effective communication and alignment on objectives along with the shared understanding of the possible negative outcomes and impacts on all organisations involved particularly on reputation and credibility and the committed efforts to mitigate these. The relationship process also included a good level of engagement and support on an individual basis.

Overall, participants specifically stressed the importance of having realistic contracts, statements of work or proposals from third-parties that reflected the reality of the engagement as much as possible and free from optimistic bias, and contracts that also removes ambiguity as one of the critical factors to achieving a successful outcome for LSCITP implementations particularly for those that rely heavily on third-party support for implementation. Participants felt that address the issue of third-party fit helps to address wider issues such as mitigating the issues of cost overruns, schedule delays and poor quality and technical performance being experienced. Participants felt that arriving and such clarity and unambiguity of contracts, contractual framework models, and statements of work or proposals that reflects reality requires a thorough due diligence process but also requires the support and cooperation of third-parties and suppliers and senior stakeholders.

7.6 OTHER IDENTIFIED CHALLENGES ON LSCITP

In examining and understanding the challenges of LSCITP, the expert interviews provided an opportunity to also identify other related issues experienced by participants that might not have been previously covered by the researcher or identified during the literature review exercise and during the case studies. Participants were asked to provide a view of the other issues and challenges that they experienced during the LSCITP implementations that fall outside of the set of factors contained within the evaluation criteria presented to them during the interviews. As a result, some participants identified specific additional issues that they felt contributed negatively to the outcomes experienced for their projects. These issues are discussed and described in the sections below.

7.6.1 Research Areas Addressed

The other research areas address in this study are discussed below.

7.6.1.1 Project Management Methodologies

This section attempts to address the sub-question derived from the main research question posed below:

SQ4. Do specific project management methodologies and their application to the implementation and delivery of LSCITP influence the outcomes of LSCITP?

The table below shows the results of the assessment of the impact of the use of specific project management methodologies on LSCITP outcomes.

No.	LSCITP Implementation Methodologies	Total	
		Projects	Percentage
1	Agile/Scrum	5	13.5%

2	Prince2	**3**	**8.1%**
3	Waterfall	**19**	**51.3%**
4	None (*No specific methodology applied*)	**6**	**16.2%**
5	PMI/PMBOK	**1**	**2.7%**
6	Bespoke Methodology	**2**	**5.4%**
7	Hybrid Methodology	**1**	**2.7%**
Total		**37**	**100%**

Table **44**: The breakdown of the project management and implementation methodologies applied to the challenged LSCITP examined.

From the analysis of the above data on the use of specific project management methodologies and in assessing the resulting outcomes of the LSCITP examined, the study did not find enough evidence to address a part of the research objectives which was to understand whether the use of specific project management methodologies and frameworks contributes to the poor performances experienced with LSCITP and whether the use of specific methodologies contributes to overall negative outcomes. Though, from the sample data set, the majority (nineteen) of the challenged LSCITP examined applied the use of the waterfall methodology in the implementation of the projects, there was no sufficient evidence in the analysis of the data gathered and from the discussions from participants to suggest a significant link between the use of the waterfall methodology and the resulting poor performance outcomes of the LSCITP examined.

During the discussions, the majority of participants had stressed the need for the use of modern agile-oriented implementation and delivery methodologies and processes particularly those designed or adapted from existing methodologies to support the development of large-scale complex technology-related projects to support the incremental and iterative implementation of component parts of such projects. For example, the use of methodologies such as the scale agile framework (SAFe) or scaled scrum was amongst the ideas expressed by participants. The objectives expressed in the recommendation of these methodologies include the fact these modern implementation and management methodologies significantly help to address the current challenges faced with regards to developing large-scale IT/IS initiatives particularly those involving a heavy element of software systems, technology infrastructure and solutions.

Furthermore, other comments arising from the above discussions was that some participants felt that quite often the implementation and delivery teams do not have a significant say nor the complete authority with regards to the selection and application of the preferred implementation and delivery methodology for the implementation of projects, programmes or component workstreams where applicable. The participants in these scenarios felt that in their experiences, clients, sponsors and key stakeholders often impose a management or delivery methodology on the project for various reasons. Amongst the major reasons provided relates to the need to align the implementation of LSCITP with existing organisational delivery frameworks and methodologies. In these instances, participants felt that such decisions are made by stakeholders without having a comprehensive understanding or detailed experiences of other suitable implementation and delivery frameworks that could be better suited and adaptable to the implementation of these projects and to the organisation. Participants felt that such decisions are largely driven by the lack of awareness by senior stakeholders of modern project management methodologies and frameworks, the advancements within the project management domain and the inability of such organisations to change or adapt their existing internal project management implementation practices and processes. Other participants argued that the key questions on the relevance and use of conventional methods for LSCITP implementation are not about whether they are being applied and used ruinously, but rather, whether conventional methods should be adopted in the first place in the implementation of LSCITP.

In summarising the discussions on the project management processes on LSCITP, several participants expressed the views that the execution and delivery of a LSCITP should be driven by an industry standard and modern implementation and management framework that is suitable, customisable and adaptable to the nature of the project being implemented and more importantly, the use of a framework that is particularly proven to be effective especially on LSCITP based on industry feedback and proven research. The examples of some of the preferred project management methodologies and frameworks discussed by participants include the use of agile-oriented implementation methods such as scrum, kanban and hybrid project management methods such as the combinations of waterfall, agile and lean methodologies. Though it was emphasised by participants that the use of agile-oriented and or lean methodologies was not necessarily an automatic guarantee for success rather, participants felt that the use of such methodologies can help to provide a way to decompose a large scale project implementations into smaller units of work leading to faster implementation timeframes and that the use of such methodologies also help to technically assure the delivery of the component parts of the implementation processes.

7.6.1.2 Time and Availability

Amongst the other issues discussed by participants was on the difficulty in getting the required time commitments from key stakeholders and senior management stakeholders. For example, participants discussed the struggles to schedule meetings, workshops and engagement and feedback sessions with senior stakeholders critical to the implementation process due to their levels of seniority and their existing busy schedules. These participants expressed that on occasions this has resulted in issues relating to delays in decision making and resulted in creating the resulting issues and risks to the implementation process. Participates also addressed the issue of limited time with these senior stakeholders in instances where they were able to obtain such time, it was severely limited and not sufficient enough to accommodate the needs and required engagement duration needed by the implementation teams.

7.6.1.3 External Factors

In the challenged LSCITP examined, some participants expressed the fact that external factors such as regulatory requirements, regulatory changes, political environment, geographic locations, resourcing, financial markets, personal circumstances, technology, the economy, markets and competition and external pressures contributed to the set of challenges faced during the implementation and delivery cycles of their LSCITP. These impacts varied with some projects experiencing positive or no impacts at all and others experiencing varying levels of negative impacts ranging from major to minor resulting in different impacts and outcomes to their LSCITP initiatives. These external factors experienced resulted in substantial detrimental impacts on areas such as schedule, performance, budgets, spend, planning, resourcing, procurement and scope.

The table below shows the results of the discussions and assessment of the impact of external factors on the challenged LSCITP examined.

No.	External Factors	Total	
		Projects	Percent
1	LSCITP that experienced no significant negative impacts from External Factors	12	32.4%
2	LSCITP that experienced major negative impacts from External Factors	17	45.9%
3	LSCITP that experienced minor negative impacts from External Factors	7	18.9%
Total		37	100.0%

Table 45: The results of the analysis of the impact of external factors on challenged LSCITP.

As can be seen from the above analysis, seventeen of the challenged LSCITP examined encountered significant major issues relating to the set of external factors reported above that contributed significantly to their outcomes. Seven of the LSCITP examined experienced minor issues around the reports set of external factors while twelve of the projects did not experience external factors nor experienced any that were significant enough to have contributed negatively on the implementation processes and eventual outcomes.

A summary of the examples of some of the external factors and issues experienced by participants during their LSCITP implementations include:

- Personal Circumstance - A Chief Executive Officer (CEO) who was the sponsoring client owner that was dealing with the loss of a child during the implementation process. The bereavement led to significant delays in decision making, approvals, and agreements as the client was unavailable to provide the required level of support and engagement at critical stages of the implementation. Though the decision making and approvals were delegated to the Chief Operating Officer (COO), the process still required the overall oversight and confirmation from the CEO who was the executive sponsor and obtaining such approvals proved challenging considering the personal circumstance being experienced.
- Regulatory - A change in a financial regulatory mandate to an existing regulation that came into effect mid-way through the LSCITP implementation process with the implementation teams having to adjust the implementation and delivery timeframes so that they are able to understand, address and implement the resulting regulatory changes into the large-scale software implementation since the regulatory changes essentially form a critical component of the intended usage and deliverables expected from the financial trading software platform. The changes in regulation lead to a delay in the estimated timeframes for the delivery of the trading platform. Though the regulatory changes were anticipated, and contingency planning was provided, the implementation teams were slightly ahead of schedule and this meant that some specific parts of the developed software platform had to be revisited and reworked to address the requirements of the regulation.
- Financial Markets - A key technology vendor that experienced financial difficulties and faced possible administration as a result of the collapse of a planned acquisition by the vendor. The fallout resulted in negative stock market conditions. As a result of the internal issues being experienced by the vendor, the implementation process was significantly challenged as the implications of the issues being experienced by the vendor were assessed by the client and a possible replacement vendor was sought to progress with the implementation process.
- Political Environment - A long-term public sector LSCITP implementation that goes through an annual funding approval and review process had to be significantly delayed mid-way through the implementation process because of changes in government and changes being made in the government department that was responsible for the programme. The new incoming government specifically requested a re-assessment of the suitability of the project to be conducted and also specified significant changes in the scope and future direction of the programme. In addition, the new government also requested a review of its funding and conducted a funding assessment. These changes in government led to a seven-month delay to the defined implementation timeframe.

In addition, some participants also noted that the longer durations associated with their LSCITP meant that they were more susceptible to the risks from these external factors as the risk landscape changed significantly over time during the implementation process.

Giving the nature of external factors and specifically because they typically fall outside the control of the implementation teams and stakeholders, some participants discussed having to pay special consideration and regularly monitoring for any possible changes and performing an early assessment of the possible impacts of the external factors on their implementation and delivery processes. Participants felt that such assessments based on risks would help to track the emergence of possible risk, their potential impacts and help to produce the required mitigating controls.

7.6.1.4 Internal Factors

Participants noted that specific sets of internal factors such as the project environment, organisational culture, organisational structure, governance processes, policies and procedures as having specific impacts positively and negatively on the LSCITP implementation and delivery process of their initiatives in their shared collective experiences.

Amongst the set of issues relating to internal factors reported by participants include:

- The fact that quite often there are other major projects running concurrently within most organisations alongside other transformation and business change projects and that these multiple projects do tend to have operational dependencies that touch on several areas such as infrastructure, organisational change and commercial strategies and that challenges on a particular project tend to have a knock-on effect on the other major projects that are running concurrently particularly where critical dependencies exists across these projects within the organisation

In participants views, stakeholders and practitioners need to be cognizant of these internal factors and structure to a degree the implementation and delivery process so that it is adaptable to the organisation or environments being operated in. Especially because these sets of internal factors are manageable as they fall within the boundary of control of the implementation teams and stakeholders.

Some participants also suggested that where possible an analysis should be conducted in the early stages of the LSCITP implementation process to determine where possible which of the internal factors pose a greater risk to the implementation outcomes and to share such analysis with key stakeholders so that high-risk factors can be closely monitored and controlled and also so that stakeholders can put in place the required contingency plans and mitigations strategies to help address any possible risks materialising and reduce any potential negative impacts and outcomes.

7.6.1.5 Change Management

During the interview process, a key theme and particularly common issue that was frequently discussed was on the significance and importance of change management in the context of LSCITP. From the literature review exercises carried out and along with the case studies the topic of change management did emerge however what was not clear was its criticality or critical importance to the implementation process of LSCITP and criticality to the successful outcomes for LSCITP. The analysis of the change management issues raised during the interview process on both the challenged and successful LSCITP has led to an increased understanding of the specific issues being faced and more importantly, its critical significance to the outcomes of these large-scale initiatives, particularly during the implementation process.

Some of the change management related issues expanded upon by participants include:

- Issues were identified with regards to the lack of business impact assessments being carried out by affected organisations focusing on the impacts of the introduction of new technology solutions and services and a measurement and assessment of the readiness levels of the organisation across various business units to utilise and adopt the solutions being delivered. More importantly, the issues highlighted in this area extended to the lack of an assessment of the levels of understanding of the business and end-users on the technology solutions being introduced or delivered
- Other issues were specifically around the lack of efforts on ensuring business and departmental buy-in for the technology solutions being delivered into the organisations, business areas and client environments via the LSCITP being implemented and delivered
- Other participants highlighted the lack of readiness and adoption measures being put in place and the lack of the definition of operational readiness requirements to define and prepare the end-users of their technology implementations on the required organisational process changes needed to migrate, transition and adopt the new technology solutions and services being delivered via these large-scale initiatives
- Other issues highlighted by participants include the lack of defined responsibilities, for example, the lack of ownership and accountability for change within the affected environments to provide the required level of support and engagement on the levels of change and change processes required and to drive through the implementation of such changes across all affected entities
- Furthermore, other challenges experienced by participants was on having to implement and deliver LSCITP and resulting initiatives in internal and external environments that are traditionally and culturally resistant to changes

Some participants alluded to the use of change management frameworks or models to support the operational readiness and embedding of the rollout of services, solutions and outcomes brought about through the implementation of an LSCITP within an organisation. For example, participants on some of the successful LSCITP interviewed indicated that one of the contributing factors for the successful operationalisation of the outcomes of their LSCITP implementations was that the level of change management implemented in the organisations was robust enough and was appropriate and proportionate to the environment in context while also taking into account the complexity of the organisation (for example, the complexity of the existing internal structures, the governance structure, the culture and the processes and people). The participants felt that the complexity of an organisation can impede the introduction of changes being brought about by the implementation of an LSCITP and the adoption of the delivered outcomes. In the success examples on change management, the approaches taken not only accounted for the operational readiness of the LSCITP deliverables and outcomes being implemented and the wider change management objectives required, but the readiness approach extended to areas such as readiness support, operational support, extensive training, and embedded support for technical and operational modifications where required including post-implementation and delivery processes.

7.6.1.6 Optimism Bias

Participants also discussed and addressed the issue of optimism bias with regards to whether this was an issue that was experienced on their projects and if yes, to provide the analysis as to the nature, project areas and an assessment of the degree of the impact optimism bias had on the project. Particularly how optimism bias contributed to the poor performance and other negative outcomes of the LSCITP and the contributory factors generated as a result.

The table below shows the results of the assessment of optimism bias on the challenged LSCITP examined.

No.	Optimism Bias	Total	
		Projects	Percent
1	LSCITP that did not experience negative impacts from Optimism Bias	15	40.5%
2	LSCITP that experienced significant negative impacts from Optimism Bias	21	56.8%
3	LSCITP where the negative impacts of Optimism Bias could not be determined	1	2.7%
Total		37	100.0%

Table **46**: The results of the assessment of optimism bias on challenged LSCITP.

As can be seen from the above analysis, twenty-one of the LSCITP analysed experienced optimism bias and the experience was significant enough to impact key project areas negatively. Fifteen of the projects felt that optimism bias was not experienced and any forms of optimism bias where experienced did not impact the outcomes of their projects negatively.

For the LSCITP examined where optimism bias was an issue, participants identified the following areas where optimism bias was particularly inherent and was a regular occurrence:

- **Requirements**: Participants expressed the issue of optimistic assumptions being made around the project requirements resulting in the lack of a clear and honest assessment of expected deliverables including the ability to obtain an honest assessment of such deliverables against schedule, cost and expected benefits. Amongst the optimism bias issues experienced on requirements include technical estimation errors, deliberate underestimation and poor and inaccurate estimation particularly driven by a lack of knowledge and experience of estimation. Some participants provided a specific example of technical estimation errors. For example:
    - On a particular project implementation, a certain component deliverable of the project was estimated to take a set duration to turn around and the provided schedule duration was realistic and accurate. However, due to lack of adequate due-diligence being performed on the set of requirements that was required to deliver on the specific component and the associated dependent components that would have to be implemented prior to the specific component deliverable being addressed, biased and optimistic forecasting was provided which resulted in the particular component deliverable taking three times the initially estimated duration. This resulted in knock-on effects on other dependent component deliverables throughout the implementation process.
- **Third-Parties**: Participants also expressed a high-level of dissatisfaction with third-parties (for example, technology vendors, consultancy organisations, system integrators, contractors and other external entities) on their LSCITP implementations where such third-parties were engaged to provide technology solutions and consultancy related services to support or lead on the implementation and delivery process of the initiatives. In particular, some participants discussed the issue of unrealistic proposals being put forward by third-parties, with highly optimistic proposals on costs, implementation timeframes and on the resulting deliverables. Participants felt that these areas were being deliberately misrepresented by third-parties in order to secure the contracts knowing full well that significant cost increases are inevitable during the implementation and delivery cycle and that such misrepresentation will have resulting impacts on scope and schedule as a result. Some participants attributed this inherent behaviour largely to two factors:
    - Because costs is one of the critical factors that several organisations apply in their decision-making process in deciding whether to undertake significant investments in LSCITP or components parts of it, third-parties feel that organisations are more likely to justify and approve the resulting business cases for implementing these initiatives or their component parts when reduced costs are presented. Particularly in the private sector where there is a

reluctance by organisations to undertake costly LSCITP initiatives due to the extensive process required to justify costly LSCITP undertakings and in securing approvals for the underlining business cases. Furthermore, participants identified that significantly lowering costs also provide third-parties with an entry point or a foothold into the client environment as an opportunity to build long-lasting relationships and secure further contracts and work engagements

- Because of the challenges faced in the industry with regards to LSCITP, third-parties deliberately reduce costs with the view that LSCITP stakeholders are aware that LSCITP typically overrun on costs, schedule and performance and that these are an inherent part of these undertakings so subsequent cost increases are always inevitable. Participants expressed the view that most stakeholders now see challenges such as cost overruns and schedule delays as the cost of implementing an LSCITP

Furthermore, several participants expressed the opinion that some of the estimation processes that was applied to some of their LSCITP lacked the use of a vigorous evidence-driven estimation process particularly drawing on experiences, learnings and evidence on similar LSCITP and similar related sets of deliverables. Participants felt that issues experienced around optimism bias led to subsequent challenges being experienced on schedule, planning, costs, benefits assessments and value realisation. They expressed the opinion that while making adaptations to schedule estimates considering the nature, context and uniqueness of the project was a best-practice to be followed, estimators should also conduct research into previous similar projects and use the learning and outcomes of such projects to provide an evidence-based estimation decision making to help inform and provide a more realistic and honest estimate on current and future projects.

In other discussions on optimism bias, one participant suggested that cognitive bias was amongst the set of issues they felt were inherent in the requirements facilitation, planning and estimation process on their implementations.

7.7 ADDITIONAL RECOMMENDATIONS IDENTIFIED ON SUCCESSFUL LSCITP

The sections below provide a view of some of the additional factors identified during discussions on successful LSCITP as discussed by participants during the data gathering process. These factors were not particularly identified on challenged LSCITP but were practical measures and processes that were applied by participants who acknowledged the positive contributions to the resulting outcomes for their LSCITP.

7.7.1 Research Areas Addressed

This section of the findings attempts to also contribute to the existing set of answers provided to the sub-research question posed below:

Sub-RQ1: What are the key factors that help to improve or hinder the management, implementation and delivery of LSCITP?

7.7.1.1 External Projects Audits and Verification

From the discussions with participants on successful LSCITP, amongst the key measures applied to aid the successful implementation and delivery of their LSCITP was the use of external audits and external assurance mechanisms provided by external organisations during key implementation cycles to provide an independent perspective and independent assessment of various elements of the LSCITP's implementation. Such independent assessment covers, for example, conducting a review of the technical architectures of the implementations, a review of the management and governance structures in place, a review and validation of the proposed technical solution particularly on the reasonability of the technical architecture, intended system functionality to be delivered and on the operational design of the systems including a review of the setup of the execution and delivery of the project as well as the capability and capacity of the organisation to successfully implement and deliver the project. These independent assessments would then be fed back to the steering groups, oversight committees, single responsible owners, business owners and other key stakeholders so they can understand and perform a comparison of the internal perspective held with the external perspective gained.

Additionally, the key emphasis provided for undertaking independent audits for LSCITP is to perform regular or required health checks during specific milestones to help identify ongoing challenges, understand project performance, identify ongoing issues, obtain a realistic view of project statuses, identify unknown risks, track benefits realisation, understand connected and impacted business processes, obtain visibility of structures of leadership and governance and identify challenges around change management. Furthermore, the process also allows the LSCITP to meet and validate relevant legal, compliance and regulatory obligations where applicable.

Some participants felt that such external assessments can help to provide the required assurance, verification and validation of outcomes and help to uncover challenges, establish an independent view and uncover current and potential issues that may not be reported or uncovered by the implementation teams and also allows the stakeholders to consider the impact and likelihood of any identified risks on the performance, objectives and expected outcomes of the project.

Furthermore, the view from some of the participants was that such reviews help to assure key stakeholders that the LSCITP initiative continues to meet the defined objectives, is well on track in delivering on its objectives, and more importantly, that it is being implemented and delivered in an approach that is controlled and within acceptable risk levels to the organisation and all parties involved.

Though participants did suggest that external independent audits and verifications might only be performed when performance challenges surface during the implementation process. Two participants suggested that project audits should be performed at logical intervals or gated milestones regardless of the detection of performance challenges particularly for LSCITP as they argue that the outputs from such exercises provide significant value and will aid and support a more informed decision-making process including recommendations on improvements that can help to avoid any potential future performance challenges.

CHAPTER 8

LSCITP Challenged Assessment Framework

8.1 INTRODUCTION

Amongst the objectives of the study as outlined in *Chapter One*, *Section 1.5* was to look at the possible development of a methodology or framework based on the knowledge gained and the findings obtained from the study that can be used to support LSCITP stakeholders and practitioners with the management of LSCITP. The feasibility of an assessment framework was evaluated in the analysis of the data gathered and the evidence obtained on the challenges of LSCITP was then analysed to look at the development of a tool that can be used by stakeholders and practitioners to support the implementation of LSCITP towards the achievement of successful outcomes. The assessment outcomes derived subsequently led to the development of the Challenged Status Assessment Framework (CSAF).

8.2 DEVELOPING THE ASSESSMENT FRAMEWORK

In developing the assessment framework, the domain model developed in *Chapter Six*, *Section 6.3.4* of this study formed a key input and contributed towards the conception and design of the framework. The evidence afforded by the extensive reviews of literature and the data derived also contributed to the production of the assessment framework. Furthermore, the outcomes from the three case studies carried out in *Chapter Five*, *Sections 5.4 to 5.6* and the data gathering via the expert interviews in *Chapter Seven* collectively helped to produce the list of prospective items for inclusion into the framework. The challenged factors identified from the examination of challenged LSCITP subsequently provided the assessment criteria upon which the framework was developed. Collectively, these various areas of the study and outcomes derived helped to guide and shape the approach to the development of the framework.

The framework was designed as a structured and specific guide to support LSCITP assessments based on a phased approach. The framework describes the steps and areas to be assessed on a LSCITP through each phase of the assessment and is designed to be beneficial and practical. The phases in the assessment process were derived from the understanding of the data from the study and the immersion into the problem domain from which the resulting six phases *Scope*, *Acquire*, *Assess*, *Fix*, *Review* and *Monitor* (abbreviated as SAAFReM) were derived. The phases were designed to help uncover issues identified within the challenged knowledge areas including their challenged factors and to provide a process for addressing, remediating and monitoring them.

Overall, the framework includes elements on establishing assessment areas, understanding their criticality, determining the critical factors to be evaluated, the assessments to be carried out, the results obtained and how to apply remedial actions and monitor and measure improvements including building in review cycles. Throughout the LSCITP life cycle, the use of the framework can provide visibility into the possible challenged postures and help to identify specific areas of challenges and any resulting risks. The outcomes of the assessments are positioned to help lead to LSCITP performance improvements through the definitions of the expected outcomes and required actions from each phase. The key components of the assessment framework are summarised below:

1. **Scope** - Focuses on allowing stakeholders to gain an understanding of the LSCITP in context along with the understanding of the progress of implementation across implementation areas and to use the information derived to define the scope and levels of the assessments to be performed. The resulting outcomes allow stakeholders to gain detailed context on the LSCITP, its objectives, approaches, completeness of implementation strategy and progress of delivery and determination of levels of capability.

2. **Acquire** - Focuses on the gathering of the required challenged assessment data via interviews, the use of questionnaires, running workshops, using observations and through the reviews of specific and explicitly defined project artefacts or via pre-set checklists to help discover the challenged posture the LSCITP and identify potential actors and associated roles. The outcomes allow stakeholders to gain a detailed understanding of the ongoing performance of the LSCITP, the performance against the knowledge areas and identification of specific challenged factors and management challenges being experienced across knowledge areas and across other implementation areas.

3. **Assess** - Focuses on the execution of the assessments to evaluate and determine the performance of the identified knowledge areas in the context of the specific LSCITP, the extraction of challenged factors and the assessment of criticalities and producing detailed reports post assessment. The resulting outcomes allow stakeholders to gain a detailed understanding, the comprehension of the assessment, qualification, quantification of identified challenges and the identification of applicable remediation solutions and the resulting implications.

4. **Fix** - Focuses on the determination and implementation of applicable solutions based on the use of a prioritised approach and the application of provided recommendations derived from the study to address and remediate the challenges identified and to address issues within the challenged knowledge areas. The outcomes allow stakeholders to perform the controlled implementation of remedial actions and obtain results and also understand the post-implementation posture including supporting engagement and enablement and the embedding of new behaviours.

5. **Review** - Focuses on the conduct of regular assessment reviews on a defined review cycle to help to establish and maintain an improvement cycle and to obtain regular feedbacks. The outcomes of the review process will help to support efforts around performance measures for process and governance effectiveness. The outcomes provide stakeholders with measurable performance indicators and immediate performance outcomes and visibility of progress of change that is measurable in terms of capability implemented and delivered.

6. **Monitor** - Focuses on the monitoring and measurements of the outcomes from the above stages to determine the effectiveness of implemented solutions and to communicate the outcomes derived to all concerned stakeholders. The outcomes provide stakeholders with the identification of follow on actions and the application of lessons learned including sustaining and enhancing the implementation and delivery model and culture and embedding a philosophy to continuous implementation improvement.

Overall, the entire assessment process describes the set of measures required from which the challenged status of a LSCITP can be derived. The outputs from an assessment carried out using the framework can then be used to adapt the implementation phases and processes to remediate the challenged factors identified and to improve overall implementation outcomes. The above framework elements were subsequently collated and presented visually in a model diagram that expresses the framework along with textual annotations of specific areas.

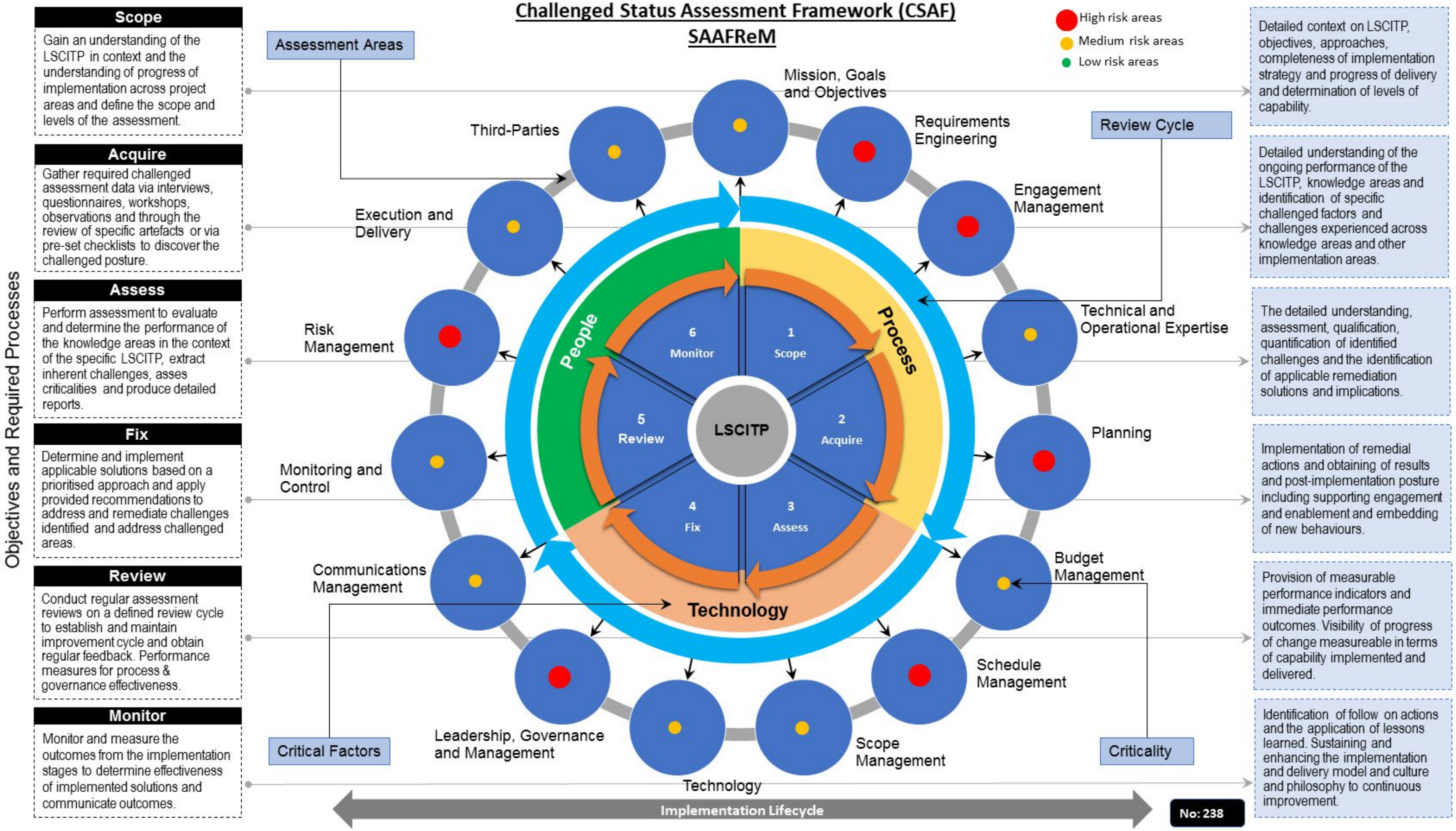
The objective of the framework was not to produce a new methodology or the creation of a new process improvement model since various models already exist for example the Capability Maturity Model Integration (CMMI) and other similar models. The objective was to produce a structured and specific guide that can be used to assess the challenges of LSCITP based on derived evidence since frameworks to support the identification and remediation of LSCITP challenges do not exist.

8.3 SUMMARY OF THE ASSESSMENT FRAMEWORK

The information provided above helps to highlight the possible applications and use of the framework by LSCITP stakeholders and practitioners and helps to clarify its purpose. The practical application and the benefits of the assessment framework are discussed in the discussion section in *Chapter Nine*, *Section 9.6*.

While the application of the assessment framework is not positioned to be an automatic guarantee of successful outcomes on LSCITP, it does however offer a mechanism for stakeholders and practitioners to identify management challenges, identify challenged factors during the LSCITP implementation process and helps to identify gaps in the processes, tools and resources required to deliver a LSCITP successfully including the required remediation steps. The challenged assessment framework will be of value when performing reviews and investigations into LSCITP performances such as identifying challenged factors and management challenges or evaluating management performance within a challenged context. The assessment framework is presented in the figure below.

Figure **12**: The LSCITP Challenged Status Assessment Framework (Source: Author).



Challenged Status Assessment Framework (CSAF)
SAAFReM
Scope
Gain an understanding of the LSCITP in context and the understanding of progress of implementation across project areas and define the scope and levels of the assessment.
Acquire
Gather required challenged assessment data via interviews, questionnaires, workshops, observations and through the review of specific artefacts or via pre-set checklists to discover the challenged posture.
Assess
Perform assessment to evaluate and determine the performance of the knowledge areas in the context of the specific LSCITP, extract inherent challenges, asses criticalities and produce detailed reports.
Fix
Determine and implement applicable solutions based on a prioritised approach and apply provided recommendations to address and remediate challenges identified and address challenged areas.
Review
Conduct regular assessment reviews on a defined review cycle to establish and maintain improvement cycle and obtain regular feedback. Performance measures for process & governance effectiveness.
Monitor
Monitor and measure the outcomes from the implementation stages to determine effectiveness of implemented solutions and communicate outcomes.
Objectives and Required Processes
Assessment Areas
High risk areas
Medium risk areas
Low risk areas
Mission, Goals and Objectives
Requirements Engineering
Engagement Management
Technical and Operational Expertise
Planning
Budget Management
Schedule Management
Scope Management
Technology
Leadership, Governance and Management
Communications Management
Monitoring and Control
Risk Management
Execution and Delivery
Third-Parties
Review Cycle
Critical Factors
Criticality
People
Process
Technology
LSCITP
1 Scope
2 Acquire
3 Assess
4 Fix
5 Review
6 Monitor
Implementation Lifecycle
No: 238
Detailed context on LSCITP, objectives, approaches, completeness of implementation strategy and progress of delivery and determination of levels of capability.
Detailed understanding of the ongoing performance of the LSCITP, knowledge areas and identification of specific challenged factors and challenges experienced across knowledge areas and other implementation areas.
The detailed understanding, assessment, qualification, quantification of identified challenges and the identification of applicable remediation solutions and implications.
Implementation of remedial actions and obtaining of results and post-implementation posture including supporting engagement and enablement and embedding of new behaviours.
Provision of measurable performance indicators and immediate performance outcomes. Visibility of progress of change measureable in terms of capability implemented and delivered.
Identification of follow on actions and the application of lessons learned. Sustaining and enhancing the implementation and delivery model and culture and philosophy to continuous improvement.
Performance Improvement

CHAPTER 9

Discussion

9.1 INTRODUCTION

In this chapter, the findings from the study are discussed and analysed and relevant conclusions are drawn regarding the challenges of large-scale complex information technology projects (LSCITP). The chapter synthesizes and highlights these key findings based on the results presented in *Chapter Seven* above and discusses their implications for LSCITP. The findings are also compared with similar studies from existing literature. Finally, the chapter presents the recommendations and propositions for an assessment framework to support LSCITP implementation and delivery based on the outcomes and learnings that emerged from the study.

The objectives of this study were to acquire a detailed understanding of the challenges affecting the successful implementation and delivery of LSCITP within actual real-world project environments that lead to their eventual failures. The research study subsequently explored these challenges associated with the management, implementation and delivery of LSCITP. The objective extends to providing analysis and evidence that can be used by stakeholders and practitioners across various industries globally that implement and deliver large-scale, complex technology projects to improve the management, implementation, delivery of these projects. The objectives also extend to the provision of appropriate recommendations from successful LSCITP implementations that can be applied on LSCITP.

The sections below discuss the findings structured by the following areas:

- The challenges of LSCITP
- The challenged factors of LSCITP
- The impacts of the challenges identified for LSCITP
- Improving the management, implementation and delivery of LSCITP
- The proposed framework to support the assessment of LSCITP performance, management, implementation and delivery

9.2 DISCUSSION: THE CHALLENGES OF LSCITP

Much of the existing research studies into IT/IS challenges and failures have reached different conclusions and identified different explanations and outcomes with regards to the causes of challenges and the resulting causes of failures of normal and large IT/IS initiatives. Some studies identified the following issues as part of the set of issues contributing to the poor performance or failures of LSCITP for example, technological advancements (Durney and Donnelly, 2013), technology challenges (Ewusi-Mensah and Przasnyski, 1995), complexity challenges, management challenges, budget challenges, and schedule challenges (Van Marrewijk, *et al.*, 2008; Yeo, 2002; Willcocks and Griffiths, 1994), Other studies identified the complexity of the problem domains (Ewusi-Mensah, 1997), knowledge requirements (Al Khouri, 2007), project management methodologies (Al-ahmad, Al-fagih and Khanfar, 2009). Furthermore, other reasons identified in previous studies also include the chaos in the process of project implementations and delivery (Abbas and Sanavullah, 2008), the size and scale (Philbin, 2008), the high levels of complexity inherent (Patanakul, 2014; Patanakul and Omar, 2010) while others studies put the blame on management (Omar and El-Haddadeh, 2016) and governance challenges (Miller and Hobbs, 2005), others emphasise on social causes in addition to technology causes (Philbin, 2008) political factors (Miller and Hobbs, 2005) and instability and uncertainties within the project environments (While Van Marrewijk. *et al*. (2008). Furthermore, other identified causes include technological difficulties, organizational and functional problems, managerial issues, and other reasons (Al-ahmad, Al-fagih and Kand Khanfar, 2009) including poor goal orientation and alignment (Buhl and Meier, 2011) while others put the blame of failures on the chaos in the project processes (Abbas and Sanavullah, 2008).

The above challenge with regards to accurately identifying and determining the causes of LSCITP poor performance and failures is highlighted by Al Khouri (2007, p.3) who notes that "research to date has found no single explanation for system success or failure". The above views are similarly echoed by Al-ahmad, Al-fagih, Kand Khanfar (2009, p.94) who argued that "studies, so far, have identified over 50 reasons for failure."

These differences in views and opinions from prior research prompted this study to approach the assessment of LSCITP challenges from a different perspective. Particularly because in the review of existing studies conducted, there was the perception that all of the causes of failures of IT/IS initiatives are already known (Al-ahmad, Al-fagih, Kand Khanfar, 2009). However, as Al-ahmad, Al-fagih and Kand Khanfar (2009) argued, there are other factors that are yet to be explored and new research studies into LSCITP challenges and failures ought to explore various areas of LSCITP for additional new factors. In summarising the outcomes from this study, the results challenge some of the above perspectives and conclusions from previous studies that indicate singular or multiple causes for IT/IS project failures including those that indicate that the causes of IT/IS failures are not fully known or cannot be determined.

9.2.1 The Challenges to the Successful Delivery of LSCITP

The research gap identified in the initial stages of the study from the literature reviews carried out was addressed through the provision of empirical analysis and insights into the emblematic syndromes of failures of LSCITP by understanding and examining the factors that influence the poor performance and challenges of LSCITP and IT/IS projects. In addition, a conceptual schema was developed that assisted with the process of building the knowledge areas and the identification, analysis and assessment of the critical problem areas for LSCITP leading to the establishment of the LSCITP challenged factors framework. This section addresses the main research question posed.

> *What are the challenges to the successful delivery of LSCITP, how can they be avoided, and why do most projects fail to meet their original objectives?*

The findings from the study have identified that the majority of the challenges encountered on LSCITP leading to their poor performance and subsequent negative outcomes are connected to human factors which are the results of innumerable failures in implementation and delivery, suboptimal management and inadequate governance and leadership structures. These challenges are further aggravated by the lack of adequate risk management processes and lack of knowledge integration.

The findings identified that challenges encountered are the results from the series of negative impacts experienced from one or more factors across one or identified LSCITP knowledge areas. Furthermore, these negative impacts being experienced were further exacerbated by other factors such as failures in change management, size and scale, extended implementation durations, the urgency of implementation, complex organisational structures, complex project environments and uncontrollable external factors.

9.2.2 Discussion: Understanding the Challenges of LSCITP

The expert interviews and the case studies carried out provided a rich set of qualitative data that complement the quantitative data also derived. There was an abundance of experience gained from the participants and the outcomes of their insights and views on the set of challenges faced can be seen to be representative of the set of challenges being faced on LSCITP. This section addresses the sub research questions posed.

> *Sub-RQ2:* *What are the challenged knowledge areas on LSCITP that stakeholders and practitioners need to be aware of?*

The study subsequently identified the set of critical areas across the identified LSCITP knowledge areas that contain factors significantly contributing to the challenges of LSCITP and considerably impacting their performance and outcomes. The six knowledge areas listed below represent the identified critical knowledge areas:

KNWL-Area:1. Requirements Engineering

KNWL-Area:2. Engagement Management

KNWL-Area:3. Planning

KNWL-Area:4. Schedule Management

KNWL-Area:5. Leadership, Governance and Management

KNWL-Area:6. Risk Management

The analysis of the results obtained helped to identify that the combination of these six areas presented the most challenge to LSCITP practitioners and stakeholders during the management and implementation cycles and were found to be fundamental areas with significant challenged factors that have a critical impact on LSCITP implementation outcomes. These areas are therefore critical areas that require effective management, oversight, increased levels of competency, knowledge integration and further research to help achieve improved LSCITP outcomes.

In addition, the analysis of the various factors contained within these identified knowledge areas and their relationships and interrelationships further enabled the identification and understanding of the critical challenged factors and the assessments of their levels of impacts on LSCITP outcomes. The knowledge gained from the assessments of the knowledge areas helped to provide an explanation and understanding of the requirements and competencies needed to effectively support the management, implementation and delivery process of LSCITP and the roles of stakeholders and practitioners in meeting and addressing these challenges that were identified.

Moreover, the findings also identified the need for significant improvements in other LSCITP implementation knowledge areas where challenges are also occurring regularly particularly on the following areas:

KNWL-Area:7. Mission, Goals and Objectives

KNWL-Area:8. Technical and Operational Expertise

KNWL-Area:9. Budget Management

KNWL-Area:10. Scope Management

KNWL-Area:11. Technology

KNWL-Area:12. Communications Management

KNWL-Area:13. Monitoring and Control

KNWL-Area:14. Execution and Delivery

KNWL-Area:15. Third-Parties

While the conclusion from this study differs slightly from some of the existing related studies carried out, the conclusions reached still aligns with the majority of studies that have argued that the failures of LSCITP are down to the set of multiple determinant factors (Hughes, Rana and Simintiras, 2017; Buhl and Meier, 2011; Verner, Sampson and Cerpa, 2008; Williams, 2005). For example, Williams (2005), argues that the causes of failure of a project are derived from several interrelated sets of factors rather than by a single factor. The findings also correlate with Al-ahmad, Al-fagih, Kand Khanfar (2009) conclusions in their study on IT project failures, they concluded that the cause of IT/IS project failures were down to multiple implementation categories based on a developed taxonomy. Buhl and Meier (2011, p.63) also argued that the "the reasons for the failure of IT projects can rarely be attributed to a single cause" and that failures of IT/IS initiatives can instead be narrowed down to specific categories which in their study were technology, organisation, human factors and environmental changes. Charette (2005) concludes that IT projects fail for a variety of reasons and not just a single reason. In other studies, for example, Buhl and Meier (2011, p.62) describe the lack of alignment between organisational and project objectives as the "root of all evil" in the failures of IT projects and that all other factors that emanate from the failures of IT projects are simply down to the core issue of misalignment.

However, the outcomes from this study have demonstrated that it is the combination of several failures in implementation and delivery processes across critical and non-critical implementation areas that compound one another that causes LSCITP to become severely challenged and eventually fail. Such management and implementation failures are heavily connected to the human factors of LSCITP. Furthermore, the findings also indicate that though the LSCITP examined were challenged based on the identified knowledge areas and contained challenged factors, the degree of challenges and poor performance of each project in the context of the factors identified differed.

The human factors of LSCITP refer to the need for increased focus on knowledge integration and organisational learning. Based on the understanding gained, the study suggests the commitment to knowledge improvement efforts that include enablement, training and awareness initiatives, challenge and the transfer of internal and external knowledge between industry and academia including the synthesis and cognizance from past implementation success and failures. These efforts should be supported with ongoing maintenance of established knowledge bases, investments in applicable tools and technologies and the acceleration of IT/IS project implementation and management knowledge into applicable resources (bodies of knowledge) to provide knowledge and support for IT/IS stakeholders and practitioners to aid improved LSCIP implementation outcomes.

9.3 THE CHALLENGED FACTORS OF LSCITP

The new challenged factors identified from the results of this study are summarised at a very high-level in the table below and are distributed across the relevant knowledge areas that they relate to. These findings are unique as previous studies have not provided the depth of challenged factors within knowledge areas besides providing a description and a list of success and failure factors. This section addresses the sub research question posed.

Sub-RQ1: What are the key factors that help to improve or hinder the management, implementation and delivery of LSCITP?

The full description and analysis of the factors listed below are detailed in the explanation of the results in *Chapter Seven, Section 7.5*.

Knowledge Areas	No	LSCITP Challenged Factors Identified
Mission, Goals and Objectives	1	The difficulties in regularly obtaining a consistent view from stakeholders on how the goals and objectives translate to success and what the measures of success were
	2	The lack of the formalisation of regular reviews and refinement of the goals and objectives and resulting business cases during the implementation stages to reflect significant changes introduced or realised since the start of the implementation process
	3	The occasional lack of sufficient low-level detail, clarity and gaps in the goals and objectives and the resulting business cases coupled with the lack of definitions of applicable constraints
Requirements Engineering	4	The lack of a well-established and continuous process of requirements engineering during the implementation phases
	5	The lack of the application of a well-established or effective formal requirements management approach for the requirements aspects before and during the implementation phases
	6	The lack of the application of well-established configuration management processes to organise, manage and control changes connected to the systems and technology platforms and solutions for complex projects
	7	The continually changing requirements and the resulting inconsistencies created in other dependent projects and component parts of the programmes being implemented
Engagement Management	8	The lack of the adequate and continuous monitoring of stakeholder expectations over the entire implementation lifecycles

	9	The failure to adequately identify and map all relevant stakeholders across all the stakeholder groups and the failure to regularly assess the levels of interest of stakeholders
	10	The lack of the full understanding of stakeholder objectives, goals, expectations and priorities in the context of the ongoing implementation
	11	The failure to regularly identify and understand stakeholder concerns throughout the implementation lifecycles
	12	The lack of assessments and understanding of conflicts in stakeholder goals, objectives and expectations in the context of the project's objectives, goals and implementation deliverables
	13	The lack of the ongoing monitoring of stakeholder behaviours, engagement and commitment levels during the implementation lifecycles
	14	The lack of regular stakeholder engagement with the business areas and end-users significantly impacted by the solutions being implemented and the lack of understanding and anticipation of the resulting change processes required
Technical and Operational Expertise	15	The failure to engage external organisations to help perform a verification and validation of the proposed technical architectures and technical solution designs where internal expertise was lacking
	16	The non-usage of external organisations to assess delivery progress during key implementation and delivery milestones and during critical project implementation phases to assess current performance levels against defined objectives
	17	The lack of the engagement of experienced resources and their deployment early on in the implementation cycles to help shape the implementation and delivery roadmap from the onset
Planning	18	Quality of planning through lack of formal effort estimation process and lack of estimate validations
Schedule Management	19	The lack of understanding and detailed assessments carried out on interdependencies between various programme initiatives and workstreams being undertaking concurrently within the multi-project environments of LSCITP
	20	The increasingly aggressive and unrealistic timescales given to implementation teams to achieve unrealistic and unclear expectations while being bound by specific implementation constraints
Budget Management	21	The lack of adequate and regular monitoring of cost forecasts, actual costs and spend and the lack of regular continued updates to cost forecasts reflecting the actuality of implementation throughout the implementation process
Scope Management	22	The lack of rigorous change control processes leading to significant implementation challenges and resulting in technical changes in the ongoing implementation of component parts of the implementation
	23	The inability to baseline the implementation scope throughout the implementation phases due to constant changes and

		realignment of objectives throughout key implementation phases
	24	The high-levels of changes introduced to the implementation scope by stakeholders
	25	The failure to regularly map changes in scope to high-level requirements and the business case through every significant change cycle introduced
	26	The lack of implemented formalised change control processes to control and re-baseline the implementation scope amidst constant volatilities in implementation realities
	27	The regular inconsistencies between defined requirements, subsequent changes to requirements and the defined implementation scope and project objectives
	28	The lack of regular analysis and assessments of the impact of required changes on the project and defined objectives
Technology	29	The lack of detailed understanding of interface, data and integration requirements between new and legacy systems and the interface and integration requirements of dependent external organisations
	30	The incompatible operational interfaces implemented for end-users to interact with new technology solutions being rolled out
	31	The poor solution architectures and complex integration requirements defined to integrate new and existing disparate technology systems and data
	32	The over customisation of commercial off the shelf (COTS) software solutions and platforms
	33	The lack of regular technical feasibility assessments being carried out for implementation areas with high levels of complexity, utilising new technology and where prior experience with such technologies is relatively low
	34	The lack of adequate planning for go-live and operational readiness of the new solutions delivered coupled with insufficient capacity planning for the operationalisation of technology solutions
Leadership, Governance and Management	35	The established governance and steering committee forums that often lack the adequate representation from all relevant stakeholders, business areas, clients and third-parties on a regular basis
	36	The reduced and inadequate levels of challenge from senior stakeholders and the inadequate levels of scrutiny placed on specific project areas that are reported by the project and delivery teams by responsible stakeholders
	37	The occasional failure to fully establish and implement an effective governance plan and the failure to leverage, operationalise and fully implement such established governance plans where defined
	38	The lack of regular and ongoing monitoring of stakeholders and changes in stakeholders and changes in governance structures

	39	The high levels of stakeholder volatility leading to challenges and difficulties in implementation processes
	40	The expectation of failures by stakeholders at the onset and during the implementation phases
	41	The lack of adequate and prompt decision making by stakeholders and lack of agreements between stakeholders including the occasional lack of clarity of execution
	42	The lack of awareness of the complexity of the technical solution architecture and designs connected to the various parts of the implementation by members of steering groups, senior management and key stakeholders
	43	The presence of inexperienced stakeholders, owners on LSCITP implementations with significant input and control
	44	The occasional lack of a Single Responsible Owner (SRO)
	45	The perception of LSCITP by stakeholders as purely a technology challenge without considering wider organisational challenges and views that embeds the organisational, cultural or operational contexts
	46	The complex governance structures often inherent in organisations impacting decision-making and governance
	47	The lack of implications being established and defined for late LSCITP projects
Communications Management	48	The failures by project management teams to regularly provide senior stakeholders with the required accurate, objective project performance and project status information that is a true reflection of the reality of implementation
	49	The inability to manage and orchestrate high-volume dynamic communications and interactions with various stakeholders, business areas and internal and external entities within the LSCITP ecosystem
	50	The failures by senior management teams and stakeholders to process and assimilate implementation communications and feedback provided timely
	51	The use of poor communications mediums as the primary source of communications throughout the implementation and delivery cycles
	52	The lack of transparency in certain areas particularly to do with reporting to senior stakeholders, lack of objectivity and combined with the lack of frequent updates
	53	The lack of visibility of issues to senior stakeholders and responsible individuals particularly to do with issues within the implementation process
Monitoring and Control	54	The lack of regular attendance by key members of the steering or executive committee groups, sponsors and responsible stakeholders in programme/project checkpoint meetings and workshop sessions where required
	55	The failures by the key stakeholders to regularly monitor the speed of implementation and the progress being achieved

		towards the defined objectives in each program implementation phases
Risk Management	56	The lack of documented comprehensive risk management plans, contingency planning, risk response strategies and the lack of the conduct of regular and periodic risk reviews during the implementation lifecycle
	57	The lack of available and detailed existing checklists for large-scale complex IT project risks to act as an initial primary source of possible risks to consider by implementation teams
	58	The occasional tick box exercise approach being taken by implementation teams to risk management activities on LSCITP
	59	The lack of an iterative risk identification and management processes with the appropriate set of risk response strategies defined and implemented throughout the implementation lifecycle
Execution and Delivery	60	The occasional lack of focus, sufficient steer and formalisation of project and project steering meetings and workshop sessions
	61	The lack of regular attendance by key members of the steering groups, business owners, key stakeholders and other required participants in execution related meetings and sessions
	62	The lack of clarity on responsibilities with regards to authority and accountability on decision making coupled with the lack of timely decision making and on the scope of the decision makings
	63	The lack of available and suitable expert resources and specific subject matter experts across both business and technology domains when specifically required during the implementation
Third-Parties	64	The low levels of the technical and operational competence of third-parties
	65	The less integrative, inclusive and progressive nature of the relationships forged with third-parties
	66	The issues with the strength and depth of the relationships and the collaborations between the project teams and third-parties which was particularly weak on occasions and often lacked a formalised structure

Table **47**: The challenged factors identified for LSCITP distributed across the relevant knowledge areas established.

In addition to identifying and providing a view of the critical challenging areas and factors on LSCITP implementations, the study also provides some applied and proposed mitigating solutions and ideas where they are suggested by participants in the study to help address some of the challenges identified for LSCITP. Moreover, the study has also identified that the following areas contribute to and exacerbate the set of challenges experienced across the factors contained within the knowledge areas for LSCITP identified above:

1. Optimism Bias

2. Change Management
3. Technical Complexity
4. Management Complexity

Though the results of the study identified that negative outcomes from a set of factors in a single LSCITP knowledge area is sufficient to induce challenges and failures in LSCITP, the findings identify that most often the challenges of LSCITP are caused by the combination of several failures in multiple factors across several LSCITP knowledge areas. Furthermore, the findings from this study suggest that the follow-on impacts of the challenges being experienced with LSCITP implementations in the knowledge areas leads to other significant challenges for LSCITP such as:

- Cost Overruns
- Schedule Overruns
- Scope Increases
- Poor Quality and Technical Performance

Overall, the challenged LSCITP examined in the study varied with regards to their intended objectives. The LSCITP were also different with regards to the implementation processes and procedures that were applied and particularly different with regards to the industry environments they were implemented in. However, what the findings showed was that the knowledge areas and the set of challenges faced within these knowledge areas that influenced the negative outcomes of these projects were very much the same. These findings are also consistent with some existing research that have identified that the majority of IT/IS initiatives are often different, however, the symptoms and causes of failures are all still very similar (Afzal, 2014).

9.3.1 The Analysis of the Identified Critical LSCITP Knowledge Areas

The challenged LSCITP examined in the study all followed a similar pattern and exhibited related symptoms at varying levels across the knowledge areas which goes on to demonstrate that there are significant issues that are inherent in the way that LSCITP are being implemented and delivered by practitioners currently and that these challenges are increasing continuously.

The table below provides the summary of the outcomes of the discussions and analysis on the issues encountered on the challenged LSCITP in a quantitative form and shows how participants rated each of the knowledge areas positively and negatively with regards to the overall respective contributions and performance of the knowledge areas to the resulting outcomes of their LSCITP. The table presented shows the summary of the aggregated results of the knowledge areas.

No.	LSCITP Knowledge Areas	Impact

		Positive	Neutral	Negative
1	Mission, Goals and Objectives	75.7%	10.8%	13.5%
2	Requirements Engineering	32.4%	13.5%	54.1%
3	Engagement Management	43.2%	2.7%	54.1%
4	Technical and Operational Expertise	48.6%	16.2%	35.2%
5	Planning	24.3%	10.8%	64.9%
6	Budget Management	40.5%	24.3%	35.2%
7	Schedule Management	29.7%	13.5%	56.8%
8	Scope Management	46.0%	13.5%	40.5%
9	Technology	46.0%	10.8%	43.2%
10	Leadership, Governance and Management	32.4%	21.6%	46.0%
11	Communications Management	43.2%	16.2%	40.6%
12	Monitoring and Control	54.0%	21.7%	24.3%
13	Risk Management	32.4%	29.8%	37.8%
14	Execution and Delivery	43.2%	16.2%	40.6%

Table **48**: The performance summary of the challenged LSCITP examined across the identified knowledge areas.

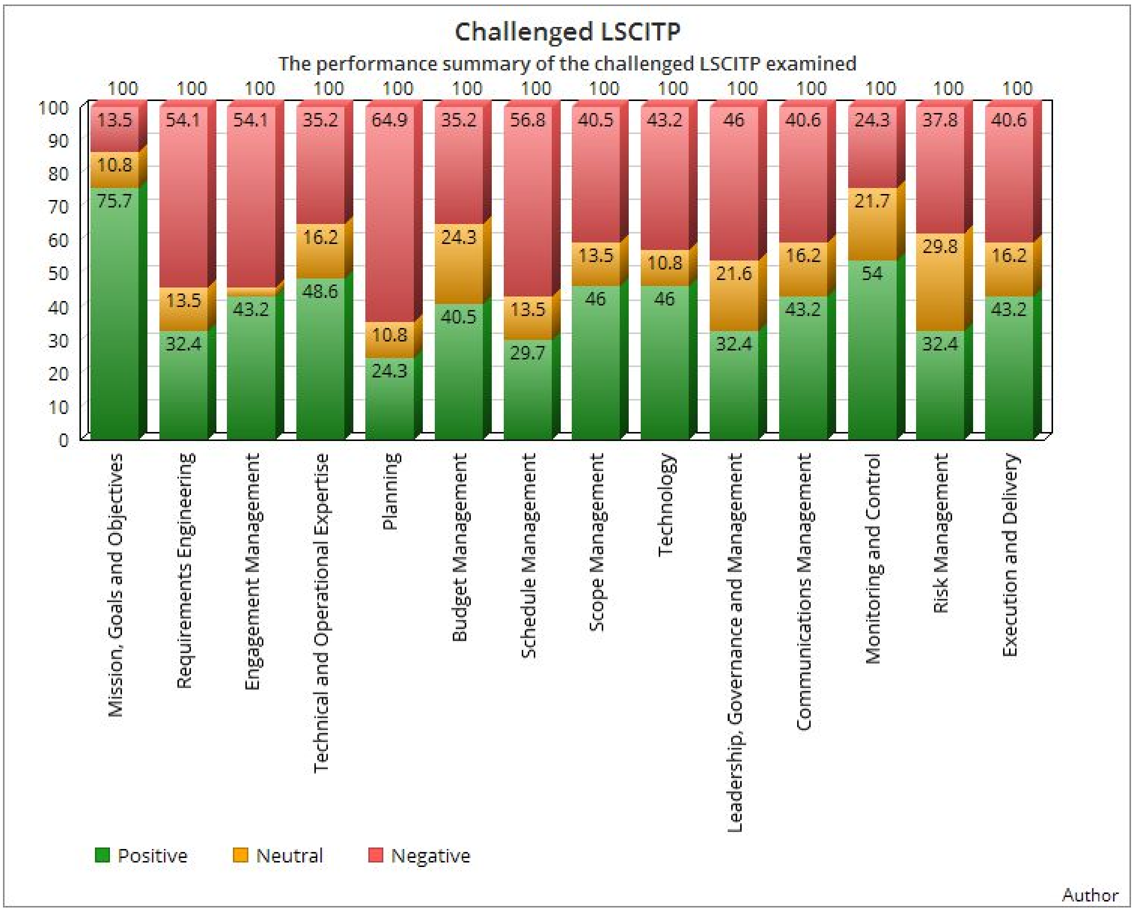


Figure **13**: The performance summary of the challenged LSCITP examined across the knowledge areas identified.

The above results on the challenged LSCITP when compared to the successful LSCITP provide a different picture on performance and outcomes as can be seen from the table below.

No.	LSCITP Knowledge Areas	Impact		
		Positive	Neutral	Negative
1	Mission, Goals and Objectives	100.0%	0%	0%
2	Requirements Engineering	89.4%	5.3%	5.3%
3	Engagement Management	78.9%	15.8%	5.3%
4	Technical and Operational Expertise	89.5%	10.5%	0.0%
5	Planning	63.1%	31.6%	5.3%
6	Budget Management	78.9%	15.8%	5.3%
7	Schedule Management	68.4%	15.8%	15.8%
8	Scope Management	84.2%	5.3%	10.5%
9	Technology	57.9%	31.6%	10.5%
10	Leadership, Governance and Management	89.4%	5.3%	5.3%
11	Communications Management	78.9%	15.8%	5.3%
12	Monitoring and Control	84.2%	5.3%	10.5%
13	Risk Management	84.2%	10.5%	5.3%
14	Execution and Delivery	100%	0.0%	0.0%

Table **49**: The performance summary of the successful LSCITP examined across the identified knowledge areas.

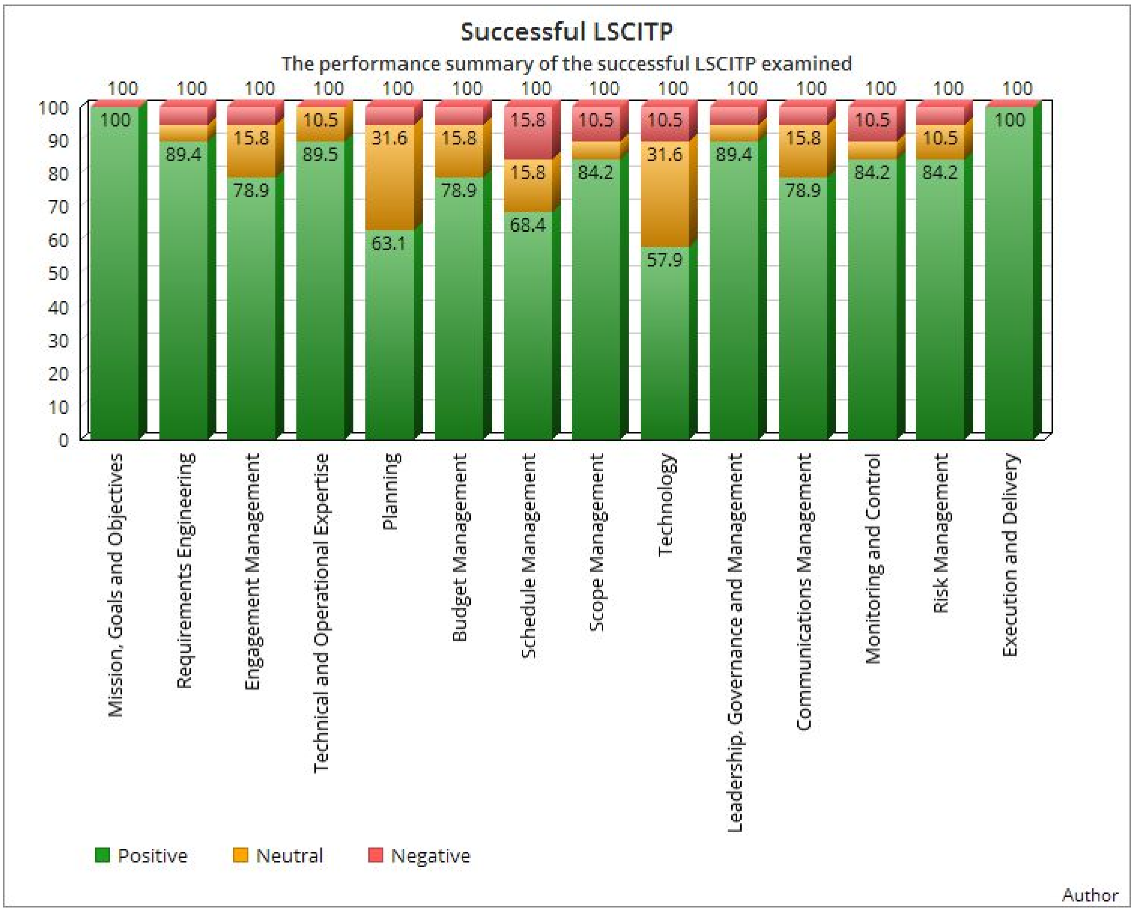


Figure **14**: The performance summary of the successful LSCITP examined across the identified knowledge areas.

The analysis of the data provided evidence of clear patterns of performance differences amongst the successful and challenged LSCITP examined. The successful LSCITP examined presented analogous patterns of factors and the resulting relationships between the knowledge areas of the factors. For example, improved outcomes across all knowledge areas were demonstrated by the successful LSCITP examined. The challenged LSCITP examined also presented similar analogous patterns of factors and the resulting relationships between the knowledge areas connected to the factors. In the successful LSCITP examined, the positive impacts from the determinant factors explored across the knowledge areas were critical in reaching a more successful outcome with a positive effect on overall success which suggests that the successful outcomes of a LSCITP is determined by the set of positive determinant factors within identified knowledge areas.

The six critical challenged knowledge areas to emerge from the analysis of the results of the study are further discussed and summarised in the sections that follow below.

9.3.1.1 Requirements Engineering

On the *Requirements Engineering* knowledge area, the findings from the study indicate that the requirement engineering aspects of LSCITP continue to be a major area that has a significant influence and impact on their implementation outcomes. For example, in the analysis of the findings, the negative impacts of the requirements engineering factors on LSCITP outcomes was found to very significant in the majority of the challenged projects examined. Requirement engineering issues were also present in the successful LSCITP examined. The findings also demonstrate that the challenges experienced with regards to requirements engineering go on to have a significant knock-on effect and negatively impact the performance of other LSCITP implementation areas such as planning, scope management, budget management, schedule management and including creating negative impacts on the benefits realisation processes.

The summary outcomes identified above on requirements engineering is consistent with similar findings from existing literature on large complex major technology initiatives which identified poor requirements and other requirements related issues as a contributory factor to LSCITP failures (Patanakul, and Omar, 2010; Al Khouri, 2007). For example, in a study on IT/IS project failures, Patanakul (2014) found that requirement challenges were identified in eleven out of fourteen large-scale IS/IT projects examined. However, while existing literature identified that requirements challenges contribute to the set of challenges experienced on LSCITP, they do not sufficiently identify all the specific factors relating to requirements challenges that specifically contributes to poor performance. Much of the existing literature only provide a high-level overview of poor requirements and the resulting impacts to IT/IS initiatives with a lack of detailed specific examples of low-level requirements challenges currently being experienced on LSCITP.

Besides the identification of new requirements factors and the validation of existing factors already identified through existing literature, the study also suggests areas of improvements on requirements engineering for stakeholders and practitioners to help address the recurring challenges being faced particularly on ensuring that the application of a formalised process or method for requirements facilitation, elicitation, management and documentation is applied on LSCITP before and maintained during the implementation lifecycle.

Overall, besides the various factors already identified on requirements engineering challenges, the primary take away from the assessments of the requirements engineering knowledge area on the LSCITP examined was that the majority of stakeholders do not fully understand the complexity of the business problems that they are seeking to address through the introduction of technology. As a result, high and low-level requirements elicitation processes are proving to be a significant challenge for LSCITP practitioners. Subsequently, where requirements are specified, the lack of detailed understanding of the problems being addressed in turn leads to endless cycles of requirement revisions, changes and refinements as further clarity on the business problems being addressed become clearer during implementation and these cycles results in significant negative impacts on other implementation areas.

9.3.1.2 Engagement Management

The *Engagement Management* knowledge area was also identified to be a critical knowledge area in the management and implementation of LSCITP in this study. The subject of engagement management particularly that of stakeholders and end-users involvement including their commitment and engagement throughout the implementation and delivery lifecycles of projects is one that is extensively covered, examined and discussed in existing studies on project failures and has been identified one of the critical success factors for projects (Hughes, Rana and Simintiras, 2017; Patanakul *et al.*, 2016; Doherty, Ashurst and Peppard, 2012).

In the course of this study, specific engagement management challenges are identified, the challenges highlighted within this knowledge area focuses on new issues discovered such as the lack of the timely identification of stakeholder groups and the identification of key stakeholders within the identified stakeholder groups on LSCITP particularly as LSCITP implementations typically comprise a large and diverse sets of stakeholders. Adding to the issues identified was the lack of identification of stakeholder expectations, objectives, priorities, alignment, concerns, their expected roles, their responsibilities, commitment, understanding and the identification of possible stakeholder risks. Furthermore, the issues discovered included the lack of the ongoing monitoring and evaluation of changes in stakeholder behaviour, goals, expectations and commitment levels. These issues were seen by participants as part of the set of issues severely impacting the successful implementation of LSCITP leading to their challenged outcomes, poor performance and ultimate failures.

In the challenged LSCITP examined, the cataclysmic effects and resulting impacts from poor stakeholder engagement management were highly visible and these resulted in the negative outcomes experienced. Furthermore, this study identified six additional predominant factors on engagement management from the review of the challenged LSCITP. These factors were viewed to be part of the core set of significant failings within this knowledge area as experienced by the participants in the study on their challenged LSCITP.

Overall, the key outcomes was that engagement levels on LSCITP across sponsors, stakeholders, end-users and other interested parties needed to be significantly improved and specific processes applied effectively by practitioners as the knowledge area was one of the critical areas that is continuing to the poor performances being experienced with LSCITP. More importantly, the specific new factors that were uncovered from the study that caused significant negative impacts are provided in the results of this study along with recommendations on how to improve their performance and how practitioners can move stakeholders along an engagement and commitment journey during the implementation of LSCITP that is filtered down through all the levels of the project environment and throughout its implementation and delivery lifecycles. These recommendations include tracking the engagement and commitment levels of stakeholders and tracking the levels of understanding of stakeholders and end-users and other interested parties in line with the progress of implementation being achieved.

9.3.1.3 Planning

The *Planning* knowledge area was also part of the critical areas that was identified as a critical area in the management and implementation of LSCITP in this study. The subject of planning, the importance and consequences of planning within projects is covered in various existing literatures that examine various aspects of projects including project failures and has been identified as one of the critical success factors for projects (Afzal, 2014; Fan, 2010).

In discussing the findings, the study identified that the challenges experienced with regards to the planning aspects of large-scale projects were primarily driven by the set of challenges that are experienced within other knowledge areas primarily on the requirements engineering, scope management, mission goals and objectives and on the leadership, governance and management knowledge areas. In particular, the results demonstrated a strong link between the requirements engineering and the planning areas and highlighted the significant dependencies between continually changing requirements and scope and changes to objectives and the ability to implement and deliver an effective implementation roadmap accordingly. These challenges experienced also extended to the resulting inability of implementation practitioners to maintain a comprehensive delivery plan.

The critical headaches for practitioners seems to stem from the high levels of complexity and uncertainties, the high levels of significant changes to scope and the significant high number of variables to include in the planning processes particularly because LSCITP are typically composed of various project workstreams and operate in multi-project environments and as a result, scope challenges on a particular project stream effectively creates a cascading effect that cuts across all dependent projects in the program. The cascading effects are felt because in such multi-project environments typical of LSCITP, various levels of dependencies exist, from dependencies on infrastructures, resources, and component parts including implementation activities.

Participants expressed the need for robust and varied planning models to be established through research to assist practitioners with the selection of the appropriate planning models that can be applied for LSCITP planning processes. The view expressed was that traditional plan-driven approaches to planning were still prevalent on LSCITP implementations and that new planning models are required particularly new models that support agile-oriented planning approaches. Thus, emphasising the need to shift away from the continued use of traditional waterfall-like planning approaches in the planning aspects of LSCITP.

In summarising the key outcomes on planning, participants on the challenged LSCITP examined expressed the fact that though the management of the planning processes were satisfactory in the majority of projects, the lack of stable and valid requirements and the constant changes in specified or defined requirements coupled with the constant changes to scope and the lack of timely decision making and approval from stakeholders and sponsors meant that the planning for the implementation of the various component parts of the entire implementation was a challenging process from the onset. As an example, participants often felt that they were unable to establish a clear implementation roadmap and as a result, the planning and re-planning efforts for the various aspects of the implementation such as workstreams implementation planning, planning for key implementation milestones, dependency planning, release planning and delivery planning were severely impacted. In addition, the planning challenges experienced on these projects extended to other planning related issues such as challenges around the sequencing of implementations, resourcing challenges and optimism bias in the estimations processes. Other areas of concern to practitioners that was argued on the planning matters was also due to the unrealistic initial plans developed on the back of the unstable requirements, unrealistic schedules and volatile implementation scope.

9.3.1.4 Schedule Management

On the *Schedule Management* knowledge area, the summary from the findings from the study indicated that various factors collectively contribute to the set of schedule challenges faced on LSCITP. Schedule management challenges experienced include the occasional lack of clarity on implementation priorities and tasks, resource constraints, inaccurate duration estimation and dependency management for component tasks, unrealistic expectations set in the planning phases and aggressive timescales for implementation and delivery teams to contend with. Overall, these schedule challenges contributed to the derailment of implementation projects, workstreams, and milestones and embedded work items across implementation phases resulting in missed deadlines and creating resulting consequences and impacts on preceding and succeeding activities as well as on current and concurrent activities.

Furthermore, challenges encountered within the planning areas cascaded into challenges on the schedule management aspects. Additionally, the lack of dependency understanding between the various projects and workstreams contained within the multi-project environments synonymous with LSCITP was another aspect of the highlighted challenges being faced with the schedule management of LSCITP.

Participant opinions seems to largely suggest that a key part in scheduling issues faced were inherently driven by the need to turn around the implementation of LSCITP in shorter aggressive timeframes due to external pressures such as the need to gain competitive advantage, the need to attain compliance with applicable regulations, value creation and innovation, increasing market share and organisational stability and other related factors. Practitioners felt that quite often the high-level milestones and deadlines set are primarily driven by these factors rather than through a detailed and calculated assessment of all embedded factors and their potential impacts.

Schedule challenges affect the successful implementation of projects and some of the findings from this study is supported by previous studies into projects and project failures that have identified schedule issues as a significant challenge for projects (van Marrewijk, *et al.*, 2008; Dalcher and Genus, 2003). Other studies have identified schedule overruns as contributory factors to project failures. The majority of existing studies on projects touching on schedule areas focus heavily on the issues of schedule overruns and unrealistic schedules without providing specific details on the causes, challenges and remedies for addressing the wider schedule management challenges on projects. This study further extensively articulates the specific schedule management challenges faced on LSCITP including the sources and origins of schedule issues which have not been covered in previous studies.

The need for a formal approach to project scheduling was also an aspect discussed by some participants to highlight the extent of the schedule challenges faced particularly because LSCITP scheduling aspects are larger and are composed of various moving parts along with complex sets of dependencies and interdependencies that need to be managed more dynamically.

Overall, the key outcomes from the assessment of the schedule management knowledge area on both the challenged and successful LSCITP were that defining, managing and maintaining a realistic project and implementation schedule was a recurring challenge highlighted by the assessment of the schedule performance outcomes on the LSCITP examined as discussed by participants. The set of schedule challenges faced include both anticipated and unanticipated challenges which were further exacerbated by the high levels of dependencies and interdependencies between milestones across multiple projects, workstreams, component parts, tasks and implementation teams.

9.3.1.5 Leadership, Governance and Management

On the *Leadership, Governance and Management* knowledge area, the findings from the study indicated that the knowledge area has a highly significant influence and impact on the implementation outcomes of LSCITP especially where the majority of the several factors contained within the knowledge area are resulting in negative outcomes. The reasons are because of the significant number of challenges that were identified and experienced on the LSCITP examined in the study where the levels of leadership, governance and management and the governance models were found to be of significant concern.

The need for effective leadership, governance and management for major projects has been identified as a critical success factor in existing studies (Miller and Hobbs, 2005). However, the majority of existing studies highlight the need for leadership, governance and their implications along with the recommendations for the use of governance frameworks without providing a sufficiently detailed and exhaustive view of the specific leadership, governance and management challenges currently being faced by practitioners with regards to LSCITP. This study has attempted to address this specific issue by providing the set of critical current challenges being experienced by practitioners that are affecting the effective governance, leadership and management of LSCITP.

About twelve new significant factors on leadership, governance and management were identified from the challenged and successful LSCITP examined. These new issues which have not been previously detailed in existing studies were a significant contributory factor to the negative outcomes that were experienced by these projects. In addition, management complexity was also identified as an issue that was impacting the successful management and implementation of LSCITP.

Furthermore, the increasing need to manage complex expectations and how to translate these complex expectations into implementation outcomes, including the need for more top-down leadership, improved governance structures, increased sponsor and ownership focus and engagement as well as the need to drive the governance and management of LSCITP through the use of a formal governance models were amongst the critical outcomes established. In existing research, the need for governance frameworks has been explored. Miller and Hobbs (2005) suggest that because of their riskier nature, the implementation of large-scale projects require governance frameworks that are specific and tailored to the nature of these endeavours. These outcomes in this study are combined with the recognition by participants that the project environments of LSCITP are increasingly more complex than ever and that the management of these initiatives requires a host of new methods, solutions, procedures, skills and competencies across stakeholders and practitioners to govern, drive and support the achievement of expected outcomes.

Overall, the leadership challenges of LSCITP was extensively highlighted by practitioners as an urgent challenge facing the management and implementation of LSCITP and an area that currently impacts the performance of LSCITP negatively and also a leading contributory factor to their poor performances. This was particularly demonstrated by the several leadership and management challenges identified by participants on their LSCITP during the discussions. The effective leadership, governance and management aspects of LSCITP was viewed by participants across both successful and failed LSCITP as a critical component in the implementation and delivery of these initiatives, critical to achieving defined outcomes positively and critical to addressing the challenges and complexities being experienced within their project environments.

9.3.1.6 Risk Management

On the *Risk Management* knowledge area, the summary from the findings from the study suggested that the levels of risk management being performed on LSCITP was inherently insufficient. Particular issues identified relate to the fact that risk management was often thought of or performed as a tick box exercise and there was a lack of a systematic approach or the use of well-established risk management frameworks for undertaking effective risk management within LSCITP. The findings also pointed to the lack of a comprehensive risk management checklist being established for LSCITP and the fact that most risk management activities performed were static and not iterative nor performed consistently enough throughout the implementation lifecycle of these projects. Perhaps more importantly, the lack of understanding of the dynamics of the complex environments that LSCITP operate in coupled with their constantly changing environments to help identify the scenarios and situations that could give rise to risks that may impact their performance was also an area that was addressed by participants in the study.

A key challenge originating from the analysis on risk management on LSCITP was that there was an issue in identifying the various areas on LSCITP within the project environment and across all dependent projects in the project environment that could be potential sources of risk and the various categories of such possible risks where identified. The immaturity of risk management practices on IT/IS projects has been identified in previous studies (Kappelman, McKeeman and Zhang, 2006; Willcocks and Griffiths, 1994). Furthermore, existing studies have also attempted to develop a list of common risk factors for IT/IS initiatives as there was a sense of inadequacy with current levels of risk understanding (Schmidt, *et al.*, 2001) including studies focused on building risk frameworks (Huang, *et al.*, 2004) while other studies have focused on understanding risk practices in the context of IT project success (Pimchangthong and Boonjing, 2017; Willcocks and Griffiths, 1994). However, more research has been identified as being required by this study to help establish a set of common risk factors and formalised risk management processes, particularly for LSCITP.

This analysis and outcomes presented here corroborate existing studies that have specifically studied the risk perspectives or IT/IS initiatives and have drawn on the need for special attention to be paid to the risk assessments and management as a critical element of implementing LSCITP (Al Khouri, 2007; Willcocks and Griffiths, C. 1994). As expressed by Willcocks and Griffiths (1994), far too often, the lack of effective risk management processes and practices is a common scenario in these major undertakings.

9.4 DISCUSSION: THE IMPACTS OF THE CHALLENGED FACTORS ON LSCITP

This section looks at the impacts to LSCITP performance and outcomes as a result of the challenges encountered on LSCITP. The objectives of gaining an understanding of the impact of the factors on LSCITP performance and outcomes is to understand the effects challenged factors have on specific areas of LSCITP in particular, scope, schedule, budget, quality and technical performance, etc. Additionally, such knowledge and insight gained from the analysis and understanding can then be used to contribute to ways of mitigating identified factors thereby contributing towards the efforts to achieve improved successful outcomes for LSCITP.

9.4.1 Research Areas Addressed

This section attempts to answer the sub-research questions posed below:

Sub-RQ3: Why do the majority of LSCITP fail to meet their original objectives?

9.4.1.1 Cost Overruns

The section of the results analyses the impacts of the challenged factors experienced on the cost performance of the challenged LSCITP examined in the study and looks at the extent of the cost overruns, the targets against initial cost estimates and whether there are improvements in the cost performances of LSCITP.

No.	Challenged LSCITP Cost Overruns	Total	
		Projects	Percent
1	LSCITP where cost overruns could not be determined	3	8.1%
2	LSCITP that were delivered over the initial budget	14	37.8%
3	LSCITP that were delivered to the initial budget	11	29.7%
4	LSCITP that were delivered significantly over budget	8	21.6%
5	LSCITP that were delivered under the initial budget	1	2.7%
Total		37	100.0%

Table **50**: The results of the assessment of cost overruns on the challenged LSCITP examined.

Participants were asked to discuss and evaluate the issue of cost overruns and assess whether their projects experienced cost overruns and if yes, to provide the variance between initial cost estimates and eventual resulting costs. In performing the analysis, participants also expressed the connected reasons for the issues experienced with regards to cost overruns as a result of the challenges experienced on their LSCITP particularly around scope management, requirements engineering and execution and delivery.

The issue of cost overruns in IT and large-scale IT initiatives has been extensively covered in existing literature (Jørgensen and Moløkken-Østvold, 2006; Moløkken *et al.*, 2003) with some arguing that the reported percentages of cost overruns overtime might be inaccurate or misleading and could impact current and future estimation approaches if further clarity and research on understanding the determinants of cost overruns is not sought (Jørgensen and Moløkken-Østvold, 2006).

As can be seen from the above results, around fourteen of the challenged LSCITP examined experienced cost overruns including eight LSCITP that experienced significant cost overruns. For these projects that exceeded their initial cost estimates, some overran on their estimated budgets from between 4 percent to about 300 percent. The results of the assessment of the extent of cost overruns on the LSCITP examined where cost overruns could be analysed is shown in the table below.

No.	LSCITP Cost Overruns	Percentage
1	Project #1	**20%**
2	Project #2	**40%**
3	Project #3	**20%**
4	Project #4	**4%**
5	Project #5	**40%**
6	Project #6	**45%**
7	Project #7	**10%**
8	Project #8	**100%**
9	Project #9	**75%**
10	Project #10	**25%**
11	Project #11	**50%**
12	Project #12	**10%**
13	Project #13	**30%**
14	Project #14	**200%**
15	Project #15	**10%**
16	Project #16	**5%**
17	Project #17	**50%**
18	Project #18	**20%**
19	Project #19	**300%**
Total		**14**

Table **51**: The results of the assessment of the degree of cost overruns on the challenged LSCITP.

Most participants affected by cost overruns on their project implementations indicated that the anticipated and unanticipated challenges around requirements engineering, leadership, governance and management and resulting impacts on schedule management and planning created difficulties and challenges on costs particularly on difficulties around cost estimations, cost forecasting and rework costs. Participants felt that these issues inevitably led to cost overruns and as a result emphasizes the significantly strong connection between schedule overruns and cost overruns and requirements engineering and leadership, governance and management. Others highlighted the fact that though in their experience, schedule overruns were a primary factor of cost overruns, cost overruns was also triggered by other factors such as the inaccurate initial cost estimates, the significant scope increases during the implementation phases, and the internal and external factors experienced that impacted the implementation cycles carrying along with them certain cost implications. The causes of cost overruns expressed extended to other factors such as poor initial scope definition, poor schedule management, poor technical architecture and design and increases in the cost of technology infrastructure components over an extended implementation duration.

Some participants also identified that there is a growing sense amongst LSCITP stakeholders and practitioners about the inevitability that LSCITP initiatives normally tend to extend far beyond their defined schedule and costs estimates and are beginning to perceive these issues as being the norm for these types of undertakings. However, the majority of participants recognised that by mitigating the set of challenges faced with LSCITP in general, this false perception of inevitability by stakeholders and practitioners can be changed.

Furthermore, some participants also noted that with LSCITP, a reconsideration of the ways cost estimates are performed particularly for large complex technology-related undertakings is required. Participants suggested that the traditional approaches of cost estimations and cost management processes applied through existing project management approaches or existing industry practices might no longer be suitable or adequate for the cost estimations of LSCITP in today's dynamic and complex technology environment. Reasons attributed where primarily because of the inherently complex nature of these undertakings but more importantly because of the inherent volatility being experienced across various implementation areas of LSCITP that makes accurate and reliable cost forecasting a significant challenge. Some participants related this scenario to trying to shoot down a constantly moving target. In other words, estimating the cost of an LSCITP is like trying to estimate the cost of a constantly moving target. A small number of participants suggested that this particular issue might be one of the reasons responsible for the significant cost overruns synonymous with LSCITP in that there may be a misrepresentation of the actual costs of undertaking LSCITP initiatives from the onset prior to the implementations of these programmes. In general, participants suggested that periodic reviews of budgets and cost estimates should be performed tailored in line with implementation progress as part of the measures to provide an accurate view of the costs of undertaking and implementing an LSCITP through its implementation phases.

Existing literature on IT/IS projects recognise the occurrence of cost overruns and their resulting impacts and some offer strategies to mitigate and address the issue (Abbas and Sanavullah, 2008; Ewusi-Mensah, 1997), however, the root causes of cost overruns are often not addressed nor is sufficient explanation and evidence provided on the causes. This study addresses the issue by understanding challenged and failed LSCITP and establishing a link between the performance and outcomes achieved across knowledge areas for the affected projects and the resulting impacts on costs overruns.

9.4.1.2 Schedule Overruns

This section of the results analyses the impacts of the challenged factors experienced on the schedule performance of the challenged LSCITP examined in the study and looks at the extent of the schedule overruns experienced, the variance in targets against initial schedules and whether there are improvements in the schedule performances of LSCITP.

No.	Schedule Overruns	Total	
		Projects	Percent
1	LSCITP ahead of schedule	1	2.7%
2	LSCITP behind schedule	28	75.7%
3	LSCITP on target against initial schedule	5	13.5%
4	LSCITP where schedule overruns could not be determined	2	5.4%
Total		37	100.0%

Table **52**: The results of the assessment of scope increase on challenged LSCITP.

Participants were asked to share their perspectives and experiences as to the reasons for the schedule overruns on their LSCITP. Besides the common causes of schedule delays already identified through existing research and through the findings from this study as described in the results in *Chapter Seven*, *Section 7.5.2.6*, some other possible causes of schedule delays were also sought and identified in this study to help validate the findings from the study that had showed high levels of schedule overruns. This study also identified that these causes vary between organisations, project environments and the nature of the LSCITP initiative being implemented. In addition, the degree of schedule delays is also dependent on unique factors internal and external to the project environment and often unique to the implementation of the project in context. For example, a detailed unique example of schedule delays provided to the study as narrated by a participant include the following scenario:

> A large global organisation with operations in over thirty countries had decided to undertake a large-scale digital transformation programme to transform its operations digitally across the entire organisation to meet strategic objectives and a changing market and competitive landscape. The organisation was made up of a leading group organisational entity and several organisational legal entities belonging to the group entity. The need for a digital transformation programme was identified by various entities but was, however, being driven by the group entity for various reasons.
>
> In the participant's view, undertaking a firm-wide large-scale complex digital transformation programme required the involvement, support and engagement of all the organisation's business entities, divisions and business sectors globally. The group organisation had prioritised the implementation of the digital transformation

programme as part of its long-term strategic objectives for a number of years. In planning for the implementation of the programme, the organisation had planned for and anticipated the support of all group organisational entities and divisions and sectors within the organisation. However, during the early stages of the implementation process which was being led by an external consultancy organisation, the implementation teams faced significant challenges with the initial discovery exercise and the requirements engineering process as they were unable to gain the required level of access and support from the senior members within the various organisational entities to identify and gain an understanding of their current work practices, current challenges and future requirements to support the formulation of the appropriate set of digital transformation requirements. The various group entities each had their own priorities including legal and commercial commitments and committed targets to achieve that they had de-prioritised support for the digital transformation programme within their respective organisations.

The group entity had failed to conduct an appropriate assessment of the priorities of its various group entities and had imposed an enterprise-wide digital transformation programme across all entities. In doing so, there was an 18-month delay experienced during the early stages of the project while the group organisation had to undertake a re-prioritisation of objectives across all group entities to gain the required level of support for its digital transformation programme. The external consultancy organisation had to endure a complex requirement engineering process that was complicated by a complex organisational structure with an additional layer of complex governance and leadership processes. These challenges led to extended delays, delays in the commencement of the implementation workstreams and connected processes, extended rework of the requirement engineering process and significant disruptions during the implementation phases. Furthermore, these delays and rework in turn led to extended costs as a result of increased resourcing costs, rework costs, cost of waste (for example, purchased software licenses that are no longer required due to changes in scope, technology and technology platforms) and contract costs due to the need to review and update existing contracts and statements of works to reflect the increased scope of work and changed objectives.

Due to the large-scale nature of the initiative, the implementation process required complex interactions with various stakeholders across various group operating group entities, including the need to manage various relationships, and it resulted in several dependencies across the business interests and requirements of the various group entities. The challenges faced also created dependencies between the various implementation workstreams and dependencies on the component parts of the implementations and deliverables, being implemented.

9.4.1.3 Scope Increase

This section of the results analyses the impact of the challenged factors experienced on the scope management aspects of the challenged LSCITP examined in the study and looks at the extent of the increases in scope experienced, the variance in targets against initially defined scope and whether there are improvements in the scope management performances of LSCITP. This analysis sought to identify and understand if there are significant increases in the scope of LSCITP from the initially defined scope.

No.	Scope Increases	Total

		Projects	Percent
1	LSCITP that delivered less scope than initially specified	9	24.3%
2	LSCITP that delivered significantly more scope than initially specified	16	43.2%
3	LSCITP that delivered the same scope as initially specified	7	18.9%
4	LSCITP where the additional scope levels could not be determined	4	10.8%
Total		**37**	**100.0%**

Table **53**: The results of the assessment of the quality and technical performance of challenged LSCITP.

Participants expressed challenges with the scope management processes as a result of increasing growth and frequent changes in operational and technical requirements and changes in business and organisational objectives and realities. Additionally, some participants expressed that the issues experienced on scope management contributed to quality issues and affected the technical performance of the outputs and the resulting solutions delivered. The common scope issues being experienced with LSCITP, in general, were identified by participants included example issues such as:

- The occasional lack of clarity of scope, incomplete scope, volatile scope, were amongst the set of scope issues identified as part of scope management processes

As can be seen from the results above on the challenged LSCITP examined, about 43.2 percent of the projects examined delivered significantly more scope that was initially specified. A further 18.9 percent of the projects were delivered to the same scope objectives initially defined. About 24.3 percent of the projects delivered less scope that was initially specified while about 10.8 percent of the projects could not determine if reductions and increases in scope throughout the implementation phases amounted to a significant increase in defined scope.

9.4.1.4 Quality and Technical Performance

This section of the discussion analyses the impact of the challenged factors experienced on the quality and technical performance of the challenged LSCITP examined in the study. Some aspects of quality and technical performance connected to the deliverables and outputs (for example, the systems, subsystems, interfaces, and other components) of the implementation of the projects were briefly explored at a high-level. The analysis looked at various areas such as the progress on the quality of implementation, the quality levels of implemented solutions, the products or delivered outputs and the performance on a selected set of technical parameters with regards to how they tie in with expected levels of quality and performance defined or otherwise anticipated by stakeholders for these initiatives.

Amongst the objectives included where possible, the identification and understanding of the factors within LSCITP that influence the technical performance and quality of deliverables. The discussions and assessment of quality and technical performance examined the following areas (a) whether deliverables were delivered with less quality than initially specified, (b) whether the outputs and deliverables were delivered with more quality than initially specified, and (c) whether outputs and deliverables met the defined quality levels.

No.	Quality and Technical Performance	Total	
		Projects	Percent
1	LSCITP that delivered less quality than initially specified	15	40.5%
2	LSCITP that delivered more quality than initially specified	5	13.5%
3	LSCITP that met the quality levels that was initially specified	10	27.0%
4	LSCITP where quality and technical performance could not be determined	7	19.0%
Total		**37**	**100.0%**

Table **54**: The results of the assessment of the quality and technical performance of challenged LSCITP.

As can be seen from the results presented above, there were variations in the quality and technical performances levels of the challenged LSCITP examined which had profound effects on delivered outputs as a result of the challenges encountered that impeded their performance and outcomes.

Considering the quality and technical performance issues identified above, some participants suggested based on their experiences ideas and recommendations for improving quality and technical performance on large-scale technical implementations. Amongst the ideas suggested includes the use of well-established performance measurement frameworks that can help to support the ongoing or regular monitoring and the verification of the extent of expected and actual attainments of quality and technical performance objectives. Equally, the use of such frameworks will also help to ensure the alignment of delivered outputs against expected outcomes. For example, two participants felt that this was important particularly for large complex initiatives where the tracking and assessment of quality and technical performance is obscure and can be a challenging process for practitioners. These participants also felt that overall, the benefits of the use of performance measurement frameworks or methodologies will help LSCITP stakeholders to acquire the appropriate levels of visibility into whether the implementation deliverables will meet their defined quality and technical performance objectives when eventually delivered.

Furthermore, other quality and performance suggestions include the use of defined metrics and measurements parameters by tracking and analysing them regularly to monitor quality and performance levels and to apply such gained visibility and corresponding metrics data obtained to continually improve on quality and technical performance during the implementation phases.

Additionally, participants highlighted the fact that the challenges faced with regards to schedule and cost overruns and poor decision-making processes and on the leadership, governance and management aspects resulted in a strain on the quality of the solution deliverables on and the technical performance of the technical component outputs of the implementations. Implementation areas particularly those faced with challenges on requirements engineering had to ultimately economize on quality and performance to try to fit with issues such as the adjusted implementation schedules, increased scope and the late refinements and clarity on requirements. Examples of some of the economisation approaches shared by participants include having to undertake simultaneous dependent implementations workstreams, having to undertake a reduction of implementation timeframes, for example, cutting down on the time spent on the requirements gathering and elicitation process, reducing the time spent on the testing process for developed software applications and on integration systems, compressing the timeframes for application, data and infrastructure migrations, making use of cheaper resources (for example external contractors), switching to cheaper implementation and systems integration partners during the implementation stages. Some participants noted that while these economisations strategies were put in place to address schedule concerns, these approaches, in turn, introduced further risks to the implementation and delivery process and created risks to the fitness of purpose of some of the delivered components.

Equally, some participants also emphasised the strong link between the quality of the implementation and delivery process and the quality of the deliverables and solutions borne out of the implementation of LSCITP initiatives.

9.5 DISCUSSION: IMPROVING THE MANAGEMENT, IMPLEMENTATION AND DELIVERY OF LSCITP

The summary of the recommendations identified, and the suggestions elicited from participants in the study are discussed below to provide LSCITP stakeholders and practitioners with a view of ideas and solutions that have been applied to assist with some of the challenges encountered on LSCITP implementations.

The findings critically highlight the fact that regardless of the implementation and delivery methodology that is being applied in the implementation of LSCITP, for example, the use of waterfall, rapid application development, agile, SAFe, and other industry standard project management methodologies, frameworks and bodies of knowledge (for example, PMBoK, APM and PRINCE2), that the challenges being encountered in the implementation process that leads to their negative outcomes are still inherent and common across LSCITP. As such, the results suggest that the use of specific methodologies and frameworks on LSCITP while helping to effectively manage, guide, improve and steer LSCITP implementations towards achieving successful outcomes do not necessarily prevent the occurrence of challenges and negative impacts rather, it is the associated and connected human factors of LSCITP implementations that pose the greater risks to achieving desired LSCITP objectives and outcomes. The human factors refer to the need for increased focus on knowledge integration and organisational learning. Thus, this aspect of LSCITP management and implementation requires a greater deal of attention and increased focus across both the academic and professional industries. This view reached is also slightly similar to the views expressed in previous related research on IT/IS project failures (Al-ahmad, Al-fagih, Kand Khanfar, 2009; Denker, 2007; Mitchell, 2006, Dalcher and Genus, 2003).

An additional suggested reason on the need for the increased focus on knowledge integration aspects of LSCITP is that it appears that the knowledge and skills required to manage the implementation and delivery of these IT/IS initiatives is still lagging behind and cannot keep up with the fast-moving pace of technological advancements and innovation being experienced (Denker, 2007).

Therefore, this study proposes that to reduce the negative impacts of risks to specific factors across the LSCITP knowledge areas identified thereby leading to improved LSCITP performance and outcomes, LSCITP stakeholders and practitioners and the IT industry as a whole need to focus heavily on the human factors of LSCITP management, implementation and delivery. This includes engaging in a broad range of activities and initiatives aimed at influencing inherent human behaviours, improving implementation and management competence development levels and improving knowledge mobilisation and knowledge integration processes within organisations and with practitioners to support the knowledgeability of LSCITP stakeholders and knowledgeability of practitioners on improving awareness and understanding of the impacts of human factors for large complex programme technology initiatives. The research findings on the successful LSCITP examined suggests that the detailed understanding of the challenges being experienced within each of the knowledge areas identified for LSCITP and the alignment of knowledge across all knowledge areas and improved competence by practitioners and stakeholders will lead to improved outcomes for LSCITP.

For example, in Mitchell's (2006) study into knowledge integration and IT project performance, the ability to successfully integrate various sources of specialised knowledge and subsequent management and application of such knowledge during the implementation process were demonstrated to result in a positive impact on large-scale projects outcomes. In addition, the results in this study also share part of the conclusions reached with studies such as that by Denker (2007) who argued that significant improvements in professionalism in the IT/IS domain is required to help improve implementation outcomes. This view is also echoed by Patanakul, and Omar (2010) who indicated in their study that the required processes and methods for effectively managing and delivering large scale projects are well defined and known however effectively implementing these methods and procedures is what seems to be largely presenting difficulties and challenges for LSCITP practitioners (Patanakul, and Omar, 2010). Similarly, within an IT/IS context, the level of the professionalism of software engineers and software architects involved in the implementation of these initiatives was listed as part of the challenges affecting the successful implementation and delivery of LSCITP in the United Kingdom (Glass, 2006) based on the findings from the study carried out by the British Royal Academy of Engineering and the British Computer Society. Equally, another suggested contributory factor to the knowledge integration challenges being experienced was that because of the evolution of technology, the knowledge requirements are also increasingly changing in turn thereby making the knowledge requirements process for large, complex IT undertakings a complex and challenging process (Al Khouri, 2007).

In Haider and Haider (2012) view, LSCITP stakeholders and practitioners need to realise that the management of these technology-intensive initiatives is no longer a linear process. Organisations need to respond to changes dynamically in an adaptive approach to successfully accomplish the goals and objectives defined for an LSCITP. Such dynamic adaptive process will enable, support and incorporate a learning model and organisational culture that facilitates the need for continuous improvement, development and knowledge advancements through practical learnings, experiences and identified initiatives applied (Haider and Haider, 2012). Improved organisational learning is really required to help address some of the challenges being experienced with IT/IS projects (Ewusi-Mensah, 1997).

Existing research has helped to prove that by following well-established processes and procedures, along with the effective management of identified critical factors in specific critical knowledge areas, that the success of large-scale projects can be achieved (Patanakul, and Omar, 2010). The implementation and delivery of large complex projects are insufficiently understood and are poorly managed (Morris and Hough, 1993) and this contributes to the negative outcomes experienced in their management, implementation and delivery. The continued high-profile IT/IS failures suggest that the lessons learnt, and knowledge gained from past failures are not being effectively applied in the implementations of new IT/IS projects and thus highlights the need for continued research (Dwivedi *et al.*, 2015) particularly on the human aspects of LSCITP.

When combined with the findings from existing related research studies, the collective outcomes including that from this study provides LSCITP practitioners and stakeholders with a reminder that LSCITP initiatives are incredibly complex undertakings and that the challenges encountered are primarily down to the innumerable failures in implementation and delivery processes, suboptimal management and inadequate governance and leadership structures amongst other issues. As the results suggest, when LSCITP end up being challenged or fail, it is simply not down to the failure of the project as a whole but rather, it is the combinations of the failures of executions connected to the people, process, procedures and technology aspects of the implementation.

While various methods, frameworks and processes have been proposed to support the improvement of large-scale project implementation and outcomes (Somanchi and Dwivedula, 2010; Ewusi-Mensah, 1997), the current approaches to the implementation and delivery of LSCITP might not lead to the desired results of improved outcomes until stakeholders and practitioners change their perspectives, understand the determinants of failures and implement suggested measures for change. As Hughes, Rana, and Simintiras (2017, p.151) notes, "without formal controls, structure and application of suitable standards and methodology, problems are likely to remain". Such failures ultimately result in the challenged outcomes or the eventual failure of an LSCITP. Omar and El-Haddadeh (2016) in their study on institutionalisation frameworks for large-scale digital transformation programmes identified that stakeholders and the internal structures of the environment that an LSCITP operates in play a significant part and can either support or impede the implementation process, and as a result the people, structure, culture and organisational context should not be ignored.

Overall, the management and implementation of LSCITP will create an inevitable and inherent change in the technological and operational architectures of the affected and connected organisations. What the findings in this study have also helped to demonstrate is that the management of these undertakings has become more complex and challenging largely due to the complexity of the solutions being addressed and implemented through technology which is also constantly evolving and with such rapid advancements being witnessed with technology, in turn, creating resulting uncertainties for LSCITP that impacts their outcomes as argued by (Durney and Donnelly, 2013). Despite these challenges, the study has also attributed the primary blame for LSCITP challenges and subsequent failures on management failures and inadequacies in knowledge integration processes.

9.5.1 Recommendations for Improving LSCITP Management

As part of the above discussion on improving the management of LSCITP, the specific recommendations obtained by participants across the challenged and successful LSCITP examined during the study where extricated and analysed. The analysis identified the set of recommendations that contained useful insights that are beneficial to LSCITP stakeholders and practitioners in the management of LSCITP as they provide solutions that can be implemented to address the challenges with managing LSCITP uncovered. Furthermore, these recommendations have been grouped and arranged into the knowledge area categories they relate to in order to align with the challenged factors findings (e.g. presented in a similar structure) and are presented in the table below.

Knowledge Areas	No.	Recommendations
Mission, Goals and Objectives	1	Availability of detailed business cases to help perform an analysis of anticipated costs, expected benefits, understand the value drivers including value propositions and to provide confirmations and validations of defined business goals and objectives
	2	Use of established processes and definitions of specific metrics to assist with the measurement of business cases during implementation and to ensure that stakeholder agreement and alignment is easily obtained on revised business cases
	3	Continuous tracking and monitoring for changes in value forecasts due to resulting changes in business objectives, scope, stakeholders, stakeholder expectations, governance structures, sponsors, end clients and end-users
	4	Implementing LSCITP through the lens of the overall mission, goals and objectives defined for such projects that expresses up to date reality
	5	Regular reviews of LSCITP objectives including assessing value drivers, value propositions, vision, strategy, anticipated benefits and costs and performing business objective assessments and technical feasibility assessments conducted to identify any material changes and any deviations from defined objectives tailored to the scale and nature of LSCITP under implementation
	6	Regular reviews of business cases on a quarterly basis as part of the LSCITP implementation activities
	7	Reviews of business cases and objectives to be conducted ideally semi-annually at a minimum for a very large and complex IT programmes
Requirements Engineering	8	Application of formalised processes or methods for requirements elicitation, facilitation and documentation
	9	Required low-level engagement of all connected business areas, units, end-users and required stakeholders should be performed

		prior to any high-level strategic decisions and directions being made
	10	Preventing critical request for changes being introduced and approved by stakeholders very late into the implementation phases to help reduce the impact on defined operational readiness plans, risks and the security of the technology solutions being implemented
	11	Regular reviews of business cases with agreements on changing objectives formally secured with stakeholders to support and ensure requirements completeness that in turn supports design readiness and in turn supports the implementation and delivery readiness
Engagement Management	12	Monitoring of stakeholder behaviours, engagement and commitment levels during the LSCITP implementation lifecycle
	13	Increasing the levels of stakeholders and end-user engagement, management and commitment during LSCITP implementation lifecycles
	14	Ensuring effective and improved engagement management with business functions, units, end-users and other interested parties to help undertake regular reviews of proposed solutions for reasonability especially considering the solution architectures, technical and operational designs defined and intended system functionalities proposed
	15	Definition of a strategy for effective engagement management to be established early on to govern and guide the engagement and relationship management processes with all relevant stakeholders on LSCITP
	16	Regular reviews on engagement levels with end-users to be conducted to support the comprehension and utilisation of the LSCITP technology deliverables by end-users prior to LSCITP delivery
	17	Ensuring availability and continued availability of committed and influential stakeholders and sponsors throughout LSCITP implementation lifecycle to ensure seamless execution and delivery on all objectives in the scope of implementation
Technical and Operational Expertise	18	Ensuring appropriate levels of LSCITP implementation and delivery skills and capabilities for senior implementation resources including ensuring the significant experience and expertise of core resources connected to the LSCITP implementation and delivery efforts within the project environment while ensuring that resources with the appropriate levels of skills, abilities, experience and domain expertise are embedded within key implementation roles
	19	Embedding highly experienced technology domain experts and subject matter experts across core implementation functions and areas within the LSCITP environment specific and tailored to the technological domain of the implementation
	20	Ensuring a level of significant experience and expertise in the theoretical and practical aspects of LSCITP management,

		implementation and delivery by senior resources engaged on LSCITP implementations and delivery.
	21	Ensure that implementation leads (*e.g. programme managers/project managers/heads of delivery/delivery directors/delivery leads, etc.*) possess significant experience, expertise, knowledge and skills that spans beyond programme/project management and delivery knowledge to include areas such as technology, business and organisational change, change management, transformation and enablement, business design, leadership, and communications management
Planning	22	Use of formal effort estimation processes and performing validation of defined/provided estimates (where necessary)
Schedule Management	23	Establishing ways of working and defining engagement models with third-parties and external entities engaged on LSCITP implementations to support effective collaborations and engagements during the implementation cycle
Budget Management	-	---
Scope Management	-	---
Technology	24	Use of external audits and assessments where necessary during LSCITP implementations to review technical architectures and perform validations of technical solutions, operational designs and review of capability and capacity to successfully implement and deliver the implementation objectives
Leadership, Governance and Management	25	Ensuring the appointment of a SRO mandated with overall responsibility and accountability for the implementation and delivery of the LSCITP particularly for very large and distributed complex programmes
	26	Undertaking advanced succession planning for core implementation resources and anticipation of resource volatility issues in the governance, management and implementation structures of LSCITP to help mitigate resulting impacts on schedule, costs, governance and accountability, etc.
	27	Establishing and using decision-making frameworks and guiding principles as a basis for critical and effective decision making by steering committees, governance boards, and leadership teams during LSCITP implementations.
	28	Enforcing and ensuring strong and engagement-driven level of leadership to maintain strategic directions of LSCITP and objectives and to help mitigate challenges and negative receptions with frequent changes in objectives and scope
	29	Ensuring the roll down of delivery responsibilities including accountability for the value realisation from the implementations of component parts of LSCITP to the various ownership and responsibility structures of the organisations and business areas involved
	30	Ensuring the setup of effective governance structures to support effective and adequate oversight of LSCITP implementations, establish governance standards and to introduce required levels

		of transparency and accountability including objectivity and responsiveness and issue management on LSCITP
Communications Management	31	Use of best practice/tailored assessment and evaluation methodologies during the LSCITP implementation lifecycle to gather, assess, monitor and provide visibility and systematic reporting on progress being made towards achieving implementation objectives
	32	Use of improved top-down and bottom-up communication processes during LSCITP implementation phases that is supported through using new tools of communication that can be tracked and measured for effectiveness and engagement
	33	Regular monitoring and identification of actual project statuses, project and implementation performances, issues and challenges, risks, expected outcomes in line with progress, results and benefits and the various change processes connected to the embedding of delivered outputs into the target organisations and applicable environments including the communication of derived performance outputs to key stakeholders.
Monitoring and Control		
	34	Establishing a project implementation monitoring database throughout the LSCITP implementation lifecycle that is populated in real-time with ad-hoc, daily and weekly status updates and key reports and metrics across all connected programme/project implementation areas
	35	Ensuring the implementation of enhanced monitoring processes to offer support for the regular measurements, assessments and reporting of the LSCITP performance based on specifically defined Large Project Performance Indicators (LPPI) both unique and generic and tailored to the LSCITP in context
	36	Regular ongoing assessments of the primary organisation delivering LSCITP to ensure that projects and various component parts of the implementation and delivery are being implemented, managed and delivered according to the defined principles on governance, management, goals and objectives, technical and operational expertise and execution and delivery by the stakeholders
Risk Management	-	---
Execution and Delivery	37	Use of Agile delivery methods, frameworks and methodologies in the implementations of LSCITP to help improve and support performance, delivery and outcomes
	38	Use of value realisation parameters as an ultimate measure of success and in measuring LSCITP performance rather than the traditional methods of cost, time and quality
	39	Use of external audit and assurance mechanisms where necessary on LSCITP particularly for very complex programmes to provide an independent perspective and an independent assessment of various elements of the LSCITP implementation and delivery

	40	Use of external audits and assessments where necessary on LSCITP to review management and governance structures, validate operational designs, target operating models, execution and delivery setup and review of capability and capacity to successfully implement and deliver the LSCITP objectives
Third-Parties	41	Forging of productive and healthy relationships with third-parties and external entities engaged during LSCITP implementation and delivery that includes effective communications, individual levels of engagement, joined up alignment on objectives and aligned understanding on possible negative outcomes and impacts on reputation and credibility on all parties involved and the understanding of required committed joined up efforts to mitigate these
	42	Ensuring that realistic contracts, statements of work, contractual framework models and commercial models from and with third-parties and service providers reflects the reality of the engagement and is free from optimism bias, uniqueness bias and strategic misrepresentation
	43	Ensuring third-party "fit" during the selection and engagement of third-parties and external entities to help address and mitigate possible issues early on such as cost overruns, schedule delays and poor quality and technical performance by third-parties

Table **55**: The set of recommendations for improving LSCITP management obtained during the study.

9.6 THE PROPOSED LSCITP CHALLENGED STATUS ASSESSMENT FRAMEWORK

In addition to the conceptual model, the study also provides an assessment framework that will enable LSCITP stakeholders and practitioners to shape and evaluate the performance of LSCITP primarily to identify challenges and map out challenged factors and to obtain a view of the progress of the LSCITP against the defined goals and objectives. The assessment framework has been developed on the back of the work efforts in the study spanning the literature reviews, the case studies, the domain model and the expert interviews to provide a knowledge base and information and guidelines to help LSCITP and stakeholders and practitioners to understand the challenges of LSCITP using a new approach and to support the conduct of challenged status reviews on ongoing LSCITP particularly when challenges are being encountered and also to help support LSCITP challenged status remediation. The *Challenged Status Assessment Framework* provides the basic structure that allows LSCITP stakeholders and practitioners to appraise the challenged posture, identify and review challenged factors and obtain the required focus on challenges occurring that needs to be addressed including how they can leverage the framework to diagnose and address challenges in their ongoing LSCITP implementations.

Practitioners can apply the framework to perform an objective and methodical assessment of an ongoing LSCITP by following the six-step approach to conduct high, medium and low-level qualitative and quantitative assessments taking into account the size and complexity of the project by conducting in-depth interviews, gathering relevant data via questionnaires and conducting a review of specific artefacts of the LSCITP to help uncover the presence of LSCITP challenges as identified in the study that can induce failures and to help implement mitigating and corrective actions provided. It is a generic framework that can be applied in the assessment of any LSCITP. More importantly, the challenged review framework can be adapted, tailored and applied to a specific LSCITP.

The challenged status assessment can be performed at any stage of the implementation process though it is suggested that it is carried out during formalized phases/stages/gates in a LSCITP's implementation cycle. If an assessment is conducted early on during a project's implementation lifecycle, such assessment can be used to focus on identifying the likelihood of the project encountering the challenged factors identified and to build in early mitigating and corrective actions into the project's implementation process. An early stage assessment can also be used to determine if the LSCITP has a solid basis to proceed. If the assessment is conducted during the later stages of the project implementation lifecycle, such assessment can be used to identify the extent of the challenged nature of the LSCITP and identify challenges across the knowledge areas and also to determine the actual status of the project and the overall performance to date. Additionally, such assessment can also be used to reassure stakeholders to carry on with the implementation of the project and provide assurances on future performance of the project and obtain a view of the benefits realisation progress.

Though existing research studies have provided a detailed view on the particular set of success and failure factors for large IT/IS projects, they have not provided such views within the lens of a conceptual schema nor identified related knowledge areas and corresponding relating factors and their inherent relationships nor provided an assessment framework to measure and assess LSCITP for challenges and challenged factors. This study demonstrates and proposes that achieving successful outcomes from LSCITP undertakings requires a significant shift from existing views by stakeholders and practitioners into new views through the lens of a conceptual schema and an assessment framework that can provide a holistic view of the LSCITP implementation and delivery challenges through a conceptual schema and an assessment framework.

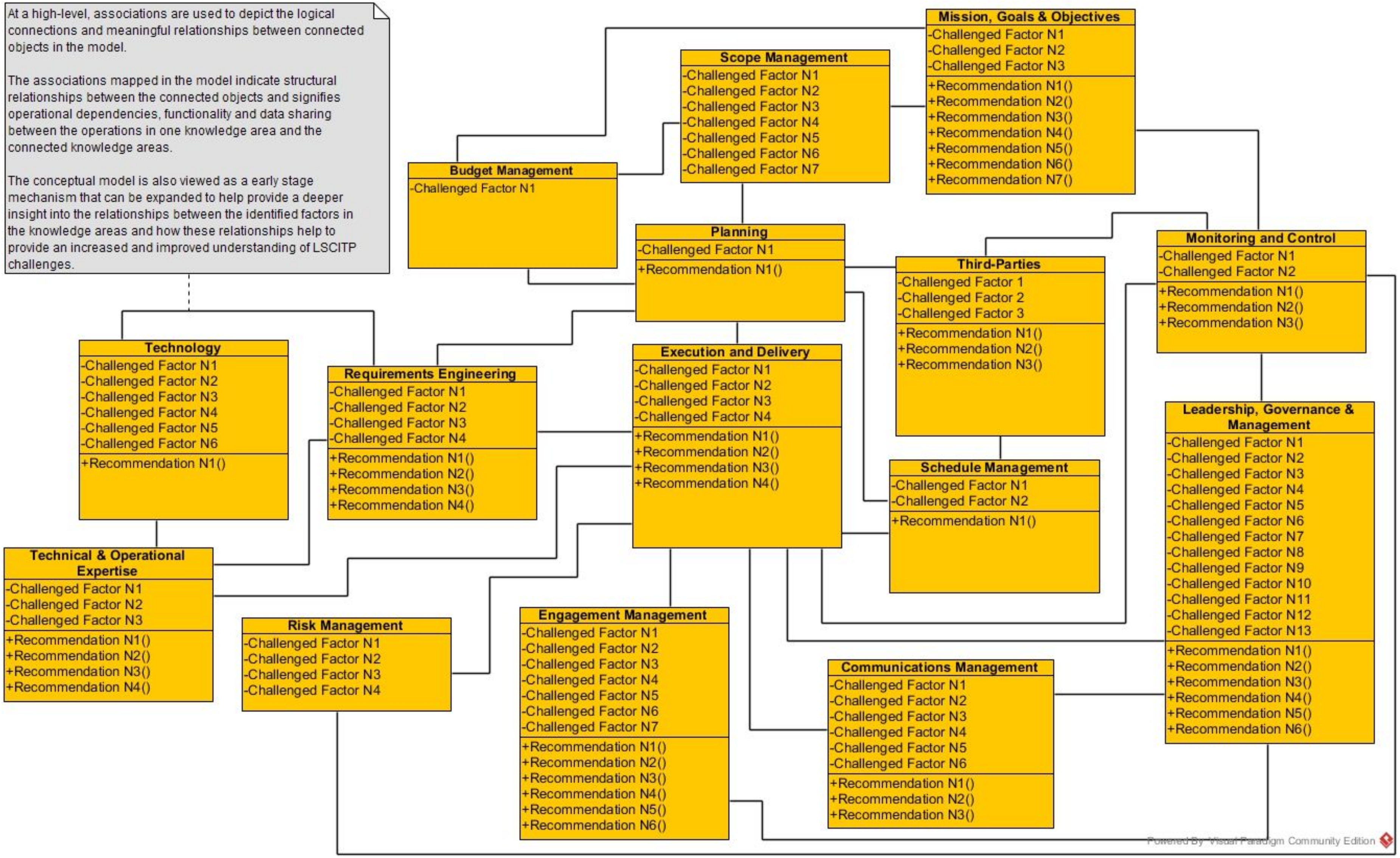
9.7 THE CONCEPTUAL DOMAIN MODEL AND CHALLENGED FACTORS

The conceptual domain model modelled in *Chapter Five* captured the principal knowledge areas on LSCITP implementation and their inherent factors to support practitioners in the understanding, assessment, and operationalisation of the challenged factors identified as part of LSCITP management, implementation and delivery processes. Furthermore, it provides a holistic model and approach by which the effects and impacts of specific negative factors across various critical knowledge areas can be analysed, assessed and managed during the implementation processes of LSCITP as demonstrated during the assessment of the results of the study. The conceptual model and associated framework can be developed into a tool or system that can be used to conduct holistic qualitative and quantitative reviews and assessments of the management and implementation practices of LSCITP.

The use of a conceptual domain model approach to assist in identifying and visualising the key knowledge areas, their entities and their interactions within the LSCITP problem domain can be viewed as a system that can help to provide a deeper level of sagacity into the various factors involved and their relationships and associations and to provide the required deeper understanding of how these entities and their relationships can have an impact on LSCITP success and failures positively or negatively. Amongst the objectives in the development of the conceptual framework was to emphasise that there are new sets of factors that need to be identified, analysed and understood. The objectives also include the need to identify and map out the specific knowledge areas that contribute immensely to successful or negative outcomes as part of the collective efforts in the pursuit of improved understanding and outcomes and increased success rates for LSCITP.

As part of the analysis and understanding of the results obtained from the expert interviews, the conceptual schema was revisited to consider new data obtained from the expert interviews and data gathered for the study that can help to improve the model from the results of the analysis performed. The process identified new connections and associations between specific knowledge areas including challenged factors and these were reflected into the conceptual schema to provide an updated model. The updated conceptual model is provided in the figure below.

Figure **15**: The updated conceptual model for understanding LSCITP challenged factors and associated recommendations (Source: Author).


At a high-level, associations are used to depict the logical connections and meaningful relationships between connected objects in the model.
The associations mapped in the model indicate structural relationships between the connected objects and signifies operational dependencies, functionality and data sharing between the operations in one knowledge area and the connected knowledge areas.
The conceptual model is also viewed as a early stage mechanism that can be expanded to help provide a deeper insight into the relationships between the identified factors in the knowledge areas and how these relationships help to provide an increased and improved understanding of LSCITP challenges.
Mission, Goals & Objectives
-Challenged Factor N1
-Challenged Factor N2
-Challenged Factor N3
+Recommendation N1()
+Recommendation N2()
+Recommendation N3()
+Recommendation N4()
+Recommendation N5()
+Recommendation N6()
+Recommendation N7()
Scope Management
-Challenged Factor N1
-Challenged Factor N2
-Challenged Factor N3
-Challenged Factor N4
-Challenged Factor N5
-Challenged Factor N6
-Challenged Factor N7
Budget Management
-Challenged Factor N1
Planning
-Challenged Factor N1
+Recommendation N1()
Third-Parties
-Challenged Factor 1
-Challenged Factor 2
-Challenged Factor 3
+Recommendation N1()
+Recommendation N2()
+Recommendation N3()
Monitoring and Control
-Challenged Factor N1
-Challenged Factor N2
+Recommendation N1()
+Recommendation N2()
+Recommendation N3()
Technology
-Challenged Factor N1
-Challenged Factor N2
-Challenged Factor N3
-Challenged Factor N4
-Challenged Factor N5
-Challenged Factor N6
+Recommendation N1()
Requirements Engineering
-Challenged Factor N1
-Challenged Factor N2
-Challenged Factor N3
-Challenged Factor N4
+Recommendation N1()
+Recommendation N2()
+Recommendation N3()
+Recommendation N4()
Execution and Delivery
-Challenged Factor N1
-Challenged Factor N2
-Challenged Factor N3
-Challenged Factor N4
+Recommendation N1()
+Recommendation N2()
+Recommendation N3()
+Recommendation N4()
Leadership, Governance & Management
-Challenged Factor N1
-Challenged Factor N2
-Challenged Factor N3
-Challenged Factor N4
-Challenged Factor N5
-Challenged Factor N6
-Challenged Factor N7
-Challenged Factor N8
-Challenged Factor N9
-Challenged Factor N10
-Challenged Factor N11
-Challenged Factor N12
-Challenged Factor N13
+Recommendation N1()
+Recommendation N2()
+Recommendation N3()
+Recommendation N4()
+Recommendation N5()
+Recommendation N6()
Schedule Management
-Challenged Factor N1
-Challenged Factor N2
+Recommendation N1()
Technical & Operational Expertise
-Challenged Factor N1
-Challenged Factor N2
-Challenged Factor N3
+Recommendation N1()
+Recommendation N2()
+Recommendation N3()
+Recommendation N4()
Risk Management
-Challenged Factor N1
-Challenged Factor N2
-Challenged Factor N3
-Challenged Factor N4
Engagement Management
-Challenged Factor N1
-Challenged Factor N2
-Challenged Factor N3
-Challenged Factor N4
-Challenged Factor N5
-Challenged Factor N6
-Challenged Factor N7
+Recommendation N1()
+Recommendation N2()
+Recommendation N3()
+Recommendation N4()
+Recommendation N5()
+Recommendation N6()
Communications Management
-Challenged Factor N1
-Challenged Factor N2
-Challenged Factor N3
-Challenged Factor N4
-Challenged Factor N5
-Challenged Factor N6
+Recommendation N1()
+Recommendation N2()
+Recommendation N3()
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Finally, an extended framework for large-scale technology projects implementation, delivery and assurance could be developed or existing methodologies and frameworks enhanced on the back of the conceptual model and the outputs of this study incorporated to allow LSCITP stakeholders and practitioners to speak a common language and to provide a unified lifecycle by which existing practices can be integrated along with new findings and new outcomes on research into LSCITP successes and failures.

9.8 SUMMARY OF DISCUSSIONS

The findings from the case studies and expert interviews have provided valuable insights into the challenges of LSCITP and the resulting impacts on LSCITP outcomes. Particularly because the LSCITP examined were from across various IT/IS application domains and across various industries and locations globally. The outcomes also help to increase the understanding of the impacts of specific factors across various knowledge areas on LSCITP. The results indicated that in LSCITP environments, there are specific knowledge areas that contain factors that are highly significant, occurring frequently and severely affect the positive outcomes of these initiatives. These knowledge areas require special focus and attention from stakeholders and implementation and delivery teams to reduce the negative impacts of risks to successful outcomes.

The results of this study also provide LSCITP stakeholders and practitioners with practical insights and applied solutions obtained on real-world LSCITP implementations and provide them with an understanding of the common set of challenges faced in implementation and delivery so that appropriate measures can be taken and applied to reduce the likelihood of failures. The findings also allow us to see how stakeholder perception of LSCITP, their lack of in-depth understanding and the lack of timely decision making severely affects outcomes critically.

More importantly, the results of the study also indicate the importance of the conceptual framework for LSCITP implementation and delivery by providing knowledge areas that cover the critical and challenging implementation areas and their sources of negative impacts and their implications. However, as the findings also indicate, other knowledge areas and the factors contained are also equally important towards improving LSCITP outcomes so the focus by stakeholders and practitioners should not solely be on the critical areas identified.

The approach applied and outcomes from the study will allow LSCITP stakeholders and practitioners to obtain the required levels of visibility into the reality of the implementation processes of LSCITP and they are able to monitor and measure LSCITP knowledge areas for possible challenges and any potential impacts during the implementation lifecycle and allows them to prepare and provide sufficient mitigating controls to address potential risks and issues. Furthermore, it provides insights on how to develop IT implementation and delivery practitioners to enhance their capability and ability to undertake the management, implementation and delivery of LSCITP.

CHAPTER 10

Conclusion and Recommendations

10.1 INTRODUCTION

This chapter draws the conclusions from the research and provides the overview of the work that has been presented in this study, covering the focus of the research, the review of literature, the summary of the findings, the outcomes, the contributions of the study, including recommendations following on from the findings, the limitations of the study, the possible implications and areas for further research.

10.2 RESEARCH SUMMARY

The conduct of the literature review exercise identified a gap in the understanding of the challenges and emblematic syndromes of failures of LSCITP, the challenged factors for LSCITP and in the identification of the critical problem areas in LSCITP that hinder success and contribute to challenges that become inherent in their implementation and delivery through the evidence presented.

The primary research question that was addressed by the study was about understanding

> *What are the challenges to the successful delivery of large-scale, complex information technology projects, and why do most projects fail to meet their original objectives?*

In addressing the research question above, the following sub-questions were pursued to help address the main research question outlined above:

Sub-RQ1: *What are the key factors that help to improve or hinder the management, implementation and delivery of LSCITP?*

Sub-RQ2: *What are the critical knowledge areas on LSCITP that stakeholders and practitioners need to be aware of?*

Sub-RQ3: *Why do the majority of LSCITP fail to meet their original objectives?*

Sub-RQ4: *Do specific project management methodologies and their application to the management, implementation and delivery of LSCITP help to improve the successful outcomes of LSCITP?*

The extensive review of literature helped to broaden the understanding of existing theories and concepts relating to the research topic under investigation. It has also helped to acquire, investigate, establish and build detailed knowledge around the set of factors that create challenges for LSCITP and subsequently influences their performance and outcomes. The review of existing literature identified a gap in empirical research on LSCITP particularly focusing on understanding the determinants of both success and failures of large-scale complex IT initiatives and the specific challenges faced in relation to their management, implementation and delivery and an attempt has been made by this study to address this identified research gap. In addition, a large proportion of existing studies examined focus heavily on the failures of LSCITP with limited research focused on assessing and investigating successful LSCITP, in response, this study also addresses this research gap.

The research summary provides a critical analysis of the findings considering the research questions developed. The study provides empirical evidence on the set of factors in specific implementation areas that are behind the causes of the challenges resulting in the poor performance and eventual failures of LSCITP. Additionally, the study has also attempted to provide an updated view of the current challenges of LSCITP including identifying a set of new challenged factors previously unidentified in existing studies that impede LSCITP performance and contribute to the negative outcomes being experienced.

The use of three major LSCITP as a case study and further research data gathered on fifty-six LSCITP globally has allowed the study to coalesce knowledge on various areas of LSCITP. In many ways, the study provides a detailed insight into the internal workings of LSCITP, the challenges and complexities being experienced and highlight the areas with significant challenged factors that affect performance and lead to negative outcomes that impede success. In addition, the study developed a conceptual schema through the use of domain modelling exercise to help create a taxonomy of LSCITP challenged factors into a set of domain areas for LSCITP stakeholders and practitioners to focus on particularly during the pre-implementation, implementation and post-implementation stages to understand challenging areas of implementation an delivery and to be better prepared to deal with and respond to the set of known challenges that often arise.

In understanding the challenges of LSCITP, it was necessary to obtain, examine and understand the insights and perspectives of the key practitioners involved in the implementation and delivery of LSCITS and LSCITP. Overall, the study incorporates the findings, outcomes, insights and perspectives from the literature review, case studies and expert interviews conducted.

10.3 SUMMARY OF CONTRIBUTIONS

One of the primary objectives in the conduct of this study is to contribute to the existing knowledge and improve the understanding of challenges inherent in the management and implementation of LSCITP.

To that end, this research study provides several significant contributions to existing knowledge, to begin with, the research activities carried out in this study contributes to the increase in knowledge and understanding of LSCITP, their challenges and on the recommendations for improving their management, implementation and delivery and supports the goal of helping to improve the current success rates. In addition, the study also identified sixty-five new challenged factors and thirty-one recommendations that are to be considered by LSCITP stakeholders and practitioners as part of the efforts to support the successful implementation of LSCITP that has not been covered or sufficiently articulated in previous research studies and it provides an examination of these new factors in the context of LSCITP implementation and delivery. One of the significant outcomes from the study was that the findings identified that the challenges of LSCITP are not limited by geographical boundaries and are instead a global phenomenon.

The outcomes of the findings by the study have also helped to identify that changes are required in the way LSCITP are implemented and delivered to improve their outcomes and increase success rates. The findings have also indicated that the challenges encountered in the implementation and delivery of LSCITP presents an opportunity to not only understand the factors responsible for their poor performance but also to develop the required solutions and mitigating strategies to address these challenges and also help to reduce the failure rates thereby leading to an increase in successful outcomes.

Equally, amongst the value and the contribution of the study is that it allows LSCITP stakeholders to better understand and visually comprehend the complexity of the challenges of LSCITP. This study complements existing research by providing a conceptual schema for LSCITP that identifies knowledge areas and provides new insights into their implementation and delivery that allows LSCITP stakeholders to improve the current understanding, management, implementation and delivery of LSCITP thereby contributing to improving current success rates. This includes providing recommendations for LSCITP practitioners to assist with reshaping LSCITP implementation and organisational strategies in achieving defined LSCITP objectives.

The outcome of this research study and the results obtained helps to contribute to the existing body of knowledge within the IT, software engineering and project management domains thereby expanding the current sets of increasing literature on LSCITP and LSCITS. Primarily because there are limited studies that have performed a detailed examination and analysis of both successful and failed LSCITP collectively. Additionally, the research provides practical solutions and recommendations reflecting the collective insights and experiences of practitioners who have undertaken the implementation and delivery of LSCITP successfully. Furthermore, the results provided should assist in the understanding of the current challenges faced in managing, implementing and delivering large complex technology and engineering projects successfully in the current age.

10.4 RESEARCH LIMITATIONS

Though this research is primarily focused within the IT/IS domain and heavily related to large complex IT systems and projects, the resulting outcomes should not limit the study to this domain as the results obtained are also applicable to other related industries where similar large-scale implementations are being undertaken. For example, the engineering and construction domains share certain similarities with the IT/IS domain where some of the challenges experienced with LSCITP are also being experienced.

The dataset gathered and explored in this study was applicable and suitable for the data gathering methods applied which was primarily through the use of expert interviews and case studies. However, running the same interview instrument and data gathering process via other methods of data gathering for example, through the use of questionnaires and survey could help provide a larger data set that can then be statistically analysed to identify patterns, correlations and other statistical tests. Equally, the number of data gathered during the interview process could possibly impact the ability to generalise the findings or limit the generalisability of the study when further drill downs, relationships, correlations and trends into the data set is required using a statistical process.

The majority of the LSCITP examined in the study originated from the United Kingdom which is the primary research base of the researcher. There could be an argument made on region bias, particularly where culture and local contexts might exert a possible influence on the implementation and delivery process or project environments of LSCITP. However, the data gathered spans multiple countries and some projects were implemented over multiple regions and locations and therefore the LSCITP examined reflects a global view of the challenges of LSCITP, so any possible bias was significantly mitigated and reduced.

A limited number of the expert interviews were conducted via video conferencing platforms due to geographical location challenges between the interviewer and the interviewee. The same interview process that was applied to face to face interviews was replicated for the interviews performed via video conferencing. The use of a technology platform might provide a minimal variation in the interview settings, conditions and discussions held, however, any variation is seen to have a minimal effect since the same formal process and conditions were replicated in these interview settings.

10.5 FURTHER RESEARCH

In conducting this research, several other areas were identified for further research. Firstly, the study examined a set of 37 *Challenged* and 19 *Successful* LSCITP that it was able to obtain detailed data on during the research. As part of the future expansion of the study and future research on LSCITP successes and failures, the dataset can be further expanded to cover a wider set of LSCITP across an increased geographic boundary. In particular, more data is required on LSCITP from the private sector where the implementations of LSCITP are more frequent and where the resulting outcomes of such projects are not always visible or provided. In addition, future research into LSCITP can also look to address the areas of value realisation and how to measure and quantify the impacts and lost values of challenged and failed LSCITP.

A research diving deep into LSCITP leadership, governance and management will also be valuable and enable a more detailed assessment of the management challenges and failures and the decision-making processes including the systems of governance established for LSCITP and how they impede these undertakings. The findings can provide valuable insights on how to improve the management of these projects. Furthermore, future research can also consider conducting detailed examination of the similarities and differences between the different types of LSCITP across different industry domains to better understand their performance and outcomes and to determine if there are other sets of challenges inherent in the implementation and delivery of LSCITP that can be identified.

Moreover, the outcomes identified in this study can support researchers within the domains of large complex IT projects, major programme management, complex programme management and large-scale complex systems and can be used as the foundation from which to build and develop further theories and hypothesis or conceptual models relating to the understanding of these undertakings and how to improve their performance and outcomes. The recommendations and proposed solutions from participants in the study including the outcomes from the case studies can also form the starting point for further research and expansion into those specific areas.

Further research can also be conducted to help to focus on the deeper exploration of specific key areas of LSCITP for example, the front-end processes, and the project management processes to improve the current understanding and seek improvements into their planning, management, and execution. Additionally, future research can also help to expand on some of the additional themes that surfaced during this study these areas include optimism bias, strategic misrepresentation, external factors, change management and project management methodologies.

Future research could also be conducted via specific case studies that include the use of an observational approach of an LSCITP right from its inception through to its implementation and to its conclusion as this will provide an opportunity to gain a detailed insight into the internal and external environments of a LSCITP, front its front-end to its back-end and identify and understand the set of challenges encountered right through its journey and to uncover other inherent yet undiscovered challenges that contribute both to successes and failures equally. Others have urged that a case study approach offers a more suitable process by which to undertake future research into LSCITP giving their large-scale and complex nature and as a result of how unique each LSCITP is (Kipp, Riemer and Wiemann, 2008).

With regards to the developed conceptual domain model, the domain model can help to provide a groundwork for future research work. Future research can look to expand on the domain model by refining the model and translating the model into a tool or a toolset targeted or focused at supporting the various aspects of the management of large-scale complex IT projects. The use of domain models provides a commonly used approach to support software tool design particularly as they help to capture the requirements of the problem domain (Tanriöver and Bilgen, 2011) and are central to software design (Evans, 2003) and can, therefore, help to support the development of an application/tool more easily. For example, the development of tools incorporating the domain model could be targeted at LSCITP workflows, processes or administration and the resulting solutions can help to support LSCITP stakeholders and practitioners across several phases involved in the management of LSCITP.

Furthermore, further research to be undertaken on the back of the work carried out in this study will look to expand further into the challenged assessment framework developed to focus on its implementation and evaluation and the communication of its value to LSCITP stakeholders and practitioners via publications in applicable academic journals.

These further research suggestions will help to support the overall objectives of identifying the problems with LSCITP and offer knowledge on how to improve the implementation and delivery of future LSCITP undertakings. The research suggestions will also help to contribute to new ways of understanding and improving the implementation and delivery of large-scale major technology projects and contribute towards their assurance process, they are highly beneficial and should be continued.

Having said that, amongst the key challenges for further research will be on how to demonstrate that the remedial actions proposed in current research outcomes are effective and applicable on future LSCITP while putting into context the constant technological advancements and how this applies to the nature of future LSCITP being undertaken.

10.6 RESEARCH IMPLICATIONS

The increasing poor performance and failures of LSCITP could have a threatening effect on organisations involved and the economy particularly in an era where increasing numbers of LSCITP are being initiated and implemented more than ever before. Thus, it is extremely important to understand and learn lessons on past failures to drive the success of future initiatives. There is a challenge to be addressed with regards to whether LSCITP stakeholders and practitioners learn effective lessons from the implementation failures of past LSCITP undertakings to improve future LSCITP outcomes. These issues have been called out by Denker (2007) as contributory factors to continued large-scale IT project failures.

While the research focuses on LSCITP primarily within the IT/IS domain, the findings and outcomes are equally applicable to other industry domains particularly other engineering disciplines such as engineering, construction and other related sectors where large-scale complex initiatives are being undertaken. Equally, there is a dearth of research in existing studies on identifying, analysing and understanding the characteristics of LSCITP, their challenges, the management challenges they present including assessing areas such as implementation challenges, performance challenges, benefits realisation, value realisations and risks inherent, this study has attempted to address these research challenges to a degree.

There are also challenges identified for the academic community as well with regards to the ongoing and continued research on LSCITP and strong collaboration is required between academia, industry organisations and industry practitioners to help provide amongst other things a suitable environment with similarity to the real-world LSCITP environments available in industry that fully replicates the challenges experienced on LSCITP more accurately and where industry and academic research on real LSCITP can be carried out and an environment where LSCITP can be studied and examined more effectively that facilitates the study of the performance and behaviour of LSCITP experimentally. Such collaboration can be a rewarding source of significant knowledge of LSCITP. The need for strong involvement and collaboration across academia and the industry is that the academic environment alone cannot fully depict the real-world environments of LSCITP and cannot provide the full-scale level of experience, expertise and environments required as part of the efforts to understand their challenges.

Although this study provides specific evidence, outcomes and recommendations for addressing some of the identified challenges of LSCITP and on how to improve their outcomes, there is a prospect that the findings and outcomes from this study and indeed from other similar studies will not be adequately adopted by LSCITP practitioners and stakeholders due to the lack of adequate knowledge mobilisation and integration processes within organisations to support the knowledgeability of practitioners and stakeholders on improving awareness of current research outcomes for large complex programmes particularly within the IT/IS domain. To that end, this research is intended to be published in leading academic journals and presented at IT/IS, project management, software engineering, and major programme management conferences to help disseminate the findings for LSCITP stakeholders and practitioners.

The proliferation of failures of LSCITP suggests that significant amounts of efforts are required to better understand the determinants of failures and provide solutions to remedy such failures and guide LSCITP towards a more successful outcome and provide solutions that are repeatable across different variants of large-scale, complex initiatives. These increased understanding will support the efforts to respond to rapidly changing business environments, economic circumstances, competition, regulation, etc. and other driving factors within the context of LSCITP.

10.7 RECOMMENDATIONS

Growing numbers of LSCITP are being implemented and the ubiquitous and evolving nature of technology has meant that new research is needed more frequently to help address and understand the on-going challenges of LSCITP implementations in line with technology advancements. This is critical because the pervasive nature of technology is now a key determiner of success and one of the biggest factors that have a significant impact on the outcome of an LSCITP implementation.

This study has broadened the existing knowledge on current management and implementation processes to enhance and improve the implementation and delivery of LSCITP and the results obtained from the study should provide a level of increased confidence for LSCITP practitioners and stakeholders as the findings including the ideas, strategies and solutions proposed can significantly help to improve the performance and outcomes of their current and future LSCITP undertakings.

In particular, the understanding of results of the study and the practical applicability of the recommendations provided where understood and applied, should enable a targeted support approach that can assist LSCITP implementations that are challenged and are at risk of failure and provide required feedback to help improve and recover their implementation and delivery and help to improve delivery reliability.

Collectively, the work efforts in this study will help to contribute to the desired future for the technology industry where significant value and millions of dollars are being wasted through lost opportunities from LSCITP undertakings. It will help contribute to a world where the implementation and delivery of LSCITP initiatives are better understood, where the implementation and delivery of LSCITP can be assured and where extensive theoretical and practical knowledge, experiences and understanding gained on their successes and failures can be used to develop the required frameworks, methodologies, tools, processes and techniques to help address the set of challenges identified and also help to ensure LSCITP can be implemented and delivered more successfully. Reaching this desired future for LSCITP will require more fundamental research studies particularly those based on practical real-world case studies that can help to uncover and address known and unknown current and future challenges.

There are a wide range of methodologies, frameworks, procedures, processes, tools and techniques available to help guide and support the implementation and delivery of large complex initiatives however, the value of these tools, methodologies, frameworks and processes can only be gained if the underlying causes of challenges and determinants of failures are understood and more importantly, what LSCITP practitioners are able to learn from them. As highlighted by Hughes, Rana and Simintiras (2017, p.142) "there is still much to do in the context of a better understanding of how failure occurs, what can be done to further improve project outcomes and the development of models and frameworks that can highlight potential areas of failure early in the lifecycle". It is also equally important that the frustrations experienced with extricating valuable lessons from existing research on LSCITP failures are addressed equally so that collectively organisational and industry-wide learning and knowledge mobilisation processes on LSCITP can be significantly improved.

For organisations seeking to implement or undertake LSCITP or large-scale complex initiatives, learning lessons on successes and failures from previous similar undertakings should be a critical component part of their implementation and delivery process and project management processes. The failure by stakeholders and practitioners to learn lessons from past LSCITP failures could lead to the failures of current and future LSCITP initiatives when previous mistakes are repeated (Hughes, Rana, and Simintiras, 2017). As highlighted by (Dalcher and Genus, 2003, p.404), "learning from a failing project is costly. Failing to do so is even worse!".

As identified from this research and prior research, implementing and delivering LSCITP is a challenging process, LSCITP is inherently more complex than other IT project undertakings and there is currently no silver bullet that can guarantee their successful implementation and delivery. In expressing the fears shared by participants from the study, these LSCITP initiatives introduce significant innovations particularly from a technology perspective and they also bring about significant changes into their respective environments and equally to any other connected environments. LSCITP inevitably involve massive transformation initiatives that can radically change an organisation and its internal and external structures, and they introduce such large-scale changes over a relatively short timeframe. These fears expressed by participants is backed up by prior research that has established a link between the implementation of large-scale project initiatives and the resulting changes to organisational frameworks (Miller and Hobbs, 2005). Additionally, existing research also suggests that large-scale initiatives that are properly integrated into organisational frameworks tend to deal with challenges much better in comparison to initiatives that are not (Miller and Hobbs, 2005). As a result, LSCITP undertakings should signal a cautionary note to key stakeholders and practitioners alike. Additionally, LSCITP should also signal a notice of warning to stakeholders of the possible occurrence of challenges particularly on the specific challenging areas identified in the study. Previous research on large-scale project failures has suggested that their failures are completely avoidable and predictable (Denker, 2007; Charette 2005). Others have suggested that the early detection of challenges on LSCITP means that these issues can be sufficiently addressed, and their possible failures prevented (Fridgen, *et al*., 2014).

The need for modern technology solutions and systems and other outcomes derived from the LSCITP undertakings like the examples explored in this study is undeniable, the benefits they provide is unquestionable, and the impact and benefits they provide are far-reaching. However, continued research into the challenges being experienced and on the poor performance of LSCITP to improve our understanding is highly important (Gemino, Reich and Sauer, 2007) to address the causes of failures and to help improve and increase success rates and deliver value for stakeholders.

LSCITP are different to most IT project undertakings and the stakes are very high particularly giving the high degree of complexity involved. LSCITP management, implementation and delivery is therefore undeniably a challenging process and it is very important that stakeholders and practitioners learn, understand and apply lessons learned from past failures and lessons identified in studies like this one so that they are better prepared to respond and address the challenges that may arise and overcome the obstacles faced on LSCITP implementations.

Finally, effectively managing, implementing and delivering LSCITP successfully requires an adaptive, customisable, repeatable, consistent, measurable and tailored processes and procedures informed through research and experiences that can be applied to help to address and manage the challenged factors across key knowledge areas and mitigate their risks and impact on LSCITP outcomes. A result which will enable stakeholders to gain the required clarity on outcomes and assurance and also allows them to secure the required value from investments into LSCITP initiatives because the ability of stakeholders to maximise the value of the investments in LSCITP now relies heavily on the ability to manage, implement and deliver them successfully.

APPENDIX

Appendix A

A.1 INTERVIEW GUIDE

The interview instruments used as part of the data capture activities for this study is attached in the appendix below.

An Empirical Investigation into the Challenges and Failures of Large-Scale Complex Information Technology Projects

Dear Participant,

At University College London (UCL), we are conducting a research project to understanding the challenges of large-scale and complex technology projects, and to understand the reasons why they fail far too often.

Your participation in this study is greatly appreciated, and you are requested to review the sections below to support your decision to participate in this academic research study.

Research Purpose

This research explores the issues relating to the challenges, difficulties, complexities and failures inherent in the implementation and delivery of large-scale complex information technology projects (LSCITP). The research looks to seek an understanding of the reasons why nearly all LSCITP run into difficulties and end up being severely challenged, and why many fail to deliver value for their stakeholders.

Additionally, the research study is also looking to develop a methodology to support the implementation and delivery of these major technology projects.

Participant Information

Participation in this research study will help to make a significant contribution to improving the knowledge and the understanding of the challenges facing large-scale complex IT projects. Your participation is being sought because you have been identified as a "subject matter expert" or an individual with significant experience in the domain of large-scale technology project management and implementation and your contributions will be invaluable to assist with the understanding of how large-scale complex IT projects can be delivered more successfully.

The data gathered during the course of this study will be used strictly for academic research purposes, and all responses received will be kept anonymous and confidential. Please note that no personal information is being collected in the course of this study.

Participants who wish to obtain a copy of the research findings will be asked to provide their name and email address at the end of the process in order for a research findings report to be sent to them upon the completion of the research.

Duration

There are a number of discussion points and about thirty questions that will be discussed in total. The interview should take around one hour to ninety minutes to fully complete.

Contact Information

Should you have any comments or questions, please feel free to contact the author of this research using the contact details provided below:

Email: meshach.bolutiwi.14@ucl.ac.uk
Telephone:

Thank you for taking time out to participate in this research study.

Meshach Bolutiwi

Appendix B

B.1 INTERVIEW INSTRUMENT

The interview instrument used as part of the data capture activities for this study is attached below.

The Challenges of Managing Large-Scale Complex Information Technology Projects

Data is being gathered on projects that have Information Technology (IT) as a fundamental part of the project. For example, projects that make strong use of IT or are based on the implementation and delivery of IT artefacts, solutions, and services, etc.

The data being gathered here is regarding any recently completed IT project, whether successfully completed, challenged or abandoned. Please see the definitions of *Successful Challenged* and *Abandoned* below. The study relates to an IT project that you were directly connected to in either a business or IT capacity.

This research uses the definitions below to classify a completed project:

- **Successful**: *Successful LSCITP are viewed as projects that have met their defined success criteria and defined objectives and have been completed on schedule, completed on budget and have met specified requirements including the objectives of the projects being achieved and the projects meeting the minimum criteria of satisfaction of the stakeholders concerned. This definition also includes projects meeting the defined success criteria described above but also those that experienced minimal delays to schedule, minimal increase in scope and minimal budget overruns with minimal changes to outcomes but still managed to achieve their intended outcomes and met the majority of their required objectives.*
- **Challenged**: *Challenged LSCITP are viewed as projects that have failed to meet their defined success criteria or defined objectives, including projects that have significantly overran on budget, and have either been delivered significantly behind schedule or have been partially delivered. This definition also includes projects that have had to be scaled back from their original objectives.*
- **Abandoned**: *Abandoned LSCITP are viewed as projects that meet the definition of challenged above and includes projects that have failed to deliver a solution or required outputs as a result of being severely challenged that they have been unable to meet defined objectives or have been cancelled or abandoned.*

Was the large-scale complex IT project in context SUCCESSFULLY COMPLETED, CHALLENGED or ABANDONED? *Please provide your response taking into account the definitions provided above (see cover sheet).*		
#	**Category**	**Response**
Q1	Abandoned	Yes/No
	Challenged	Yes/No
	Successful	Yes/No

In the discussion on the following LSCITP Challenged Knowledge Areas and their contribution to the OUTCOME of the project in context, please discuss and specify the degree to which you agree with each of the areas that follow below.		
#	**Category**	**Response**

Q2	Mission, Goals and Objectives	Please see Q2.1
	Requirements Engineering	Please see Q2.2
	Engagement Management	Please see Q2.3
	Technical and Operational Expertise	Please see Q2.4
	Planning	Please see Q2.5
	Budget Management	Please see Q2.6
	Schedule Management	Please see Q2.7
	Scope Management	Please see Q2.8
	Technology	Please see Q2.9
	Leadership, Governance and Management	Please see Q2.10
	Communications Management	Please see Q2.11
	Monitoring and Control	Please see Q2.12
	Risk Management	Please see Q2.13
	Execution and Delivery	Please see Q2.14

MISSION, GOALS & OBJECTIVES: The project's objectives and goals and deliverables were clearly defined along with a clearly defined business case. The objectives were also regularly reviewed during the lifecycle.
Please consider the following factors for this category (see accompanying sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, discuss the degree to which you agree with the performance of the MISSION, GOALS & OBJECTIVES aspects in the context of this project below.

#	Category	Response
Q2.1	<Agree>	
	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

REQUIREMENTS ENGINEERING: The project's requirements were clearly defined. The requirements were reviewed regularly. Requirements were unambiguous and prioritised accordingly.
Please consider the following factors for this category (see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to which you agree with the performance of the REQUIREMENTS ENGINEERING aspects in the context of this project below.

#	Category	Response
Q2.2	<Agree>	
	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

ENGAGEMENT MANAGEMENT: End users and key project stakeholders were fully engaged throughout the project's lifecycle.
Please consider the following factors for this category (see the accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, discuss the degree to which you agree with the performance of the ENGAGEMENT MANAGEMENT aspects in the context of this project below.

#	Category	Response
Q2.3	<Agree>	

	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

TECHNICAL & OPERATIONAL EXPERTISE: The project teams had relevant technical and technology and operational expertise and relevant experience to undertake the project implementation.
Please consider the following factors for this category (see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to which you agree with the performance of the USER TECHNICAL & OPERATIONAL EXPERTISE aspects in the context of this project below.

#	**Category**	**Response**
Q2.4	<Agree>	
	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

PLANNING: The project planning was adequate with clear milestones, estimates and phase deliverables. The planning took into account the scope, schedule, and resources. Project deadlines were realistic.
Please consider the following factors for this category (Please see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to which you agree with the performance of the PLANNING aspects in the context of this project below.

#	**Category**	**Response**
Q2.5	Agree	
	Disagree	
	Neither Agree nor Disagree	
	Strongly Agree	
	Strongly Disagree	

SCHEDULE MANAGEMENT: The project schedule was realistic and accurate. The schedule took into account the project's scope and resources.
Please consider the following factors for this category (Please see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to which you agree with the performance of the SCHEDULE MANAGEMENT aspects in the context of this project below.

#	**Category**	**Response**
Q2.6	Agree	
	Disagree	
	Neither Agree nor Disagree	
	Strongly Agree	
	Strongly Disagree	

BUDGET MANAGEMENT: The initial cost estimates for the project were realistic. The project's budget was committed and realistic. Ongoing reviews were performed.
Please consider the following factors for this category (see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to which you agree with the performance of the BUDGET MANAGEMENT aspects in the context of this project below.

#	**Category**	**Response**

Q2.7	<Agree>	
	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

SCOPE MANAGEMENT: The project's initial scope was clearly defined. Changes to the project's scope were managed effectively while taking into account the impacts of scope change on the project.
Please consider the following factors for this category (see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to which you agree with the performance of the SCOPE MANAGEMENT aspects in the context of this project below.

#	**Category**	**Response**
Q2.8	<Agree>	
	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

TECHNOLOGY: The technologies used within the project were mature and suitable. The high use of disparate and evolving technologies was minimal. The technologies used were well understood, and all technologies were interoperable where applicable.
Please consider the following factors for this category (see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to which you agree with the performance of the TECHNOLOGY aspects in the context of this project below.

#	**Category**	**Response**
Q2.9	<Agree>	
	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

LEADERSHIP, GOVERNANCE & MANAGEMENT: The leadership of the project was satisfactory, and the project had the required level of Top Management support throughout the project's lifecycle. Management commitment and support to the project objectives extended to areas including the scope, schedule, and resources.
Please consider the following factors for this category (see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to which you agree with the performance of the LEADERSHIP, GOVERNANCE & MANAGEMENT aspects in the context of this project below.

#	**Category**	**Response**
Q2.10	<Agree>	
	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

COMMUNICATIONS MANAGEMENT: There was a clear and active communication with all relevant parties/stakeholders throughout the project's lifecycle. An effective stakeholder management process was in place.
Please consider the following factors for this category (see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to

which you agree with the performance of the COMMUNICATIONS MANAGEMENT aspects in the context of this project below.

#	Category	Response
Q2.11	<Agree>	
	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

MONITORING and CONTROL: - A comprehensive monitoring and control process was carried out at each stage of the project's implementation to help monitor and control the project's progress.
Please consider the following factors for this category (see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to which you agree with the performance of the MONITORING and CONTROL aspects in the context of this project below.

#	Category	Response
Q2.12	<Agree>	
	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

RISK MANAGEMENT: Risk management was performed on the project, and the level of risk management carried out on the project was detailed and satisfactory.
Please consider the following factors for this category (see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to which you agree with the performance of the RISK MANAGEMENT aspects in the context of this project below.

#	Category	Response
Q2.13	<Agree>	
	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

PROJECT EXECUTION & DELIVERY: - The project management, execution and delivery was adequate. An effective change control process was implemented to help manage changes to scope, cost, and schedule. Roles and responsibilities were adequately defined.
Please consider the following factors for this category (see accompanying Evaluation Criteria sheet) and the degree of contribution to the specified OUTCOME of the project. Finally, specify the degree to which you agree with the overall performance of the PROJECT EXECUTION & DELIVERY aspects in the context of this project below.

#	Category	Response
Q2.14	<Agree>	
	<Disagree>	
	<Neither Agree nor Disagree>	
	<Strongly Agree>	
	<Strongly Disagree>	

Was the LSCITP project a PUBLIC-sector project or was it a PRIVATE sector project		
#	**Category**	**Response**
Q3	<Public Sector>	Yes/No
	<Private Sector>	Yes/No
	<Do not know/Other>	<Specify>

Which of the following implementation CATEGORIES best describes the project that was implemented? Please indicate all the categories that the project falls under		
#	**Category**	**Response**
Q4	Software Development/Product Development	<Select>
	Enterprise Web Application Development	<Select>
	Enterprise Resource Planning (ERP) System	<Select>
	Supply Chain Management (SCM) System	<Select>
	Human Resources Management (HRM) System	<Select>
	Management Information System (MIS)	<Select>
	IT Infrastructure Project (*e.g. Hardware, Networks, Data Centre, Databases, Cloud Computing, etc*.)	<Select>
	IT Integration Project (e.g. Systems Integration Projects etc.)	<Select>
	Data Warehousing/Data Migration Project	<Select>
	IT Services Project (ITS)	<Select>
	Application Development Project	<Select>
	Application/Infrastructure Migration Projects	<Select>
	Other	<Please specify>

In what COUNTRY was the majority of the project's activities based/performed?		
#	**Category**	**Response**
Q5	<Country>	<Select Country>

What was the overall implementation DURATION of the project?		
#	**Category**	**Response**
Q6	<Less than 1 Year>	<Choose>
	<1 Year>	<Choose>
	<2 Years>	<Choose>
	<3 Years>	<Choose>
	<4 Years>	<Choose>
	<5 Years>	<Choose>
	<More than 6 Years>	<Choose>
	<Do not know/Other>	<Please specify>

Which of the following best describes the target INDUSTRY sector of the project?		
#	**Category**	**Response**
Q7	<Select Industry>	<Specify Industry>

What was the project's approximate BUDGET (USD)? Please specify the budget for the entire project.
Please specify the budget for the entire project.

#	Category	Response
Q8	About 5 Million	
	About 10 Million	
	About 15 Million	
	About 25 Million	
	About 50 Million	
	About 100 Million	
	Between 100 to 200 Million	
	More than 200 Million	
	Do not know/Other	<Please specify>

When was the Green-Light decision for the project made?
Green light in this context refers to when the go-ahead to implement the project was made. Please specify the year this decision was made.

#	Category	Response
Q9	<Specify Green-Light Year>	

What was the project's initial estimated implementation DURATION?
Please specify the initial estimated implementation duration of the project from greenlight to delivery.

#	Category	Response
Q10	<1 Year>	
	<2 Years>	
	<3 Years>	
	<4 Years>	
	<5 Years>	
	<More than 6 Years>	
	<Other>	<Please specify>

What was the project's TEAM SIZE?
Please specify the estimated number of people working on the project full-time during its peak period, including key contributors that were critical to the project.

#	Category	Response
Q12	<Specify Team Size>	

How many other ORGANISATIONS were involved in the project implementation and delivery besides your organisation?
Please provide the list of all organisations involved in the project including consultancies, vendors, partners and other third-party entities that the project depended on for inputs, etc.

#	Category	Response
Q13	<Specify Number of Organisations>	

What was the level of the TECHNICAL COMPLEXITY of the project?
Technical complexity includes technical or technology-based complexities e.g. number of technologies involved, number of technical interfaces, number of components, use of modern/cutting edge technologies etc.

#	Category	Response
Q14	Low Complexity	<Specify>
	Medium Complexity	<Specify>

	High Complexity	<Specify>
	Very high Complexity	<Specify>
	Do not know/Other	<Specify>

What was the level of the MANAGEMENT COMPLEXITY of the project?
Management complexity refers to the organisational and business areas of the project such as team size, management structure, number of interested parties (e.g. vendors, suppliers, business units), requirements complexity, volatile project environment, issues with time and cost, politics etc.

#	**Category**	**Response**
Q15	<Low Complexity>	<Please specify>
	<Medium Complexity>	<Please specify>
	<High Complexity>	<Please specify>
	<Very high Complexity>	<Please specify>
	Do not know/Other	<Please specify>

How many STAKEHOLDERS were involved in the project?
Please specify the total number of project owners, sponsors, accountable executives, etc. that were involved in the project.

#	**Category**	**Response**
Q16	<Number of Stakeholders>	<Please specify>

What was your role on the project?
Please specify the set of roles and your involvement on the project.

#	**Category**	**Response**
Q17	<Team Lead>	
	<Manager>	
	<Executive>	
	<Senior Manager>	
	<Programme Manager>	
	<Management/C-Level>	
	<Programme Director>	
	<Project Manager>	
	<Programme/Project Owner>	
	<Senior Executive>	
	<Consultant>	
	<Other Direct Roles>	[Please specify]

From a SCHEDULE perspective, the project was…

#	**Category**	**Response**
Q18	Ahead of schedule	
	On target against initial schedule	
	Behind schedule	
	Significantly behind schedule	
	Do not know / Other	<Please specify>

If the project was behind SCHEDULE, how late was the project against its initial SCHEDULE?
Please provide the number of years and months that the project fell behind schedule.

#	**Category**	**Response**

Q19	<Years>	
	<Months>	

From a SCOPE perspective, did the project had…

#	Category	Response
Q20	Less scope than initially specified	
	Same scope as initially specified	
	More scope than initially specified	
	Significantly more scope than initially specified	
	Do not know / Other	<Please specify>

If the project added more SCOPE, approximately how much additional scope was added to the project?
Please specify the percentage increase in scope relative to the original specification.

#	Category	Response
Q21	<Additional Scope>	<Please specify>

What was the dominant project management METHODOLOGY used during the project's life-cycle?

#	Category	Response
Q22	Agile/Scrum	
	PRINCE2	
	Waterfall	
	PMI/PMBoK	
	Rapid Application Development (RAD)	
	Bespoke Methodology	
	Do not know / Other	

Where there external circumstances that had a significant impact or caused a delay to the project?

#	Category	Response
Q23	<Yes – Minor>	
	<Yes – Major>	
	<None>	
	<Not Sure>	

On reflection, do you feel you were overly optimistic about the project's likely outcomes at the start of the project, overestimating the benefits and underestimating the risk or costs involved?

#	Category	Response
Q24	<No>	
	<Yes>	

From a BUDGET perspective, was the eventual project cost…

#	Category	Response
Q25	<Under the initial budget>	

	<Same as the initial budget>	
	<Over the initial budget>	
	<Significantly over budget>	
	<Do not know / Other>	

If the project EXCEEDED its initial budget, by how much did it exceed the Budget? *Please specify the percentage (%) figure by which the project exceeded its initial budget estimates.*		
#	**Category**	**Response**
Q26	<Specify Percentage>	

From a QUALITY and TECHNICAL PERFORMANCE perspective, did the project...		
#	**Category**	**Response**
Q27	<Deliver less quality than initially specified?>	
	<Meet the quality levels that was initially specified?>	
	<Deliver more quality than initially specified?>	
	<Do not know / Other>	

If the project delivered less QUALITY, by how much? *Please specify the percentage (%) by which the project delivered less quality than initially specified*		
#	**Category**	**Response**
Q28	<Specify Percentage>	

From an organisational perspective, were all the project GOALS and OBJECTIVES was achieved? *Below are a number of statements about how well the resulting outcomes from the IT initiative met the defined objectives. Please discuss how well you agree or disagree with the following statements.*		
#	**Category**	**Response**
Q29	From an organisational perspective, all the project's GOALS and OBJECTIVES was achieved?	[Agree] [Disagree] [Neither Agree nor Disagree] [Strongly Agree] [Strongly Disagree]
	Will the PRODUCTS, SOLUTIONS or SERVICES created out of the project be used or fully utilised?	[Agree] [Disagree] [Neither Agree nor Disagree] [Strongly Agree] [Strongly Disagree]
	Will the PRODUCTS, SOLUTIONS or SERVICES created from the project contribute to increasing organisational strategy, competitiveness, effectiveness and growth?	[Agree] [Disagree] [Neither Agree nor Disagree] [Strongly Agree] [Strongly Disagree]
	From the CLIENT (e.g. business owner/stakeholders/sponsors) point of view, did the project achieve all of the defined requirements and they were satisfied overall with the outcome?	[Agree] [Disagree] [Neither Agree nor Disagree] [Strongly Agree] [Strongly Disagree]

Open-Ended: From your perspective, what were the key challenges faced during the implementation of the project?		
#	**Category**	**Response**
Q30	Discussion	<Response>

Open-Ended: Can you give some examples of processes or solutions or actions (if any) that was applied to address some of the challenges encountered during the implementation of the project?		
#	**Category**	**Response**
Q31	Discussion	<Response>

Open-Ended: From your perspective, what went well during the implementation of the project?		
#	**Category**	**Response**
Q32	Discussion	<Response>

Open-Ended: Do you have any other points that you would like to discuss?		
#	**Category**	**Response**
Q34	Discussion	<Response>

Appendix C

C.1 EVALUATION FRAMEWORK

The "evaluation criteria" document supporting the interview sessions is attached below.

Domain Categories	Identified Factors	Source	
		Literature	Case Study
Mission, Goals and Objectives	Lack of clearly defined goals and objectives or business case	x	x
	Lack of clearly defined business case	x	x
	Lack of regularly validated and reviewed business case		x
	Unclear business goals and objectives		x
	Significant volatility in delivery objectives and project's implementation roadmap		x
	Lack of clearly articulated and validated goals and objectives		x
	Failures in benefits and value realisation processes and ongoing value and benefits assessments		x
	High-level business cases defined with missing low-level details		x
	Lack of adequate definition and regular updates to low-level objectives and business cases		x
	Lack of clarity on expected short and long-term benefits realisation		x
	Lack of adequate understanding of business cases and adequate dissemination of business case across project organisational structures		x
Requirements Engineering	Lack of appropriate functional requirements	x	x
	Requirements volatility	x	
	Business process re-engineering	x	
	Misunderstanding of the requirements	x	x
	Complex requirements	x	
	Abstract requirements	x	
	Lack of detailed business requirements		x
	Poor requirements analysis and definition		x
	High-level requirements and specifications		x
	Lack of stable and valid business requirements		x
	Conflicting business requirements		x
	Lack of user involvement and commitment	x	

Engagement Management	Lack of adequate user engagement	x	
	Lack of effective client consultation	x	
	Lack of top management commitment and support	x	
	Lack of "end-user" involvement and engagement	x	x
	Lack of adequate stakeholder and end-user involvement and engagement		x
	Lack of adequate engagement across various business functions and with end-users and third-parties		x
	Lack of a methodical and coherent approach to engagement management		x
Technical and Operational Expertise	Lack of technical know-how, skills and required domain knowledge	x	x
	Quality assurance issues	x	
	Lack of relevant large-scale project management experience	x	
	Lack of understanding of complexity	x	
	Lack of technical expertise and competency for complex solution delivery		x
	Lack of relevant management experience and implementation expertise		x
	Lack of technological know-how in architecture and solution design of complex systems and solutions		x
	Lack of required knowledge and expertise of technology and managing large-scale technology projects		x
	Lack of required training and knowledge and expertise on technology solution design and complexity		x
	Lack of assessment on organisational and technical capacity		x
Planning	Poor planning	x	
	Lack of adequate planning	x	
	Inaccurate estimates	x	
	Unrealistic planning		x
Schedule Management	Poor estimation	x	
	Schedule problems and unrealistic timeframes	x	
	Unrealistic schedules	x	
	Shorter implementation time-frames	x	
	Schedule delays		x
	Significant delays in schedule and delivery milestones		x
	Lack of understanding and management of priorities		x

Budget Management	Budget management failings and costing issues	x	
	Escalating project costs	x	
	Budget constraints	x	
	Failures in budget management processes		x
	Financial mismanagement		x
	Lack of regular lifecycle assessments of estimated costs vs actual costs		x
	Lack of continuous monitoring and reporting of the impact of changes and decisions on costs		x
Scope Management	Changing scope and objectives	x	
	Significant changes to project scope	x	
	Lack of adequate scope management		x
	Lack of clarity in overall scope during implementation stages		x
	Volatile implementation scope		x
Technology	Use of inappropriate technology	x	
	Use of new or immature technology	x	
	Suitability of technology/technical framework	x	
	Lack of alignment of technology implementation with business objectives	x	
	High use of disparate technologies	x	
	Poor system architecture	x	
	Design errors	x	
	Poor system architecture	x	
	Lack of the understanding of the impacts of new technology on existing business processes		x
	Lack of proper integration and compatibility between new and existing systems	x	
	Technical obsolescence		x
Leadership, Governance and Management	Lack of leadership/effective leadership	x	
	Lack of strategic direction and management of the programme objectives and deliverables;		x
	Poor and ineffective change management	x	
	Lack of responsiveness and resistance to change	x	
	Multiple stakeholder views	x	
	Political environment	x	
	Lack of expectations management and unrealistic expectations	x	
	Lack of resources	x	

	Changes to key stakeholders and stakeholder conflicts	x	
	Lack of "single" project owner	x	
	Lack of adequate an effective governance structures		x
	Poor governance structures and oversight		x
	Lack of a single responsible owner (SRO)		x
	Lack of sustained single responsible ownership, senior management ownership and leadership;		x
	Lack of independent technical assurance on technology solution design and architecture		x
	Lack of a robust programme and project management process		x
	Lack of effective accountability structures		x
	Lack of senior stakeholders with significant technical and technology expertise		x
Communications Management	Poor communication	x	x
	Lack of effective communication		x
	Complex interactions		x
	Lack of adequate and regular communications throughout the implementation lifecycles across all projects tiers		x
Monitoring and Control	Lack of adequate monitoring and control	x	x
	Lack of adequate and effective monitoring and control of implementation and delivery across project lifecycle		x
	Lack of effective monitoring and collaboration between the business and the third-party supplier		x
	Lack of regular assessments of the implementation and delivery progress across the implementation lifecycle		x
Risk Management	Poor risk management	x	
	Lack of adequate and ongoing risk assessment		x
	Lack of effective risk management processes and formalised approach to risk management		x
Execution and Delivery	Poor project management	x	x
	Poor project management processes	x	x
	Lack of an adaptive project management processes	x	
	Inappropriate delivery methodology	x	

	Use of unsuitable software development methodologies	x	
	Insufficient staffing	x	
	Internal and project team conflicts	x	
	The large number of external parties involved	x	
	Lack of effective project management methodology	x	
	Resource volatility	x	x
	High staff turnover of senior and project team personnel		x
	Inappropriate staffing	x	
	Poor stakeholder management	x	
	Poor project team	x	
	Human errors	x	
	Large-scale and complex nature	x	
	Cross-functional and geographically distributed teams	x	
Third-Parties	Dependence on third-parties/contractors/consultants/suppliers	x	
	Failures by external contractors and third-parties	x	
	Loss of key suppliers during programme implementation and delivery		x
	IT supplier problems	x	x
	Lack of proper procurement processes with vendors and suppliers		x
	Number of third party/external entities involved	x	
	Lack of a competitive bidding process	x	x
	Failures in the procurement process	x	x
	Poor contract management		x
	Poor vendor management processes		x
	Lack of a clear statement of obligations on all suppliers engaged and between suppliers		x

Domain Categories	**Identified Factors**	**Source**	
		Literature	Case Study
Other	External Pressures	x	x
	Market and competitive pressures		x
	Unsuitable political environment	x	x
	Political instability and political and external influences		x

	External factors	x	x
	Poor change management	x	x
	lack of effective change management processes		x
	Lack of adaptation to change/technology	x	x

Appendix D

D.1 RECOMMENDATIONS BY KNOWLEDGE AREAS

The summary of the recommendations discussed in *Chapter Seven* are listed in the table below and are mapped to relevant knowledge areas established.

Knowledge Areas	No.	Recommendations
Mission, Goals and Objectives	1	Availability of detailed business cases to help perform an analysis of anticipated costs, expected benefits, understand the value drivers including value propositions and to provide confirmations and validations of defined business goals and objectives
	2	Use of established processes and definitions of specific metrics to assist with the measurement of business cases during implementation and to ensure that stakeholder agreement and alignment is easily obtained on revised business cases
	3	Continuous tracking and monitoring for changes in value forecasts due to resulting changes in business objectives, scope, stakeholders, stakeholder expectations, governance structures, sponsors, end clients and end-users
	4	Implementing LSCITP through the lens of the overall mission, goals and objectives defined for such projects that expresses up to date reality
	5	Regular reviews of LSCITP objectives including assessing value drivers, value propositions, vision, strategy, anticipated benefits and costs and performing business objective assessments and technical feasibility assessments conducted to identify any material changes and any deviations from defined objectives tailored to the scale and nature of LSCITP under implementation
	6	Regular reviews of business cases on a quarterly basis as part of the LSCITP implementation activities
	7	Reviews of business cases and objectives to be conducted ideally semi-annually at a minimum for a very large and complex IT programmes
Requirements Engineering	8	Application of formalised processes or methods for requirements elicitation, facilitation and documentation
	9	Required low-level engagement of all connected business areas, units, end-users and required stakeholders should be performed prior to any high-level strategic decisions and directions being made
	10	Preventing critical request for changes being introduced and approved by stakeholders very late into the implementation phases to help reduce the impact on defined operational readiness plans, risks and the security of the technology solutions being implemented
	11	Regular reviews of business cases with agreements on changing objectives formally secured with stakeholders to support and

		ensure requirements completeness that in turn supports design readiness and in turn supports the implementation and delivery readiness
Engagement Management	12	Monitoring of stakeholder behaviours, engagement and commitment levels during the LSCITP implementation lifecycle
	13	Increasing the levels of stakeholders and end-user engagement, management and commitment during LSCITP implementation lifecycles
	14	Ensuring effective and improved engagement management with business functions, units, end-users and other interested parties to help undertake regular reviews of proposed solutions for reasonability especially considering the solution architectures, technical and operational designs defined and intended system functionalities proposed
	15	Definition of a strategy for effective engagement management to be established early on to govern and guide the engagement and relationship management processes with all relevant stakeholders on LSCITP
	16	Regular reviews on engagement levels with end-users to be conducted to support the comprehension and utilisation of the LSCITP technology deliverables by end-users prior to LSCITP delivery
	17	Ensuring availability and continued availability of committed and influential stakeholders and sponsors throughout LSCITP implementation lifecycle to ensure seamless execution and delivery on all objectives in the scope of implementation
Technical and Operational Expertise	18	Ensuring appropriate levels of LSCITP implementation and delivery skills and capabilities for senior implementation resources including ensuring the significant experience and expertise of core resources connected to the LSCITP implementation and delivery efforts within the project environment while ensuring that resources with the appropriate levels of skills, abilities, experience and domain expertise are embedded within key implementation roles
	19	Embedding highly experienced technology domain experts and subject matter experts across core implementation functions and areas within the LSCITP environment specific and tailored to the technological domain of the implementation
	20	Ensuring a level of significant experience and expertise in the theoretical and practical aspects of LSCITP management, implementation and delivery by senior resources engaged on LSCITP implementations and delivery.
	21	Ensure that implementation leads (*e.g. programme managers/project managers/heads of delivery/delivery directors/delivery leads, etc.*) possess significant experience, expertise, knowledge and skills that spans beyond programme/project management and delivery knowledge to include areas such as technology, business and organisational change, change management, transformation and enablement, business design, leadership, and communications management

Planning	22	Use of formal effort estimation processes and performing validation of defined/provided estimates (where necessary)
Schedule Management	23	Establishing ways of working and defining engagement models with third-parties and external entities engaged on LSCITP implementations to support effective collaborations and engagements during the implementation cycle
Budget Management	-	---
Scope Management	-	---
Technology	24	Use of external audits and assessments where necessary during LSCITP implementations to review technical architectures and perform validations of technical solutions, operational designs and review of capability and capacity to successfully implement and deliver the implementation objectives
Leadership, Governance and Management	25	Ensuring the appointment of a SRO mandated with overall responsibility and accountability for the implementation and delivery of the LSCITP particularly for very large and distributed complex programmes
	26	Undertaking advanced succession planning for core implementation resources and anticipation of resource volatility issues in the governance, management and implementation structures of LSCITP to help mitigate resulting impacts on schedule, costs, governance and accountability, etc.
	27	Establishing and using decision-making frameworks and guiding principles as a basis for critical and effective decision making by steering committees, governance boards, and leadership teams during LSCITP implementations.
	28	Enforcing and ensuring strong and engagement-driven level of leadership to maintain strategic directions of LSCITP and objectives and to help mitigate challenges and negative receptions with frequent changes in objectives and scope
	29	Ensuring the roll down of delivery responsibilities including accountability for the value realisation from the implementations of component parts of LSCITP to the various ownership and responsibility structures of the organisations and business areas involved
	30	Ensuring the setup of effective governance structures to support effective and adequate oversight of LSCITP implementations, establish governance standards and to introduce required levels of transparency and accountability including objectivity and responsiveness and issue management on LSCITP
Communications Management	31	Use of best practice/tailored assessment and evaluation methodologies during the LSCITP implementation lifecycle to gather, assess, monitor and provide visibility and systematic reporting on progress being made towards achieving implementation objectives
	32	Use of improved top-down and bottom-up communication processes during LSCITP implementation phases that is

		supported through using new tools of communication that can be tracked and measured for effectiveness and engagement
	33	Regular monitoring and identification of actual project statuses, project and implementation performances, issues and challenges, risks, expected outcomes in line with progress, results and benefits and the various change processes connected to the embedding of delivered outputs into the target organisations and applicable environments including the communication of derived performance outputs to key stakeholders.
Monitoring and Control		
	34	Establishing a project implementation monitoring database throughout the LSCITP implementation lifecycle that is populated in real-time with ad-hoc, daily and weekly status updates and key reports and metrics across all connected programme/project implementation areas
	35	Ensuring the implementation of enhanced monitoring processes to offer support for the regular measurements, assessments and reporting of the LSCITP performance based on specifically defined Large Project Performance Indicators (LPPI) both unique and generic and tailored to the LSCITP in context
	36	Regular ongoing assessments of the primary organisation delivering LSCITP to ensure that projects and various component parts of the implementation and delivery are being implemented, managed and delivered according to the defined principles on governance, management, goals and objectives, technical and operational expertise and execution and delivery by the stakeholders
Risk Management	-	---
Execution and Delivery	37	Use of Agile delivery methods, frameworks and methodologies in the implementations of LSCITP to help improve and support performance, delivery and outcomes
	38	Use of value realisation parameters as an ultimate measure of success and in measuring LSCITP performance rather than the traditional methods of cost, time and quality
	39	Use of external audit and assurance mechanisms where necessary on LSCITP particularly for very complex programmes to provide an independent perspective and an independent assessment of various elements of the LSCITP implementation and delivery
	40	Use of external audits and assessments where necessary on LSCITP to review management and governance structures, validate operational designs, target operating models, execution and delivery setup and review of capability and capacity to successfully implement and deliver the LSCITP objectives
Third-Parties	41	Forging of productive and healthy relationships with third-parties and external entities engaged during LSCITP implementation and delivery that includes effective communications, individual levels of engagement, joined up

		alignment on objectives and aligned understanding on possible negative outcomes and impacts on reputation and credibility on all parties involved and the understanding of required committed joined up efforts to mitigate these
	42	Ensuring that realistic contracts, statements of work, contractual framework models and commercial models from and with third-parties and service providers reflects the reality of the engagement and is free from optimism bias, uniqueness bias and strategic misrepresentation
	43	Ensuring third-party "fit" during the selection and engagement of third-parties and external entities to help address and mitigate possible issues early on such as cost overruns, schedule delays and poor quality and technical performance by third-parties

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