

**Factors influencing software development in complex IT projects using Agile
approaches – A single telecoms case study**

A Research Paper presented to
The Department of Information Systems

University of Cape Town



By

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In fulfilment of the requirements of the MCom in Information Systems

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ABSTRACT

Customer's needs and wants are forever changing and organisation need to be able to rapidly respond to the shifts in the market coupled with changing customer behaviour. Companies are continuously striving for different and innovative approaches to address these challenges. Several different approaches ranging are used by these organisation which range from incorporating new technologies, developing new products and services, and thoroughly understanding customer needs and requirements.

These approaches require the organisation to adapt and adopt to new ways of working and moving away from traditional project management methods to agile methods. However, this transition gives rise to challenges such as the natural human resistance to change, needing to ensure that staff remain positive during these periods of uncertainty and change, ensuring that the organization does not backslide into its old ways of working (whilst under immense pressure to conform), effectively prioritizing projects and resources, as well as managing the cultural shift required to support these (organisational) changes. Coupled with these various challenges is a steep learning and adoption curve that must be overcome if the newly embedded technologies and processes are to be successfully assimilated into the organization.

Thus it is crucially important that organisation not only understand the benefits associated with transitioning to agile methods, but also those barriers that need to be overcome to ensure a successful transition. Therefore this research is aimed at providing insight into the barriers and benefits associated with transitioning from Traditional Project Management (TPM) methods to agile approaches, specifically in the context of large complex IT projects.

Throughout the study an inductive approach to data analysis was used to categorise the findings into broader themes after which two frameworks were used to interpret these findings. The Technology organisation environment framework (TOE) as well as the Socio-Technical Theory (STT/STS) framework were used to interpret the findings obtained. TOE assisted in analysing the relationships between the organisation, the external environment and the technological environment in which it operates. STT/TSS supported the TOE framework by guiding the analysis of the technical subsystem (agile tools) in conjunction with the social subsystem (employees) within the organisation.

The study included a combination of agile- and non-agile practitioners within a telecommunications organisation, who all had previous experience of working on complex IT projects in a traditional and agile construct.

The research provides insights into those themes that are associated with these barriers, for example poor and ineffective management style being displayed, teams still using a traditional TPM mindset when placed under duress, ineffective agile adoption within the teams, poor change management within the organisation, lack of support from business to enable delivery, and ineffective or unclear roles within teams and management, etc. and also highlighted several benefits to the transitioning which include empowered teams that are able to function autonomously, improved transparency and visibility within teams, improved speed of delivering and improved performance metrics in use within the organisation.

During the course of the research several differing opinions were found which lead to contradicting themes arising as each team witnessed the agile transition and implementation differently, which highlighted areas of future research. For example team autonomy was identified as a benefit to the transition allowing for self-direction but also sighted as a negative theme where teams empowerment is lacking; Traditional Project Management methods still providing improved speed of delivery when compared to agile methods. Other examples include some teams being disempowered with little or no decision-making authority, whilst others were able to self-direct and manage. Measurement metrics had been identified as both an advantage as well as a barrier to successfully transition to agile approaches as some felt the teams were measured effectively, whilst others lamented a lack of appropriate metrics.

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1. INTRODUCTION

Organizations must be able to respond to rapidly changing business requirements, volatile factors in the market as well as changing customer demands in order to sustain the proper level of business growth, whilst still maintaining its customer service levels and without interrupting or destabilizing the organizations' infrastructure. Often it is quite difficult for organizations to change course when these requirements change (Howell, Riedl, & Waco, 2017). These new developments are often challenging and prone to different types of resistance, which can range from general resentment towards a new system, non-adherence to new procedures (by following legacy processes), and apathy as well as passive/active resistance (Lapointe & Rivard, 2005).

Organizations are continuously looking for different and innovative approaches to address these difficulties associated with the rapid responses required to accommodate changing requirements and shifts in the market, and the ever-changing needs of their customers. Approaches used to address these difficulties include activities such as the incorporation of new technologies, the development of new products and services, and through proper identification of customer needs (Queensland Government, 2016) for example. However, the adoption or introduction of new technologies, processes, procedures, or frameworks, give rise to many challenges.

Some of these challenges include the natural human resistance to change, needing to ensure that staff remain positive during these periods of uncertainty and change, ensuring that the organization does not backslide into its old ways of working (whilst under immense pressure to conform), effectively prioritizing projects and resources as well as managing the cultural shift required to support these (organizational) changes (Stanleigh, 2017). Coupled with these various challenges is a steep learning and adoption curve that must be overcome if the newly embedded technologies and processes are to be successfully assimilated into the organization.

These new technologies and processes can only cohesively contribute to the economic growth of an organization, and their associated benefits fully realised, once they (new technologies, processes, or frameworks) are fully diffused and embedded in the organization (Hall & Khan, 2003). Organisations need to be able to respond to rapidly changing business and customer requirements whilst still providing a stable and reliable infrastructure and the operating environment if they wish to remain successful and relevant in the marketplace.

Striving to remain relevant and respond to changing market conditions and customer requirements give rise to short term endeavours, also referred to as projects, to deliver on a specific set of goals or objectives within a set timeframe (Guthrie-Jensen, 2018). If done properly, proper project management and software development practices are some of the key drivers to assist an organization in addressing these challenges and overcoming inherent resistance.

Project management is central to a successful organization, and there are several key tangible benefits to the organization and its people if project management is done successfully aside from the successful completion of software development activities, some of which include the ability to manage budgets effectively and meet project deadlines. There are also some intangible benefits such as allowing for improved risk management, improved teamwork, and improved business processes (Hartman, 2011) if project management principles are applied successfully. Different approaches to project management exist as no organizations or projects are exactly the same with approaches ranging from phased (traditional) approaches to benefits realization approaches (Guthrie-Jensen, 2018).

Traditional project management (TPM), a linear process whereby all phases in the process are performed / occur in sequence, depends on repeatable, predictable tools and techniques in order to deliver a solution. The entire project is planned and committed to upfront with no scope changes during the life of the project, often resulting in budget and timeline constraints (Carr, 2017). Traditional project management does allow for clearly defined objectives, clear documentation, and more accountability, but it does so at the expense of flexible prioritisation, earlier delivery, improved quality, and predictable costs (Kashyap, 2018).

Organizations who have long been advocates of Waterfall and TPM, might suffer from closed-mindedness, and are therefore not able to adapt to newer ways of working and new technologies (Mahanti, 2006). Often these organization might also be openly hostile to new initiatives or new ways of working, i.e., agile adoption (Epp & Hummel, 2015). This hostility can be attributed to a number of factors ranging from the perceived threat to job security, a misunderstanding of the real purpose for the change and the fear of the unknown (of the new process / way of working) (entrepreneurshipinbox, 2016).

In the organisation where the study was conducted, both TPM and modern project management tools and techniques are used during a software development cycle (SDLC) within an organisation. SDLC consists of various stages, including planning, analysis, design, and implementation, with many different traditional models in use, including Waterfall, Spiral and V-Model (Mahalakshmi & Sundarajan, 2016). One of the development management approaches coming to the fore to combat the rapidly changing requirements, changing market conditions and changes in customer expectations, is the group of agile methodologies,

including SCRUM, first published as part of the Agile Manifesto (Hobbs & Petit, 2017). With the current agile adoption wave, companies firmly entrenched in traditional systems and approaches will most likely find it difficult to adapt (to agile approaches) (Nerur, Mahapatra, & Mangalara, 2005).

Differing mindsets ranging from serial thinking to a rigid black-and-white mentality are also evident in these organization who remain locked into their traditional project management principles and processes (Gandomani, Zulzalil, Ghani, & Sultan, 2013). This is a large contributing factor to staff members being resistant to change, and even going as far as to be fearful of changes. Finally, some organizations have a documentation-heavy mindset and struggle to adapt to the concept of only documenting what is needed and see the lightweight documentation (of agile) as a barrier to successful agile transitioning (Gandomani, Zulzalil, Ghani, & Sultan, 2013).

There are, however, serious consequences to an organization if proper project management principles are not enforced or adhered to, such as the high financial cost of failure (\$50 - \$150 Billion per year in the United States), loss of financial reward, loss of life (Hardy-Vallee, 2012) and decreased market share. Other impacts of poor project management and planning include poor user adoption, unrealized project benefits, projects delivery delays, reputational damage, unsatisfied customers, and ultimately failed projects (Ten Six Consulting, 2017). Unfortunately, no matter how good the management of a project, if it cannot adapt to changing requirements, it will fail (IT Leadership Consultant, 2013).

These problems become more evident when these newly adopted technologies and associated processes and procedures, are coupled with complex Information and Telecommunications Technology (ICT) projects. Complex projects can be defined as projects consisting of various interrelated parts, with the complexity further exasperated by differentiation (the number of element variation) within the project as well as interdependencies within the projects (Williams, 1999).

Jones (1993) extends this definition by including the concepts of the variety of the tasks within the projects, as well the uncertainty or instability on which the various project assumptions are based, as illustrated by Figure 1 below.

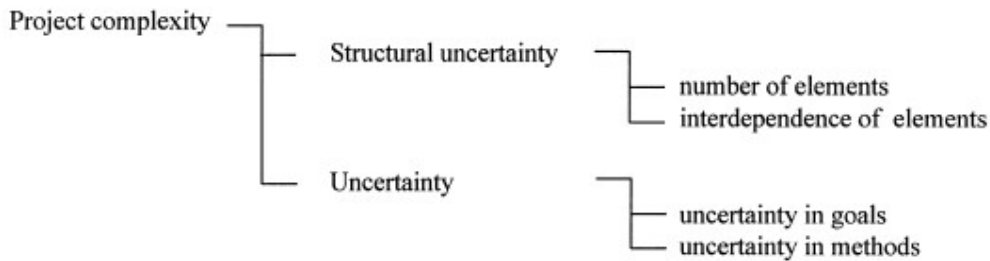


Figure 1 - Project complexity (Williams, 1999)

The larger the variety of tasks within a project and the greater the number of elements and interdependencies, the more complex the project will become. Coupled with this is increase in project complexity if there is uncertainty in the goals (of the project), and uncertainty in the approaches that are to be applied during the project.

Initially, much of the agile project management research focussed on the adoption of agile approaches (Boehm, 2002), with later studies focussing on the importance of team dynamics (Dingsøyr, Dybå, & Moe, 2009), adoption-and post-adoption issues (Cao, Mohan, Ramesh, & Xu, 2009), as well as the challenges experienced when adopting agile in distributed locations (Ramesh, Cao, Mohan, & Peng, 2006)& (Balijepally, Dingsoyr, Moe, & Nerur, 2012).

As both TPM and agile have their benefits and detractors it cannot be unilaterally stated which approach is better, so different approaches are required to meet the requirements and needs of different projects. TPM is better suited to portfolio level; i.e. large projects (Spundak, 2014), and for exaple in cases where a high level of project control is required. Agile project management is preferrrred for projects with high uncertainty, creativity or innovation (Chin, 2004). Spundak (2014) denotes the key differences between TPM and agile methods and suitability of each approach (refer Table 1 - Difference between TPM and agile approach below).

Characteristic	Traditional approach	Agile approach
Requirements	clear initial requirements; low change rat	creative, innovative; requirements unclear
Users	not involved	close and frequent collaboration
Documentation	formal documentation required	tacit knowledge
Project Size	bigger projects	smaller projects
Organisational support	use existing processes; bigger organizations	prepared to embrace agile approach
Team members	not accentuated; fluctuation expected; distributed team	collocated team; smaller team

System criticality	system failure consequences serious	less critical systems
Project Plan	Linear	complex; iterative

Table 1 - Difference between TPM and agile approach

This study aims to add to this body of knowledge by focussing on the transitioning from TPM to agile approaches and the challenges this adoption introduces into a telecommunication organisation (Telco). The Telco has only recently embarked on the Agile transitioning journey and is very much exposed to the numerous challenges and stumbling blocks that this transition to, and adoption of, Agile approaches gives rise too.

Due to the nature of a telco, most if not all systems are interrelated and reliant upon one another to function successfully, thus increasing the project complexity manyfold. Software solutions developed to address new demands in the market must therefore include multiple systems, architecture types, diverse teams, and differing process in order to deliver a working solution. The transition to agile approaches is key for the organisation in ensuring that they retain market position and establish a stronger price position, through their ability to pioneer new and innovative products (Pefindo, 2019).

The research study's positioning will be studied by initially focussing on the problem statement and the research questions, followed by the objectives, research context and Scope of the research project.

1.1. Problem Statement

The transitioning from TPM to more modern agile approaches create uncertainty within the organization and can result in unrealistic expectations from both senior management, investors, and other stakeholders. If organizations are to successfully mitigate this uncertainty, they must ensure that the transitioning is well structured and completed successfully, thus enabling the organization to be able to adequately respond to rapidly changing customer requirements and market conditions. Choosing the most appropriate project management approach is critically important to ensure that the transitioning to agile methods is successful.

The uncertainty surrounding choosing the PM approach and the transitioning, is further compounded when dealing with complex IT projects, when the transitioning must occur within a limited timeframe; and when there are differing levels of understanding and knowledge within the organization. Without properly identifying these challenges as well as gain a better understand of project complexity, the organization will be unable to address these and other challenges and will thus be unable to transition from the traditional practices it currently employs to the more modern project management techniques, thus it is important

to ensure that senior management have a balanced view of both the benefits and barriers attributed to transitioning to agile methods.

1.2. Research Questions

The purpose of the study is to **identify the benefits and barriers attributable to transitioning from TPM to modern software development techniques (i.e. agile approaches) in the context of large complex IT projects.**

To assist in answering this research problems, the research will address the following research questions:

- What are the barriers of transitioning from TPM to agile approaches in large complex IT projects?
- What are the benefits of transitioning from TPM to agile approaches in large complex IT projects?

Coupled with the above research questions, the factors contributing to a complex IT project will also be researched and addressed, with the primary research question to be answered is - What are the barriers and benefits of transitioning from TPM to agile approaches in large complex IT projects?

1.3. Research Objectives

In order to successfully answer the preceding research questions, the following research objectives must be met.

- Identify the factors resulting in IT projects being classified as complex.
- Identify the barriers to the successful transition from TPM to agile approaches in large complex IT projects
- Identify and document the benefits attributable to transitioning from TPM to agile approaches in large complex IT projects.

1.4. Research Approaches

The research approaches chosen to address the before-mentioned problem statement, research questions and objectives is the Qualitative research approach as this was found to be best suited to examine real-life phenomena within organisations through direct interaction with the participants via interviews. Whilst still allowing for gaining an understanding of complex problems within the organisation. It was also fitting as it allowed knowledge to be derived even though only a small sample of respondents would be interviewed.

1.5. Context of the research

This research will follow an Interpretivist philosophy, and utilise an Inductive approach, whereby the narrative will be viewed in the context where it was stated, coupled with the subjective viewpoints of the participants (CIRT, 2019).. The research approach chosen as best suited to address the before-mentioned problem statement and objectives is the Qualitative research approach .

A case study strategy will be employed, and the study will be cross-sectional in nature utilising a single data collection strategy (Interviews) and data analysis technique. The research method, including the rationale behind choosing this specific research method and not others, will be discussed and elaborated on in Chapter 3.

The case study research must be viewed in the context of a single telecommunications organisation within the ICT industry, that has recently embarked on the agile transitioning journey. The organisation is still heavily invested and indoctrinated in traditional project management (TPM) approach and are still displaying the characteristics of an organisation in transit (from TPM practises to agile approaches).

This research will extend to various teams within the organisation to ascertain the impact of agile adoption across the enterprise, including customer services, human resources, business intelligence (BI) as well as the Agile programme office. This research will also engage with the organisation at all levels to comprehensively ascertain the impact of the transition to modern project management approaches and practises.

1.6. Scope of the Research

This research study focusses on a single South African telecommunications organisation that have recently embarked on the agile transition journey from TPM to an agile approach. The research spans all layers of the organisation and includes various areas within the organisation, with specific focus on those teams actively involved in software development. All research / interviews are cross sectional in nature.

A single case study was acceptable as the different telecommunications organisations are exposed to similar market demands and the necessity to effectively respond to changes. And although the adoption process might differ, the constraints and challenges will not (differ). The scope of the research will be further limited to focusing on the adoption of SCRUM approach only.

1.7. Structure of the Report

The first chapter in the dissertation provides an overview and holistic introduction of the research topic. It sheds light on the research problem and questions to be answered in the latter chapters of the dissertation and sets the boundaries wherein the research will be conducted. It provides the rationale for the dissertation and establishes the context of the research and how it (the research) will contribute to the existing body of knowledge.

The introduction is followed by the second chapter, the detailed literature review. The academic literature review establishes the foundation of knowledge on the research topic, identifying teams of existing research and giving appropriate credit to other researchers. This chapter also identifies areas of improvement where existing literature is lacking, and thus highlights areas requiring additional research (to address these gaps).

The third chapter elaborates on the research methodology followed and provides an overview of the methodology / research design followed whilst conducting the research and should contain enough information to allow for the study to be replicated (if required). It provides structure to the research and shows how each of the sections (i.e., Strategy & Purpose, Philosophy, Sampling, Data analysis, methods, and Measurement, etc.) collectively address the research questions.

The fourth chapter is primarily concerned with the data that was gathered during the various interviews and the analysis of the gathered data. It elaborates on the findings and extends to the interpretation of the data using analytical and logical reasoning to identify patterns, trends, or underlying relationships.

The fifth chapter discusses the findings in light of the research questions. Chapter 6 provides an overview of all the preceding chapters, findings, etc. It is not merely a summary of the topics covered in the dissertation. It is an amalgamation of the critical points highlighted in the research, as well as recommendations for future areas of study. It demonstrates the importance of the research, how it answered the research problem, and introduces new ways of thinking about the problem.

Chapters 7 provides the list and details of the references used throughout the dissertation and the final chapter (8) includes the appendices relevant to the research.

2. LITERATURE REVIEW

2.1. Introduction

The following chapters provide an overview of the origins of traditional project management (TPM) processes and practises as well as the evolution into more modern agile approaches. It also provides an overview of the unique challenges associated with TPM and agile approaches, and how these challenges are related to complex IT projects.

2.1.1. Project Management Origins

In order to comprehend the implications and business value of agile project management approaches, it is important to understand the origins of the project management profession. Some of the earliest documentable projects date back millennia to the time of the ancient Egyptians, who first started construction of the pyramids some 4500 years ago (Weaver, 2007), also importantly Sun Tzu first wrote about strategy and planning as early as 2500 years ago, noting that “every battle is won before its ever fought” (Tzu, 2012) clearly demonstrating the use of basic principles to manage a project or endeavour to achieve a specific end-goal/objective.

Incidentally, these olden day projects did not include the concept of schedule optimisation as a routine activity (Collins, 2015) which is evident in modern project management approaches. Schedule optimisation refers to the concept of scheduling activities in such a way as to execute on delivery in the most efficient way possible (Vargas & Moreira, 2015). In the latter part of the 19th century, the need for more structure in the various industrial sectors (transportation, manufacturing, and construction) resulted in the project management tactics we know and use today (Collins, 2015).

Since Sun Tzu, numerous projects have been undertaken and successfully completed ranging in size and complexity, from the first transcontinental railway constructed in 1863 to 1869 (History.Com, 2010), to the first modern high-rise building construction completed in 1884 (Hawk, 2016). Only in the last half of the 20th century has the concept of Project Management come to the fore, with the Manhattan Project widely considered to be the first “program” successfully completed (Weaver, 2007).

Projects are seen as temporary endeavours to create a product and / or a service with a defined start and end date (BusinessDictionary, 2007), whereas Project Management can be defined as the “application of knowledge skills, tools and techniques to project activities” (MPI, 2010) to meet the requirements of the project. Project Management is still considered

an emerging profession that is not yet matured and (the profession) has been in development over the past 30 – 40 years.

During this period, many project management associations have been compiling Bodies of Knowledge (BOKs) – a consistent view of project management principles, specifically modern project management (Weaver, 2007), to assist in the application of project management principles.

Modern project management can trace its roots back to the Protestant revolution of the 15th century where certain key concepts were first introduced. These concepts included reductionism (reducing unnecessary elements of a process and breaking the process down to its smallest components) and individualism (assigning tasks to individuals), which are core to the principles of modern project management (Weaver, 2007).

There are numerous project management methodologies that have been developed over the years including (but not limited to) Agile, Waterfall, Scrum, Prince II, PERT, Adaptive Project Framework, Extreme Programming (XP), Critical Path Approaches (CPM), PMI/PMBOK, Kanban as well as some hybrid approaches (Seymour, 2014). Refer to Appendix 8.1 for a comparison on the various Methodologies, grouped together based on similarity and popularity.

Traditionally, project development followed a very rigid and stringent process and had a set series of phases, with the final delivery only being realised at the end of the project (Inflectra, 2017). This approach had a number of drawbacks as the process is inflexible to accommodate changes in customer requirements; features are designed and built which are no longer required and thus time unnecessarily wasted; end-user feedback was not solicited until the end of the project, also importantly the stability and usability of the system were only known at the end of the project (Inflectra, 2017). Whereas utilising Agile practises and approaches provides for a clear view of the effort involved in developing the solution as well as the costs associated with the solution development. This enables the organisation to objectively compare and rate projects and determine the best value for money projects.

Characteristics	Agile approach	Traditional approach
Organizational structure	Iterative	Linear
Scale of projects	Small and medium scale	Large-scale
User requirements	Interactive input	Clearly defined before implementation
Involvement of clients	High	Low
Development model	Evolutionary delivery	Life cycle
Customer involvement	Customers are involved from the time work is being performed	Customers get involved early in the project but not once the execution has started
Escalation management	When problems occur, the entire team works together to resolve it	Escalation to managers when problem arise
Model preference	Agile model favors adaption	Traditional model favors anticipation
Product or process	Less focus on formal and directive processes	More serious about processes than the product
Test documentation	Comprehensive test planning	Tests are planned one sprint at a time
Effort estimation	Scrum master facilitates and the team does the estimation	Project manager provides estimates and gets approval from PO for the entire project
Reviews and approvals	Reviews are done after each iteration	Excessive reviews and approvals by leaders

Figure 2 - Differences between traditional and agile project methodology (Kashyap, 2018)

Figure 2 - Differences between traditional and agile **project** methodology indicates numerous differences between TPM and agile methods, for example TPM denotes a high client involvement with customers being involved throughout the duration of the project, contrasting with agile methods where the bulk of the involvement is at the start of the project, with only limited involvement once the project starts. Also TPM is shown to be more suited towards large-scale projects with agile methods to be used in smaller and medim-sized projects (Kashyap, 2018). Importantly the change roles and responsibilities are noted whereby the project manager plays a significant role in TPM projects, with the scrum master playing a similar role in the agile space.

As organisations continued on the agile adoption journey, the concept of DevOps comes to the fore, i.e., the act of combining cultural practises, philosophies, as well as tools to enable and assist an organisation in its ability to deliver applications and services at an increased velocity. Utilisation of the DevOps model allows for the evolution and improvement of products at a faster rate than organisations using traditional software development (and infrastructure) practises and processes (aws, 2019).

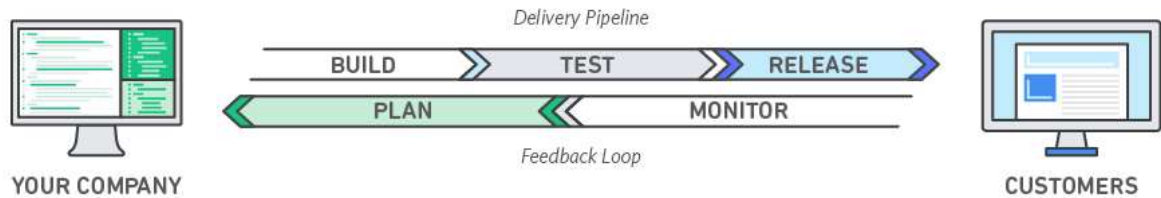


Figure 3 - DevOps delivery pipeline (aws, 2019)

2.1.2. Agile Approach origins

These issues which arose from utilising TPM as mentioned in the previous chapter, which include the inability to accommodate customer changes; unwanted features, wasted time and resources, (Inflectra, 2017). etc. finally came to a head during the early 1990's in the period known as the "Application development crisis", during which the time between identifying a valid business need and producing the solution was estimated at approximately 3 years (and up to 20 years in more complex environments) (TechBeacon, 2015). This frustration resulted in the gathering of various industry pioneers and experts whose vision gave rise to the Agile Manifesto and its 12 principles, which forms the basis of all the agile methodologies as described in Appendix A.

In general, all agile methodologies adhere to prioritising individuals and interactions above processes (tools); working software preferred over comprehensive documentation; collaboration preferred over negotiating contracts and prioritising responsiveness to changes over following a predefined plan (Inflectra, 2017).

Over the past decade, the adoption of agile methodologies has grown dramatically with 71% of organisations canvassed (3234 PM practitioners) making use of agile approaches for their projects, (see Figure 1) "sometimes, often or always" (Langley, 2017). Notably, more projects are now being completed within budget whilst meeting the original project intent, and fewer projects are now being classified as failures (see Figure 2). Notably, this indicates a positive uplift in projects successfully completed within budget, the first since 2011 (Langley, 2017). A slight increase in projects being completed on time was also evident, although scope creep was still an issue, but less so than in the past.

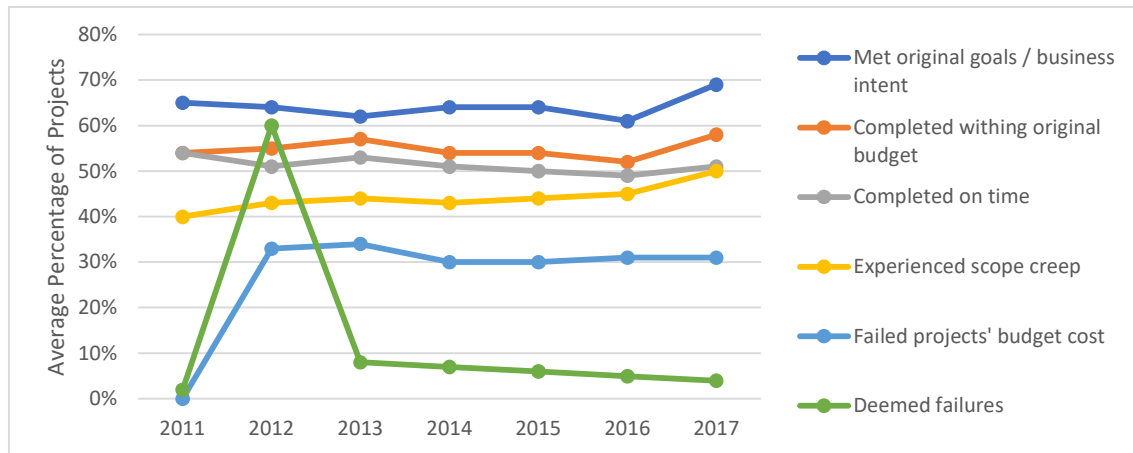


Figure 4 - Project Performance Metrics (Langley, 2017)

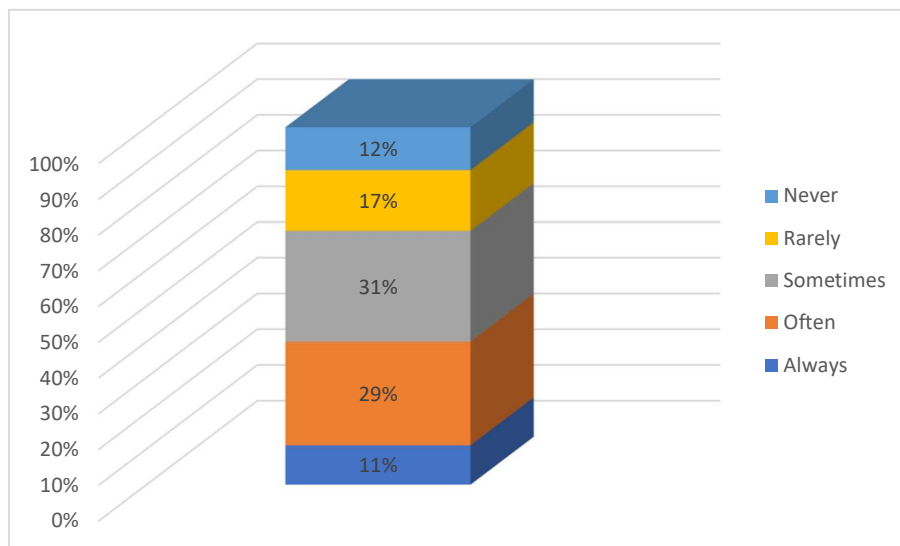


Figure 5 - Agile Adoption (Langley, 2017)

2.2. Traditional Project Management (TPM) characteristics, practices, and principles

Traditional project management practices, of which the Waterfall System Design Lifecycle (SDLC) model is the oldest and most well-known, includes the phases or stages that are essential to software development. These stages are planning, analysis, design and finally implementation and are sequential in nature. (Balajai & Murugaiyan, 2012).

Balajai & Murugaiyan (2012) identified several attributes and / or conditions associated with the Waterfall model. The first of these stated that the waterfall model is a sequential model; therefore, nothing can be changed based on (new) customer requirements (Mahalakshmi & Sundarajan, 2016). All requirements must be clear before the next phase of design can be attempted. Testing is only conducted once development has been completed and documentation only happens at the end of the phases. There is no overlap between the development stages and proceeds in a set order, and a specific amount of time is allotted in order to complete each of the phases. Also, defects are normally only detected extremely late in the process due to the lack of involvement of the team since the start of the project, and which can also be attributed to the fact that testers are only involved with the testing phase.

2.3. TPM vs Agile / Scrum

In order to fit in with the new cultures within software development companies, new software development approaches had to be found, as companies aim to produce working, valuable software in a much shorter timeframe at a reduced cost. The below table highlights some of the differences between Traditional and agile approaches, which are explored below.

	Traditional	Agile
Fundamental Assumptions	Systems are fully specifiable, predictable, and can be built through meticulous and extensive planning	High-quality, adaptive software can be developed by small teams using the principles of continuous design improvement and testing based on rapid feedback and change.
Control	Process centric	People centric
Management Style	Command-and-control	Leadership-and-collaboration
Knowledge Management	Explicit	Tacit
Role Assignment	Individual - Favours specialisation	Self-organising teams - encourages role interchangeability
Communication	Formal	Informal
Customer's Role	Important	Critical
Project Cycle	Guided by tasks or activities	Guided by product features

Development Model	Life cycle model (Waterfall, Spiral or some variation)	The evolutionary-delivery model
Desired Organisational Form/Structure	Mechanistic (bureaucratic with high formalisation)	Organic (flexible and participative encouraging cooperative social action)
Technology	No restriction	Favours object-orientated technology

Table 2 - Traditional vs Agile Software development (Nerur, Mahapatra, & Mangalara, 2005)

In order to objectively compare TPM and agile approaches, Mahalakshmi et al (2016) suggest focussing on the following three elements; Roles, Meetings, and Artefacts. Below is a short summary denoting the differences between traditional and agile approaches as per the before-mentioned elements.

2.3.1. Roles

In traditional project management the project manager plays a key role in getting estimates and obtaining approvals. In the areas making use of agile methods there is no longer a traditional project manager as this role has been replaced with the scrum master (Kashyap, 2018). When using agile methods product Owners also play a big role in ensuring the successes of the product journey.

2.3.2. Meetings

Traditional lengthy project meetings have now been replaced with shorter and more productive sessions. These new session types include Sprint planning sessions, daily scrum meetings, sprint reviews meetings. These sessions are focussed discussions to discuss specific aspects of the projects.

2.3.3. Artefacts

Teams have moved away from using the the traditional project plan purely tracking achievement against project timelines and major milestones. Those areas making use of agile methods, now utilise elements such as the Product backlog, Sprint backlog, and burndown charts to manage their deliverables in an ongoing and agile fashion.

2.3.4. TPM advantages

Traditional project management does have several advantages, such as it is easy to implement as it is a sequential model. A large number of resources are not required to implement TPM, and the quality of the development is underpinned by proper documentation (Mahalakshmi & Sundarajan, 2016). Thesing, Feldmann, & Burchardt (2021) also note the following advantages of traditional project management approaches as

compared to agile approaches; whereby there exists fixed roles with clear responsibilities. Planning is systematic, stable and documented and team member capacity can be predicted. Project progress can be measured via project milestones allowing for the reliable estimation of budget and time, all of which makes it possible to plan for obtaining high efficiency.

2.3.5. TPM disadvantages

Traditional Project management approaches do have a number of drawbacks, though, such as the inability to accommodate changing customer requirements; inability to resolve problems that arise in the current phase before moving to the next phase, lower likelihood of success, more documentation required to be completed, all activities are sequential with limited team flexibility and creativity as well as the customer being required to agree / contract to a scope freeze (Mahalakshmi & Sundarajan, 2016). The following figure summarizes the main differences between Waterfall and agile (SCRUM) approaches.

Waterfall	SCRUM
Deals with project	Deals with product
Traditional model consists of different phases	SCRUM methodology consists of different sprint
Does not expect changes	Expect changes and accept the changes
More documentation	Less documentation
Project cost determined during planning	Project cost set during project
Probability of success is low	Probability of success is high
Team flexibility and creativity is limited	Team flexibility and creativity is unlimited
Sequential	Overlapping

Figure 6 - TPM vs Agile approaches (Mahalakshmi & Sundarajan, 2016)

2.4. Agile approach adoption Benefits and Challenges

Agile approaches are gaining widespread popularity and traction, with one of the key value drivers, underpinned by the agile manifesto, being that agile approaches value “individuals, and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan” (Fowler & Highsmith, 2001). Therefore, agile approaches would allow an organisation to respond to changes quicker, more thoroughly and still enable the organisation to maintain its key business activities.

Agile morale, increased approaches adoption benefits include accommodating changes in business priority, project visibility, increased productivity in teams, improved speed to market, improved software quality, and reduction in project risk (VersionOne, 2017).

From a project perspective, the agile (SRCUM) approaches has the following additional advantages as compared to traditional approaches (Mahalakshmi & Sundarajan, 2016). Firstly, customer satisfaction is higher as the project turnaround time (speed of delivery) is faster and quality is improved. The agile model allows for easy acceptance of changes, with improved effort estimate accuracy. The modern way of working is ideal for rapidly changing business requirements as the scope of the project can be adjusted to meet the release dates.

In addition, Thesing, Feldmann, & Burchardt (2021) denote the following additional advantages of implementing an agile approach; whereby changing requirements are quickly recognised. Errors are also identified quickly due to short cycles of development, allowing for changing requirements to be responded to quickly and flexibly. False development risk is decreased and project processes are continuously optimised. Team take personal responsibility and are highly motivated, and there are no limits in the process when searching for a solution.

In order to transition from traditional project management approaches to agile approaches, various changes are required for an organization. Nerur et al. (2005) highlight several key differences between traditional and agile software development practices (see Figure 3) as with the movement to agile approaches, there are stark differences between traditional and the more modern approaches. Some of these key differences include the move from process-centric to people-centric control; changes in management leadership styles from command and control orientated to collaboration focussed; the customer becoming critical to the success of the project; as well as including the move from no technology restrictions to adopting technology that favours object-oriented design (Conboy K. , Coyle, Pikkarainen, & Wang, 2011).

Diker et al (2016) also highlight various success factors that need to be present in an organisation to allow for a successful agile adoption, commencing with the required support from, and strong leadership by, management needing to be in place. The organisation needs to be committed to change and should select and customise the agile approach to suit the organisation. It is preferable to pilot the agile implementation in a smaller area to gain acceptance.

Appropriate training and coaching should be provided to all staff, after successfully Engaging with people. Management should communicate appropriately and with transparency, and

assist in garnering the the appropriate mindset and alignment. Autonomous teams should be established allowing for requirements to be managed appropriately.

Numerous challenges associated with implementing agile have already been identified in prior literature and includes challenges such as developer fear due to visibility of perceived skills deficiencies; increased reliance on social skills, lack of developer motivation to utilise agile approaches, and a lack of business knowledge amongst developers (Hajjdiab & Taleb, 2011). This will be expanded upon in the next chapter (refer to Agile adoption challenges).

However, preliminary research has determined that most research deals extensively with the non-IT implications of agile adoption. Little has been found that deals with IT-specific challenges organisation are experiencing when transitioning to agile, and thus this research will focus on the IT challenges associated with transitioning to agile approaches.

2.5. Agile adoption challenges

Agile approaches are an appealing alternative to many organisations wanting to improve their performance, however, agile approaches were originally intended for use by small teams and individuals and therefore agile implementation do have several associated challenges. Diker et al (2016) identified several challenges associated with agile implementation in organisations, such as Resistance to change by management and staff. Insufficient investment; including lack of training, coaching and excessive team workloads. In some cases agile is too difficult to implement, and often times agile concepts are misunderstood.

Multi-team environment often times result in challenges coordinating the workload. With multi-team agile adoption, differeing agile approaches are implemented for the respective teams. Organisational boundaries and hierarchal management structures also increase the likelihood of failed agile adoption within the organisation. Challenges in requirements engineering and quality assurance also detract from a succesfull agile adopton, and lastly the integration of non-developmental roles into the agile construct can also prove challenging.

Thesing, Feldmann, & Burchardt (2021) expanded on the above and included the following additional challenges or disadvantages of an agile approach; in some organisation the iterative approach is not compatible with the company culture and its only the team's self-organisation that drives the success of the project. Large and distributed teams have limited communication and more time and budget may be required for iterative development with a high number of users are required for testing.

2.6. Key Agile roles and responsibilities

In Agile, there are several key roles that are common across the different agile frameworks that can be used. The following roles are relevant to this research study. Firstly there is the team lead, also known as the Scrum Master, who is a facilitator for the Agile Development team, and manages how information is exchanged (Visual Paradigm, 2020). Then there are the agile Team Members that are “responsible for the creation and delivery of a system” (Ambler, 2021). The Product Owner is responsible for prioritising the workload items on the product backlog, making timely decisions, and providing information at the appropriate time (Ambler, 2021).

There are also additional scrum related roles in addition to those mentioned above, i.e. The Agile Software Development Lead, who is responsible for leading and directing the team in all development facets ranging from design, planning to debug through facilitation (Lynn, 2019). The Solutions Architect who is responsible for leading the practice of solution engineering in respect of specific business challenges, as well as introducing the overall technical direction/vision for the solution to address the specific business challenges (altexsoft, 2020). And lastly, the Delivery Manager who is responsible for leading the team on lean and agile practices; ensure and maintain team health and happiness; and support the overall project delivery (Webber, 2020).

2.7. Case description

The case study pertains to a single global telecommunications organisation based within South Africa with approximately 10000 employees. The organisation has recently embarked on an agile transition journey moving away from TPM (Waterfall) to agile approaches. This programme is being conducted across the organisation, with many departments and teams involved ranging from business-as-usual operational activities to key business projects and initiatives.

The organisation decided to move away from TPM to modern agile methods and sighted the need to be able to deliver solutions quicker to the market, across many platforms, in a controlled manner whilst still being able to respond quickly to changing market conditions. A combination of Waterfall, SCRUM and Agile methods are used within the organisation to drive the successful implementation of IT projects. These IT projects range from developing new bespoke applications, enhancement to existing applications, to designing, developing and implementing retail product offerings.

Agile methods have been adopted (or are in the process of being adopted) throughout the organisation.

2.8. Factors increasing the complexity of IT projects

There seems to be a lack of consensus when deciding on what makes projects complex. One area of research defines complex projects as the combination of the following: “differentiation of functions between project participants, dependencies between systems and subsystems, and the consequential impact of a decision field. Project complexity can also be interpreted and operationalized in terms of differentiation (number of elements in a project) and interdependencies and connectivity (degree of interrelatedness between these elements), which are managed by integration, that is, by coordination, communication, and control” (Cristóbal, Carral, Diaz, Fraguela, & Iglesias, 2018). The following table lists and briefly describes the main factors considered in the literature as project complexity drivers.

Factor	Description
Size	To consider it an indication of complexity, the organizational structure of the project should be over a minimum critical size, and their elements need to be interrelated.
Interdependence and interrelations	An event in an interconnected structure can cause totally unknown effects on another entity inside the structure.
Goals and objectives	They must be adequately and properly defined both at a strategic and at an operational level.
Stakeholders	The number of project participants and how the information flows between them are a key factor affecting project complexity.
Management practices	Relationships between project participants, suppliers, overlapping of activities, approaches, and techniques are factors that affect project complexity.
Division of labour	Adding project organizational structure by dividing labour, the way for personnel selection, and the level of pressure on these this personnel to achieve project objectives are factors that increase project complexity.
Technology	Task scope or the variety of tasks that need to be accomplished is the most critical dimension of technology. It explains why there is a need for a variety of technologies and a given level specialization in each of them.
Concurrent engineering	It breaks down functional and departmental barriers by integrating team members with different discipline backgrounds often, known as crossfunctional teams.
Globalization and context dependence	Globalization boots complexity by the erosion of boundaries, higher mobility, hierarchy, and higher dynamics. It can be an essential feature of complexity.
Diversity	A higher number of elements and a higher greater variety across elements increase complexity.
Ambiguity	It expresses the uncertainty of meaning in which multiple interpretations are plausible.
Flux	Flux is affected by external and internal influences. It also implies constant change and adaptation to changing conditions.

Table 3 - Main factors affecting project complexity (Cristóbal, Carral, Diaz, Fraguela, & Iglesias, 2018)

2.9 Summary

This chapter provided an overview of the origins of project management and how it has matured and evolved over time into the agile approach we are familiar with. It also focussed on identifying the main differences and characteristics of both TPM and agile approaches, including the benefits and detractors of both. It also showed that both approaches are valid and the use of each approach is dependant on the size of the project, complexity of the solution, etc.

This chapter also shed light on those factors defined in literature that impact on the complexity of the IT projects. Going forward, agile adoption challenges, agile roles and responsibilities and factors contributing to complex IT projects will be investigated in more detail using the real-world use case of a single telecommunications organisation. Some aspects to be focussed on are those factors inhibiting a successful agile adoption; how the organisation has chosen to conduct the agile transitioning journey as well as how the transition is measured and derived benefits tracked?

The next chapter focusses on the research methodology and methods used during the course of the study and provides insight into the research paradigm and approach chosen. It also provides a detailed narrative regarding the research process and how this was applied in the real world setting. As a combination of two research theories are used, the next chapter also provides a detailed discussion as to the suitability of the Technology Organization Framework (TOE) as well as the Socio-Technical Theory (STT/STS).

3. RESEARCH METHODOLOGY

The following chapter details and narrates the approaches followed in conducting the research. Firstly, it focuses on the research philosophy/ paradigm, which provided the boundaries within which the research was approached and conducted. Secondly, the research approaches / purpose is discussed, including the exploration of the strengths and weaknesses associated with the research approaches. Thirdly, the research strategy / process is examined, including the research timeframe, research data collection, research quality and data analysis techniques. Lastly, the research project's ethical consideration is noted and discussed.

3.1. Research paradigm and Approach

All researchers have their own individual views of what constitutes reality (truth and knowledge). These views shape their beliefs and assumptions about both society and them, which has a direct correlation on how they view / frame the world, that is how they gain perspective and view the world (Mackenzie & Knipe, 2006). This is scientifically referred to as a paradigm and it constitutes the principles and beliefs that moulds how a researcher interacts with and interprets the world (Kivunja & Kuyini, 2017).

The paradigm can be deconstructed into the following four elements; ontology, epistemology, methodologies and axiology (Guba & Lincoln, 1985), which comprises the basic beliefs, assumptions, values, and norms that each paradigm holds. Ontology concerns itself with the nature of reality, and the essence of the phenomena being investigated. Saunders et al. (2012) detail two aspects of ontology, that is, Objectivism and Subjectivism. A researcher who prescribes to the objectivism view, is of the opinion that subjects exist independent of their surroundings and social actors. Whereas a researcher subscribing to the subjectivist view is of the belief that social phenomena are created by the actions and perceptions of social actors, and that this social interaction between actors is continuous in nature and constantly changing. Subjectivism was chosen for the research as subjects personal experiences were relevant.

Epistemology seeks to understand the answers to questions relating to what is known and how it is known (Vanson, 2014), and whether knowledge should be gained subjectively or objectively. Epistemology and ontology are off course linked and decisions made with the one, will impact on the other. Again subjectively was chosen to explore the views and experiences of the participants.

Saunders et al. (2012) lists and expands on four research paradigms researcher can adopt: Pragmatism, Positivism, Realism, and Interpretivism. A researcher who subscribes to the pragmatism position, is of the opinion that only concepts that are supportive of action, are important. They recognize that different approaches can be taken to interpret the world and, when undertaking research, to advance the research.

A researcher who prescribes to the positivism position, believe objects are to be observed and measured, whilst developing law-like generalizations similar to those produced by natural scientists Saunders et al. (2012). In positivism, the researcher might use existing theories to develop their hypothesis, or they can collect the data and make observations without a hypothesis being formulated and tested. The researcher is “value-neutral” and does not impacted nor is impacted by their research subjects. It utilizes a highly structured methodologies to allow for replication, with the emphasis being placed on the collection of quantifiable data / observations that naturally lends itself to statistical analysis.

Realism is another research paradigm relating to scientific enquiry that predisposes that all objects exist independent of human observation / mind. Saunders et al (2012) further elaborates on the realism position by introducing the concepts of Direct and Critical realism, with direct realism denoting that only what we see is real, and that our senses accurately portray the real world. Whereas Critical realism points out that what we experience are not the real-world objects directly, but only the sensations of these objects, alluding to the fact that our senses mislead / deceive us on a regular basis.

A researcher who prescribes to the Interpretivist position emphasizes that research needs to be conducted amongst people and not only objects (Lewis, Saunders, & Thornhill, 2012), but also allows for the integration of human interest into the research (Dudovskiy, 2016). This philosophy extends to the belief that persons cannot be divested from their knowledge, thus portraying a direct link between research and research subject. As researchers have to understand and make sense of subjective opinions and/or meanings expressed by the participants, this philosophy is well suited as it naturally lends itself to this type of analysis (Lewis, Saunders, & Thornhill, 2012). This approach was chosen for the study to ensure person’s views and beliefs were accurately portrayed.

The research will make use of qualitative methods, with the researcher evaluating the different points of view of the participants, assessing this in the context of their position and work environment, whilst at the same time applying the researcher’s own knowledge, experience and beliefs of the environment and research topic.

The research approach best suited for the type of research to be conducted is the Inductive approach. This approach is characterised by four main characteristics. Firstly, it starts with observations and theories are only proposed at the end of the study. Secondly, it involves the search for patterns whilst performing observations, and developing the reasons/ explanations for the observations, through a series of hypothesis. Thirdly no theories / hypothesis need to be evident at the start of the research, however, the existing theories discussed in the previous section will be used to direct and formulate the research questions to be explored. Lastly, inductive reasoning is centred on learning from experience (Dudovskiy, 2018). In addition, it firstly utilizes / focuses on the use of research questions to narrow the scope of the study, as compared to the use hypothesis as is the case with deductive research approaches (Gabriel, Inductive and deductive approaches to research, 2013).

This research also aims to view existing research phenomena from a different perspective, in this case the perspective includes a single telecommunications organization. The researcher is unimpeded by theories or hypothesis at the start of the research, as these will developed over time during the research. (Dudovskiy, 2013). Inductive approaches are also normally associated with qualitative research, although some qualitative studies might have a deductive orientation (Gabriel, 2013). This is in contrast with deductive theory, which first aims to test specific theories and starts with a defined hypothesis.

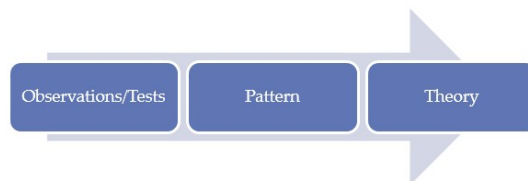


Figure 7 - Inductive approach (Dudovskiy, 2018)

	<i>Concepts associated with quantitative methods</i>	<i>Concepts associated with qualitative methods</i>
Type of reasoning	Deduction Objectivity Causation	Induction Subjectivity Meaning
Type of question	Pre-specified Outcome-oriented	Open-ended Process-oriented
Type of analysis	Numerical estimation Statistical inference	Narrative description Constant comparison

Figure 8 - Qualitative / Quantitative approach concepts (Dudovskiy, 2018)

3.2. Research approach

This research was not limited to an academic environment or a laboratory but was conducted in the real world. It was limited to a single telecommunication organization within South Africa, encompassing a large range of teams/departments within the organisation and spanning across all levels of management and it followed the descriptive research design. Descriptive research is categorised as an attempt to describe what is (Dudovskiy, 2016), that often uncovers new knowledge or insights that might otherwise have gone unnoticed. It aims to allow for the statistical analysis of a target audience / group via the collection of quantifiable information (CIRT, 2019).

It does not answer questions about how/why or when the characteristics occurred, but it does describe the characteristics specific to the target group / audience that is being studied. It is being used to answer those questions concerned with the “who, what, when, where and how” relevant to specific research questions, and is not used to discover inferences, try to establish causal factors nor make predictions (CIRT, 2019) and it can be broken down into three research methods, i.e., Observational, Case Study and Survey methods.

Of the three main descriptive research approaches, this research did not make use of Observational or Survey methods but instead utilized the Case study approach to interact with and study the research participants (CIRT, 2019). The other research approaches were not deemed appropriate as the researcher directly interacted with the research participants through the use of interviews and not surveys (CIRT, 2019). This allowed for the collection and analysis of qualitative data, whilst still offering unique insights and adding to the body of knowledge (Blakstad, 2008).

This approach was best suited to examine real-life contemporary phenomena within organizations (Yin, 2012), as well as allowing for the exploration and gaining an understanding of complex issues (Zainal, 2007). This approaches also allowed for intensive and detailed knowledge to be developed / derived from a relatively small number of cases (Zainal, 2007).

The shortcomings of using a case study methods were handled as follows (Gaille, 2018) (Study Lecture Notes, 2013), e.g. the data collected electronically was transcribed by a independent party, analysed and coded multiple times to ensure fact-based data collection with minimal researcher bias. Although there were limited interviewees, the sample size was adequate to allow for generalisation and classification. Memory and judgement errors were minimised as all interviews were recorded and transcribed shortly after the interviews took place. The data collection was time consuming and labour intensive, however software was utilised to speed up the process where-ever possible and allowances for these time delays were made during the research process.

The telecommunications organization chosen for the research case study was a good candidate as it enabled the researcher to identify the various challenge the organization was exposed too whilst transitioning to agile approaches, as it had only recently embarked on the Agile adoption journey. Thus, a large part of the organization was unfamiliar with agile approaches and TPM practices were still deeply entrenched. The agile adoption within the organization was being driven by executive management with extensive commitment and focus across all levels of the organization.

It should be noted that using a case study research approaches had several strengths and weaknesses, with the benefits including allowing for the research concepts to be developed / matured during the course of the research, and for the research questions to be adapted during the course of the project if they were more value-adding than the original questions. Some drawbacks included the heavy reliance on the researcher to integrate the research and thus exposing the findings to the risk of no longer being subjective (Bhattacharjee, 2012).

Bhattacharjee (2012) and Qualtrics (2019) identify the following potential errors when utilising the case study approaches. Researchers do not understand who they should be interviewing, referred to as “population specification”. “Sampling and sample frame rate errors” occur when the incorrect sub-population is used resulting in the sample not being an accurate representation of the population concerned. “Selection” errors, when only certain respondents make themselves available based on their interest to the project topic, creep in thus there already exists an inherent bias (towards the research topic). “Non-responsive” error where chosen where participants fail or refuse to respond, resulting in the absence of research data.

These potential errors were addressed as follows during the research project. The researcher had an in-depth understanding of the organisation and was well positioned to understand and identify those who were interviewed / involved in the research project. All subjects selected for interviews were agile practitioners, thus ensuring a fair representation of the target population concerned. The subjects were chosen based on their areas of expertise and involvement in TMP and agile projects. All research participants were contacted in person and all research data was collected via faceto-face / Skype interviews.

3.3. Research Theory

This research aims to utilize two distinct theories to collectively interpret the findings and understand the implications and realizations of new agile methodology adoption. The first theory is concerned with the process by which new technology innovations are adopted by the organization, and the second theory is concerned with problems associated with new technology implementation.

3.3.1. Technology Organization Environment Framework (TOE)

Various factors influence the adoption and implementation of new technologies within an organization, these factors include the technological context, the environmental context as well as the organizational context (DePietro, Wiarda, & Fleischer, 1990).

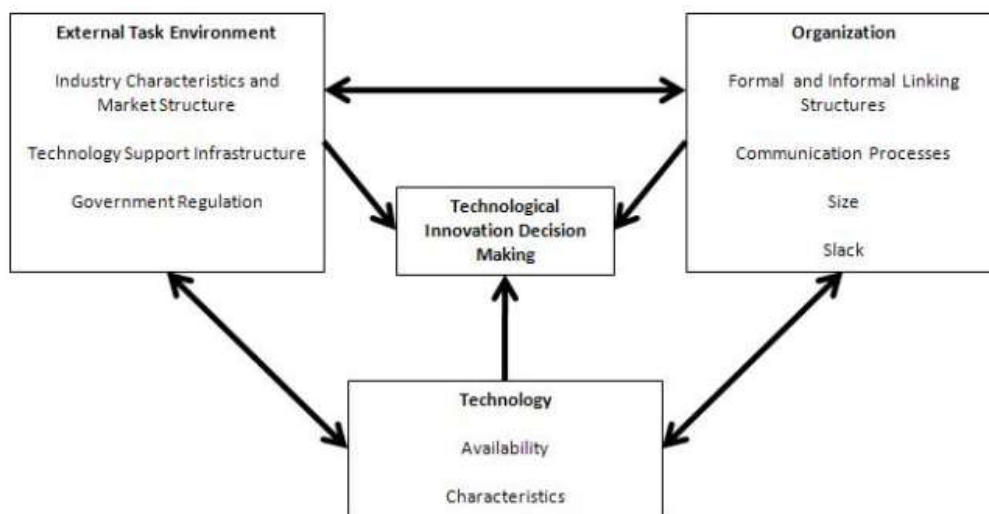


Figure 9 - Technological organisation environment framework (DePietro, Wiarda, & Fleischer, 1990)

All the internal and external technologies in use by the organization, or to which it is exposed, are included in the technology context, which also extends to processes and equipment. Organizational context extends to the characteristics of the organization, including “the firm’s size, degree of centralization, degree of formalization, managerial structure, human resources, number of slack resources, and linkages among employees” (Baker, 2016). Lastly, the environmental context includes the regulatory environment, the organization’s size, and the structure of the industry (DePietro, Wiarda, & Fleischer, 1990). Combined, these three elements present “both constraints and opportunities for technological innovation” (DePietro, Wiarda, & Fleischer, 1990), and significantly effect and influences new technology research and adoption in organization.

3.3.2. Socio-Technical Theory (STT / STS)

By the middle of the 20th century, many predicted that technology would have a major impact on the productivity and efficiency in business, however, this was found not to be the case. Many examples were touted, where implementation problems (e.g., resistance to change, not achieving the expected benefits) were causally related to the implementation of new technologies. This theory was developed to assist in providing a fit between the technical and social subsystem, which collectively made up the organisation (Akbari & Land, 2016).

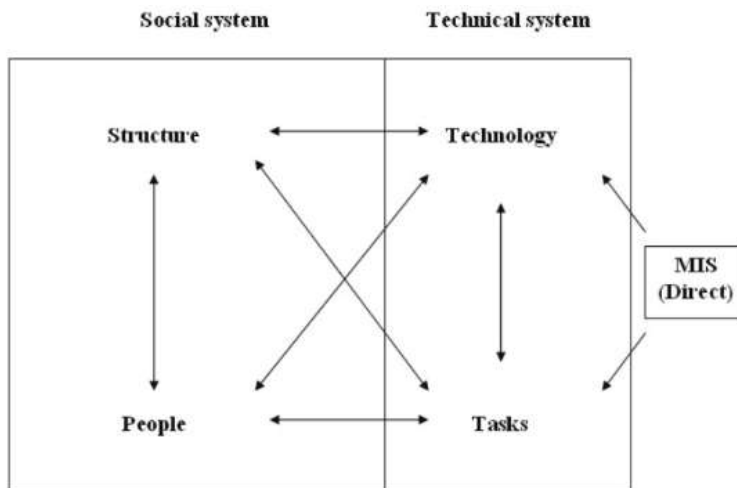


Figure 10 - Socio-technical theory (Cartelli, 2007)

Technical aspects of the subsystem include the tools, devices and techniques required to process input and produce meaningful outputs to add to the economic performance of the organisation. In contrast, the social subsystem includes both the employees (at all levels) and skills/values within the organisation, but also the reward system in use in said organisation. This theory hypothesises that an optimal fit of technical to social subsystems is only possible if the interdependencies of these systems are explicitly recognised and must ensure these subsystems are working harmoniously (Akbari & Land, 2016).

3.3.3. Motivation for choice of research Theory

The combination of TOE and STS are ideally suited to be used as a lens to assess the transitioning to agile methods as the organisation is exposed to all of the respective elements of each method, ranging from government involvement to technologies being utilised. The TOE framework allows for organisation-level analysis (Awa, Ojiabo, & Orokor, 2017), whilst the STS framework allows for lower-level analysis of the people, processes and procedures within the organisation.

3.4. Research Process

3.4.1. Sample

The telecommunications organization chosen for the research case study was a good candidate as it enabled the researcher to identify the various challenges the organization was exposed to whilst transitioning to agile approaches, as it had only recently embarked on the Agile adoption journey. Thus, a large part of the organization was unfamiliar with agile approaches, and TPM practices were still deeply entrenched. The agile adoption within the organization was being driven by executive management with extensive commitment and focus across all levels of the organization.

3.4.2. Time Horizon

This research was cross-sectional in nature and focussed on the status of agile adoption within the telecommunications organisation at a specific point in time. This was deemed appropriate due to the limited time available for the research as set by the master's project time limit.

3.4.3. Data Collection & Sampling

The data obtained was analysed and organized / grouped into specific themes, with emphases being placed on the organization of the data and rich description of the datasets. Chun, Birks, and Francis (2019) iterate that theory will be constructed from the data analysed and is not discovered. All qualitative data obtained was analysed using constant comparison and inductive analysis (Glaser & Strauss, 1967) to categorize events and behaviours, with analysis starting as soon as the first data was collected. Concept categories were developed and interrelated with open data coding utilized to analyse and assess the data, allowing the researcher to overcome subjectivity and bias (Corbin & Strauss, 1990).

Qualitative data can normally be characterized by the richness and voluminous of the data, due to the researcher having the opportunity to fully explore the subject being researched. This also allows for meaning to be derived not from numbers, but words (Lewis, Saunders, & Thornhill, 2012). To aid in the analysis of the data, additional tools / mechanisms will be used, for example, progress- a transcript summaries.

Myers and Newman (2007) list three types of qualitative interviews; firstly, structural interviews with a completed script prepared beforehand with no room for improvisation. Unstructured or semi-structured interviews with an incomplete script allowing room for improvisation, and finally, Group interviews where multiple persons are interviewed at the same time.

The researcher made use of semi-structured interviews to collect data from all the participants. Open-ended questions enabled the researcher to develop their theory over the course of the interviews / research, whilst minimizing the amount of personal bias that might be introduced (by the researcher) (ReadingCraze.com, 2017).

Both on- and off-campus participants were interviewed, an mediated access models (Skype) (Lewis, Saunders, & Thornhill, 2012) was used to conduct the feedback. During the course of the research, research instruments completed by both the researcher will was used (i.e., Interview schedules and Observations) (CIRT, 2016).

The use of unstructured or semi-structured interviews has various problems and pitfalls (Myers & Newman, 2007) such as the interview might seem artificial as the researcher will be interviewing a stranger, requiring them to provide answers and create opinions in a time-sensitive / limited environment. As the interviewees are strangers, a lack of trust from the interviewee could be evident and could results in certain information not being shared which invalidates the research or results in incomplete data collection. Due to the limited time available during the interview, the data collection can be incomplete or unreliable if the interviews creating opinions under pressure which skews the research data as it is giving a strong voice to matters not really considered important. If the researcher enters the organization at the wrong level, then might find it impossible to engage with the executive management later. The same holds true for unions and gatekeepers within the organization barring access.

As a researcher might only involve the elite / persons of high standing within the organization they can fail to gain an understanding of the broader situation, due to the elite bias introduced. Qualitative interviews are intrusive and thus prone to the Hawthorne effect, whereby the researcher potentially impacts on the social setting of the organization and potentially changes the interviewee's behaviour, as the interviewers are not "effect neutral". Interviewers are not only assimilating data during interviews, but they are also, in fact, constructing knowledge forcing interviewees to reflect in more detail on issues they would not previously have considered so explicitly and need to construct their stories such as to appear knowledgeable.

The written and spoken language is fraught with ambiguity. Fontana & Frey (2000) state the following "Asking questions and getting answers is a much harder task that it may seem at first. The spoken or written word has always a residue of ambiguity, no matter how carefully we word the questions or how carefully we report or code the answers". Interviews are not cut and dried and are fraught with possible problems and pitfalls, and the interviewer can inadvertently offend or unintentionally insult an interviewee, resulting in the interviewee being abandoned.

The researcher resolved these challenges by providing a safe and secure space for the interviewees to function in. As the interviewees were personally acquainted with the researcher it provided a truer & trustworthy narrative. All interviews allotted for more time than was required for the interviews, allowing for appropriate discussion. The neutrality of the interviewer was maintained as only areas outside of their areas of involvement were interviewed. All interviewees were given the opportunity to review a transcript (and the original recording) of the interview to ensure ambiguity was kept to a minimum.

The intended target audience consisted of telecommunication professionals and managers spanning a large portion of the organization. The audience included developers, scrum masters, agile practitioners, and middle / senior management. The research was localized to one target site, a telecommunications organization, located within the borders of South Africa. During this research project, various ICT tools and aides were utilised, ranging from video- and teleconferencing equipment, MS Word, MS Planner, MS Excel, Attendance registers, audio recording equipment, etc.

Due to the closed and limited nature of the target audience within the respective telecommunications' organization, a Probability/Representative sampling technique was used to determine a suitable sampling frame, -sample size, & most appropriate sampling technique whilst ensuring that the sample is representative of the organization as a whole (Lewis, Saunders, & Thornhill, 2012). Both operational support and development staff formed part of the target audience, with representation at all levels of the organization being available for selection and sampling. This research project was small as it focused only on one organisation and only aimed to gather data from between 10 – 20 participants, spread throughout the organisation.

Role	Number of participants
Scrum Master	4
Agile Software Development Lead	2
Agile Programme Manager	2
Delivery Manager	3
Release Train Engineer	2
Application Support	1

Table 4 - Participant breakdown

Goffman developed the dramaturgical model / perspective, which utilises a theatre metaphor to explore social life where "Social interactions are seen as a drama where there are actors (individuals and groups) who perform on a stage (a variety of settings and social situations) using a script (norms, rituals, expectations of how one should behave)" (Myers & Newman, 2007).

This is very much applicable to qualitative interviewees as these are social interactions where individuals impact upon each other through their actions when in each other's immediate presence, i.e. One individuals' action impacted another, whilst at the same time being impacted upon (by another individual). Therefore, each qualitative interview can be treated as a drama. Here follows a table extracted from Myers & Newman (2007) derived from Goffman (1959).

Concept	Description
Drama	The interview is a drama with a stage, props, actors, an audience, a script, and a performance.
Stage	A variety of organisational settings and social situations although in business settings, the stage is normally an office. Various props might be used, such as pens, notes, or a tape recorder.
Actor	Both the interviewer and the interviewee are actors. The researcher must play the part of an interested interviewer; the interviewee plays the part of a knowledgeable person in the organisation.
Audience	Both the interviewer and the interviewee are the audience. The researcher should listen attentively while interviewing; the interviewee(s) should listen to the questions and answer them appropriately. The audience can also be seen more broadly as the readers of the research paper(s) produced.
Script	The interviewer has a partially developed script with questions to be put to the interviewee to guide the conversation. The interviewee normally has no script and must improvise.
Entry	Impression management is especially important, particularly first impressions. It is important to dress up or dress down depending upon the situation.
Exit	Leaving the stage, possibly preparing the way for the next performance (finding other actors – snowballing) or another performance later (e.g., perhaps as part of a longitudinal study).
Performance	All the above together produce a good or a bad performance. The quality of the performance affects the quality of the disclosure, which in turn affects the quality of the data.

Table 5 - The Qualitative interview as a Drama (Myers & Newman, 2007)

Based on the dramaturgical model, Myers & Newman propose certain guidelines to assist the interviewer when conducting the interview; refer to figure 11 below.

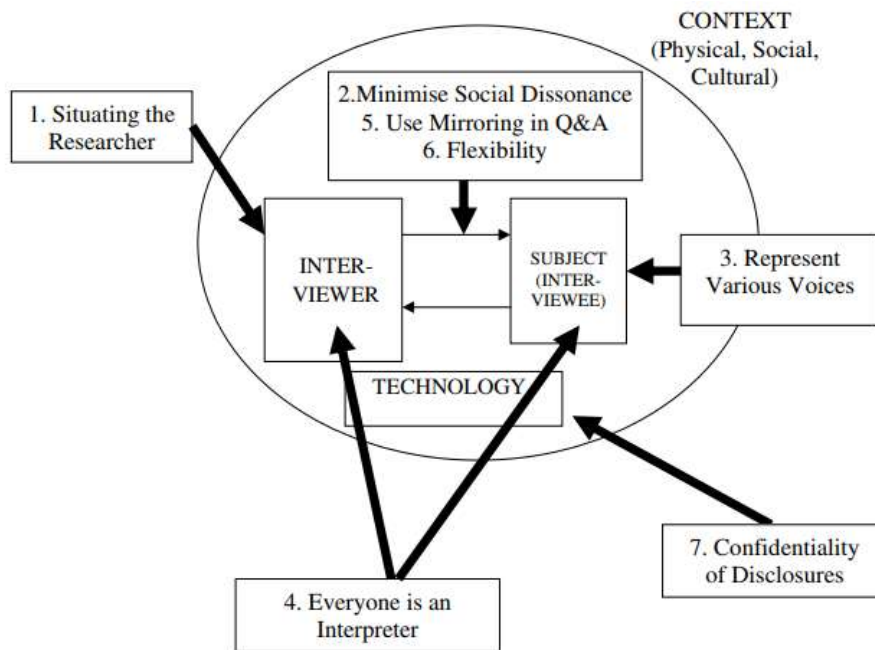


Figure 11 - Qualitative Interview improvement guidelines overview (Myers & Newman, 2007)

Qualitative Interview Guidelines explored (source: (Myers & Newman, 2007))

- If the researcher is the interview, he/she needs to situate themselves prior to the interview as the interview is a social encounter and the data gathered is idiographic. This information might prove useful when assessing the validity of the findings later.
- Social dissonance should be minimised, i.e., Remove as many factors as possible that could result in an interviewee feeling uncomfortable.
- Interview a variety of persons within the organisation to represent as many voices as possible.
- Interview subjects are all interpreters of their own worlds and experiences.
- Answers should be mirrored in subsequent questions, using the language of the interviewees. This also allows for the interviewee to describe their world in their own words.
- Flexibility, openness, and improvisation is required when making use of open-ended questions, (incomplete “script”), and the interviewer should be prepared to explore different trains of thought / avenues of discussion and be able to react accordingly.
- All correspondence and data gathered must be kept confidential and secure.

The researcher implemented these guidelines in the following manner; The “stage” for each interview was a soundproof cubicle or meeting room, in which to conduct the interviews. All interviews made use of semi-structured open-ended questions (“script”) allowing for

additional questions to be added & opinions to be voiced and discussed. Each interview's audio was recorded after consent was provided by the interviewee, and completely transcribed. The transcription focussed on the content rather than try to include the manner of delivery, with additional notes being taken by the interviewer to aid in providing context to the transcriptions where so required. If comments or statements were unclear, they were validated with the interviewee following the interview. All transcriptions were shared with the interviewees to ensure correctness and accuracy as well as to ensure the feedback is in the right context. All data collected was anonymised and stored securely.

3.4.4. Data Analysis

The data analysis was conducted in the same window as the data collection, i.e., the data was transcribed and analysed in parallel with the interviewees being conducted. This approach has the advantage that the data collection process can be adjusted slightly to accommodate the themes that emerge during the data analysis, to allow for these themes to be investigated in more detail (Bhattacharjee, 2012). The data that was collected was classified using thematic analysis, a approaches to identify and analyse patterns within the collected data (Braun & Clarke, 2006).

Braun et al (2006) also highlight some points that need to be considered before embarking on thematic analysis;

- What constitutes a theme? "A theme captures something important about the data in relation to the research question and represents some level of patterned response or meaning within the data set."
- "Should a rich description of the data set or a detailed account of one particular aspect be provided?"
- The identification of the themes can be driven either by the theoretical interests of the researcher, or by the data (inductive).
- Themes can either identified by investigating underlying concepts shaping the sematic data, or it can be identified at a superficial level focussing on the comments and statements made by the interviewee.
- Finally, special care needs to be taken when defining the various questions in play whilst performing research studies, i.e., Research / Interview and data coding & Analysis questions.

The themes arose organically from the data based on the feedback from the interviewees, and was first loosely grouped into minor themes / areas of interest as the themes "bubbled

up” at the time of the interviews. The data was reviewed again and grouped into the final major themes discussed in this dissertation.

The data obtained from the various interviewees provided a rich data set and was analysed using a range of approaches ranging from inductive to theoretical. Themes arising from both the literature review performed and the interviews themselves were introduced. Braun et al (2006) provides a step-by-step guidance to conduct thematic analysis (refer to figure below).

Phase	Description
1. Familiarising yourself with your data	Transcribing data (if necessary), reading and re-reading the data noting down initial ideas.
2. Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each node.
3. Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes	Checking if the themes work in relation to the coded extract (Level 1) and the entire data set (Level 2), generating a thematic "map" of the analysis.
5. Defining and naming themes	On-going analysis to refine the specifics of each theme, and the overall story of the analysis tells, generating clear definitions and names for each theme.
6. Producing the report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

Table 6 - Step-by-step guide to thematic analysis (Braun & Clarke, 2006)

It is important to note that there are some possible problems to be avoided when making use of this technique (Braun & Clarke, 2006); such as failure to perform proper data analysis; the use of interview questions as themes by researchers; poor or weak data analysis due to weak or overlapping themes; analytic claims cannot be supported or contradicted by the research / collected data and the theoretical framework must be in line with the interpretations of the data.

These problems were overcome by performing exhaustive data analysis and recoding the data multiple times according to different areas of interest. The interview questions were not theme based, but based around the TOE and STS frameworks used to interpret the data. Only distinct themes were included in the research and the gathered data is rich in findings and areas to be further investigated and interrogated.

There are, however, various benefits to making use of thematic analysis, as highlighted by Braun et al (2006), namely It is a flexible and easy approaches to learn; Even researchers unfamiliar with Qualitative research methods can make use of this technique; It can draw parallels across data sets and lastly it assists in producing insights which were not originally anticipated. A CAQDAS¹ software package was utilised to assist in the data analysis, coding, and thematic analysis. NVivo was used during this research project. NVivo is supplied and supported by the University of Cape Town.

3.4.5. Perceived business value

This study was undertaken with the objective to understand those factors that influence software development in complex IT projects, including those factors influencing the successful transitioning from TPM to modern approaches and practises practices and add to the body of knowledge already in existence in this regard. By successfully identifying these factors, it could result in improved project delivery, reduction in project failures, increased delivery team velocity as well as improved return on investment for the organisation.

3.4.6. Ethics/ethical considerations

3.4.6.1. Access

As this research needed to be approved by the University of Cape Town's Ethics Committee, a completed Ethics form, and a cover letter will be included in the research design. Permission from the participating organisation was obtained in the form of written consent from two senior members of the organisation. A non-disclosure agreement with the organisation's legal department might be required and will be completed if so required. Only upon receiving approval will the interviewer contact the identified participants and request their involvement and cooperation for the research. The interviews will be scheduled and conducted with interviews being contacted as the need arises / schedule allows.

¹ Computer Aided Qualitative Data Analysis Software

3.4.6.2. Privacy

All information of a personal nature remained private and was not divulged. The dataset was cleared of all identifiable information gathered during the interviews. Any data of propriety nature was discarded, and all data obtained during the research was anonymised.

3.4.6.3. Confidentiality

All the data gathered was holistically analysed and no participants was identifiable in the final report.

3.4.6.4. Ethical Issues

All participation in this research was voluntary, and although no participants (nor their organisation) was identified in the final technical report, all processes were accurately documented. It is important to ensure that ethical norms are maintained throughout the research as it promotes the aims of the research; it promotes the values essential to collaborative work, it ensure researchers can be held publicly accountable; it helps to build public support and it promotes important social and moral values (Resnik, 2015).

The researcher always ensured that the following ethical principles was always adhered too; honesty; objectivity; integrity; carefulness; openness; confidentiality; legality and non-discrimination. Objectivity specifically was adhered by interviewing those respondents involved with the implementation of agile methods within the organisation, whereas the interviewer as not involved in the implementation of agile method.

3.5. Limitations / Risks

A considerable amount of research had already been performed to assess the challenges and benefits of agile adoption; however, this research focused specifically on the transition from TPM to agile approaches. Telecommunication organizations are continuously exposed to challenges such as increased competition, gearing up for new technologies and decreases in traditional revenue streams (dubber.net, 2017), and thus are required to be able to quickly respond to a high rate of change, both in changing customer requirements and product offerings, whilst still maintaining a high level of service to its customers.

Some organization-specific limitations that can impact on the effectiveness of the study include the number of the available participants, the operational workload of those required to participate and technical issues that could also hamper the research data gathering (University of Southern California, 2017). This study scope was limited to a single telecommunications company with the borders of South Africa.

The study was further limited to focus only on those IT-related challenges experienced when adopting agile approaches and might not be representative of the greater agile community.

This research, as like all research, is subject to certain general limitations outside of the control of the researcher. Randall (2007) identifies the following research limitation, first of which is the failure of respondents to understand the questionnaire's format and/or content. Secondly, the qualitative methodology itself might result in certain limitations, and thirdly the research sample selected can be inadequate to satisfy the research requirements, and lastly, the data itself that was obtained could be inadequate, specifically as the research is cross-sectional in design.

The above limitations were addressed as follows; the respondents were well-versed in the subject matter and each question was comprehensively explained during the interview. All responses were assessed for consistency and relevancy to the question being asked, highlighting any questions where answers could be misconstrued, or improperly answered. The research sample was adequate with the same themes prevalent in the interviewee responses.

3.6. Validity and Reliability

3.6.1. Validity & transferability

Validity in the context of qualitative research refers to the appropriateness of the process, tools and data. It is concerned with establishing if the research question is "valid for the desired outcome, the choice of methodology is appropriate for answering the research question, the design is valid for the methodology, the sampling and data analysis is appropriate, and finally, the results and conclusions are valid for the sample and context" (Leung, 2015). In the context of the qualitative research paradigm, external validity can be replaced with transferability, i.e., the "ability of research results to transfer to situations with similar parameters, populations and characteristics". Trochim (2016) denotes various threats to external validity, which include people, places, or times.

To ensure the validity of the research, the selection of interviewees (although not random), was wide-spread throughout the organisation and represented different roles, etc within the organisation. The respondents were chosen without any personal bias, and the sample was of adequate size as was shown when saturation was reached after the 10th interview, although several interviews were conducted after saturation had been reached.

3.6.2. Reliability

Trochim (2016) suggests means to improve external validity, which include drawing a random instead of non-random sample; ensure dropout rates are kept low, and all respondents participate; and performing the study in a variety of places and at different times. In the case of this research study, these threats are minimised as the research only includes a single telecommunications organisation and does not extend to other organisations and will be conducted with a non-random sample of participants, and at a specific point in time.

External validity was improved by involving multiple teams within the organisation and by increasing the number of participants. The threat of time can be mitigated by the fact that the study focusses on the adoption of agile approaches to aid in software development, and an organisation can logically be expected to only adopt modern project management practices once, for example, It is not a recurring activity, so the time factor is not as important as it would be exceedingly difficult to replicate the study.

Care was taken to ensure the questions posed to interviewees were aligned to the research method, matched to the data and the analytical procedures. Again the sampling was shown to be adequate as evidenced by replication and saturation (Morse, 1991) indicating enough data had been obtained. The data was collected and analysed concurrently, incrementally building a solid foundation through theoretical thinking, culminating in a well-developed and informed theory (Morse, Barrett, Mayan, Olson, & Spiers, 2002).

The next chapter deals with the Research findings that arose during the various interviews that were held. The initial part of the chapter provides an overview of the research questions, with the latter part of the chapter being concerned with the actual answers to these research questions.

4. RESEARCH FINDINGS

The following chapter provides a detailed write-up of the various themes that arose during the interviews with the respective respondents. These respondents were asked to answer questions relating to the following research problem – Identifying those factors attributable to transitioning from traditional software development practices & principles to modern software development techniques, which negatively impact on the organization's ability to successfully deliver complex IT projects.

Specifically, questions were positioned around obtaining enough empirical evidence to the following research questions.

- What are the barriers of to transitioning from a TPM to agile approaches in complex IT projects?
- What are the benefits of transitioning from TPM to agile approaches in complex IT projects?

The initial section is primarily concerned with the demographic makeup of the respondents, with the latter sections delving into the detailed themes surrounding the benefits as well as the negative factors that influence agile adoption. The chapter concludes by providing answers to the before-mentioned research questions.

4.1. Description of respondents

Interviews were held with various participants within the organization. The makeup of the interviewees is listed in the below table, which includes a definition of each role. This allows for the interview comments to be seen in the context of their work environment, as well as their knowledge and skills (refer Table 7 - Profile of respondents). All interviews were conducted telephonically over a two-week period and the first round of broad questions were focussed on obtaining an overview of each respondent to identify their role in the agile landscape, determine their respective years of service as well as confirming what agile-specific training they had received.

Role	Role Description	Number of participants
Scrum Master	Facilitator for an Agile Development team, and manages how information is exchanged, and SCRUM refers to a methodology that allows a team to self-organise and respond quickly to changes in line with the Agile approach (Visual Paradigm, 2020).	4
Agile Software Development Lead	Is responsible for leading and directing the team in all development facets ranging from design, planning to debugging through facilitation (Lynn, 2019).	2
Solutions Architect	Is responsible for leading the practice of solution engineering in respect of specific business challenges, as well as introducing the overall technical direction/vision for the solution to address the specific business challenges (altexsoft, 2020).	2
Delivery Manager	Is responsible for leading the team on lean and agile practices; ensure and maintain team health and happiness; and support the overall project delivery (Webber, 2020).	3
Release Train Engineer	Fulfils the role of coach and servant-leader for the Agile Release Train (ART); whilst facilitating the various ART-related events and processes, all the while assisting the various teams in ensuring value is being delivered (SAFe, 2019).	2
Application Support	Is responsible for supporting the various IT services that are delivered to users within the respective organisation, thus ensuring the business processes needed by the business to be successful, are enabled (FDM, 2010)	1

Table 7 - Profile of respondents

4.1.1. Interviewee role classification

Questions were asked to the interviewees to firstly establish what role they currently play in the agile landscape and how long they have been operating in this role. Table 7 - Profile of respondents highlights the various roles in which the interviewees are operating, along with a definition of each of the roles.

All the respondents operate in a team construct, either in permanently assigned teams or squads, or in temporary teams formed to address a specific project or deliverable. The teams locations differ from being collocated to being dispersed within (and outside) the borders of South Africa, thus teams are both physical and virtual in constructs.

4.1.2 Interviewee length of service in existing role

It is also important to understand for what length of time each of the interviewees has been operating in their respective roles in order to ascertain their level of bias / knowledge in terms of those factors which could impede the successful adoption of agile approaches in a complex IT project. Table 8 – Interviewee Role & Years of experience breakdown details the years of experience each of the interviewees have in each of their respective roles.

It can be noted that in most cases, the level of experience is a junior (inexperienced), which is consistent with the status of agile adoption within the organisation, which only embarked on the agile adoption journey a little over 2 years ago. 4 Out of the 13 interviewees have been in this role for 1 year or less, with 8 being in their respective roles shorter than 5 years. Only 5 have been in their roles for longer than 5 years, and these roles were pre-existent prior to the organisation beginning their agile journey, insourcing and right skilling².

² One interviewee did not disclose their length of service in their current role and was excluded from the years of experience calculations.

Respondent	Role	
		Length of service
RE1	Agile Software Development Practice lead	< 5 years
RE2	Scrum Master	1 year
RE3	Solutions Architect	>5 years
RE4	Delivery Manager	>5 years
RE5	Scrum Master	< 2 years
RE6	Delivery Manager	< 3 years
RE7	Scrum Master	< 1 year
RE8	Scrum Master	Undisclosed*
RE9	Release Train Engineer	10 months
RE10	Release Train Engineer	5 years
RE11	Delivery Manager	10 years
RE12	Solutions Architect	10 months
RE13	Scrum Master	18 months
RE14	Application Support	> 5 years

Table 8 – Interviewee Role & Years of experience breakdown

4.1.3. Training received

When asked what level of training they had undertaken or been offered, various interviewees indicated that they had been offered and had undertaken various formal courses offered both within the organisation as well as external suppliers. Some also indicated that they were already in the possession of formal certification achieved after the successful completion of these courses. It is also important to note however that some interviewees indicated that they had not received any formal training but were making use of the various online training courses on offer by the organisation.

4.2. Empirical Findings

This chapter provides answers to the main research question - **What are the barriers and benefits of transitioning from TPM to agile approaches in complex IT projects**. The main question consists of two sub-questions as well as an overview of the factors influencing project complexity. The answers to these questions take into consideration the major themes that arose during the research and is compared to literature to establish correlation.

Initially, an inductive approach to data analysis was used to categorise the findings into broader themes, after which two frameworks were used to interpret these findings. The Technology organisation environment framework (TOE) as well as the Socio-Technical Theory (STT/STS) framework were used to interpret the findings obtained. TOE assisted in analysing

the relationships between the organisation, the external environment and the technological environment in which it operates. STT/TSS supported the TOE framework by guiding the analysis of the technical subsystem (agile tools) in conjunction with the social subsystem (employees) within the organisation. The following table highlights the categorisation of the questions as per the TOE & STS/STT framework as each interview question was in support of one more of the framework elements.

Question	Technology-Organisation-Environment (TOE)			Sociotechnical system (STS / STT)			
	Technological	Organisational	Environmental	Structure (Org)	People	Technology (HW/SW)	Tasks (Work)
1		x		x	x		
4		x		x			
5		x			x		
6		x			x		
7		x	x		x		x
8			x		x		x
9	x	x	x	x	x	x	x
10		x			x		
11		x	x	x	x		x
12							x
13							x
14			x				x
15		x		x	x		
16					x		
17			x		x		x
18	x					x	
19	x				x	x	
20		x		x	x		
21	x		x		x	x	x

Table 9 - Categorisation of interview questions per Research Framework

The interview questions were grouped in two broad categories dealing firstly with “People, process, knowledge and structure and secondly with “Process & Technology. (Please refer to Appendix 8.3 for the interview guide).

The findings are grouped into three main sections, with the first section focussing on the factors influencing project complexity, the second section includes all the thematical information related to the benefits of transitioning TPM to agile approaches in complex IT projects whilst the third section includes all the thematical information related to barriers of transitioning from a TPM to agile approaches within complex IT projects. Each section contains the major summarised themes, which is then broken down and discussed (including

the detailed statements made by the respective interviewees). A short summary of the research findings in relation to the research questions concludes the chapter.

4.2.1. IT project complexity in large organisations

As this research is primarily focussed on complex IT projects, it is especially important to understand what factors make a project more complex than other projects. Hence, during the interviews, the respondents were asked what aspects / characteristics of a project would result in them classifying it as complex. The below table notes those major themes which emerged during the interviews as direct contributing factors to project complexity.

Theme	# of Incidents	# of References
System Complexity and complex business rules	5	6
Time Pressures	3	3
People complexity	6	7
Virtual Team setup	1	1
System dependencies and System Interdependencies	6	13

Table 10 – Major themes emerging from project complexity.

4.2.1.1. System Complexity and Complex Business Rules

The concept of complex systems came through strongly in the interviews, and according to (Efatmaneshnik & Ryan, 2016) system complexity can be measured either objectively in relation to system size “independent of any viewpoint” or subjectively depending on the observers / actor’s frame of reference. Multiple interviewees agreed that the greater the numbers of systems involved, the greater the system complexity as these “systems need to be integrated to talk to each other [RE2]”.

The interviewees also indicated that the various “types of technologies [RE6]” used to design and build the individual systems throughout the organisation, also added to the complexity of the project as it increases the “technology components that can just go wrong [RE9]”. These systems span the entire organisation and range from HR related applications to customer-facing front end systems and include all layers of infrastructure from database to presentation layer, e.g., Different infrastructure components used by different applications (Oracle vs Exadata technologies).

3 of the 14 interviewed indicated that the complexity is also increased when the number of integration / touchpoints outside IT, increase, e.g. For example, when the systems require interaction and feedback from multiple teams within the organisation ranging from Customer services to sales to distribution. In some cases, they are required to integrate with the wider IT landscape within the organisation as sometimes “eight, nine systems are involved [RE1]”

with the integration. This also holds true for those projects required to integrate with “external systems [RE10]” outside of the organisation as well.

Some also indicated that the legacy applications are especially challenging due to the way they are built and the technologies they use, as these are “not built to fit into the agile world [RE9]”. These systems also incorporate extraordinarily complex processes which themselves “have complex rules that need to be built to support the requirement [RE11]”. This adds to the system complexity as these systems are sometimes designed around the process complexity.

4.2.1.2. Time Pressures

In general, interviewees felt that pace at which new requirements are formulated as well as the fast pace of development add to the complexity of the system / project. 3 of those interviewed indicated that the complexity of the solution is worsened by the “pace at which things are moving [RE6]” as there are severe time pressures under which the development must be completed. This situation further pressurises the team “to deliver quality work in very noticeably short [RE9]” amount of time. Some interviewees indicated that they deem any project that has a completion timeframe of time “of longer than three to 3 – 6 months [RE1]” to be complex, because it spans multiple sprints.

4.2.1.3. People complexity

As people play a crucial role in all system development projects, the human elements add to the complexity of the system being developed. Interviewees identified two specific human-related aspects which adds to the complexity of projects. Firstly, “because we do not understand the technology, it becomes immediately complex [RE1]”, it makes the “technologies...tough [RE3]” as it can include new systems, new environments as well as new interfaces / areas that the organisation might not have encountered before. An understanding can be gained over time, but it is a lengthy process.

Secondly, they noted that in some teams, “there is a general lack of certain basic skills [RE1]”. These skills then must be developed “in conjunction with the solution being developed which adds to the complexity [RE1]” (and time required). As demonstrated in Table 8 – Interviewee Role & Years of experience breakdown, 3 of the participants had less than a year’s experience in using agile and less than half of those interviewed had 3 or more years’ experience. This combination of experience and inexperience across the teams impacts all aspects of the project including delivery and cadence.

4.2.1.4. Virtual Teams Setup

One interviewee felt that when the development teams are “geographically spanned [RE10]”, (i.e., distributed across different geographical areas), the management of the team becomes more complex due to the time zone differences. This is a problem for the organisation as teams use resource located in countries such as Germany and India spanning different timezones and locales, which increases the difficulties associated with managing and coordinating tasks.

4.2.1.5. System Dependencies and System Interdependencies

The “number of systems involved and the maturity of those systems, greatly impact on the complexity of an IT project [RE1]”. This can be illustrated by Metcalfe’s law (Fisk, 2020), which theorises the greater the number of operators, the greater the number of connections³. For example, 5 applications that are interdependent due to shared data sources, for example, can result in a total of 10 interdependencies, thus greatly increasing the project complexity. This scenario is further complicated when there are “lots of integration with the wider IT landscape [RE9]” and “it’s new systems, new environments and new interfaces or areas that [RE8]” have not been explored previously. “Integration with external systems outside of the [RE10]” organisational domain also adds to the project’s complexity.

The following sections explores the theme of Identifying those factors attributable to transitioning from traditional software development practices and principles to modern software development techniques.

³ $N(n-1)/2$, where n = the number of connections.

4.3. Barriers of transitioning from a TPM to an agile approach in complex IT projects

Unfortunately, as with any adoption or move to new technologies and approaches, it often has adverse implications. Those interviewed indicated that the major themes described below are proving to be barriers to moving from a TPM to an agile approach. Each theme is shown in relation to the respective framework assisting with the data analysis.

Theme	TOE Framework	STT/STS Framework	# of Incidents	# of References
Poor Management	Organisational	StructurePeopleWork	13	53
Traditional Project Management (TPM) mindset	Organisational	People	2	2
Ineffective Agile Implementation	Organisational	Structure People	12	53
Inconsistent adoption		Structure	12	48
Budget constraints	Environmental	Tasks	4	8
Poor Change Management	Organisational	Structure People	4	10
Ineffective Coaching	Organisational	People	1	3
Sub Optimal Organisational Structure	Organisational	Structure People	9	42
Ineffective / Incorrect architecture	Technological	Technology	8	12
Poor organisational Culture and Behaviour	Organisational	Structure People	8	18
Insufficient knowledge		People	10	15
Ineffective, unclear or Conflicting roles		People	8	27
Lack of support from business	Organisational	Structure People	11	27
Lack of empowerment and autonomy in teams		People	8	17
Lack of capacity		People	7	11
Ineffective measurement	Organisational	Tasks	11	38

Table 11 – Barriers to transitioning to agile approaches, incl research framework

4.3.1. Poor management

This major theme includes the sub-themes of absent leadership, lack of adherence to agile values and principles by management, autocratic management styles and behaviour and different levels of adherence to agile values and principles.

4.3.1.1. Absent leadership

Although some indicated that management was more inclusive and supportive, 2 respondents still felt that leadership was absent, and they were not involved in co-creating and leading the agile transition. In these cases, the participants explained that there was no mention of agility from senior management and the team had to “figure it out for [RE2]” themselves. The teams were left to their own device to figure out the agile implementation within their teams.

There seemed to be an overall “reticence [RE7]” in some teams not to be part of the agile process, and as RE7 indicated, “my own executive has not once stepped into an agile event”. The absence of leadership also extended to the agile centre of excellence team instructed to provide strategic direction and guidance across the organisation, during the agile adoption. Some interviewees felt that the agile centre of excellence team was not providing enough support, with some going so far as indicating that “there’s actually very little happening [RE11]” to drive adoption.

4.3.1.2. Lack of adherence to agile values and principles by management

As some of the interviewees indicated, “no number of courses... is going to make an ME or a HOD become an agile evangelist [RE3]”, and this is evident in the behaviour of some of those in management. These executives have not shifted their mindset and, “they are not talking about sprints, they are not talking about little milestones [RE6]”. “They are still posing questions in ways that would support waterfall (and TPM) [RE6]”, and they are still expecting project plans and due dates for the entire solution and not interested in sprint driven deliverable timelines and “delivering an MVP(minimum viable product) [RE6]”.

According to some of the interviewees, management only supports agile adoption “when it is convenient [RE7]” but will quickly put pressure on teams to expedite resolving items, which did not form part of the original sprint and becomes a question of “I need this, you make it happen [RE8]”. This is counter to the agile approaches of protecting the sprint at all costs. As RE10 indicated, there still seems to be “some missing links in terms of support and buy-in [RE10], and they “don’t necessarily have the support and buy-in from an executive level [RE11]”.

Over time the personalities and behaviours of executive management starts to imprint themselves on their direct reports, and they believe and support only those concepts and ideas supported by management, i.e., their “DNA starts to imprint themselves with the teams [RE3]” which has a negative impact on the agile adoption journey as the teams are not open to new ideas and new ways of working.

Some of the management team still share the legacy waterfall mindset of only focussing on what was delivered, whether it was on time, or wanting to lay blame for late delivery. They do not focus on what was learnt, was wastage identified and reduced, and was the customer satisfied” Their actions were not congruent with the behaviours they are trying to instil in the organisation and teams.

One respondent indicated that in some teams, members are not willing to support and assist other teams, which is contrary to the agile principles and values. Importantly this behaviour was mandated by their respective management as they were “instructed [RE1]” not to support other teams and focus on their own deliverables.

4.3.1.3. Autocratic management styles / behaviour

In some cases, agile adoption was forcefully imposed on the teams, and the respondents were told projects will not be managed in any “other way [RE2] than using agile methods, ie. “Come high or low water [RE14]” they must adopt the agile approach. In some cases, the teams were still being told, “You would do this [RE4]”. As opposed to being autonomous, some teams were pressurised to maintain a “delivery mindset [RE9]”, and were not allowed to go through the agile processes of capacity planning, effort estimation, etc. They were forced to include items in their current backlog as management was still in the “what is the release, was it released on time, kind of mindset [RE9]”.

The teams were susceptible to disruptions to accommodate additional urgent requirements and were told, “you guys need to commit to this project [RE7]”. Many of those interviewed believed the attitude of lower management was being pushed down from the senior executives, and leadership style was not something that would change overnight. And it will persist if the “legacy type of leadership style, especially at that high level in the organisation [RE8]” exists.

In some teams, it was noted that they were still being micro-managed and not being allowed to make their own decisions as management was not “really letting go of power [RE8]”. The teams were not being empowered to be able to reach their own consensus and decisions.

4.3.1.4. Different levels of adherence to agile values & principles

Certain teams are further along in their agile adoption journey and are misusing their agility in forcing their requirements through to completion without doing their “planning as well as they should have [RE9] “. These teams are not following the correct agile principles and are not cognisant of other user stories within the other team that are required to be completed. In some instances, this type of behaviour is rewarded as it generates results, but these results are at the cost of other team deliverables not being completed and creates a “bit more chaos with the delivery teams [RE11]”.

4.3.2. Traditional Project Management mindset

When under duress or stress, people are likely to revert to their default behaviour which differs from their learned behaviour. Some interviewees echoed the sentiment of scrum masters and managers “regressing to (their) pre-existing behaviours under stress [RE1]”. i.e., sending out emails to solicit feedback instead of conducting the normal daily stand-up session. Management and business requested feedback along the lines of “how long are you going to take to deliver this? [RE7]”, instead of affording the team the opportunity to go away, assess and estimate properly.

It was still an “I need this and just make it happen kind of thing [RE8]” which was not in line with recommended agile principles and ignored concepts such as backlog, backlog refining, etc.

In some cases, it was noted that the teams were able to deliver more effectively when reverting to TPM approaches, as a single person would be acting in the roles of product owner or (Sudo) scrum master / project manager, thus able to manage or prioritise “for oddities... and what we need before we can move forward [RE12]”. This person would be in constant communication with the team, managing the team in a project-orientated manner for “the people who have dependencies on us to understand what we’re waiting for [RE12]”. This is a contravention of Scrum recommendations as the Scrum Master and Product Owner roles should be separate and not shared by a single person.

4.3.3. Ineffective agile Implementation

One of the major themes that arose during the interviews is that of an ineffective agile implementation within the organisation. This theme included aspects such as how the organisation contracts with its vendors and staff, general non-adherence to agile ceremonies and structures and lack of appropriate governance. This theme has been divided into minor themes / grouping to allow for more detailed discussion.

4.3.3.1. Forced agile adoption.

In some teams, the adoption of agile practices was forced upon the teams and was counter to their normal way of working, resulting in the teams being entirely change-resistant. As one respondent noted they are “wired to execute a project in a certain way [RE3]”. The team perceived that they had not bought into the value add and benefits of agile adoption as “it’s forced down on them and in their minds, they don’t want to (do agile) [RE3]”.

4.3.3.2. Non-adherence or compliance to agile ceremonies

One observation that stood out was that in some cases, because the proper ceremonies, i.e., Sprint planning, were not being followed, the requirements were not unpacked / fleshed out sufficiently. This resulted in an increased negative impact on the operational support area as products were being rolled out without the proper “bells and whistles [RE14]” (functionality and reporting required to support the application) in place to allow for the operational teams to effectively support the environment.

4.3.3.3. Incorrect agile assumptions

One of the major incorrect agile assumptions some of the teams shared was that they “don’t need documents or we must do it faster [RE11]”. The teams had the incorrect perception wrt agile approaches and did not realise that “Agile principles are very structured [RE11]”. As one respondent noted, the teams almost exclusively had “speed (of delivery) in their minds [RE11]”, and they had not yet realised that “there’s a structured way of working and that structured way of working needs to be protected [RE11]”.

Some teams created their own “flavour [RE11]” of agile and introduced concepts that did not exist in the agile landscape. For example, some teams were using the construct of a “spill-over list [RE11]” to manage their requirements backlog. This list was used for items that were not addressed in the sprint, and was tracked outside of the sprint, resulting in not all capacity being reported on, etc. Again, these incorrect agile assumptions had a negative impact on the successful transition to agile approaches, as items could spill over to the next sprint due to incorrect effort estimates, while these should not be managed as a separate artefact.

4.3.3.4. Low level of agile maturity

As the transition to agile approaches was only initiated recently, there was a relatively low level of agile maturity within the organisation, including vendors services, were being provided to. As one respondent noted, “I don’t think that (agile) has been sufficiently integrated into our environment, even within the current IT structure [RE11]”.

Some noted that although the vendors contracted to deliver on software development, had indicated that they had transitioned to, or were in the process of transitioning to agile approaches, whilst “they still have their processes [RE10]”, they were still operating in a manner that was “counter agile [RE10]” and waterfall-based. Therefore, the vendor strategy was not being aligned to the organisational strategy and resulted in a “lot of gaps in terms of transition and with partners, both externally and internally [RE10]”. The organisation was heavily dependent on external vendors and is in fact, “at the mercy of these vendors [RE10]”.

Some of the teams were new to the agile journey, and “there is still a long way from perfecting this (agile) because everybody is just looking at Agile as a methodology from a development point of view [RE14]”. They are not focussed on the concept of “delivering fast to customers [RE14]”, and not looking at agile holistically. Some of those interviewed felt that agile approaches had not been sufficiently integrated into their environment as management still questioned “where did it go wrong, and who did it [RE9]” instead of addressing the issues first. “If your executives, in your leadership that people look up too, are behaving in such a manner [RE9]” it makes a successful agile adoption difficult.

It was noted that some teams within the organisation had refused to adopt agile approaches, although these teams were essential to the delivery of complex IT solutions across the organisation. They are not “actually looking at the value proposition that they could offer to our customers [RE6]”. This further reduced the level of agile maturity within the organisation. In some of the business-as-usual teams with legacy processes, agile approaches were difficult to implement. Although agile implementation “looks easy [RE7]” at first, they “found it hard and sometimes the teams kicked back against it [RE7]”, thus the agile adoption failed as “the teams refused to go with it [RE7]”.

4.3.3.5. Agile window dressing

13 of the 14 respondents indicated that although they adopted agile practices in their respective teams and teams, it was not a true agile adoption as in some cases, “IT pretends that they have adopted agile [RE1]”. Some teams have adopted the agile ceremonies, but they are “definitely doing it in a waterfall way [RE2]”. In other words, they do traditional project management in the background with a “big façade [RE7]” of agile ceremonies veneered over the constructs in order to be able to report that the area has embraced agile approaches.

Although they have tried to adapt some of the agile ceremonies and constructs, some teams are calling “something agile [RE1]”, when in fact, it is not. They are “considered an agile team because they have JIRA boards and...events [RE1]”, “but the project itself is not agile in totality [RE1]”. Therefore, the area ends up with segmented agile implementations, which are problematic to manage. In some cases, the appropriate tools are being used to support the agile implementation, but the way information is captured with these tools are still waterfall based. For example, the requirements are “written in a waterfall format (a single user requirement specification). It's not written in the MVP and a user story manner, and then you can't link the functional requirements, and then you can't link the test cases to those functional requirements [RE11]”.

Some teams only pretended to implement agile practices; they were only “doing the façade of agile [RE1]”. These teams were not co-located, did not partake in the required ceremonies and ended up “in this disaster zone of you (scrum master) project managing the team [RE1]”. Instead of the information being shared during the proper ceremonies, the information was circulated via email, and updated on the Kanban board to illustrate adherence to agile approaches.

As one respondent noted, “we do project management in the background as we go in for this veneer of agile over it [RE1]”, making use of agile approaches (including Kanban boards) whilst doing a waterfall-type implementation. The teams were “putting a plaster on top of a waterfall system to be agile [RE12]”, and according to some, it is “too early in the process for people to fully understand how to use the (agile) tools [RE12]”.

Some teams made use of the proper agile toolsets but in a disconnected manner whilst trying to force TPM approaches into an agile construct. The teams were painting TPM approaches with an agile brush. In the opinion of one of the respondents, they felt that “there has been such a strong drive to get in the toolsets immediately, (without) completely understanding how the tools work [RE12]”, again undermining a successful agile implementation.

4.3.3.6. Limitations in vendor contracting modus operandi.

Some participants indicated that the scope of work was contracted at a “fixed cost [RE3]” for specific deliverables. However, when the requirements changed, the contract could not be changed, and the team “cannot leave the project to work on something else, because the scope is for a new project [RE3]” and did not include the existing project. Thus, the teams needed to “down tools [RE3]” and stop all development, initiate an additional process to obtain funding in order to be able to deliver a solution. The organisation was “not chipping away at trying to get some sort of standard. Some sort of commonality, the vendors “don’t even talk the language like we... internally do [RE9]”. They are still operating in a TPM mode, with requirements etc and not working in accordance with the new agile approaches.

4.3.3.7. Lack of inspect and adapt mentality.

According to one of the interviewees, the organisation did “not have an inspect and adapt mentality [RE1]”. The teams did not “instrument things and go and measure those instrumentations [RE1]” afterwards, in order to identify problem areas (inspect) and adapt the relevant processes to improve performance. Also, the teams did not have consistent measurement approaches / instruments, in order to facilitate continuous lean management.

These are key organisational cultural behaviours that were lacking within the organisation, as the project teams were seen as a production line, and little or no retrospection was done to identify things that needed to change “so you can do better every time [RE1]”. Due to the conveyor belt practices, the organisation has “no time for evaluating the existing processes that need to change [RE11]” as they “don’t retrospect and look at what are the things that we can change, we just move on to the next item on the conveyor belt [RE11]”.

The development teams did not actively measure wastage where deliverables had changed due to instruction from business and were not actively “looking for ways to improve the way we work [RE11]”. Teams do not measure changes in requirements (churning) effectively, again due to the lack of an inspect and adapt mentality.

A logical extension of the lack of inspect and adapt (I&A) mentality is the inability to deliver fast enough as the teams are not investigating the systemic reasons for the slow delivery and adapting their processes and approaches accordingly.

4.3.3.8. Lack of appropriate governance

According to some of the respondents, “the governance around the tools needs to be reined in [RE4]”, as any open-source tool could be downloaded and used, which might be counter to future group strategies, requiring licensed software in future “where we don’t have budget [RE4]” for the software purchases. There was “no structure...no standard [RE6]” with no “common language guides [RE6]” as to how to use these tools, and the teams cannot be “applauded for utilising hundreds of tools in your area... It’s just totally impractical [RE6]”.

The general impression is that “there has not been much visibility and transparency in terms of what the intentions (with the agile implementation strategy) are” [RE8] as the strategy “spans over different areas [RE8]”, and there was uncertainty as to how it was going to be structured. There was “a lot of staff disruption [RE10], and people felt uncertain as the changes were not managed properly, highlighting the lack of overall governance during the agile implementation process.

4.3.4. Inconsistent agile adoption

“A different approach being adopted by different areas [RE11]” with “no unified adoption process [RE11]” within the organisation, whilst some would have liked to see “a drive of three to six months of intensive sensitisation across all the business units [RE11]” to assist in a consistent adoption across the organisation. Additional examples of the inconsistent adoption include “adopting the scrum ceremonies – kind of - Doing it in a waterfall way [RE2]”; teams “who do not do stand-ups every day [RE4]”; scrum boards only being updated “the day before [RE7]” the Gemba walk and not being consistently maintained, as well as teams “still very much driven in terms of getting me a Statement of Work (SOW) [RE6]” and not focussing on delivering iterative value and only valuing the complete project.

One big area of concern, as noted by one of the respondents, was due to the lack of consistency whereby if something had to change it now had to change at multiple locations and “you (have to) do it 100 times [RE1]” as you had to do it for “every system differently [RE1]” and “we don’t have our ceremonies down pat [RE1]”. For example, “if you want to measure success of checking in code, you have to go to every system and ask them how they check in code? [RE1]” as each area is doing it differently. Therefore, due to this lack of consistency, if the company wanted “to improve by one percentage point, we have to go and improve it 100 times by one percentage point [RE1]”.

Initially, those in the organisation “thought we had silos and agile was going to eliminate that, because everyone went agile, but now we ... got agile siloed [RE6]”, again highlighting the lack of consistency. These inconsistencies result in chaos when multiple teams must work together to satisfy a business requirement as each area arrives with their own concept of agile and “each manager or team do it differently [RE14]” with no unified approach.

Importantly, these inconsistencies were also evident in the vendors utilised by the organisation to assist on key and other projects as perhaps they were not “being exposed to the same kind of learning and opportunities [RE5]” available within the organisation. According to some, the vendors “don’t even talk the language like we... internally do [RE9]”. They are still operating in a TPM mode, still just focussed on the “requirement [RE9]” etc and not working in accordance with the new agile approaches. Even if they are sent on training, “it means nothing if you (they) don’t know what it means to be agile across the board [RE14]”.

Another obstacle within some teams was the fact that the teams were utilising a “bi-model, there’s some waterfall and some agile teams [RE4]”, where “unnecessary energy must be spent [RE4]” to manage expectations and conflicts when the agile- and TPM teams had to engage and collaborate. The TPM teams “have a specific way of working and they don’t necessarily have to work agile or are much exposed to it [RE5]” and were not working from the same basis of understanding as those teams that have adopted agile. Teams use different approaches to estimate the effort required, which places additional pressure on the teams, thus increasing the likelihood of the team reverting to their default unagile approaches/practices.

In conjunction with inconsistent agile methodologies adoption, is the inconsistency when selecting and applying agile toolsets. Respondent 6 noted that “we have latched onto the word tools and looked for every tool out there and just threw it at the organisation” and again, due to the agile silos mentioned previously, “people will be using certain tools, and you go to another silo and they are using different tools”. In some teams, there is a perception that if “in your silo, if you are using 2000 tools, it means you are doing something right, and people acknowledge and applaud you for using so many tools [RE6]”. This again demonstrates the lack of consistency and standardisation across the greater organisation whereby using so many different tools were a barometer of success as well as contributing to “tool overload [RE6]” within the organisation.

4.3.5. Budget constraints

“Constantly struggling with budget constraints that is a moving target [RE12]” succinctly sums up the challenges being experienced by the majority of the teams within the organisation with forever changing deadlines and scope creep are a big concern and can impact significantly on projects and development activities. The fluctuating budgetary landscape limits the agile implementation and speed of development & delivery as they can be reduced throughout the course of the year due costs being reallocated to other strategic projects, therefore, there is much “uncertainty of how much you can invest into your application at the beginning of the year versus what's happening throughout the year and how it looks at the end of the year [RE12]”.

Changes in the way the organisation funds people resources that are key to development activities, can also negatively impact on the delivery as the organisation was moving away from capital expenditure (capex) to operational expenditure (Opex) as the organisation no longer wanted to fund development houses and instead focus on keeping the lights on. This “drives a lot of decisions that have anti-agile adoption effects [RE3]”.

The reduction in the available budget also impacted on the tools to be used as “we are not given the budgets to adopt or source tools that will help us get things into the market faster [RE11]”. For example, “not having an integrated test environment to test within [RE11]” impacts negatively on the development of software in IT. Opportunities existed to make use of “unsupported [RE11]” open-source software and freeware, with the risk of no maintenance or support. But some of those interviewed complained that with the dwindling budgets, support contracts were also being reduced and could possibly result in some bespoke applications not being supported.

4.3.6. Poor change management

As with any major transition within any organisation, change management is vital to the success of the incumbent process / methodology. Without proper change management, any new initiative is likely to be met with resistance and as RE11 stated unilaterally: “I do not believe we had sufficient change management around the agile principles, methodologies and adoption”. Some of those interviewed indicated that there was a distinct lack of change management when the organisation moved from TPM approaches to implementing the agile approaches ology and dealing with agile transformation. The change management challenges spanned the organisation as well as the individual teams.

“Lack of change management [RE4]” was a sentiment echoed by several respondents. It is a “big mindset changes to move from a waterfall approaches to an agile collaborative approach [RE4]” and some teams forced the agile approaches ology into a so-called “wagile [RE4]” hybrid. The teams were wanting to see “behavioural changes [RE9]” in support of the agile transition, but unfortunately, this was not the case. Teams were “feeling uncertain [RE10]” about the adoption, further highlighting the poor change management that took place within the organisation.

The initial transition to agile started off “in a very different, let us call it, not the correct manner [RE11]”, without a proper “change management project (initiated) for agile transformation [RE11]” The organisation forced agile into a TPM approaches, which required extensive coaching and training to remediate the behaviour. One person indicated that the initial adoption started in an incorrect manner as they were only focussed on a certain key project. A lot of resources were allocated to these projects and very little remained for teams that were outside of the initial adoption wave. The organisation did not rectify the initial adoption, which was not aligned to the greater organisational adoption approach, and (the organisation) missed an opportunity for “wider sensitisation [RE11]” driven from the top, maybe influencing people to change their mindset.

In some cases, the teams are change-resistant as they are not seeing the value and are of the opinion that they are only seeing a limited amount of) behavioural changes. This was particularly felt by those that have been in the organisation for a while. They were not buying into the agile adoption and did not see any value in it, which was detrimental to project successes.

4.3.7. Ineffective coaching

In some instances, agile coaches were brought into the organisation to assist the teams with their agile adoption journey. However, some of those interviewed felt that this was the “biggest negative... because they brought in people from outside”, which was not as effective as the coaches taught agile in a way that was not congruent with the way the organisation operates and did not take the business context into account. For example, RE13 felt that as we “got coaches from different companies, they all speak a different language” that was not congruent or optimal for the agile transition, as the experience sets of the agile coaches lent itself more to banking and investment. The coaching was ineffective in respect of the rapid rate of changes required within the organisation.

Importantly, issues raised by the teams early in the engagement were placed in the “parking lot [RE13]” and never addressed by the coaches. The team were assured that eventually, “it was all going to fall into place [RE13],” but it never did, and some of these issues manifested later in the journey and were never suitably addressed.

4.3.8. Sub-optimal organisational structure

One of the interviewees commented that they “did not think that the structures in terms of people have been adjusted to support agile delivery, (as) they are still within their traditional teams [RE11]” which was not structured correctly to facilitate efficient adoption of agile methodologies. “This hierarchal structure that we find ourselves in, is a big barrier to having agile work perfectly in an organisation [RE4]”, all of which added to the complexity and risk of implementing agile approaches incorrectly, and thus detracting from delivery. The teams felt that a “flatter (management) structure [RE4]”, with fewer managers and with the product owner closer to the delivery teams, needed to be put in place.

Some felt that the organisation needed to “identify those business value streams (and be) more structured around the value streams [RE1]” as well as ensure the “vertical structure adoption, to be aligned between product owners and business value streams [RE1]” in order to unlock value. Some felt that “we need to be structured closer to the business product (with) proper ownership [RE1]” as “business is completely out of the loop... and only involved when it comes to planning [RE10]”.

According to one respondent, not enough had been done to ensure that the “specific roles in terms of the delivery manager... and the product owner [RE5]” was present throughout all the teams, and the teams were still in their TPM constructs. They felt that the teams’ roles were not aligned” and in some cases, the “training and identification of product owners [RE7]” had either not been done, or the training had been inefficient.

The filling of the “gaps in terms of structure [RE7]” as well as the role identification was perceived to be critically important to the success of agile adoption and delivery in general. For example, “if you do not have a proper product owner... (or) product owner is not aware of what they are supposed to do [RE7]” they cannot assist the scrum masters in implementing scrum or assist in driving delivery within the organisation. “No coaching [RE7]” was also sighted as a contributing factor adding to the uncertainty surrounding roles and lack of knowledge regarding specific responsibilities in the agile landscape.

The organisation makes extensive use of contractors & vendors to provide development-related services, however, these third parties “are not authorised to make decisions [RE1]”

on behalf of the company. This had a negative impact on the cadence of the teams as they had to routinely wait on key decision-makers to be available to make decisions.

As these decision-makers may not be actively participating in the delivery process (sprints, it was causing unnecessary delays. There is also a perception that there was “a level of power, where the bucks stop in the organisation [RE4]” where the decisions are made, again echoing the fact of teams not being appropriately empowered to make their own decisions.

The consensus was that the teams needed to be structured around the revenue streams providing the most value for the organisation, in order to deliver value sooner and more efficiently. According to most of those interviewed, the organisation had not yet implemented the correct vertical and horizontal structure as prescribed by the agile methodology. For example, the concepts of tribes and squads are not implemented throughout the organisation.

In some teams, they “are not getting the capacity” from another team to deliver on joint objectives as “that team has their own priorities [RE4],” resulting in long delays and reduced delivery. In the event the teams require assistance from other teams, the team is “fighting to have someone look at it (the requirement) [RE7]”, which will negatively impact on the delivery timelines. Due to the conflicting priorities between the teams, items could be delayed indefinitely, and “temporary solutions (need) to be put in place [RE7]” impacting on the quality of the service being delivered.

4.3.9. Ineffective / incorrect architecture

As the organisation had been around for quite some time, many of the business and mission-critical systems were exceptionally large in nature as they had grown systemically over time into “a beast or a juggernaut (and became) ...more than what it is...and then becomes very difficult to manage and handle [RE3]” due to these systems being “monolithic and rigid [RE3]”, which does make it “very difficult to adopt to organisational change [RE3]”. Also, the organisation was not able to achieve an optimal rate of change as “we are not architected for [RE1]” it.

If the applications within an organisation are architected incorrectly, it could result in the organisation not unlocking the full value from the agile implementation due to delays whilst design issues are being rectified, resources are being appropriately upskilled, etc. As respondent RE8 indicated, there was still a lot of uncertainty and “big unknown [RE8]” regarding the future direction and structure of the organisation as “I have not seen anything come up as to how they are going to structure to accommodate this [RE8]”. Importantly, as

RE14 stated, some teams “just deploy agile solutions and do not take capacity into account,” impacting in the proper expansion of the system.

To ensure that the applications within the organisation are architected for the future, it will require “investment, people and unfortunately, quite a bit of money [RE9]” and to get the systems changed “is an expensive journey [RE13]”. Unfortunately, in some cases, the strategy might just be to “let it play itself out until that system dies [RE4]” as these “legacy teams are not easily going to be able to change [RE4]”.

4.3.10. Poor organisational culture & behaviour

According to respondent 6, “if you are thinking agile is going to keep you abreast with what the world is doing, and agile is going to fix your problems. You are absolutely mistaken”. It is the “culture change within the organisation (and) it is culture adoption [RE6]” that is central to a successful agile adoption journey. In some cases, people do not have the “self-drive [RE11]” to internalise and see how they can fulfil the organisation’s vision for agile adoption. Also, as one respondent noted, “there are leaders that do not believe in it (agile), they think it is hogwash [RE13]”, and “there are genuine cases where people just cannot make that mindset shift change [RE13]” resulting in teams lagging behind and / or just not adapting to the agile ways of working.

Specific teams are “still pushing an agenda... and most times IT is on the defence of what we are going to do [RE6]”, which “we sell as co-creating [RE6]” and therefore the teams are only doing pseudo co-creation as they are not really on board with the solutions, but only making the other teams think they are. In some cases, the lack of appropriate culture is evident in the way the organisation does not assist in easing the load /stress on the scrum masters, as “they must each come up with a solution [RE1]”, when faced with a common problem, which inadvertently is a “project management (type) solution [RE1]” as they are defaulting to their normal behaviour when under duress. All of which have a very negative impact on the agile adoption journey.

4.3.11. Insufficient knowledge

Within the organisation, there were different levels of understanding of agile practices and values, and different agile knowledge tiers. Participants felt that they had to “explain agile to them (executive management) [RE7]”. For example, “they are having a stand up for one hour every day. And they go through everything on the board [RE7]”. In some cases, the lack of agile knowledge creates “complete and utter chaos because the business is not aligned with what agile is. So, they are still giving us big products [RE10]” and not an MVP with properly sized requirements.

As with many organisations, the “first inclination is to go and hire an expert [RE3]” and not to “stop contracting project managers and business analysts [RE3]” and start “contracting engineers and learn on the job...and become thought leaders in our space [RE3]”. The same held true for nonfixed term employees as well as sometimes they did not “know the propriety language [RE3]” needed to support the application as “it was not a question that was asked as part of the Request for Proposal (RFP) [RE3]”, resulting in application downtime, long queue times to resolve queries, etc.

In some pockets within the organisation, there exists those that “have the knowledge... (but) it is not shared across the teams [RE10]” and “not enough education has been done in the company... from an IT perspective [RE4]”.

4.3.12. Ineffective, unclear or conflicting roles

A theme that came through very strongly dealt with the scenario where the agile roles assigned within the organisation were either ineffective or conflicted with the existing roles of those within the team. For example, “there have been challenges bringing in proper product owners [RE7]” in some teams, and sometimes others had taken over the missing roles “without understanding what it is [RE7]”. Ineffective or absent product owners were “not choosing the right items for us (the team) to develop [RE4]” and not “choosing the high impact processes [RE4]”, thus not unlocking enough value for the business.

There was also a lot of uncertainty amongst those interviewed regarding their roles: “as a delivery manager, I was not sure what my role [RE4]” was in the agile construct. The teams were “not given boundaries in which they can operate and what their roles are [RE11]”. Due to their roles not being defined appropriately into the new agile structures, it resulted in them “not (being) empowered to necessarily deliver and drive the changes according to agile principles [RE11]”. Within the organisation, there were “a lot of legacy type roles, that are maybe not perfect fits [RE3]” for the new agile landscape.

Many have done various training courses and certifications. However, “this does not mean that you are now skilled... to do the job [RE4]” and suitably qualified to fulfil the respective (new) role as these skills need to be practised and applied in the workplace, else it “diminishes the value you get out of it [RE8]”. Due to inexperience, staff were not confident in their new roles and unsure of what their role entailed. “There is a messy middle ground between the waterfall thinking and the agile thinking [R11]” in terms of process and people, which still needed to evolve over time.

4.3.13. Lack of trust and support from business

The respondents stated that the business community “wants to see Gantt charts, and they want to see PowerPoint slides, that give them a warm and fuzzy feeling because agile does not give you a warm and fuzzy feeling unless you breathe agile [RE1]”. This was not yet the case in the organisation as there has not been “enough take-on from (the) business community [RE1]”. The business was not yet embracing agile as “agile is for IT only [RE1]” and IT is only “being indulged by business [RE1]”.

One of the respondents indicated that there was a perception by executive management within the organisation that “IT is not innovating and delivering fast enough [RE4]”, which was fuelled by factors including their (executive management) lack of understanding of agile concepts, as well as their lack of support for agile concepts. “The initial expectations of how quickly we can apply the agile way of working, was a bit too optimistic [RE12]” and the “transition period is much longer than what was initially expected [RE1]”.

In some teams, they were not receiving support from business as business had “not been adopted the (agile) process [RE2]” or “are not doing agile at all [RE2]”. There was also an element of distrust from business as to “whether we are running agile or not [RE4]” as business still expected a certain type of reporting, e.g., “percentage... towards agile spend [RE4]” to continuously demonstrate an agile way of working. As business and IT did not share the same KPI's, and they were yet “to understand that they are part of the (agile) journey [RE8]”, there was a constant barrier to success and were not supportive to successful agile implementation.

4.3.14. Lack of empowerment and autonomy in teams

A recurring theme that also came through very strongly was the lack of empowered decision making whereby teams were not given the “autonomy to run with [RE1]” and make decisions. The organisation was not giving power to those entities (teams / groups, etc) that needed to make decisions. Teams “do not have boundaries in which they can make their decisions [RE11]” and “are still not empowered [RE1]” to make decisions.

One of those interviewed made the very important observation that the organisation “moves the information to authority, not the other way around. So, the information must always go to the authoritative person above us to make my decision [RE1]” and the team leader was “not allowed to make his own decision [RE1]”. There also existed a perception that some were “under the illusion that they are empowered to make line decisions [RE6]”, and because they were not “really empowered, it creates a lot of problems in the actual delivery process [RE10]”.

RE1 stated that sometimes the decision making was escalated to have the person in the highest authority make the decision to ensure the team was protected in case something went wrong.

4.3.15. Lack of capacity

When the agile adoption journey was initiated, the organisation took the approach to utilise a combination of existing resources and contracted coaches to assist in the adoption journey. However, some teams “did not get agile coaches [RE2]” and thus had to “figure it out by... [RE2]” themselves. “Everyone is so limited...and not really taking the time out to see where we can assist and help others [RE6]”. Unfortunately, some teams were not willing to assist others to ensure they could meet their own deliverables first “as they might have been instructed to do so [RE1]”.

This adoption strategy also resulted in teams who “were pushed a lot harder in terms of output all the time [RE4]”, with the teams feeling overtaxed. It is important to “consider that this is not the only thing that they (the teams) are doing in their day [RE9]” and their lives now consisted of “a lot of meetings, a lot of conversations, trying to keep everything together and get everyone to focus on the right thing to do [RE5]”. This added to the general theme that the teams were over-committed, whilst juggling dual responsibilities of implementing agile and continuing with business-as-usual activities.

4.3.16. Ineffective measurement

“Performance measurement is problematic (in the organisation) ... as we are measuring individuals, but in agile it is the team that should be measured [RE7]”, and “we do not have a measure everything [RE1]” mindset within the organisation. The teams had not defined a proper “metrics for success [RE3]”. “We do not inform; we would rather not know [RE1]” what is going on in the teams. The organisation did not make proper use of “data-driven decision making supported by (data) transparency [RE1]” for effective measurement metrics within the organisation.

One of the measurement metrics that was adopted was measuring the disruption ratio, i.e., the amount of disruption a team was exposed to due to either changing requirements or new requirements being added. However, “no historical data (is available) to back it up” and no retrospective had been done to “classify these disruptions [RE1]” to ensure the correct items were being measured. The teams had not determined “what disruption ratio is optimal to our revenue [RE1]” thus, this metric was not a defined measure of success or progress.

As only signature projects are included in the program increment (PI), “PI only sees a portion of the delivery [RE10] and there is no holistic view of all project activities that are on the go at any point in time. When the team performance is worse than expected, it is not possible to determine the causes as not all projects are being tracked, measured, and reported on equally.

4.4. Benefits of transitioning from a TPM to an agile approach in complex IT projects

The following section discusses the benefits of transitioning to agile approaches, and each theme is listed in the below table. The themes are shown in relation to the respective framework assisting with the data analysis

Why is the move from TPM to agile approaches necessary?	TOE Framework	STT/STS Framework	# of Incidents	# of References
Empowered / Autonomous teams	Organisational	People	6	14
Improved visibility & transparency		Tasks	6	11
Improved inter-team Cooperation	Organisational	People Structure	2	2
Improved Speed of Delivery		Tasks	8	23
Improved Collaboration and cooperation between business and IT	Organisational	People Structure	8	11
Consistent adoption of agile and use of tools	Technological	Technology People	10	23
Improved management styles and/or behaviour	Organisational	People	7	9
Improved team dynamic & Team culture	Organisational	People	8	19
Appropriate measurement metrics		Tasks	9	13

Table 12 – Thematic summary for moving from TPM to agile approaches

4.4.1. Empowered / Autonomous teams

The themes of empowered teams and autonomous teams were combined as they are both attributes of healthy, well-organised teams, and there is a significant overlap in the feedback from interviewees whenever these concepts naturally arose or were discussed. The study found that because of transitioning to an agile approach, the teams were empowered, self-organised and independent. As RE5 said, “the management style I have been experiencing, like higher up Exco, we are being trusted to work independently (and) getting results” and senior management was “encouraging us [and] enabling us.””.

Interviewees were made to feel empowered as they were given the opportunity to “feedback [directly] to C-level executives [RE6]”. They felt they were being actively encouraged by senior management and played an integral role in the delivery, as they were receiving feedback that was not filtered by their direct line management.

Teams were also deemed to be “fairly autonomous and allowed to decide the future [RE3]” direction of the project, i.e. what items are worked on first, etc. The teams now felt they had control over their project and that they were in command of the solution since they were “driving their own priority [RE12]”. RE7 supported this view as they felt much more empowered and had “control over the solution” via “direct interaction with the customer” to decide on “how best to do something”. Importantly as RE13 stated, they now had the “decision making power” further bolstering the culture of autonomy and empowerment within the organisation.

Importantly, some interviewees noted that although it was not perfect yet, there was “a growing shared... accountability for [the] deliverables [RE12]” within the teams, as a result of the teams being more empowered. Since the adoption of agile approaches, people were being afforded “new opportunities [RE13]” to grow in autonomy and upskill themselves by taking on new responsibilities, which did not exist within the organisation prior to agile approaches being adopted.

4.4.2. Improved visibility & Transparency

The concepts of improved project transparency, as well as improved visibility, came to the fore during some of the interviews. The interviewees felt that due to greater “transparency around knowing what you are doing, what everyone is working on and what our goal is [RE4]”, they could easily visualise the progress being made in the respective teams since the adoption of agile. The respondents also felt that they had greater visibility into the struggles that the teams might be facing, which would previously not been easily identifiable without the increased transparency.

This was primarily since the members “could go to anyone in the team and they’ll know exactly what is happening with everybody [RE4]”. This has been a positive improvement since the transition to an agile approach, which further ensured that team members were aligned to the same end goal. This also enabled the teams to identify problems more quickly and “make the changes quickly and keep them (the business can customers) happier [RE7]”.

Due to this increased visibility, the teams “know what is important [RE9]” and also know what “support to provide [RE9]” the other teams. Where there was “shared delivery across systems [RE9]”, the teams now received the appropriate level of focus and attention. This was supported and underpinned by the ceremonies performed, including the “stand-ups that they do [RE4]” as well as the technologies in use “backing up what is being said [RE4]”.

4.4.3. Improved inter-team Co-operation

Due to the increased visibility and transparency within the teams as well as across the delivery journey, the theme of improved cooperation between the teams became evident. RE5 shared the observation that they felt the teams were “working closely together and working well together”. They were also interacting and co-operating more often. RE12 stated, “I might have seen 20 people within a month (since the adoption of agile) that I wouldn’t have seen until the end of the process when the product was delivered”. They had clearer visibility into the business demands and agreed on “what business wants [RE9]”.

The teams were cross-collaborating (e.g. made use of shared resources, knowledge sharing, etc.) and worked in unison towards the same goal. The increased collaboration allowed for more regular engagement with the customer that was “richer in quality, and dialogue [RE12]” as opposed to previously only having a single engagement at the end of the project.

4.4.4. Improved speed of delivery

The theme of an improved speed of delivery and delivering value sooner compared to TPM was mentioned in some shape or form by 8 of the 13 interviewees. They stated that they were now “getting results [RE5]” and delivering what was required, as compared to the waterfall approaches which “take forever and what comes out is not what you want [RE7]”. Teams were “no longer committing to building a massive journey [RE5]” but realised they “should rather be focussing on the minimum viable product (MVP) [RE5]” and on delivering value to the customer sooner. Teams were also no longer spending a large portion of their time documenting requirements, but could focus on documenting what is required, which further underpins an increased speed of delivery.

Delivery improved as the teams were able to identify and resolve problems sooner via regular targeted discussions between the various teams involving all key team members. The agile way of made all team members accountable, and they could no longer hide behind (un)intended process delays This made it easier to identify non-performers and initiate the necessary performance management measures, which had a direct positive impact on delivery. Teams were also able to identify who is “working at a faster pace than another [RE4]” member within the team and were able to align accordingly via the proper use of agile tools (burndown charts, Kanban boards, etc). In some cases, performance management might have been required, or rebalancing the teams to ensure a consistent delivery across the teams.

The impact of rapid decision making had been significant as the teams were able to decide, check, move on or redo if necessary, which resulted in a significant reduction in delays. Due to the nature of the organisation, “we don’t have the luxury of months planning something [RE5]” and must be able to “at short notice, deliver something... [whilst adapting to] constantly changing customer needs [RE5]”. That is what agile is there for, which is a direct strategic driver and measurement of success for the organisation.

As mentioned in the previous section dealing with autonomy and empowerment, teams had the support and buy-in from the executive and senior management team and had regular “check-in meetings [RE13]”. Furthermore, due to the increased interaction with management it resulted in an increase in delivery cadence as issues that require executive assistance were resolved sooner. As RE3 stated, they “like the fact that we’re delivering something quickly, which is echoed by RE5 who is a “firm believer that we get better results. And we get it more effectively, efficiently by using Agile”.

The transition to agile approaches resulted in the teams being able to “fail fast after a 2-week period [RE12]”, previously the period was 3 months, again unlocking value much sooner. Due to the teams delivering value sooner, both the customer and the team were happier. They were able to deliver quicker with “less documentation... [and] less red tape [RE7]”.

4.4.5. Improved collaboration and cooperation between Business and IT

When asked about the state of the relationship between business and IT, interviewees indicated that in some cases, the business is along for the journey and “they are in it with us... and it’s about making this work [RE13]”. Previously some areas were “very much segmented [RE7]” into individual teams and areas, which is no longer the case. Through the agile adoption, there was now a lot more “collaboration [RE3]” bringing business and IT so “much closer [RE3]” as business and IT have a shared interest (and performance target) in ensuring the project’s success.

In some areas the business, was no longer a separate entity but was working together with IT to make the solutions work. Everyone worked “towards the (shared) goal [RE4]”. The teams were collaborating more effectively with business to improve the ways that they deliver, and really made business think about what it is they want to do. They were attending the same ceremonies (Stand-ups, retrospectives, planning, etc), ensuring business was involved throughout the project cycle. The engagements were more regular and “richer in quality [RE12]” than they were previously. As one interviewee stated: “business and IT are coming together and working as one [RE13]”.

4.4.6. Consistent adoption of agile and use of (Agile) tools

When asked about the status of agile adoption within the organisation, the respondents indicated that they had moved away from “the cycles of once a quarter, five times a year kind of delivery to iterative (delivery) based on completed sprints [RE12]”. The teams had changed the way they work; they brought their vendor onboard and ensured consistent understanding of agile approaches, and also ensured the vendor understood their requirement to move to market faster, all of which underpin the organisation agile adoption journey.

Awareness was created within the organisation, that “guide the business as to how much time do, we actually invest on this (agile adoption) going forward [RE8]”. RE13 also alluded to the fact that “people are learning new things and are being up-skilled”. Experienced team members were available to actively apply the various agile principles, and the teams were following the right approach: “people that are more experienced on Scrum methodologies [RE11]”.

Adopting agile approaches have resulted in some of those interviewed moving from lacking any “proper planning or priorities or stuff [RE8]” to having a “more structured [RE2]” daily routine. The routine ceremonies resulted in less wasted effort and enabling the team to be better prepared to solve issues. They were “not wasting time [RE6]” and were prepared to “solving issues [RE6]”. They indicated that there had been a lot of growth in the areas of planning as they now had a “framework [RE8]” that assisted the team in thinking not only about what was to be done, but also whether it should in fact, be done at all. The teams were able to proactively plan their delivery pipeline based on priority instead of only being reactive.

The teams used the agile framework to make other teams more aware of concepts such as MVP and what could be delivered within a short space of time. They were thus better able to control the demand from business and other areas. The teams now had “more control... in terms of what business pushes through [RE10]”. Some also indicated that they adopted different flavours of agile toolsets, e.g. a Kanban board.

They had tailored their agile implementation slightly to meet their requirements and had “experienced people that set it up [RE4]” for them. They also found value in adopting the agile ceremonies, for example, the backlog refinement process as they were able to use this as a lever in collaboration with business.

A particularly important concept identified by one of the interviewees was that the agile toolsets were just an extension of the company culture and were core to ones being: “[one] will be agile regardless [RE1]” of the toolset. One of the respondents felt that if the teams fully embrace agile, they will agile regardless and will find means and ways to make the agile adoption successful. They would strive for “creating face to face contact [RE1]” with the team, irrespective of the tools.

The majority of those interviewed agreed that they had access to the right tools, and these were being utilised throughout the organisation. The teams had the “correct attitude and appetite [RE12]” for the agile toolsets. The tools in use included JIRA, Confluence, GitHub, etc. The participants recognised that these might not be the best tools available but were making the most of what had been adopted in the organisation.

4.4.7. Improved Management styles and / or behaviour

When asked what management style was being displayed, several interviewees commented that senior and executive management are displaying a “more inclusive [RE6]” management style. This style pertained to including and engaging with the teams during the agile ceremonies, for example, the Gemba walk. The teams felt encouraged by the styles being displayed.

The participants explained that management was on the “journey of learning [RE12]” was actively trying to understand what was required from the various agile practices, team structures, definitions, etc. According to RE8 and RE11, management was displaying a more “servant leadership type style” and they were asking leading questions and providing guidance during the discussions in the smaller groups / forums. It was no longer an “us and them [RE13]” scenario anymore, and management was very much vested in the teams.

4.4.8. Improved team dynamic & Team culture

One of the greatest positive impacts since the adoption of agile approaches, according to those interviewed, was the improved dynamic within the team, the team culture, and the attitudes of the team members. The interviewees indicated that even though the team still had small hiccups, they did not “want to go back to the old way of working” [RE13]. They were facing the challenges together as a cohesive team and no longer felt like they had to resolve the issues on their own as the “leadership is there [RE13]” to assist. Agile adoption had

“brought the people closer together, in terms of relationship and working together [RE7]”. “The team’s happier [RE7]”, “honesty has come to the fore [RE6]” and it brought people closer.

In some areas they had seen personal growth with a visible positive change in their mindset which in turn was having a positive impact on changing the culture within the organisation. One respondent, [RE13], noted that the biggest change had been the “culture change, mindset change” where “business and IT (are) coming together and working as one”. Respondent [RE1] observed that inherently people had the need/want to “do a good job”, be rewarded and “feel satisfied that they’re doing a good job”, and people generally gravitate towards success and doing it better each time.

Over time, trusting and meaningful relationships were built within the teams that were delivering and demonstrating these successes, and people were brought “closer together, in terms of relationships and working together [RE6]”, and “the team is happier [RE7]”. The teams found that personal relationships also drove delivery across the teams, especially when the teams needed to rapidly adapt to changing requirements. Without these personal relationships, the team performance and delivery would have been negatively impacted.

4.4.9. Appropriate measurement metrics

The participants indicated that the measurement metrics were aligned with the delivery and goals across the team, and they had “benchmarked against what it used to be like, and as you add complexity, you can benchmark against that [RE3]”. This benchmark allowed for objective comparison between legacy projects and newly completed projects highlighting the savings brought about by adopting agile approaches. Others measured the success of the team though “new functionality added, the adoption of that functionality, user experience [RE5]” etc, which is a fair measurement according to the team.

In cases where those interviewed dealt directly with customer-facing systems, they indicated they are able to measure the benefits easily via the Net Promotor Score (NPS) or customer satisfaction index (CSI), for example, as this is “what the customer technically feeds back. It tells you whether (the) product or your engagement with (the) company is good or not [RE11]”.

The next section provides a summary overview of the research questions answered in this chapter.

4.5. Summary

The preceedings chapters provided much emperical data to support the study into the barriers and benefits of transition to agile methods, when used in conjunction with complex IT projects. The first section (4.1.) was primarily focussed on providing an overview of the study participants and to ascertain their level of agile expertise and function within the organisation.

The second section was interested in providing answers to the respective research questions and (4.2.2.) highlighted the various barriers to transitioning which included aspects such as Poor mangement being displayed and applied. Retaining a traditional project manangement mindset counter to the shift to agile methods; ineffectively implementing agile methods as well as a lack of support from business to enable a succesful agile implementation.

The next part of the chapter (4.2.3.) strove to provide answers to the second research qestion and identified those benefits that can be expected when transitioning to agile methods. These included an improved speed of delivery after a succesfull agile implementation. Teams are empowered and able to function autonomously, with greater visibility & transparency between teams. Teams are better able to collaborate and cooperate to succesfully deliver on project goals. The overall team dynamic & culture has improved with the appropriate performance measurement metrics implemented to ensure successes can be objectively measured.

Overall this chapter provided many insights and emperical findings to highlight the advantages of transition to agile methods, but also the various barriers that needed to be overcome to transition succesfully. The next chapter provides an in-depth discussion of each research question in relation to the evidence noted in the current chapter.

5. DISCUSSION

5.1. Overview

This chapter provides answers to the main research question - **What are the barriers and benefits of transitioning from TPM to agile approaches in complex IT projects**, broken up into the two subquestion. The answers to these questions take into consideration the major themes that arose during the research and compared them to literature to establish correlation. This section also identified several contradictions as themes were categorised both as a barrier to, and a benefit of, the transition to agile approaches.

The Technology organisation environment framework (TOE), as well as the Socio-Technical Theory (STT/STS) framework, were used to analyse the data obtained. TOE assisted in analysing the relationships between the organisation, the external environment and the technological environment in which it operates, whilst STT/TSS supported the TOE framework by guiding the analysis of the technical subsystem (agile tools) in conjunction with the social subsystem (employees) within the organisation.

5.2. RQ1 - What are the barriers to transitioning from a TPM to an agile approach in complex IT projects?

143 issues were identified during the course interviews, which was consolidated into 16 themes that are considered barriers to the transitioning from a TPM to an agile approach within a complex IT project.

The first of which is the abridged theme related to poor management, which includes the concepts of leadership being absent in the agile transition, management either not adhering (or only partially adhering) to the agile values and principles as defined in the agile manifesto and an autocratic management style being displayed. Diker, Paasivaara & Lassenius (2016) echoed these sentiments in their observations that where there is a top-down mandate, like there was in this case, it “creates tension” within the teams as “management (is) unwilling to adapt to change”. When teams are micromanaged, it results in disempowered teams removed from taking ownership of their project successes.

Another barrier to the success of the transitioning is when teams still operating in default TPM mindset and have not fully embraced an agile approach. If the teams are not receptive to implementing an agile approach, the agile transition will be unsuccessful. This is in line with Nuottila, Aaltonen, & Kujala (2016), that re-iterate that the “mindset of individuals must be receptive for agile principles to enable the organizational environment to accept the agile approachess”. Some did however deliver more effectively when operating in a TPM and not following an agile approach, highlighting that in some cases TPM is still suited for “small projects, repeatable projects and physical projects” (Miller & van Schaik, 2021), which is contradictory with Kashyap’s (2018) findings that TPM is traditionally more suited for Large-scale projects.

In some areas within the organisation agile methods were not implemented effectively, which proved to be a significant barrier to the successful transitioning from TPM to an agile approach. The study found that when teams were forced to transition to an agile approach, it resulted in increased resistance as teams did not perceive the value agile has to offer. This is in line with Mahanti’s (2006) concept of “close-mindedness” and inability to perceive agile as anything other than “code-and-fix in disguise”. Incorrect agile assumptions and a low level of agile maturity drove the wrong behaviour and expanded the divide between those that had already successfully adopted an agile approach and those that had not. Project delivery and value decreased as an inspect and adapt mentality was not evident.

An agile approach was only partially implemented, with TPM still being used in practice, whilst agile ceremonies are being performed. The “misunderstanding (of) the agile concepts” (Diker, Paasivaara, & Lassenius, 2016) resulted in a segmented agile implementation, which dovetailed with the inconsistent agile adoption by the teams, detracting them from the full benefits of an agile approach being realised. The study found that these inconsistencies ranged from different development tools utilised, to a lack of common practices across the teams. All of which resulted in a bi-modal model being adopted, creating additional complexity and resistance when interacting with different teams.

One of the barriers to transitioning from TPM to an agile approach in complex IT projects is the uncertainty regarding the available budget available for the transition, development, maintenance and support. Less funding is available due to funds being redirected for other key strategic projects, impacting on the delivery pipeline and limiting what can be achieved in the year. Furthermore, the restricted budget impacts not only on delivery but also on the developments tool and opportunities within the team, reducing the team efficiency and delivery. This is in line with Narkhede, Raut, Roy, Yadav, & Gardas (2019) that identified lack of funding as a significant barrier to implementing an agile approach.

The change management process supporting the transitioning from TPM to an agile approach was poor, resulting in resistance to change, a lower level of agile adoption, an increased level of uncertainty and a general lack of urgency to adopt an agile approach successfully. This is in line with Partanakul & Rufo-McCarron (2018) that acknowledged the various challenges associated with implementing agile, and “changing the mindsets of project stakeholders”. Change resistance was high in some teams as the benefits associated with an agile approach was not evident, increasing the lethargy in transitioning to an agile approach.

Ineffective coaching was identified as a barrier to the transitioning to agile approaches, as teams were exposed to coaching initiatives unsuited to their team and business context. In addition, when key issues raised during the coaching sessions were not addressed, it resulted in teams becoming disinterested in the coaching activities. This is in line with Elinger, Hamlin, & Beattie (2008) that noted that coaching inhibiting behaviours included being “unwilling to listen to staff concerns” and hoping the problems will go away. Furthermore[,] Senapathi & Srinivasan (2014) echoes the importance of effective coaching and that it is a key factor in “creating and sustaining well-balanced high-performance software development teams”.

Another detractor from successfully transitioning to an agile approach is the internal organisational structures being unable to support the agile transition. The study found that the existing structures & roles were proving to be a barrier to successfully implementing an agile approach. This view is supported by Senapathi & Srinivasan (2014) who indicated that the hierarchal and formal structure currently in place supports a “traditional software development methodology” instead of an agile approach. In addition, the associated agile roles were not evident in the current structure within the organisation resulting in the business being disinvested from delivery.

The monolithic architecture within the organisation is a barrier to successfully transitioning to an agile approach, as these applications had systematically grown and become more rigid over time. The study found that no clear, or comprehensive strategy existed detailing how these legacy applications would be transitioned, modernised or sunsetted, as often these activities are “constrained by the organisation’s technical stack” (Murphy, 2019).

One of the barriers to successfully transitioning from TPM to an agile approach is the organisational, cultural and behaviour change required to affect a successful and permanent transition (to an agile approach). The study found that management was not embracing the agile mindset, resulting in teams not adopting an agile approach. Furthermore, as these teams were still operating in a TPM approaches, team cooperation and collaboration regressed, and each team advocated their own agendas. This is in line with Dennings (2016) who reiterates that in some organisations with an “entrenched hierarchical bureaucracy,” they might not have the capability to “transform themselves and embrace” an agile approach.

Insufficient knowledge of management and teams is a considerable barrier to transitioning from a TPM to an agile approach, as it directly impacts on the ability of people resources to drive project delivery and successes. This is a view shared by Ghobadi & Mathiassen (2017) highlighting the importance of knowledge sharing and the impact it has on different project outcomes. Chow & Cao (2008) also highlighted that correctly skilled resources are critical to agile delivery success. When teams have insufficient knowledge or knowledge is inconsistent across teams, it creates confusion, uncertainty and can result in fragmentation & divergence of processes, all of which result in teams working poorly together, not delivering enough value and delayed project delivery

Ineffective, unclear or conflicting roles within the teams is another barrier to successfully transitioning from a TPM to an agile approach. When roles are unclear or conflict with existing roles, it impacts on the delivery and success of the project due to uncertainty regarding expected deliverables and outcomes. This is in line with Nuottila, Aaltonen, & Kujala (2016) who echoed the importance of having clear roles as well as ensuring the resources within these roles are “available to the agile teams” and provide the required level of assistance.

Another barrier to transitioning from a TPM to an agile approach is the general lack of trust & support from business. The study found that business stood apart and did not perceive the value, thus, they were not supportive of the transition to an agile approach resulting in teams having to continuously demonstrate agile ways of working to business. Gregory, Barroca, Sharp, Despande, & KJ (2016) reinforce the importance of business and IT collaborating in order to establish “agility throughout the value chain”.

One of the barriers to transitioning from a TPM to an agile approach in a complex IT project is the lack of empowerment and autonomy in teams. The study found that when teams are disempowered, not given boundaries in which to operate, and unable to make timeous decisions, it creates many problems in the delivery process. This is in line with (Lee & Xia, 2010) who affirms the importance of autonomy in teams to be able to solve problems creatively, be open to innovative ideas and effectively respond to changes in the environment.

Due to the agile implementation model followed, there existed a lack of capacity within the teams to continue business as usual activities whilst supporting a successful agile adoption. When teams are over-committed, they are unable to effectively support new initiatives. This is in line with Hajjdiab & Taleb (2011) who highlighted the risk that existing work commitments increases the pressure on teams resulting in the “failure of learning and implementing (an) agile” approach. Furthermore, in the event of shared deliverables, teams prioritised individual delivery targets above the shared delivery target due to constrained capacity.

The final barrier to transitioning from a TPM to an agile approach is the ineffective agile measurement metrics in use by the teams. The study found that due to untried & untested measurement metrics adopted and the lack of a holistic view of all project activities undertaken by the team, it resulted in poor-performing teams not being sufficiently analysed to determine the root cause of poor performance. This is in line with Denning (2019) who iterates that if you do not “have metrics”, the team is in trouble.

Barriers of transitioning from a TPM to Agile approaches	Supporting Evidence	Empirical	Supporting literature
Poor management	Section 4.3.1.1 – 4.3.1.4		(Diker, Paasivaara, & Lassenius, 2016)
Traditional TPM mindset	Section 4.3.2		(Nuottila, Aaltonen, & Kujala, 2016); (Miller & van Schaik, 2021)
Ineffective agile implementation	Section 4.3.3		(Mahanti, 2006)
Inconsistent agile adoption	Section 4.3.4		(Diker, Paasivaara, & Lassenius, 2016)
Budget constraints	Section 4.3.5		(Narkhede, Raut, Roy, Yadav, & Gardas, 2019)
Poor change management	Section 4.3.6		(Partanakul & Rufo-McCarron, 2018)
Ineffective coaching	Section 4.3.7		(Elinger, Hamlin, & Beattie, 2008); (Senapathi & Srinivasan, 2014)
Sub-optimal organisational structure	Section 4.3.7		(Senapathi & Srinivasan, 2014)
Ineffective / Incorrect architecture	Section 4.3.9		(Murphy, 2019)
Poor organisational culture & behaviour	Section 4.3.10		(Denning S. , 2019)
Insufficient knowledge	Section 4.3.11		(Ghobadi & Mathiassen, 2017); (Chow & Cao, 2008)
Ineffective, unclear or conflicting roles	Section 4.3.12		(Nuottila, Aaltonen, & Kujala, 2016)
Lack of trust and support from business	Section 4.3.13		(Gregory, Barroca, Sharp, Despande, & KJ, 2016)
lack of empowerment and autonomy in teams	Section 4.3.14		(Lee & Xia, 2010)
Lack of capacity	Section 4.3.15		(Hajjdiab & Taleb, 2011)
Ineffective measurement	Section 4.3.16		(Denning S. , 2019)

Table 13 - Barriers preventing transitioning from TPM to an agile approach themes & supporting empirical evidence

5.3. RQ2 - Benefits of transitioning from TPM to agile approaches

The transition from TPM to agile approaches is an extensive and expensive exercise and requires funding, commitment, and dedication from all levels within the organisation. 59 individual issues were identified based on feedback received, which was consolidated into 13 benefits of transitioning to agile approaches. This was further summarised into 9 themes ranging from empowering the development & delivery teams, improving visibility, communication & transparency within the project, as well as improving team co-operation. These and other associated themes will be discussed in this section.

One of the benefits of transitioning from a TPM to agile approaches in complex IT projects is the resulting level of empowerment and autonomy in the teams. The study found that when teams are empowered to make decisions timeously and effectively, this shapes the direction of the project. Moreover, when teams are autonomous and self-organised, they are able to decide and drive their own priority. This is in line with (Stray, Moe, & Hoda, 2018), who iterated the importance of autonomous teams to the successful agile adoption and implementation.

Another benefit of transitioning to agile approaches is the ability of teams to have end-to-end visibility of activities across the various teams and have complete freedom to approach any team and obtain appropriate feedback re project progress and blockers. Donaldson (2018) echoes this notion that visibility and “transparency enables us to make good decisions” allowing teams to unblock issues and adapt the way they are working.

The increased cooperation, collaboration and interactions between teams and individuals was clearly evident during the research, which reiterates the importance of prizing individual interactions above “processes and tools” (Nee, 2012). Teams were engaging in rich dialogue on a regular basis compared to previous single interactions only at the end of the project delivery.

The fourth benefit of this transition is the ability of teams to deliver value sooner as they only need to focus on documenting what is required to satisfy the agile artefacts. Problem-solving, decision-making and error resolution has improved tremendously, resulting in increased product turnaround time. This is in accordance with Linders (2012) who agreed that agile approaches improve productivity and quality. The teams are also able to fail fast, assess and change direction and unlock value sooner in comparison with traditional approaches.

The barriers between business and IT have been removed, and there exists regular, rich engagements to deliver quality products. The benefits of the improved collaboration and cooperation between business and IT is echoed in the agile manifesto, which “emphasises

value on customer collaboration, specifically consistent interaction of the customer with the product at every phase of development lifecycle” (GSA, 2012).

Another of the benefits of transitioning from TPM to an agile approach is the improvements in the behaviour and type of management styles being displayed. Management now has a more inclusive leadership style, with the teams responding positively to this change in (management) style. Effective agile leadership within teams assists in expanding the capacity for teams to be “to be more agile” (Agile Business Consortium, 2017).

The transitioning has improved the team dynamic allowing problem-solving at a team and not the individual level. Improved personal relationships within and across teams are driving delivery, with teams working as one cohesive unit. This is in line with the agile leadership pillars as discussed by the Agile Business consortium (2017).

Lastly, the organisation has implemented proper performance measurement metrics within the teams to ensure agile successes, focussing on an aspect such as sprint burndown reports, lead time, value delivered, NPS, etc, in line with Plutora’s (2021) agile measurement metrics.

Benefits of Transitioning from TPM to Agile Approaches	Supporting Empirical Evidence	Supporting literature
Empowered / autonomous teams	Section 4.4.1.	(Stray, Moe, & Hoda, 2018)
Improved visibility & transparency	Section 4.4.2.	(Donaldson, 2018)
Improved inter-team co-operation	Section 4.4.3.	(Nee, 2012)
Improved speed of delivery	Section 4.4.4.	(Linders, 2012)
Improved collaboration between business and IT	Section 4.4.5.	(GSA, 2012)
Improved management styles and behaviour	Section 4.4.7.	(Agile Business Consortium, 2017)
Improved team dynamic	Section 4.4.8.	(Agile Business Consortium, 2017)
Appropriate performance metrics	Section 4.4.9.	(Plutora, 2021)

Table 14 - Benefits of transitioning from TPM to an agile approach themes & supporting empirical evidence

5.4. RQ1 & RQ2 Contradicting themes

The following contradicting themes were identified during the course of analysing the interviews. The individual themes have been discussed in-depth in the preceeding chapter, and will only be discussed briefly here.

Barriers of transitioning from a TPM to Agile approaches	
Theme	Supporting literature
Lack of empowerment and autonomy in teams (4.3.14.)	(Lee & Xia, 2010)

Benefits of Transitioning from TPM to Agile Approaches	
Theme	Supporting literature
Empowered / autonomous teams (4.4.1.)	(Stray, Moe, & Hoda, 2018)

Autonomous and empowered teams are self-organised and able to make decisions effectively, shaping the direction of the project and driving their own priority. This is in contrast to some teams feeling that they are disempowered and lack autonomy within the team and are micro-managed. Therefore there was a clear contradiction between some teams, which could be attributed to the way the agile approach was implemented within each area.

Barriers of transitioning from a TPM to Agile approaches	
Theme	Supporting literature
Traditional TPM mindset (4.3.2.)	(Nuottila, Aaltonen, & Kujala, 2016); (Miller & van Schaik, 2021)

Benefits of Transitioning from TPM to Agile Approaches	
Theme	Supporting literature
Improved speed of delivery (4.4.4.)	(Linders, 2012)

Some teams sighted the perceived benefit of improved speed of delivery when transitioning to agile methods, however others experienced an increase in delivery when reverting to a traditional TPM mindset. Furthermore the teams operating in a TPM method were able to occupy multiple roles within the team, thus allowing for rapid decision making and project delivery. This contradiction challenges the perceived notion that only agile methods allow for improved speed of delivery.

Barriers of transitioning from a TPM to Agile approaches	
Theme	Supporting literature
Lack of trust and support from business (4.3.13.)	(Gregory, Barroca, Sharp, Despande, & KJ, 2016)

Benefits of Transitioning from TPM to Agile Approaches	
Theme	Supporting literature
Improved collaboration between business and IT (4.4.5.)	(GSA, 2012)

Some of the teams sighted the removal of traditional barriers, after transitioning to agile methods, allowing for collaboration and interaction with business, whilst others experienced a lack of trust and support from business. Thus highlighting the contradictory fashion the agile implementation was approached and implemented.

Barriers of transitioning from a TPM to Agile approaches		Benefits of Transitioning from TPM to Agile Approaches	
Theme	Supporting literature	Theme	Supporting literature
Poor management (4.3.1.)	(Diker, Paasivaara, & Lassenius, 2016)	Improved management styles and behaviour (4.4.7.)	(Agile Business Consortium, 2017)

Some teams noted an overall improvement in management styles and behaviours after transitioning to agile approaches, however others still felt that management were autocratic, not adhering to agile values and principles or altogether absent in the agile transitioning.

Barriers of transitioning from a TPM to Agile approaches		Benefits of Transitioning from TPM to Agile Approaches	
Theme	Supporting literature	Theme	Supporting literature
Ineffective measurement (4.3.16.)	(Denning, 2019)	Appropriate performance metrics (4.4.9.)	(Plutora, 2021)

Finally, some teams noted a difference in perception within the organisation regarding the measurement metrics in use (within the organisation) as some were of the opinion the metrics were enough, whilst others view these metrics as lacking and ineffective. Again this can be attributed to the different approaches taken within the organisation and the non-adherence to the central policy directive when implementing agile.

These divergent or contradicting themes highlight the different agile landscape for each of the teams as the agile approach is not yet mature or complete within the organisation, and all teams have not transitioned equally.

6. CONCLUSION

This chapter provides a summary of all research project including the research problem, objective, findings, etc. and concludes with a research conclusion.

6.1. Research Summary

6.1.1. Research problem and questions

The transitioning from a traditional project management approach to a more modern agile approach poses several challenges to an organisation, which include increased transparency of skills deficiencies, the need for developers to be competent across a broad range of skills, increased reliance on social interactions & skill, lack of business knowledge as well as lack of motivation to use agile approaches (Conboy K. , Coyle, Wang, & Pikkarainen, 2011).

Other challenges such as the perceptions of the differing interpretations of agile, the excessive claims about agile success, the limited information available re failures as well as the inappropriate use of agile approachess (Gregory, Barroca, Sharp, Despande, & KJ, 2016) compounds the agile adoption problem. Without properly identifying these challenges, the organization will be unable to address these and other challenges and will thus be unable to transition from the traditional practices it currently employs to the more modern project management techniques.

This research strove to answer the primary question - **What are the barriers to, and benefits of, transitioning from TPM to agile approaches in complex IT projects?**

To this end, the following questions were addressed and answered during the course of the research;

- What are the barriers to transitioning from a TPM to agile approaches in complex IT projects?
- What are the benefits of transitioning from TPM to agile approaches in complex IT projects?

6.1.2. Overview of Findings

A considerable amount of research has already been performed to assess the challenges and benefits of agile adoption; however, this research focussed specifically on the transition from TPM to a agile approaches. Throughout the study, the Technology organisation environment framework (TOE) as well as the Socio-Technical Theory (STT/STS) framework was used to guide and inform the research questions, the interview questions, as well as the final analysis of the data obtained.

Initially, a freeform data analysis approach was used to group the findings into broader categories, after which the above frameworks were used to inform the findings and analysis. TOE was chosen as the framework as it is well suited to assist in analysing the relationships between an organisation, its external (market) environment, as well as the technological environment in which it operates. STT/STS supported the TOE framework by guiding the analysis of the technical subsystem (agile tools) in conjunction with the social subsystem (employees) within the organisation. The research questions were also tailored to align with the TOE and STT/STS framework.

Research findings were divided into two main sections, with the first focussed on the respondent demographics and providing an overview of the experience and training levels of the various respondents. The second research findings section was focussed on the emperical findings and was subdivided into three smaller sections of which the first highlighted those factors considered by the participants to influence the complexity of a project. These factors were very relevant as the study focussed primarily on assessing complex IT projects, with some of the identified factors included the inherent complexity of systems with complex business rules, the time pressures the teams have to operate under, the complexities associated with human resources;[,] the additional complexities with virtual (geographically separated) teams and finally the complexities derived from systems being interdependent on each other.

The second section in the emperical findings chapter was concerned with answering the first research question, i.e. “What are the barriers of transitioning from a TPM to an agile approach in complex IT projects?”. Some of the challenges identified included insufficient direction and support received from management during the transition; non-adherence to the agile values and principles by management; autocratic management style whilst not allowing teams to selforganise and decide on the project priorities.

Other challenges include teams that were not fully committed to agility and are only pretending to be agile to appease management as they had not experienced or perceived the true value in implementing agile approaches correctly; forced agile adoption resulting in a low level of agile maturity and poor adherence to agile ceremonies. The study also found that inadequate agile coaching, because of a poor understanding of the business context, does not yield the expected outcome and is a barrier to successfully transitioning to agile approaches

Other challenges to transitioning to agile approaches include the lack of the inspect and adapt mentality in teams who neglect to analyse problem areas to improve performance. Moreover, project delivery and agile transitioning is negatively impacted by the uncertainty of funding availability for existing and future projects with teams being unable to commit to delivering and supporting new functionality. The study also found that the hierarchal organisational structure is not suited to the new agile landscape; measurement metrics are inconsistent and ineffective; legacy roles are ineffective and yield conflict; Ineffective roles create an environment where teams are overworked whilst having to accommodate both the old and new agile roles, and in such cases teams are tempted (and do) revert to TPM. Lastly, the study found that it is more difficult for organisations with monolithic legacy applications to transition (and maintain) agile approaches for complex IT projects.

The third section of the empirical findings chapter was focussed on identifying the benefits of transitioning from TPM to agile approaches. The study found that some teams were empowered to work autonomously, were self-organised and were empowered to decide on the future direction of their projects. The team enjoyed greater visibility of the end-to-end product journey both within and across teams, as they now had the freedom to interact with other teams on a regular basis. The speed of delivery was also improved with greater collaboration and cooperation between business and IT. The study also found an improved management style, team dynamics and overall company culture improvement.

6.1.3. Limitations of the study

This research study was a retrospective cross-section analysis based on retrospective data. Some bias from those interviewed might be present in the data due to the subjective perceptions of the participants, which could skew judgements or responses, when asked questions focussed specifically on the transition from TPM to agile approaches.

The analysis revealed that the themes identified were consistent across all research posing no threat to the viability of the study. The case was limited to a single telecommunications South Africa and was further limited to only IT-related challenges experienced when adopting agile approaches and might not be representative of the greater agile community. This study is relevant to the agile community as the telecommunications industry experiences a high

rate of change and are required to respond swiftly to changing customer requirements, thus the need to transition to agile methods within a short period of time. The study also highlights various key findings that are not industry specific and are relevant to the greater agile community.

6.1.4. Recommendations for future research

The following were identified as possible areas of future research. Firstly a study could be conducted with a greater sample size to deep-dive the contradicting themes and determine the respective root causes as the sample was limited to a single group within a single telecommunications organisation. A study to identify what role / actor the company culture plays in the successful adoption of agile.? (. i.e., How big a driver is company culture to the success of an agile adoption?) could be undertaken to further explore the importance of the company culture in driving successful methodology adoption.

A study could be conducted to investigate what type of company culture is most suited to an successful agile adoption. A study could be undertaken to identify those circumstances in which regressing to TPM benefit project delivery as several interviewees reiterated the value of TPM methods in achieving their project deliverables and objectives. A study could be undertaken to investigate how relevant segregation of agile roles are in a real world scenario, .i.e. Smaller teams not allowing for a separate Product owner, etc. A study could also be undertaken to determine which minimum measurement metrics must be in place to effectively monitor agile delivery.

6.1.5. Contributions to practice and research

6.1.5.1. Contributions to research

The study affirmed the benefits and barriers to transitioning from TPM to agile approaches within the confines of a complex IT project. It confirmed and re-affirmed several key themes as described in literature, whilst at the same time identified various contradicting themes to be explored in future research, which included, identifying autonomy as a benefit to the transition allowing for self-direction, whilst at the same time identifying that some teams were disempowered and lacked decision-making authority in order to be able to selfdirect and manage. Also the study found that measurement metrics was also implemented in a contradictory fashion as some teams were measured effectively, whilst others lamented a lack of appropriate metrics.

The study also found that the speed of delivery had increased due to the successful transition to agile approaches, whilst at the same time experiencing an increase in delivery cadence due

to reverting to TPM. This is inline with recent studies showing the relevance of utilising a combination of TPM and agile within the organisation.

6.1.5.2. Contributions to practice

They study illustrated that these barriers and benefits are applicable to the large scale telecommunications industry, and it provided greater insights into the various causal factors. By identifying these barriers and benefits it serves as a guide to management on which areas to leverage as well as which implementation pitfalls to avoid. For example, the study highlighted the inconsistent adoption of agile methods as a barrier to success, thus showcasing the importance of adopting agile methods in a clear and uniform fashion across the enterprise, to management.

The study also found that in some teams, the relationship with the business had significantly improved, however others reported a downturn in the collaborative and trusting relationship with business, again illustrating to management the important of clear lines of communication and areas of responsibility. It was found that although some teams reported improved team dynamic and cooperation, it was counterbalanced by an ineffective culture & behaviour, indicating to management the requirement for the correct “Tone at the top” and clear company culture when transitioning to agile methods.

Lastly, the importance of an inclusive management style was identified, highlighting to management the need to move away from an autocratic, micromanaging style in order to ensure a successful and lasting transition to agile methods.

6.2. Research conclusions

In the fast-paced environments that IT operate in, it has become extremely important to be able to deliver quality products timeously and effectively. Transitioning to agile approaches aims to remove many of the barriers and limitations associated with traditional project management approaches to provide the customer with a working product sooner and in line with their expectations.

Although the sample used within this research is small, it is still representative of contradicting and concurring viewpoints re agile adoption within the organisation. The organisation has reached a tipping point in their agile adoption and is pushing ahead to make the adoption a success and has made the successful transition from TPM to agile approaches as a strategic priority. Many lessons were learnt, and several pitfalls were identified that occurred during the transition, and whilst not all of these have been addressed, it does provide some positive undertones to the longevity and success of the project.

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8. APPENDICES

8.1. Appendix A – Project management methodologies

Grouping	Methodologies	Description & Comment
Traditional, Sequential methodologies	Waterfall	Most common PM methodology and most widely used. Previous task must be completed before the next one can start. Does not accommodate changes in scope well.
	Critical Path Approaches (CPM)	Based on principle that some tasks cannot start, if previous task has not been completed, so dependant tasks are strung together to form the critical path. Can accommodate scope changes.
	Critical Chain Project Management (CCPM)	Focused on those resources required to complete a task and identifying the “critical chain” / high-priority tasks.
PMI / PMBOK		Project broken into 5 process groups as defined by PMI (initiating, planning, executing, controlling & closing).
Agile Family	Agile	Based on the Agile Manifesto, with 4 main values and responds well to scope changes.
	Scrum	Most popular agile development framework, as it is easy to implement and solve many historic software development problems.
	KANBAN	Based on team’s capacity to do the work and uses visual aides to communicate team’s capacity to accept more work.
	Extreme Programming (XP)	Used to improve software quality and simplicity and accommodate changes in scope well.
	Adaptive Project Framework (APF)	Uses iterative stages to produce most business value.
Change Management methodologies	Event Chain methodologies (ECM)	Identifying and preparing for risks residing outside of the project.

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Grouping	Methodologies	Description & Comment
Change Management methodologies	Event Chain methodologies (ECM)	Identifying and preparing for risks residing outside of the project.
	Extreme Project Management (XPM)	Opposite of waterfall by allowing the managing of massive changes whilst still moving forward.
Process-based methodologies	Lean	Focussed on streamlining and cutting out waste.
	Six Sigma	Statistical-based methodology measuring defects or bugs and reduce to 0.
	Lean Six Sigma	Hybrid of Lean and Six Sigma.
	Process-based Project Management	Aligns project and organisational objectives, mission, and values.
Other	Prince II	Projects in controlled environments - In use in UK utilising product-based planning approach.
	PRISM	Projects Integrating Sustainable Process – managing change whilst incorporating environmental sustainability.
	Benefits Realisation	Focused on ensuring that benefit derived from project is adequate.

8.2 Appendix B – Research Consent form

	Department of Information Systems Leslie Commerce Building Engineering Mall, Upper Campus OR Private Bag X3, Rondebosch, 7701 Tel: +27 (0) 21 650 2261 Fax: +27 (0) 21 650 2280 Internet: http://www.commerce.uct.ac.za/informationssystem/
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Consent to Participate in Research Study titled “Factors influencing software development in complex IT projects”

In signing below, I hereby grant consent for the researcher, Jaco Griebenouw, to interview me as a participant of the research study described in the accompanying cover letter.

I acknowledge that:

- My participation is voluntary and can be withdrawn at any time.
- All information I provide will be kept confidential and used only for this study.
- Any information I provide may be used in anonymous form the final technical report of the project.

In addition, I grant permission for the audio of any interview I participate in to be recorded OR I do not grant permission for the audio of any interview I participate in to be recorded (Please cross out whichever statement is not applicable.) I do so understand that any audio recording made will be kept confidential and will only be used for this research study.

Name:		Signature:	
Date:			

8.3 Appendix C – Interview Guide

Opening

- Thank you very much for being prepared to let me interview you.
- As I mentioned in my introductory letter, I am researching those **Factors that influence software development within a single telecom's organisation, with specific reference to complex IT projects.**
- I have several questions I'd like to go through but would like to encourage you to be open and honest in your responses and please feel free to share any points of view as we continue with the questions.
- All the responses received will be fully anonymised and kept confidential.

Questions

Overview

1. How best would you describe your current role in the agile community / landscape?
2. How long have you been operating in this role and completed any Agile-related training recently?
3. Can you please share your understanding of what you deem a complex IT project to be?

People / Training / Knowledge / Structures

4. Do you believe the transition to agile has the necessary level of support and direction to assist in project delivery? If yes / no, please elaborate?
5. What type of management style have you seen displayed in driving this adoption?
6. Do you think this is a suitable approach or would you have wanted a different approach to be followed?
7. Do you believe teams are being empowered to make the right decisions at the appropriate times, in order to deliver?
8. Do you believe people are sufficiently right skilled to perform their respective functions, specific to developing / delivering on complex projects?
9. What is your view on the status of agile adoption within the organization?
10. Do you believe that those driving the adoption follow a unified / standardized approach?
11. In your opinion, are the areas within the organization structured correctly in order to effectively deliver?
12. Do you believe traditional project management principles have value and should be retained? Please elaborate.
13. In your opinion, is this transition to agile approaches reaping the necessary rewards and value?

Process & Technologies

14. Do you believe that the drive towards agile adoption has resulted in a misalignment between development & business requirements?

15. Do you feel that you are given the necessary support by shared teams for the delivery to be successful?
16. How is the success of your development / projects currently measured? Is this a fair measurement? Please explain.
17. Do you believe the existing systems are able to accommodate with the rapid rate of change? Both current and future view?
18. Do you believe the organization have the necessary tools (and are you suitably versed in said tools) in order successfully deliver on complex IT projects?
19. In your opinion, what are the most significant value ads / detractors from adopting agile approaches in the organization?
20. In your opinion, what are the organizational characteristics that are obstacles to the transition

General

21. In your opinion are there any other factors that negatively impact on the successful delivery of complex project development?

8.4 Appendix D – All positive themes grouped into major themes

[illegible]

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		Empowered / Autonomous	Improved visibility, Communication & transparency	Improved inter-team co-operation	Improved Speed of Delivery / Delivering Value sooner	Collaboration between business and IT	Improved agile adoption and use of tools	Improved management styles	Improved team dynamic, Team structure & culture	Appropriate measurement metrics	Increased cooperation and collaboration
12.4.1.9.	Improved (general) awareness of Agile practises methods						x				
14.4.1.1.	Receiving appropriate level of support to deliver successfully					x					
14.4.1.1.1.	Transparency		x								
14.4.1.1.2.	People understanding the value of what is to be delivered									x	
15.4.2.1.	Appropriate measurement metrics									x	
15.4.2.2.	Defined Measurement metrics									x	
18.4.1.1.	Increased cooperation and collaboration										x
18.4.1.1	Increased team autonomy									x	
15.4.2.2.3.	Improved management styles										
18.4.1.4.	Improved Speed of Delivery (SoD)				x						
18.4.1.4.1.	Improved focus				x						
18.4.1.4.2.	Testing concepts earlier in the process				x						
18.4.1.4.3	Improved transparency		x								
18.4.1.5.	Increased exposure to latest training, tools, etc						x				
10.3.2.1.	Improved Speed of delivery				x						
11.3.1.1	Improved delivery				x						
11.3.1.2	Empowered	x									
11.3.1.3	Innovation										
11.3.1.4	Improved structure								x		
11.3.1.5	Improved efficiency				x						
11.3.2.	Promoting transparency		x								
11.3.3.	Promoting collaboration					x					

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		Empowered / Autonomous	Improved visibility, Communication & transparency	Improved inter-team co-operation	Improved Speed of Delivery / Delivering Value sooner	Collaboration between business and IT	Improved agile adoption and use of tools	Improved management styles	Improved team dynamic, Team structure & culture	Appropriate measurement metrics	Increased cooperation and collaboration
11.3.4.	Improved Team culture / productivity								x		
14.4.1.2	Personal relationships driving behaviour								x		
14.4.1.3	Interventions resulting in improved delivery								x		
14.4.1.4	Autonomy	x									
14.4.3.	Relationship importance to deliver								x		
17.4.1.	Tools as extension of Culture						x				
17.4.9.	Correct appetite, attitude, and tools to be used						x				
13.3.5.	Improved communication			x							
13.3.6.	Utilising Agile Toolsets correctly						x				

8.5 Appendix E – All Negative themes grouped into major themes

[illegible]

Factors influencing software development in complex IT projects using Agile approaches – A single telecoms case study

#	Theme	Poor Management	Agile Window dressing	Anti-Agile measurements	TPM mindset	Ineffective Agile Implementation	Inconsistent adoption	Budget constraints	Poor Change Management	Ineffective Coaching	Ineffective Org / Team structure	Ineffective / Incorrect architecture	Culture & Behaviour	Insufficient knowledge & skill	Ineffective or Conflicting roles	Business expectations or lack of support from	Disempowered	Lack of capacity	Inadequacy of tools	Ineffective measurement	Legacy applications & processes	Reduced delivery and or quality
4.5.5.	Anti-Agile measurements			x																		
4.5.1.	Autocratic old school Management Style	x																				
4.5.3.	Forced adoption					x																
4.5.6.	Inconsistent adoption						x															
4.5.4.	Not using Agile Toolset effectively																		x			
5.4.6.	Anti-Agile Practices			x																		
5.4.2.	Company behaviours												x									
5.4.1	Disempowered Decision making																x					
5.4.5.	Micromanagement	x																				
5.4.3.	Organisation structure										x											
5.4.7.	Undefined or Poorly defined Roles and Responsibilities														x							
6.4.6.2	Inappropriate Ineffective Roles and Responsibilities														x							

Factors influencing software development in complex IT projects using Agile approaches – A single telecoms case study

[illegible]

Factors influencing software development in complex IT projects using Agile approaches – A single telecoms case study

[illegible]

Factors influencing software development in complex IT projects using Agile approaches – A single telecoms case study

[illegible]

Factors influencing software development in complex IT projects using Agile approaches – A single telecoms case study

[illegible]

Factors influencing software development in complex IT projects using Agile approaches – A single telecoms case study

[illegible]

Factors influencing software development in complex IT projects using Agile approaches – A single telecoms case study

[illegible]

Factors influencing software development in complex IT projects using Agile approaches – A single telecoms case study

[illegible]

Factors influencing software development in complex IT projects using Agile approaches – A single telecoms case study

[illegible]

Factors influencing software development in complex IT projects using Agile approaches – A single telecoms case study

#	Theme	Poor Management	Agile Window dressing	Anti-Agile measurements	TPM mindset	Ineffective Agile Implementation	Inconsistent adoption	Budget constraints	Poor Change Management	Ineffective Coaching	Ineffective Org / Team structure	Ineffective / Incorrect architecture	Culture & Behaviour	Insufficient knowledge & skill	Ineffective or Conflicting roles	Business expectations or lack of support from	Disempowered	Lack of capacity	Inadequacy of tools	Ineffective measurement	Legacy applications & processes	Reduced delivery and or quality
16.4.3.	System design not suited to Agile implementation / methods											x										
16.4.2.	Systemic system growth (Monsters)											x										
17.4.10	Impression of tools not providing positive benefits																		x			
17.4.7.	Inconsistent tool adoption across the organisation (Too many to choose from)						x												x			
18.4.2.3.2.	Lack of alignment with business															x						
17.4.1.1.	Lack of appropriate culture												x									
17.4.6.	Lack of appropriate governance in place					x																
17.4.4.	Lack of knowledge to use tools effectively													x								

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[illegible]

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#	Theme	Poor Management	Agile Window dressing	Anti-Agile measurements	TPM mindset	Ineffective Agile Implementation	Inconsistent adoption	Budget constraints	Poor Change Management	Ineffective Coaching	Ineffective Org / Team structure	Ineffective / Incorrect architecture	Culture & Behaviour	Insufficient knowledge & skill	Ineffective or Conflicting roles	Business expectations or lack of support from	Disempowered	Lack of capacity	Inadequacy of tools	Ineffective measurement	Legacy applications & processes	Reduced delivery and or quality
19.3.5.	Lack of empowerment					x											x					
19.3.1.	Lack of Inspect & Adapt																					
19.3.8.	Lack of or unclear agile roles														x							
19.3.6.	Legacy systems																				x	
19.3.9.	Personal accountability for improvement												x									
19.3.7.	Unrealistic initial expectations re Agile adoption															x						

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