FACTORS INFLUENCING AGILE ADOPTION IN INFORMATION TECHNOLOGY PROJECTS: A CASE STUDY OF A SOUTH AFRICAN TELECOMMUNICATIONS COMPANY

By

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DECLARATION

I, Zanda Veliswa Zawula, hereby declare that the dissertation, entitled ‘Factors influencing agile adoption in information technology projects: a case of a South African telecommunication’s company’, which I have submitted for the MTech: Business Information Systems Degree, at Tshwane University of Technology, is my own original work and that it has not previously been submitted to any other institution. All sources used or quoted are indicated and acknowledged by means of a comprehensive list of references.

_________________________ …………………………………………………
ZANDA VELISWA ZAWULA Date:
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ABSTRACT

The dynamism of the telecommunications industry and the evolution of technology means that the industry needs to be efficient and quick in delivering new products and services to customers to remain competitive. As a response, organisations in this industry are investing greatly in Information Technology (IT) and thus several IT projects are executed for improved business operational efficiencies and effectiveness, productivity, and competitiveness. However, the failure rate of IT projects is still high; more so in developing countries such as South Africa. Key to the reported causes of these project failures is the use of traditional methods in the project management lifecycle, even though agile methods have been introduced to counter most of the challenges and limitations. The primary objective of this study is to investigate the factors that influence the successful adoption of agile methods in IT projects in South African the telecommunications industry.

The study uses a telecommunications organisation in Gauteng Province as a case study. For the study, qualitative research methodology within a single case study approach was adopted, where data was collected through interviews and questionnaires. The thematic data analysis technique was used as underpinned by the key elements of the McKinsey 7-S framework which was applied as the theoretical framework of this study.

Questionnaires were used to determine the factors influencing the agile adoption in IT projects. The follow-up interviews explored further responses of the participants. The top factors identified from this study as those that influence agile adoption in IT projects are shown in terms of strategy, skills, staff, style, system and structure. In addition, analysis discovered that practitioners disagreed about the importance of the shared value of Agile. While we believe that these findings are particularly important from the South African Telecoms industry perspective, however, they also help add to the body of evidence in the field of software development process particularly in terms of agile methods adoption. Moreover, the study also can help adopters from other industries to understand and see the suitability of agile methods for their organisations. The agile adoption challenges and benefits from a South African Telecoms industry context were also established and presented.

**Key Words:** Agile methods, Information Technology projects, Agile in Telecoms, McKinsey 7-s framework, agile methods adoption and use in South Africa.
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1. INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 INTRODUCTION

The potential of agile methods has been recognised in South Africa, resulting in most organisations such as those in the telecommunication industry adopting the use of agile methods in their information technology (IT) projects. However, the actual implementation of IT projects using this method is not seen. The reported factors to this effect range from culture, budgetary constraints, accountability, requirement traceability and compatibility of agile methods in the organisation (Srinivasan & Lundqvist, 2009; Gandomani et al., 2013). Thus a gap exist in the body of knowledge as there are limited studies indicating not only the success factors and benefits of agile, but the context-specific factors that hinder the successful implementation of agile methods in IT projects.

Information and Communications Technology (ICT) innovations continue to play an important role in improving productivity while reducing costs in different industry facets today. With the existence of the internet and use of information technology, organisations have the prospective to expand their base through reaching to broader customer base, timeously launch and introduce new products and services quickly, and the ability to collaborate with other stake holders such as suppliers and business partners from all over the world (Berisha-Shaqiri, 2015). According to Butt (2015), the last two decades has demonstrated that organisations that do invest in ICTs increase their market share, financial figures and overall competitiveness.

Even though the ICT industry has changed rapidly over the past decade with the introduction of more powerful technologies e.g. robotics, and artificial intelligence, new mechanisms of accessing ICT and integrating it in multiple devices and new ways of producing digital content have been developed. radically changing the industry and accelerating the convergence among the ICT, telecommunications, and media industries, South Africa is not yet leveraging the potential benefits associated with ICT.

Significant shortcomings in terms of poor ICT adoption rate and its usage is still prominent, due to the lack of basic skills and capability availability in large segments of the population and the high costs of accessing the inadequately developed ICT infrastructure, despite efforts on the part of the business community to use ICT and integrate it in a broader, firm based innovation system. Traditionally, the general approach in software development projects were specifying the requirement, designing the code, testing, and implementation of the code. However, the requirements are continually changing, resulting to system designs or
implementation strategies having to be revised, redesigned and re-tested frequently. As a result, the development process takes a long time to deliver the desired software, thus negatively impacting on project schedule. In a fast moving and volatile business environment, this can result to several difficulties, as mostly by the time the software is deployed to be used, the original reason and requirements for it to be developed may have changed – meaning that the solution cannot then be used effectively nor meets the current business needs.

While some organisations uphold that agile methods have the potential to counter their project failure problems, there are few of those organisations that have shown consistent success over a range of typical software projects, even after attesting to the potent of agile methods (Srinivasan & Lundqvist, 2009; Gandomani et al., 2013; Coram & Bohner, 2005; Lee et al., 2010). Agile methods have advantages, especially in accommodating change due to volatile requirements. Telecommunication companies are operating in increasingly dynamic and competitive markets. The new business challenges reflect on their product development, which has to be able to respond faster to changing situations. Several agile software development methods are proposed as an alternative to the traditional heavy weight approaches.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

Competition in the telecommunications industry in South Africa is described as one of the most dynamic and vibrant on the African continent, and it is influenced by the growing mobile popularity and the increase in number of subscribers which results in increased mobile broadband penetration in South Africa (Deloitte Digital, 2013). The dynamism of the telecommunications industry and the evolution of technology mean that the industry needs to be efficient and be quick in delivering new products and services to their customers to remain competitive in response to the changing external marketing environment (Sudhakar, 2012). To be able to create new opportunities such as gaining market share, eliminating threat of substitution, and creating competitive advantage, organisations have had to rely on the successful implementation of Information Technology (IT) projects to achieve their competitiveness in the market (Chin, 2004).

As the need for IT projects intensified over the years, the traditional method of software development has been successfully used as it provides the organisations with a structured method of development that is characterized by clearly defined stages and milestones which make it a simple and easy model to use (Fergis, 2012), and a predictable and stable method with high levels of assurance (Chow, 2010).
The changes in business environmental factors usually present new constraints that require changes in the project scope or design in order to counter the challenges presented by the environmental forces (Jayawardena & Ekanayake, 2010). As all project deliverables, requirements, designs and plans are completed upfront within the traditional methods, the projects tend to fail as they may at the end not be addressing the current challenge or business need due to the rigidity of the traditional methods. To counter this challenge, a new paradigm, referred to as agile software development method that promises the desired flexibility in IT projects was adopted. Over the last decade the agile method of software development has been gaining popularity over the traditional software development method as it is based on iterative cycles which allow projects to be delivered fast while dealing with the issues of changing requirements (Hussain, 2012).

In addition to project flexibility and iterative delivery, implementing agile methodologies in IT projects is reported to yield improved customer satisfaction, developer morale, end-product quality (Misra et al., 2009; Lindvall, et al., 2002; Boehm & Turner, 2004; Srinivasan & Lundqvist, 2009), and promotes the use of the industry’s best practices designed to embrace change and promote continuous delivery (Lee, Guadagno & Jia, 2003). However, the levels of agile use in IT projects in developing countries is still very limited, thus organisations are still using the traditional methods. The potential of agile methods has been recognised in South Africa, resulting in most organisations such as those in the telecommunication industry adopting the use of agile methods in their IT projects. However, the actual implementation of this method is not seen in IT projects.

The reported factors causing the lack of actual implementation of the agile method range from culture, budgetary constraints, accountability, requirement traceability and compatibility of agile methods in the organisation (Srinivasan & Lundqvist, 2009; Gandomani et al., 2013; Coram & Bohner, 2005; Lee et al., 2010). Thus a gap exists in the body of knowledge as there are limited studies indicating not only the success factors and benefits of agile, but the context-specific factors that hinder the successful implementation of agile methods in IT projects in South Africa. This study will use the telecommunications industry as a case study to understand the underlying factors leading to the Telecommunications Company not implementing agile methods successfully.

1.3 PROBLEM STATEMENT AND PURPOSE

Agile software methodology has the potential to improve the delivery of IT projects, as it encourages continuous improvement and rapid, adequate response to change, as organisations are constantly facing evolving environments and changing requirements of
customers (Nerur et al., 2005). This change requires new software development methods that enable flexibility and adaptability in order to comply with the often-changing requirements of customers (Cao et al., 2004). According to Coram and Bohner (2005), there is proof that agile methods when applied singularly under the right circumstances, result in lower risk projects and, ultimately, better productivity and quality. Tripp 2010 cites advantages of agile adoption as a boost in productivity by creating a sustainable pace of development; building trust between the software development team and their stakeholders due to the integration of stakeholders into the project team; and better management of turbulent environments due to their focus on interactive and adaptive design and delivery. This increased delivery success is claimed to reduce risk, and to provide a better return on investment (Moran, 2002; Highsmith, 2002). These claims have spurred widespread agile methodology adoption (Ambler, 2011; Schwaber & Fichera, 2005), with more than 50% of organisations reporting the adoption of agile methodologies (West & Grant, 2010).

While telecommunication organisations have been slow in adopting agile methods, it has been suggested that ‘most organisations cannot ignore the agile wave, but for those invested in traditional systems development, adoption of agile methodologies will likely pose several challenges.’ Moreover, there are various context-specific factors that could enable or hinder the success of agile adoption in South African organisations, such as organisational culture and structure, available skills and management style; hence it is to understand those requirements and influencing factors that essential for successful adoption of agile methods in South African IT projects. This study is such an attempt, using a telecommunications organisation as a case study.

1.4 OBJECTIVES OF THE STUDY

The objective of this study is to investigate the factors that influence the successful implementation of agile methods in IT projects in the South African telecommunications industry, using a telecommunications organisation in Gauteng Province as a case study.

In order to achieve the above objective, the following sub-objectives were considered:

- To establish the current state of agile method adoption within the organisation;
- To determine perceived value and impact of agile use on IT project success;
- To identify the organisational factors contributing to IT project success;
- To establish the challenges stemming from the above factors which can influence the successful implementation of agile IT projects;
• To determine the counter measures that can be adopted to overcome these factors for agile implementation success in the South African telecommunications environment.

1.5 RESEARCH QUESTIONS

The main research question of the study is: What were the organisational factors that impeded the successful adoption of agile methods when implementing IT projects within the organisation under study?

The following secondary research questions were formulated:

• What was the current state of agile adoption within the organisation?
• What was the perceived value and impact of agile use on IT project success?
• Which of the organisational factors that contributed to IT project success were eminent in this organisation?
• Which of these eminent factors presented challenges that hindered the successful implementation of agile IT projects?
• What were the perceived counter measures that could aid successful adoption of agile in the organisation?

1.6 SIGNIFICANCE OF THE STUDY

In the body of knowledge, the research contributes by extending the knowledge on those factors that hinder successful adoption of agile methods in organisations. More specifically, the significance of this study is that it sought to reveal those South Africa specific factors that contribute to the lagging adoption of agile methods in IT projects, thus helping to understand the overall IT project failure problem from the developing countries' viewpoint. Additionally, the study was not only contributing to the body of knowledge with the context-specific enquiry but also adopt the McKinsey’s 7s theory to elicit the organisational factors stemming from strategy, structures, systems, culture, values system, skills, and leadership style that could impact and hinder agile adoption in IT projects; this has not been considered in previously related studies in any context. Moreover, in practice the research helps the telecommunications industry not only to identify these factors but provides means on how to eliminate or mitigate such, in ensuring IT project success by facilitating the adoption of agile methods within their IT project lifecycle. This will in turn bring about costs savings associated with failing projects due to the continuous use of traditional methods, over agile.
1.7 KEY TERMINOLOGIES AND CONCEPTS

This section is a preliminary literature review where the key aspects of the research are briefly discussed (Detailed discussions are provided in Chapter 2). The key focus of this research is on the factors impacting the agile software methods adoption in IT projects.

1.7.1 IT projects

IT projects have been defined as a ‘set of activities that start and end at identifiable points in time and that produce quantifiable and qualifyable software deliverables. Organisations are constantly on the search to create new opportunities such as gaining market share, eliminating threat of substitution, and creating competitive advantage. This has led to organisations having to rely on the successful implementation of Information Technology (IT) projects to achieve their competitiveness in the market (Chin, 2004). Even though organisations are investing time and money in IT projects, IT projects are still challenged. According to the Standish Report (2016), 52 per cent of IT projects are challenged, 29 per cent of IT projects are successful while the failed IT projects are at 19 per cent.

Many authors have cited different factors that contribute to IT project failures. Whittaker (1999) identifies three reasons for project failure: poor project planning; a weak business case; and a lack of top management involvement and support. Matavire et al. (2010) identified factors related to leadership, project fragmentation, and stakeholder engagement as the main factors that affect the implementation, thus contributing to project challenges in South Africa.

1.7.2 Agile Project Management

Organisations have been forced to seek flexible and agile methods in their operations as a way to manage volatile economic conditions that are threatening the way corporate organisations are conducting business. This change in the market has resulted in organisations focusing on innovation, and also adopt ‘lightweight, fast-moving versions of ‘plan, execute and measure’.’

Historically, software development has been managed by the ‘command and control’ ethos of traditional Project Managers (PMs), yet the philosophy and values outlined in the agile Manifesto advocates a more facilitative approach to project management (Fowler et al., 2001). Competencies in the agile Project Management Handbook (DSDM Consortium, 2014) value flexibility over predictability, value-driven as opposed to plan-driven, with incremental rather than one-shot delivery, putting greater emphasis on a team-based approach. These attributes assume that a PM will focus less on planning, measuring, controlling and reporting and place greater emphasis on leadership that empowers, encourages and supports the team.
In addition to project flexibility and iterative delivery, implementing agile methodologies in IT projects is reported to yield improved customer satisfaction, developer morale and end-product quality (Misra et al., 2009; Lindvall et al., 2002; Boehm & Turner, 2004; Srinivasan & Lundqvist, 2009), and promoting the use of the industry’s best practices designed to embrace change and promote continuous delivery (Lee, Guadagno & Jia, 2003).

1.7.3 Agile Methods Adoption Challenges

‘The adoption of agile is not optional. It is being driven by a fundamental business discovery: agile is the only way for organisations to cope with the 21st Century marketplace and deliver what customers expect and demand: easy, quick, convenient, personalized responsiveness at scale’ (Stephen Denning). Agile software development methods offer many tangible benefits over traditional software development methods, e.g. improved time-to-market, productivity and quality software while reducing development costs. While many organisations are interested in adopting agile methods suitable to their large and complex software development environments, the following factors have been cited as affecting the adoption of agile software methods.

McHugh (2012) cites lack of documentation; maintaining traceability; regulatory compliance and lack of upfront planning and the process of managing multiple releases as challenges when adopting agile methods in an organisation. Additionally, Srinivasan and Lundqvist (2009) cite ambiguous requirements which contribute to poor quality, challenges during the implementation phase due to agile team’s limited knowledge of agile methods, and organisational learning which has become non-existent. Conboy et al. (2011) identified the skills deficiencies, lack of multi-skilled developers and lack of team motivation as those challenges that affect agile adoption.

1.7.4 Success Factors

Factors that assist organisations completing agile projects successfully have been described as: the availability of dedicated business expertise throughout the course of the project; tools and techniques available to project members should support agile practices and approach adoption; support from an executive level; successful agile teams are measured on overall value added and creation, as opposed to the traditional ‘Constraint Triangle’ measurements (Scope, Budget & Time). Smaller teams succeed more often in agile settings, and project members should be dedicated to one project at a time. Nerur et al. (2005) and Chow and Cao (2008) identified management, organizational culture, people, process, and technological capability as success factors when adopting agile methodologies.
1.8  DELINEATIONS AND LIMITATIONS

The study was conducted in Gauteng Province in South Africa. Owing to time constraints the study focused only on one organisation in the telecommunications space. All participants are employees of the telecommunications organisation under study. In addition, the proposed targeted population for this study did not include all stakeholders involved in agile projects implementation; it focused mainly on those within the scope of these roles: IT managers, project managers, business analysts, and developers.

1.9  RESEARCH METHODOLOGY

A detailed discussion on research methods and design of the current study is provided in the research methodology chapter (cf Chapter 3). The study followed an Interpretivism paradigm, which asserts that only through the subjective interpretation of and intervention in reality can that reality be fully understood (Easterby-Smith, Thorpe & Lowe, 1991). It will be adopted to understand the organisational factors that hinder the adoption of agile methods in IT projects. According to Welman et al. (2005), research can be conducted in either a quantitative or qualitative approach. Where quantitative research is focused on facts and causes of behaviour and the results are presented in a statistical format (Leedy & Ormrod, 2005); qualitative research involves exploring issues, understanding phenomena, and answering questions through multiple methods such as open-ended interviews, informal and formal observations, open-ended questionnaires and case studies (Creswell, 2009). For this study, the qualitative research approach was adopted, within a case study design strategy. According to Yin (2003), a case study refers to an empirical investigation of an existing event in an environment, and case studies can be single or multiple-case. For this study, a single case study approach was employed for an in-depth understanding of the complete organisational factors that contribute to agile adoption within a telecommunications company. A purposive sampling method was followed and to remain relevant to this study purpose, the participants sampled included roles such as Chief Information Officer (CIO), IT managers, project managers, project sponsors, project team members, process engineers, business analysts, testing, developers, architects, and business and end-user representatives. The total number of participants of the study were twenty three (n = 23).

1.10  ETHICAL CONSIDERATIONS

According to Cooper & Schindler (2006), ethics can be described as norms or standards of behaviours that guide moral choices about our behaviours and our relationships with others. This study ensured that ethics were considered from the moment the data collecting tools were designed to when the actual data collection took place. The study sought ethical
clearance from the TUT Ethical Clearance Committee (cf Appendix C) and, also, consent forms were made available to volunteering participants (cf Appendix C). After reading the consent forms, willing participants voluntarily participated in either filling the structured questionnaires (cf Appendix A) or in the face-to-face interviews (cf Appendix A). The study is a single case study of a South African telecommunications company and involves human participants. The names of participants and the organisation used are not revealed in the findings or anywhere in the study.

1.11 STUDY OUTLINE

The current chapter (Chapter 1) contextualizes the study research problem, presents the study purpose and the research objectives, the significance of the study, key terms definitions as a preliminary literature review, as well a summary of the employed research methodology. The rest of the report chapters are outlined below:

Chapter 2 – Literature review: This chapter reviews the existing literature regarding the various aspects of IT projects, agile software methods, challenges of agile adoption, critical success factors, benefits of using agile software methods and the theoretical framework.

Chapter 3 – Research design and methodology: This chapter presents the methodology and methods as well as a justification of the methods used. In addition, the research philosophy, approach, sampling design, population, data collection and data analysis are discussed.

Chapter 4 – Research analysis and results: This chapter discusses findings and results after analysis of data that was collected through questionnaires and interviews. The key findings are analysed and interpreted and their implications are used in the study. Hypothesis testing is also conducted to test for the significance of the theory constructs used in the study.

Chapter 5 – Summary, recommendations and conclusions: The final chapter of the study presents a summary of the entire study. Limitations, conclusion and recommendations are outlined in this chapter.

1.12 CHAPTER SUMMARY

This chapter provided an outline of the current study, as it discusses the background information regarding agile projects and their challenges in terms of adoption within the South African context. The chapter also provided information regarding the problem statement and gave a brief overview of the methodology used to address the objectives.
The next chapter is the literature review. It discusses in detail how other organisations have adopted agile methods, highlighting the factors to consider, and the different agile methods, agile implementation challenges, and agile method benefits.
2. LITERATURE REVIEW

2.1 INTRODUCTION

The previous chapter, Chapter 1, presented the study background and introduction of the study by describing the background of the problem, the problem statement, research questions and objectives of the study. It provided a summary of the research methods used in this study. This chapter presents the relevant literature review of various software development methods, with specific focus on what agile really is, agile key concepts and practices, agile methodology adoption, reasons why organisations adopt agile, benefits in adopting the agile approach as well as challenges associated with agile implementation.

The chapter further presents the underpinning theoretical framework that was adopted in this study as a study lens. The literature chapter also presents other relevant empirical foundations and concepts in relation to this study, starting below with an outline of the industry and context of the study.

2.2 TELECOMMUNICATIONS INDUSTRY

The purpose of this study, as was mentioned in Chapter 1, is to investigate the adoption of agile software development methods as a solution for implementing projects efficiently and quicker in the telecoms industry in South Africa. This section focuses on the telecommunications industry and the role it plays in the South African economy, and the need for agile adoption within the sector. The telecommunications industry concerns the provision of two-way, one-to-one communications of voice, data and video. Telecommunications enable communication between people (telephony) and computers (data) and between people and computers combined (multi-media). Its purpose is to bridge the geographical divide between people, organisations and countries. However, the convergence of information, communication and broadcasting brought by new and more advanced technologies is rapidly changing the entire telecoms business landscape worldwide.

Today, more than ever before, innovations in information communication technology (ICT) are changing the business field and re-defining the basic rules of business, not only in global but also in a South African context. Ohmae (1996) points out that the world is progressing towards the central unification of global economies. This is causing competition between organisations to become more aggressive and as such, many organisations are using ICT to create sustainable competitive advantage over their competitors.
As businesses continue being faced with the challenge of competing on a global scale, Levine and Crom (1993:76) state that ‘the customer is always king and queen’ and therefore satisfying the needs of customers is supreme for business success. The separation of the organisation from its business processes and customer interface through time and geographical space has been removed by the innovations of ICT. Precise information about customers’ preferences and behaviour will enable companies to create loyal customer relationships (Slywotzky, 2000:40). At the same time, the free flow of information will give customers a much wider choice of products and services to choose from at the lowest possible prices.

This change in the way value is created for organisations and customers highlights the new marketing opportunities and threats confronting telecommunication operators. Today, customers can purchase goods, track mail items, review account balances, transfer money between accounts, set up debit orders and even request overdraft limits via the internet. It is possible to buy insurance products, obtain product catalogues, monitor stock prices and even set up personalised stock portfolios that can be tracked on a minute-by-minute basis. Stockbrokers, retailers, banks, insurance companies, medical aid administrators, wholesalers and others in South Africa have real time electronic internet sites.

According to Porter (in David, 1999) the major forces that shape all industries (including telecommunications) are:

- New market entrants - These are organisations that identify the opportunities for making a profit and then enter the respective market.
- The power of suppliers - Suppliers have the ability to influence an industry by either raising prices or reducing the quality of their products or by withholding access to key technologies in the case of telecommunications.
- The bargaining power of buyers (customers) - Customers can force prices down, demand increased quality at lower prices or ultimately engage competitors against each other. An example in the telecommunication sector is the corporate customers who have the power to negotiate tariff discounts of up to 40% with TelkomSA in exchange for long-term service level agreements (SLA).
- The threat of substitute products and services - Substitute products provide similar utility to customers for their specific needs but place a cap on the prices charged for the product or service. The best-known example of a substitute product for telecommunications is the fixed line phone and the cellular phone. Both satisfy the user’s needs for communication, but cellular phones offer the user omnipresence, fashion, style and availability.
• Industry rivalry - The South African telecommunications industry, although highly regulated, is faced with a variety of industry participants such as the Value Added Network Service (VANS) providers, cellular service providers like MTN, Vodacom and Cell C, and fixed line service providers such as Telkom SA, Esitel, Transtel and Sentech. These industry players are competing against each other to capture market share.

Therefore, organisations that compete in the telecommunications and IT industries have a high degree of research and project implementation because of the rapid rate at which their products and services become obsolete. IT projects are initiated in these organisations to develop better products all the time as industry players are always under threat of competitors developing new technologies and making existing technologies redundant.

2.3 CONCEPT OF IT PROJECTS

IT project management is the science of planning, designing and leading software development process. It is a sub-discipline extracted from project management where software development projects are planned, applied and monitored. Based on this meaning, project aspects which are mentioned are life-critical, variable scope, dynamic, accelerated schedule, team, multiple independent teams, up-front cost evaluation and up-front risk analysis (Nasehi, 2013).

To understand IT project management, one must first understand where project planning fits within the software development life cycle (SDLC). SDLC is a set of phased processes that guide a systems development effort from its inception, and through its implementation. According to Keyes (2008) projects are similar to living entities: they are conceived, they live, and then they die. This is why the term life cycle is used.

Early IT projects development methods included the code-and-fix method, the stage wise method, the waterfall method, the evolutionary development method, the transform method, and the spiral method. The most popularly used method was the waterfall method. It was able to eliminate many of the limitations of the previous methods, and was used by different organisations for developing large-scale software.

According to Boehm et al. (2006) the waterfall methods are straightforward, methodical, structured and they also provide the predictability, stability, and high assurance capabilities that organisations require when delivering projects.
Other advantages of the waterfall method include: simple and easy to understand and use; easy to manage due to the rigidity of the method – each phase has specific deliverables and a review process; Phases are processed and completed one at a time; works well for smaller projects where requirements are very well understood; it has clearly defined stages; it has well understood milestones; easy to arrange tasks; process and results are well documented.

Even though the use of the waterfall method in software development has its successes, limitations of the method have been noted and documented. Waterfall projects put effort in the beginning of the project. Time and resources are allocated upfront to mitigate risks that might occur, and plans for mitigation are also drawn up and put in place as well as contingencies. According to Sazlvay (2004), it is impossible to think up of all the possible scenarios and all the variables that might possibly impact your project and because of the uncertainties and complexities of software projects, a new software development method was then created. Jammalamadaka and Krishna (2013) summarize the pitfalls of the waterfall model as follows: requirements need to be frozen upfront; it is a rigid system; predicting/ foreseeing all problems upfront is impossible, and it is heavyweight.

Other challenges of the traditional method of software development include the rigid nature of the method; the inability of the projects to adapt to the changing circumstances in the organisations and their projects; and changing customer requirements (Misra, 2011). These challenges lead to the success of the projects to be compromised. As such, agile was proposed as an alternative that will cater for the rapidly changing business environment.

### 2.3.1 Role of IT projects in organisations

IT projects are an integral part of our society (Sudhakar, 2012). Usage of computers and software has increased at an unprecedented rate. Computers are used at point-of-sale counters, ATM machines, electronic funds transfer, e-commerce, online purchases, online ticketing, online trading, financial accounting, automatic invoice processing and order processing.

The volume of data, speed of response and accuracy of expected results makes the software projects more critical and complex. Accuracy, reliability, flexibility, accountability, reportability and completeness are some of the features of software systems. Once a software system is developed, it can be used any number of times. That is the reason software projects are different from traditional projects.
2.3.2 Measure of IT project success

In the traditional project management field, the ‘Iron Triangle’ of project management metrics, Cost, Quality and Scope, has been the traditional measure of project 'success'. However, measuring project performance this way (Scope, Time & Budget) has begun to fall out of favour. Atkinson (1999) and Phillips et al. (2002) propose that project success and outcomes should be evaluated across four categories: (1) project management metrics, (2) the quality of the project output, (3) individual benefits, and (4) organisational benefits.

Consistent with this tradition is the CHAOS report from the Standish Group, one of the most widely disseminated sources of IT project result data, which utilizes only the Iron Triangle metrics to define project success.

‘A project is successful if it is completed on time, within budget, and with all features and functions as initially specified. A project is challenged in case it is completed and operational but over budget, over the initial time forecast, and if it offers fewer features and functions than originally specified. A project is impaired or failed if it is cancelled at some point during the development cycle.’ (Eveleens & Verhoef, 2010).

In 2015 the CHAOS report studied 50,000 projects around the world, ranging from tiny enhancements to massive systems re-engineering implementations and a new definition of success was formed. This table summarises the outcomes of projects over the last five years using the new definition of success factors (on time, on budget with a satisfactory result).
2.3.3 Factors affecting IT project success

Keyes (2009) cites the following factors as those that do impact the cost, schedule, and even viability of the project: change in requirements as end-users start crafting their wish lists before a system even gets placed in production; change in regulations due to regulatory guidelines; introduction of new technologies; technological obsolescence; outsourcing of functionality to or merger into another department or company as well as employee related factors including illness, vacations, departure, and unanticipated developer-related difficulties in developing the system.

The Standish Group analysis over the last 21 years has been the identification and ranking of the factors which work together to make projects more successful.

Executive support is when an executive or group of executives agrees to provide both financial and emotional backing. The executive or executives will encourage and assist in the successful completion of the project.

Emotional maturity is the collection of basic behaviours of how people work together. In any group, organisation, or company it is both the sum of their skills and the weakest link that determine the level of emotional maturity.

User Involvement takes place when users are involved in the project decision-making and information-gathering process. This also includes user feedback, requirements review, basic research, prototyping, and other consensus-building tools. Optimization is a structured means of improving business effectiveness and optimizing a collection of many small projects or
major requirements. Optimization starts with managing scope based on relative business value.

**Skilled staff** are people who understand both the business and the technology. A skilled staff is highly proficient in the execution of the project’s requirements and delivery of the project or product.

**SAME** is Standard Architectural Management Environment. The Standish Group defines SAME as a consistent group of integrated practices, services, and products for developing, implementing, and operating software applications.

**Agile proficiency** means that the agile team and the product owner are skilled in the agile process. Agile proficiency is the difference between good agile outcomes and bad agile outcomes.

**Modest execution** is having a process with few moving parts, and those parts are automated and streamlined. Modest execution also means using project management tools sparingly, and only a very few features.

**Project management expertise** is the application of knowledge, skills, and techniques to project activities in order to meet or exceed stakeholder expectations and produce value for the organisation.

**Clear business objectives** is the understanding of all stakeholders and participants in the business purpose for executing the project. Clear business objectives could also mean the project is aligning to the organisation’s goals and strategy.

### 2.3.4 Critical success factors for IT projects

Project success traditionally has been measured by a project’s ability to deliver within the defined timeframe, budget and specified quality. There is a diversity of opinions on what drives project success. The Standish Group’s ‘top ten’ reasons include the following: User involvement; Executive management support; Clear business objectives; Optimizing scope; agile process; Project manager expertise; Financial management; Skilled resources; Formal methodology and Standard tool and infrastructure.

Whittaker (2012) notes the following factors as those that impede the successful implementation of projects: i) Inadequate risk management and a weak project plan. ii) Weak business case that justifies the need for the system in ways that do not relate directly to the
organisation's business needs. iii) Lack of top management involvement and buy-in, it also impacts the project success.

Figure 2 presents the categories of the identified critical success factors for various IT projects:

<table>
<thead>
<tr>
<th>CSF category</th>
<th>Success factor identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication factors</td>
<td>Communication in project</td>
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<tr>
<td></td>
<td>Leadership</td>
</tr>
<tr>
<td></td>
<td>Relationship between users and IS staff</td>
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<tr>
<td></td>
<td>Reduce ambiguity</td>
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<tr>
<td></td>
<td>Maximize stability</td>
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<tr>
<td>Technical factors</td>
<td>Technical tasks</td>
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<td></td>
<td>Trouble shooting</td>
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<tr>
<td></td>
<td>Technical uncertainty</td>
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<tr>
<td></td>
<td>Technical implementation problems</td>
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<tr>
<td></td>
<td>Integration of the system</td>
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<tr>
<td>Organizational factors</td>
<td>Top management support</td>
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<tr>
<td></td>
<td>Realistic expectations</td>
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<tr>
<td></td>
<td>Organizational politics</td>
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<td></td>
<td>Financial support</td>
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<tr>
<td></td>
<td>Power</td>
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<tr>
<td>Environmental factors</td>
<td>User involvement</td>
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<td></td>
<td>Customer involvement</td>
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<td></td>
<td>Vendor partnership</td>
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<td></td>
<td>External environment events</td>
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<td></td>
<td>Client acceptance</td>
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<tr>
<td>Product factors</td>
<td>Accuracy of output</td>
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<tr>
<td></td>
<td>Reliability of output</td>
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<tr>
<td></td>
<td>Timeliness of output</td>
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<tr>
<td></td>
<td>Quality control</td>
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<tr>
<td></td>
<td>Documentation of systems and procedures</td>
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<tr>
<td>Team factors</td>
<td>Team capability/competence</td>
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<tr>
<td></td>
<td>Teamwork</td>
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<td></td>
<td>Select right project team</td>
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<tr>
<td></td>
<td>Project team coordination</td>
</tr>
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<td></td>
<td>Task orientation</td>
</tr>
<tr>
<td>Project management factors</td>
<td>Project planning</td>
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<td></td>
<td>Project control mechanisms</td>
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<td></td>
<td>Project schedule</td>
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<tr>
<td></td>
<td>Project manager's competence</td>
</tr>
<tr>
<td></td>
<td>Clear project goal</td>
</tr>
</tbody>
</table>

Figure 2: Critical Success factor for IT projects (Sudhakar, 2012)

2.3.5 State of IT projects in South Africa

Information systems (IS) projects success, especially in the developing countries of Africa, continue to be characterized as 'challenged' in various studies. Faced with a double challenge of establishing its competitive position in the global market while simultaneously addressing internal problems created by the legacy of apartheid, the government of South Africa and economists continue to look to ICT to ensure better service delivery, skills development, and better productivity and economic growth. While some positive outcomes of ICT initiatives have been realised, researchers argue that ICT adoption has been generally slow in some areas of
the economy (Internet World Stats, 2009; World Wide Worx, 2005) and some ICT policy decisions are perceived to have failed (Singh, 2010).

In the context of South Africa, ICT holds a prominent position and it is not surprising that the information-related industries and services are becoming main contributors to the national income (Kyobe, 2011). IT projects in South Africa are challenged, and this highlights the need for affordability, education on ICT, and support from government and other organisations. Making access to ICTs affordable to everyone would increase participation (Ahsan and Gunawan, 2010). Matavire et al. (2010) identifies factors related to IT project leadership, weaknesses, task conflicts and institutional fragmentation as contributing factors to project implementation challenges in South Africa. The study has shown that leadership, project fragmentation and stakeholder engagement are some of the main factors that affect the implementation of IT projects at a provincial level in the South African context (Matavire et al., 2010).

South Africa in particular faces several challenges. These include limited skills in ICT, low levels of ICT R&D investment, and lack of a critical mass of high-quality research to enhance innovation, high telecommunications costs and lack of proper economic models for providing connectivity to the marginalised rural communities (IST-Africa, 2007).

2.4 CONCEPT OF AGILE METHOD

‘Agility as the ability to adapt to changing situations appropriately, quickly and effectively. In other words, agile organisations notice relevant changes early, initiate action promptly, create a feasible and effective alternative plan quickly, and re-orient work and resources according to the new plan quickly and effectively.’

Software developments methods have limitations; similarly the traditional methods have limitations. Fergis (2012) submits that the most common issues associated with a traditional method include obsolete requirements, a lack of opportunity to understand changing current customer needs and a high number of faults found during testing. In 1995, Sutherland and Schwaber (1995) came up with the first agile approach and the idea gained momentum with companies adopting agile software development and techniques as the chosen way of developing software.

Agile methods grew out of the real-life project experiences of leading software professionals who had experienced the challenges and limitations of traditional waterfall development on project after project. The agile development process caters for the short-comings of the
Agile development offers a lightweight framework for helping teams, given a constantly evolving functional and technical landscape; it maintains a focus on the rapid delivery of business value and because of this, agile methods have been touted to produce higher quality software, reducing the overall risk associated with software development. They enhance developers’ morale, and project restarts are reduced than the traditional waterfall model approach. Agile methods are underpinned by some basic concepts with core principles, defined as the ‘Manifesto for agile Software Development’:

- Individuals and interactions over processes and tools.
- Working software over comprehensive documentation.
- Customer collaboration over contract negotiation.
- Responding to change over following a plan.

Misrah, Kumar and Kumar (2009) say that agile software development (ASD) is an emerging approach in software engineering for improving quality, initially advocated by a group of 17 software professionals who practised a set of lightweight methods and shared a common set of values of software development.

Fergis (2012:1) defines agile as a relatively new framework aimed at reducing risk and production costs. It is based on iterative development and continuous feedback from all stakeholders throughout the development life cycle. In Hass (2007), the agile project management method is described as a highly iterative and incremental process, whereby developers and project stakeholders actively work together to understand the domain, identify what needs to be built and prioritize functionality.

Agile is ‘a different way of managing IT development teams and projects’ (Waters, 2007:1). According to Lassenius, Paasivaara, and Dikert (2016:88), agile software development is a set of iterative and incremental software engineering methods that are advocated based on an agile philosophy captured in the agile manifesto.

In the delivery model depicted in the figure 3, requirements are developed for the entire system up front and it is only those requirements agreed upon for the current iteration which need to be completed in order for the iteration to begin. Once the iteration begins, the features and associated requirements to be delivered in the iteration are frozen. The team then completes design, development, testing and delivery for all features for the iteration. While this does not necessarily mean that the code is deployed to production, the understanding that the code
should be deployable at the end of any iteration, at the discretion of the user, is explicit in several methodologies, including Extreme Programming and Scrum (Beck 1999; Highsmith, 2002; Schwaber & Beedle, 2002).

Figure 3: Agile Software Development Method (Beck et al., 2002)

From the definitions of agile, we can determine that the main theme in agile has to do with people and a method of working during software development; the definitions reveal that agile is about people and how they communicate and work. We can conclude from the definitions that agile is more of a collective culture as opposed to a rigid or mechanical method of working in the software development environment.

Turk et al. (2011:137) state that agile development tends to focus on early and fast production of a working code, frequent, small, incremental changes, pair programming, short iterations, rapid and continual user feedback and interaction.

Cormick (2012:7) describes agility as ‘moving quickly’; the agile software development methodology is based on iterative and incremental model of software development, the requirements and solutions are a product of collaboration between self-organising and cross functional teams. West and Grand (2010:4) describe what it means to be agile, they state that agile adoption is not black and white - in that agile provides a set of techniques that when used collectively, are intended to lead to successful software development and delivery. However, teams do not usually implement the techniques simultaneously even in the most mature agile adoptions. The objective is to work well together in order to produce high quality software, than changing the software engineering process.
2.4.1 Agile key concepts and practices

This section is not intended to give an exhaustive and comprehensive coverage of all of them, but rather to review the ones that have been dominant and have been commonly used in the software development process since the inception and promulgation of the agile Manifesto in 2001. Similar to the traditional methodology, dominance and popularity amongst software professionals and industry were used as criteria for selection. Extreme programming, Scrum, Lean Development, Feature-Driven Development, Dynamic Software Development Method, Crystal Methodologies and Adaptive Software Development are some of the most commonly used and dominant of the agile methodologies (Dyba & Dingsoyr, 2008; Rao, Naidu & Chakka, 2011; Pathak & Saha, 2013) and will be reviewed at a high level below:

Below is a list of some agile development methods commonly used:

- **Adaptive Software Development (ASD)**: Highsmith III developed ASD (Highsmith, 2000) based on iterative development methods. It focuses on continuous prototyping on complex or large systems with an emphasis on incremental and iterative development. Its process involves three repeating cycles, namely speculate, collaborate and learn. Speculate refers to the enigma of planning, collaborate is an aspect that deals with the harmonising of work activities based on environmental factors such as requirements, technology and all stakeholders. Learn refers to issues of all stakeholders arising from short iterations in the design, build and test cycles.

- **Agile Modelling (AM)**: AM (Ambler, 2002) is the process of conducting modelling activities; it also involves documenting practices and cultural principles. The developers can then have adequate models to address issues of design. Normally AM comes as an additional activity to other agile methodologies such as Extreme Programming.

- **Agile Unified Process (AUP)**: AUP modelling is a combination of Rational Unified Process (RUP) and the AM (Christou, Ponis & Palaiologou, 2010). It is designed to offer an iterative-incremental approach to software application development. When this model was created by Scott Ambler of IBM, the idea was to have a solid framework that can be used in all kinds and sizes of software development projects.

- **Dynamic Systems Development Method (DSDM)**: DSDM is an agile software project provision framework. In order to address issues of quality, cost and time, DSDM is structured around the MoSCoW prioritisation of scope into musts, shoulds, coulds and won't-haves for it to project manage deliverables within time constraints. The implementation of DSDM requires a philosophy of assuming collaborative attitudes from all stakeholders and technology implementers (Stapleton, 1997).
• **Extreme Programming (XP):** Extreme Programming was developed by Kent Beck, Ward Cunningham and Ron Jeffries and it promotes the values of community, simplicity, feedback, and courage. It also advocates short development cycles in form of ‘releases’ meant to enhance productivity. It involves programming in pairs of all codes through refactoring and test-first development. It has also been known to bring about a system of dynamic practices (Beck, 1999b).

• **Lean software development:** Lean software development has a focus on software project management aspects specifically directed at the cost and return on investment issues. It has a main focus on people and demands learning professional skills and applying them in a creative way in a team setting (Womack, Jones & Roos, 1990).

• **Scrum:** Scrum is an iterative and incremental project management framework that targets development in 30-day sprint cycles. In these cycles backlog features are provided. The major practice is the use of 15-minute team meetings for the purpose of coordination and integration. It also recognizes that during the project, customers can change requirements as need arises. It, therefore, calls for maximizing the team’s capability to deliver quickly, while still being able to react to emerging requirements.

Agile practices indicated in Boehm and Turner (2006:32) espoused to support the method’s values belong to three general areas: communication, management and technical. Examples of concepts and practices include:

- embracing change, seeing change as an ally and not as an enemy,
- fast cycles: frequent delivery and scheduling many releases within short time spans,
- simple design: designing for battle not for war,
- refactoring or removing duplications in code and improving communication,
- pair programming in which two programmers work side by side on one computer
- retrospective or reflection; post iteration review of the effectiveness of the work performed, methods used and estimates,
- tacit knowledge, establishing and updating project knowledge in the participants heads rather than in documents,
- Test driven development, developers and customers incrementally write modules or test cases before and during coding.

‘Agile project management development is conducted collaboratively, with a small co-located team. This core team usually consists of two developers who
write codes in pairs (for quality control), the customer/end-user, IT architects, a business analyst and a project manager.’ (Hass, 2007:3)

Hass (2007:6) further presents the following concepts of the agile project management method:

- Visual control, a cards on the wall method of planning to assist a team in organising the work of the project;
- Co-located high-performing teams, where all team members including end-user, are preferably in a work room;
- Test driven development, where test cases are developed at the same time of developing requirements;
- Adaptive control, everyone in the team is constantly adapting;
- Collaborative development among all team members to deliver results, capture candid feedback and implement learnings on the next iteration of the solution;
- Feature driven development that allows the team to focus on one feature, and only one feature at a time;
- Leadership and collaboration rather than command and control;
- Move from cost to revenue focus, where features are prioritized based on values such as increased revenue or market share;
- Lessons learned to determine what can be done better on the next iteration.

There are ten key principles of agile that Waters (2007:1) has listed the following in her submission:

- Active user involvement is imperative,
- The team must be empowered to make decisions,
- Requirements evolve but the timescale is fixed,
- Capture requirements at high level; lightweight and visual,
- Develop small, incremental releases and iterate,
- Focus on frequent delivery of products,
- Complete each feature before moving onto the next,
- Apply the 80/20 rule,
- Testing is integrated throughout the project lifestyle – test early and often,
- A collaborative and cooperative approach between all stakeholders is essential.

2.4.2 Benefits of agile for organisations

As companies are continuing to implement the agile method of software development to yield the benefits from agile (VersionOne Survey, 2014), there is plenty of evidence to conclude that agile works. One of the benefits of agile adoption is the short time to market (Sidky, 2010). Sidky also cites improved quality, enhanced client relationships and better team morale as benefits of agile adoption. According to Srinivasan and Lundqvist (2009:1415), agile methods have been demonstrated to enhance customer value, improve organisation morale and provide steep improvement in product quality. Barlow, Giboney, Keith, Wilson, Shuetzler, Lowry and Vance (2011:29) indicate the strengths of agile to be: focus on customer needs, adaptability to changing requirements and fast development time. Petersen and Wohlin (2009) suggest them as: ‘precise requirements, lesser need for documentation, early feedback due to frequent deliveries, rework reduction, testing resources are used more efficiently, and higher transparency of who is responsible for what which creates incentives to deliver higher quality.’

Agarwal et al. (2014) cites the following benefits of agile: the flexibility which is embracing change and working with evolving needs is an integral part of agile software development; early and continuous delivery leading to higher revenue and better market place; Cross functional collaborations, early demos, and frequent integration; by making testing an integral part of the development cycle, agile delivers better quality products early; agile’s collaborative approach encourages active stakeholder involvement throughout the product’s development; provides an excellent visibility for stakeholders, both of the project’s progress and the product itself.

According to the VersionOne survey (VersionOne Survey, 2017) there is currently significant evidence to conclude that agile works, and the benefits cited as the most important for the past four years are: the ability to manage changing priorities, increased team productivity and improved project visibility.
2.4.3 Challenges in implementing agile projects

Agile transition process or ATP is considered by Nafchi and Gandomani (2016:257) as an organisational mutation, mainly because the scope of the changes covers organisational behaviours as well as involved people’s roles and responsibilities and this is a reason why the change requires enough time and effort; the change also leads to human related challenges and barriers.

The research survey in Elshafy and Galal - Edeen (2008:30) has identified the following common issues that organisations face when adopting agile, these were perceptions of respondents in the survey:

- Lack of discipline
- Lack of structure and necessary documentation
- Only works with development process
- Incorporates insufficient software design
- Requires too much cultural change to adopt
- It is impossible to determine realistic estimates of all work effort needed
- Lack of up front planning
- Lack of predictability
- It requires highly qualified developers.

Figure 4: Benefits of agile (VersionOne Survey, 2017)
Nafchi and Gandomani (2016: 261) use grounded theory in their research to determine human aspects that were impediments in ATP as well as perceptions held by respondents about the process; the following challenges were identified: lack of knowledge, cultural issues, resistance to change, wrong mindset and lack of effective collaboration. The perceptions identified in the study revealed that participants were worried, they were enthusiastic but misguided, and they lacked belief in the change, were indifferent and had unrealistic expectations. Figure 2.1 (categories of agile transition human factors) overleaf outlines various categories of human factors that have influence on agile adoption in organisations, as well as perceptions about the change process.

While agile is implemented by organisations to solve challenges associated with software development, it should be borne in mind that the method cannot be considered a solution for all organisations and environments; careful consideration is required before implementation to ensure that the implementing organisation reaps the desired benefits of employing or implementing the method. Rigby, Sutherland, and Takeuchi (2016:42) state that agile is not a panacea and its most effective to implement under conditions commonly found in software innovation - where the problem to be solved is complex, solutions are initially unknown and product requirements will most likely change.

In Lassenius, Paasivaara, and Dikert (2016:92), the following challenges related to agile implementation have been identified: change resistance, people are not willing to change unless there is a good reason to and the change is perceived as easy enough; scepticism towards a new way of working and top down mandate. Lassenius et al. (2016:92) made an observation through their study that change that came from management and is presented in a bad way was likely to be resisted by the lower levels.

Three challenges identified by Boehm and Turner (2006:30) with regards to agile implementation are related to development process conflicts, business process conflicts and people conflicts. Development process seeks to answer the question: ‘How do you merge agile lightweight processes with standard processes, without either killing agility or undermining the years spent defining and refining systems and software engineering process assets?’ Boehm and Turner (2006) have given the thought that the agile process will not be implemented in a vacuum but could sometimes be implemented on existing processes, and as such a balancing act is needed during the implementation of agile in an organisation.

The challenges of implementing agile in an organisation are expanded by Bhoem and Turner (2006:31), and they submit four areas in their theory:
• **Managing variability** in sub-systems has proven to be difficult in that if both agile and traditional teams are developing software for the same product, they can develop radically different artefacts that might not integrate easily.

• **Working with different lifecycles** is also difficult, agile processes focus on immediately delivering functionality while traditional methods focus on optimizing development over a long period of time.

• **Applying agile to legacy systems** whether in maintenance or as new development raises numerous issues; legacy systems are not easy to refactor or disassemble to accommodate agile replacements that need to build capability in increments.

• **Difference between how agile and traditional approaches perform requirements** can also cause problems, agile requirements tend to be functional and reasonably informal.

Kumar, Kumar and Misra (2009:1871) identify two major categories of success factors in implementation of agile software development: organisational and people factors. Their theory is in alignment with that of Lassenius, Paasivaara and Dikert (2016:88), who have identified people factors as one of the impediments in the implementation of ASD.

Kumar et al. (2009:1871) state that organisational factors include customer centric issues such as customer satisfaction, collaboration and commitment. Other organisational factors identified were decision time, whereby it is suggested that the agile team needs to be given time to make decisions on their own. Kumar et al. (2009:1871) further suggest that team distribution plays a role in successful implementation of ASD; they indicate that co-located teams are often recognised as one of the important factors for successful communication, which is in turn one of the success factors for software development.

Team size is another organisational factor identified by Kumar et al. (2009:1871). They suggest that large teams would make communication difficult, their interaction is likely to be frequent, informal and rapid as opposed to those of smaller teams. The other organisational factor identified is corporate culture. Kumar et al. (2009) mention that corporate culture is unanimously perceived by agile experts to be a necessary factor in determining the introduction of agile practices, agile practices put emphasis on collaboration and as such, organisations with too much bureaucracy would find it difficult to adopt agile practices. Planning and control is the last organisational factor identified; Kumar et al. (2009) state that ASD adoption favours internalised plans over documented plans accompanied by quantitative performance measures.
Three people factors are identified by Kumar et al. (2009:1872). In their research they argue that competency, societal culture and learning & development are crucial in ASD success. Since ASD emphasizes on delivering working software fast, evidently the competency of the team members in a project is important. Competency does not only dictate the pace of development but it also ensures that the requirements are delivered according to specification.

Kumar et al. (2009) state that like any other human activity, software development is influenced by regional/local culture. The agile principles suggest using motivated individuals; people should be eager to learn from each other, be honest, collaborative and responsible. All these are affected by the societal cultural factors as well. Kumar et al. (2009) state that in ASD practices implementation, emphasis is on continuous learning - the emphasis is on people sharing information with one another and continuously learn. It is perceived that ASD practices require less formal training; mentoring and professionally guided discussions were found to be more useful than formal training.

2.4.4 Agile in South African context

According to Lyndon King, software delivery manager at BSG: ‘South Africa is at the forefront of agile adoption when compared with international markets.’ However, existing pressure on business and the lack of the required skills mean that organisations often do not take the opportunity to transition to agile.

The current literature shows that agile methods are increasingly becoming more popular as the number of organisations shifting to agile methods increases (Schwaber, Leganza & D'Silva, 2007; Salo & Abrahamsson, 2008; Zhang et al., 2010; Esfahani, Yu & Annosi, 2010; Laanti, Salo & Abrahamsson, 2011).

Despite the growing number of organisations shifting to agile, several studies have found that there are many problems, impediments and difficulties encountered with agile adoption as well as putting the proposed benefits into practice (Barlow et al., 2011; Leau, Loo, Tham & Tan, 2012; Prause & Durdik, 2012; Asnawi, Gravell & Wills, 2012; Pathak & Saha, 2013; Twidale & Nichols, 2013). Some organisations adopt these methodologies to gain a competitive advantage, while others are still sceptical as to whether agile development is beneficial (Barlow et al., 2011), or as to whether the benefits of agile outweigh the cost (Ambler, 2008; Selic, 2009).

The just discussed contradictory perspectives about agile adoption are an interesting trend that remains to be monitored. From the researcher’s viewpoint the complete phasing out of traditional methods by agile ones seems unlikely. One can only predict with some degree of
certainty a compromise situation, where the two methods will complement one another. Agile seeks to change how communication happens, and to succeed, will require changes in the organisational structure.

As expected, the same reason agile projects fail is also what keeps companies from agile adoption – culture and structure, which are inextricably related. Conway’s law applies here: ‘organisations which design systems … are constrained to produce designs which are copies of the communication structures of these organisations.’ Typical is that agile adoptions are mandated from executives to deliver the promise of agile; however, leaders underestimate the impact that it has on the people.

2.4.5 Factors affecting agile adoption

Hass (2007:3) states that agile methods are used when the following conditions are present: project value is clear; the customer actively participates throughout the project; the customer, designers and developers are co-located; incremental feature driven development is possible; and visual documentation (cards on the wall vs. formal documentation) is acceptable.

Turk and Vijayasarathy (2011:138) established the factors that contribute to agile adoption in organisations. They found that in addition to training and perception of specific benefits, supervisors, influential peers and clients had an impact on the adoption and use of the methodology in organisations; further findings in the research suggested that perceived hindrances have impact on agile use as well as all the drivers of agile use.

- **Organisational culture**: One of the most important, but extremely difficult to achieve, classes of change that is required is the change in organisational culture. Organisational culture needs a change from policy and procedure-based to that of freedom of development and management by team members. The incorporation of agile practices influences the values, norms, behaviour and actions of people (Cockburn & Highsmith, 2001; Turner & Boehm, 2003), and the decision making processes, problem resolution strategies, customary practices, and the relationships between employees and managers (Nerur et al., 2005). The cultural changes are challenging to achieve, as these require the change in the habits and mind-sets of the people with which they have worked over the years.

- **Management style**: The adoption of agile processes in traditional organisations requires a change in management styles (Beck, 2000; Cohn, 2005; Williams & Kessler, 2002) from command-and-control management to leadership-and-collaboration. In traditional development projects, the project managers’ roles are that of someone who would form a well-defined and documented plan and would exercise and control them.
However, because of the paradigm shift from traditional/plan-driven in traditional projects to depending on ad-hoc plans in agile, the role of the project managers also requires a change to someone who would facilitate the overall development of the projects, work with the team members equally, collaborate with them and coordinate their activities to ensure a smooth completion of the projects. Therefore, as we see, the project managers who are keen on adopting agile approaches in their organisations would also need to change their management style.

- **Knowledge management strategies:** Another important issue is a paradigm shift in knowledge management strategies from heavy documentation-based to that of the management of tacit knowledge that mostly resides within the agile developers. This is a consequence of the agile approaches paying less importance on documentation. If there is a lack of documentation, most of the knowledge resides with the developers - or some of the information may be buried in the code as well. Consequently, how this tacit knowledge will be managed brings in a new focus area in agile projects.

- **Development processes:** One of the important differences between traditional development practices and the agile practices is that while the former is heavily process-based, the emphasis on processes is relatively less in the latter. Instead, the agile practices pay more importance to people-centric development. Development processes need to change from heavily process-centric to short, iterative, test-driven, people-centric development, from standards compliance and measurement-driven development to development under uncertainty, from contract-compliant to change-tolerant development, and from lifecycle-based development to feature-driven evolutionary and iterative development (Nerur et al., 2005).

### 2.5 THEORETICAL FRAMEWORK

Based on the objectives of the study which seek to investigate the factors that impede the adoption of agile, McKinsey 7-S framework has been selected to underpin the study. According to Have, Have, Stevens and Elst (2003), McKinsey 7-S framework suggests a proper and comprehensive look on organisational diverse dimensions and their associated factors, rather than focusing on the organisation as just a structure (Hanafizadeh & Ravazan, 2011). This complements the aim of the study which is to investigate what factors contribute to agile methods being successfully adopted in organisations.

#### 2.5.1 Using the MCKINSEY 7-S FRAMEWORK to test agile adoption factors

The model is based on the premise that an organisation is not just the structure but consists of seven integrated and related elements. There are seven different factors that are a part of the model: shared values, strategy, structure, systems, style, staff, and skills; which
all work collectively to form the model (Manage, 2007). Shared values are the centre of the model because values are what the organisation believes in and stands for, such as the mission of the company. Strategy represents what the company plans to do to react to any changes in its external surroundings (Recklies, 2007). The structure refers to the organisational structure of the company. Systems are the portion of the model that represents ‘the procedures, processes and routines that characterize how the work should be done.’ Staff is quite obvious in that it is a proper representation of who is employed by the organisation and what they do within the organisation. Style signifies the organisational culture and management styles that are utilized within the organisation. Skills indicate the abilities and competencies of either the employees or the organisation holistically (Manage, 2007).

![McKinsey 7-S Model](image)

**Figure 5: McKinsey 7-S Model (Peters & Waterman, 1982)**

### 2.5.1.1 **Strategy**

Strategy has to do with the direction and scope of the organisation over the long term. Organisations use strategy to develop an organisational roadmap for allocating resources to identified organisation’s strategic goals. Agile adoption success is dependent on the clarity of goals in terms of planned initiatives, linkages to broader organisational goals, stakeholder understanding of reasons for particular initiatives. These findings concur with Ambler’s (2011)
claim that support from an executive level is a success factor in agile project delivery, while Chow and Cao (2008) discuss the benefits of a committed sponsor or manager in an agile project environment. Vijayasarathy and Turk (2008) argue that managerial indifference towards agile is a sure way of project failure. Chow and Cao (2008) further mention a lack of executive sponsorship and management commitment as formulas to attract agile project failure.

2.5.1.2 Structure

Structure relates to both formal and temporary (or informal) structures such as task forces, teams, business units as well as reporting lines, areas of expertise and responsibility (Anonymous, 2001:2). Organisational structure should be adaptable with as few hierarchical levels as possible because fewer levels mean greater adaptability. Instead of permanent and unchangeable departments, it is necessary to establish dynamic teams that involve themselves in processes to deal with daily challenges. Ambler (2011) comments that smaller teams succeed more often in agile settings and project members should be dedicated to one project at a time. Lindvall et al. (2002) state that teams should be allowed to adapt workspace as required, and that they should be able to negotiate project deliverables. Chow and Cao (2008) contend that coherent, self-organizing teamwork, as well as teams honouring regular working schedules with no overtime, for instance, succeed more often than not.

2.5.1.3 Systems

This category, according to an internet article (Anonymous, 2003:4), relates to procedural reports, processes and technologies (e.g. meeting formats, information technology, reward systems, etc.). Systems in the organisation implies all the methods of creating and organising knowledge, whether management information systems or point of contact customer systems, like the Call Centre or communications, both internal and external. There is often a substantial difference between the textbook ‘vanilla’ version and the actual ‘method-in-action’ used in practice as most prescribed agile practices are tailored to meet the contextual needs of software development. For example, Pikkarainen et al. (2011) found that different XP practices reached different levels of assimilation at different periods of usage, and practices that addressed specific needs of the adopting team reached deeper assimilation levels. While the significance of tool support in the adoption of software process innovations in general has been recognized, their importance in facilitating the acceptance of agile practices in terms of providing support to specific XP practices such as refactoring, continuous integration, and test-driven development is also documented (Senapathi & Srinivasan 2011).
2.5.1.4 Skills

This category deals with capabilities and competencies that exist within the organisation; and whether key people have the knowledge, skills, and ability to make the required changes. Adequate analysis of this category would require the planning team to identify key performance areas (task analysis and assessment of the skills requirement, both current and required competences) for each of these performances (Sanchez, 2001). Skills imply learning from one’s own and others successes and failures and to be able to respond to today’s requirements and readiness to respond to challenges. An observation made during the retrospectives was that individual and team attitude plays an important role in team dynamics, but also in project outcomes and results, it seems. Having the right attitude and being positive makes a difference in the way the team members interact with each other as well as the iteration outcome according to the agile coach.

This was apparent from the energy the researcher experienced from the groups in the retrospectives, as well as the results from the iteration that were discussed in these sessions. Twelve respondents mentioned skill level as a factoring success or failure of agile software development projects. Chow and Cao (2008) argue that lack of the necessary skill set, lack of team work, and resistance from groups or individuals are failure factors in delivering agile projects. Vijayasarathy and Turk (2008) offer lack of peer support and individuals’ resistance to agile as failure factors.

2.5.1.5 Style

Style implies the leadership approach of top management and the organisation’s operating approach. The direct involvement of managers in processes within the organisation should be considered, not only as people that create and supervise processes, but who participate and are aware of the necessity to constantly improve every process and so ensure its survival over a long term period. Style also characterizes how leaders and managers behave in terms of setting and achieving organisation goals. Leadership style elements include communication style, decision making preferences, symbolic behaviour, social needs, individual values and attitudes, etc.

2.5.1.6 Staff

The issue of staff addresses questions like: Do we have the right people in the right positions in terms of their training, experience and interests? It relates to the organisation’s people resources, and how they are developed, trained and motivated. Both quantitative staffing levels as well as the qualitative backgrounds of staff should be considered in relation to planned initiatives. It also deals with how communications flow among personnel.
2.5.1.7 Shared values

Shared values relate to the significant principles, guiding concepts and beliefs that an organisation fosters in its members. They might include norms, values, attitudes and the cultural elements present within the organisation. Shared values are those common values that all employees share, no matter which hierarchical level they belong to and how much responsibilities and rights they have in managing the organisation, or of offering value to the customer in every process. One of the basic responsibilities and rights of managing structures is creating an organisation culture. Every organisation has its own peculiar culture. Company culture embodies the method in which a company carries out its activities and the way in which it would like to carry them out, both in the long term and short term. Due to ever increasing competitive relations and change ability in the market, a company should be adaptable and aspire to the proactive approach in discovering the circumstances that can influence its success. The strategy of a company should be to present the mission of what the company can be in the long term given that the vision is the ability of the company and all its employees to respond to challenges in a manner that surpasses its competitors.

Customer orientation should be the joint value of all employees. Products and service change, but company culture is difficult to change and remains a constant value. Once a company culture is created and perceived by all employees, authority and hierarchical levels become less important.

Chow and Cao (2008) also contend that two success factors in agile projects relative to culture are: cooperative organisational culture instead of a hierarchical culture and organisations where agile approach is universally accepted. Failure factors related to culture, according to literature, include: organisational resistance to change (Vijayasarathy & Turk, 2008), and the organisational culture being too traditional and political (Chow & Cao, 2008).

2.6 CHAPTER SUMMARY

The world is progressing towards the central unification of global economies and this is causing competition between organisations. Organisations that compete in the telecommunications and IT industries have high IT project implementation because of the rapid rate at which their products and services become obsolete. The organisations initiate IT projects to develop better products all the time as industry players are always under threat of competitors developing new technologies and making existing technologies redundant.
The traditional method of software development, waterfall method has been previously used successfully. Waterfall methods has many shortcomings which include obsolete requirements, a lack of opportunity to understand changing current customer needs and a high number of faults found during testing. Waterfall also does not support the organisations need to deliver fast and quick services to customers with changing requirements.

The telecoms company is in the process of adoption agile method to deal with the shortcomings of the Waterfall Method in their IT projects. Agile method is publicized as a method that offers a lightweight framework for helping teams, given a constantly evolving functional and technical landscape; it maintains a focus on the rapid delivery of business value and because of this, agile methods have been touted to produce higher quality software, reducing the overall risk associated with software development. They enhance developers’ morale, and project restarts are reduced than the traditional waterfall model approach.

Benefits of agile adoption is the short time to market, cites improved quality, enhanced client relationships and better team morale as benefits of agile adoption. Agile methods have also been demonstrated to enhance customer value, improve organisation morale and provide steep improvement in product quality. Precise requirements, lesser need for documentation, early feedback due to frequent deliveries, rework reduction, testing resources which are used more efficiently, and higher transparency of who is responsible for what which creates incentives to deliver higher quality were highlighted as strengths of the agile method.

Even with the benefits, agile is not without challenges and the following challenges related to agile implementation have been identified: change resistance, people are not willing to change unless there is a good reason to and the change is perceived as easy enough; scepticism towards a new way of working and top down mandate.

From the literature review we can conclude that agile is an adaptive process that includes the customer in the development process. Agile is aimed at delivering a quality working product quicker through iterations. While agile is recognised as a methodology that has advantages predominantly in the software development world, it has its own shortcomings. Organisations need to be particularly aware what they would like to achieve and plan carefully what aspects of agile would best suit their needs, agile cannot be a ‘problem solver’ for every software development challenge.

Agile introduction or implementation is affected by organisational, human and cultural factors; organisational and human factors need to be taken into account when agile is being introduced in organisations. A top down approach to implement agile perceived by lower ranks to be
without the proper change management could be resisted by lower ranks in the organisation thereby thwarting the plans of implementing the agile process. In an organisation where the culture is that of command and control or line management, the introduction of agile could prove to be problematic as the existing culture might not augur well for the introduction or implementation of a method that requires self-organising, matrix functioning and autonomy of the delivering team. While some authors believe that the introduction of agile improves morale and result in job satisfaction, there is no conclusive research-based evidence to support this view.

This chapter has also examined the McKinsey 7-S as a theoretical framework that guides this research study. The chapter also examined the key elements that contribute to the successfully implementation of agile software projects in an organisation. These elements are shared value, strategy, skills, staff, style, system and structure and are depicted in McKinsey 7-S framework.

The next chapter presents the methodologies used in the study and the rationale behind the selection of these methodologies. All methods used in the study are discussed in detail and the justification of their use is also provided.
3. RESEARCH METHODOLOGY AND DESIGN

3.1 INTRODUCTION

Chapter 2 provided an overview of literature relevant to the study. It also discussed the notion of the McKinsey 7-S as a theoretical framework selected in the study to answer the research questions and assist in the development of a conceptual framework for the adoption of an agile software development method in implementing IT projects in the telecommunications industry.

In this chapter, the research methodology used in the study are identified and the chosen method applied in the study identified and motivated for its suitability. The research philosophy, research approach, research strategy, case study, and unit of analysis including sampling as well as data collection instruments are outlined. Sampling procedures and sampling methods suitable for the study are also presented. The chapter also discuss ethical considerations in relation to the study are also outlined. This section discusses aspects of research methodology including research philosophy, research approach, research strategy, data collection methods, as well as aspects of data analysis adopted in this study.

Research can be defined as an unbiased and objective process of finding answers to an enquiry which is undertaken within a framework of a set of philosophies or approaches (Kumar, 2005). The process makes use of procedures, methods and techniques that have been tested for their validity and reliability (Kumar, 2005). In concurrence, Leedy and Ormrod (2001) say research is a search for knowledge or any systematic investigation to establish novel facts, and gather and analyse information using scientific methods in order to enhance our understanding of the facts we are concerned about.

A research methodology on the other hand can be referred to as the use of particular research methods or techniques to acquire and analyse data to create knowledge (Robson, 2011; Petty et al., 2012). In concurrence, Welman et al. (2005) defines research methodology as an organised practice that consists of sequences, procedures and systems that are used to manage and execute the research process. The main aim of a research methodology is to broadly outline how the research process is carried out (Leedy & Ormrod, 2001). Therefore, Lindsay (1995) recommends that the research methodology should ‘provide enough details to allow a reasonably knowledgeable colleague to repeat the same study in a different environment and obtaining almost similar results.’ This has been taken into account in this study.
This study follows a research process adopted from Saunders et al. (2007) which classifies research into a model of stages called 'the research onion'. Figure 4.1 below represents the research design onion used in this study.

Figure 6: The research onion (Saunders et al., 2007)

As shown in the figure above the stages of this research are represented by layers as of an onion, which include research philosophy, research approach, research strategy, and data collection methods. More details regarding the layers forming the design of this study are discussed next, starting with the outmost layer - the research philosophy.

3.2 RESEARCH PHILOSOPHY

Research philosophy refers to the belief that influences the approach in which data about a phenomenon should be gathered, analysed and reported; with positivism and Interpretivism being the most common philosophies in IT research (Creswell, 2009). For the purpose of this study, an Interpretivism paradigm, which asserts that it is only through the subjective interpretation of, and intervention in, reality that reality can be fully understood (Easterby-Smith, Thorpe & Lowe, 1991) was adopted to understand the organisational factors that hinder the adoption of agile in IT Projects. Leedy and Ormrod (2001) support that the paradigm will assist this study, which attempts to understand people’s perceptions towards events that are external to them, as it attempts to elicit the understanding, experience and perceptions of the
participants on the identified factors around the agile adoption in IT projects within their organisation.

3.3 RESEARCH APPROACH

According to Welman et al. (2005) research can be conducted using either a quantitative research approach or a qualitative research approach. Quantitative research is focused on facts and causes of behaviour, and the results are presented in a statistical format (Leedy & Ormrod, 2005); while qualitative research involves exploring issues, understanding phenomena, and answering questions through multiple methods such as open-ended interviews, informal and formal observations, open-ended questionnaires and case studies (Creswell, 2009).

- **Quantitative research approach**: involves facts and causes of behaviour and the results are presented in a statistical format (Bogdan & Biklen, 1998; Charles, 1995). It is more inclined to the positivist philosophical paradigm as it is objective in nature (Collins & Hussey, 2003; Lancaster, 2005). Emphasis is placed on the measurement and analysis of relationships between variables (Leedy & Ormrod, 2005; Denzin & Lincoln, 1998). Quantitative research approaches use questionnaires, surveys and experiments and the analysed data is presented mathematically.

- **Qualitative research approach**: involves understanding the phenomena under study in a natural setting, that is 'real world setting [where] the researcher does not attempt to manipulate the phenomenon of interest' (Patton, 2001:39). Strauss and Corbin (1990:19) define qualitative research as ‘any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification.’ Qualitative research approaches use interviews, observations, case study (Eckert, 1998), and the analysed data is not presented in mathematical formats.

This study adopted the qualitative research approach based on the fact that most of the variables explored are behaviour related in nature. According to Malterud (2001), qualitative research techniques are useful to capture people’s viewpoints, subjective explanations, emotions and dynamics, and observations in an environment. This study made use of the case study strategy. This strategy is discussed next.

3.4 RESEARCH STRATEGY

A research strategy can be defined as the true reflection of the overall manner in which the study was conducted (Haji, 2006). A case study on the other hand is a research strategy that
is used to establish an understanding of a particular setting such as a situation, event, and set of documents (MacNealy, 1997). In concurrence, Yin (2013) defines a case study as an empirical investigation of an existing event in an environment.

The whole purpose of using the case study approach is to explore new areas and problems of an event where there is little theory or measurements to describe a process, and to explain complex phenomena that are not clear (Kohn, 1997). The case study enables researchers to gain an in-depth understanding of the unit being analysed (Welman et al., 2005).

There are different types of case studies and they are categorized in this study as explanatory, exploratory and descriptive:

- **Explanatory** – According to Yin (2011), explanatory case study provides a detailed description of a phenomenon, explaining the exact interpretation of the facts of the case. This study is in most cases suitable for casual studies where pattern-matching methods can be used to analyse complex multivariate cases (Zainal, 2007).

- **Descriptive** – is used to clearly describe a phenomenon in real-life context (Yin, 2011). A researcher presents a descriptive theory to describe a real life context phenomenon.

- **Exploratory** – sometimes referred to as pilot study, it is used to explore phenomena where there is no clear outcome or specific result (Yin, 2011). There is limited data collection done to identify and define the research questions and hypotheses to be used by studies to follow.

This particular study adopted the exploratory case study in order to explore the agile method adoption phenomena within the South African telecommunications industry context.

A case study can either be a single case or consist of multiple cases (Yin, 2011):

- **Single case** – according to Zainal (2007) is an in-depth analysis of a case or event and is mostly used when there are no other cases for replication. Single case studies allow for profound understanding of a particular event. Single case studies are used to represent a unique, holistic or embedded case (Yin, 2011).

- **Multiple cases** – according to Yin (2014) they enable analysis of multiple cases or events in order to establish differences between cases and replicate findings across cases.
As the study cannot cover all organisations within the telecoms industry and the fact that the agile adoption assessment needs an in-depth understanding of organisational factors, the study will thus employ a single case study. A multiple case study is expensive and time consuming to conduct (Yin, 2011) and it tends to follow replication logic rather than a sampling one. Single case studies are used to represent a unique, holistic or embedded case (Yin, 2013).

This study employs a single case strategy as it studies one particular company in the telecommunications industry employed for an in-depth understanding of the complete organisational factors that contribute to agile adoption within a telecommunications company. The key advantage of a single case study is that there is a greater in-depth analysis of a single case (Voss et al., 2002). The next section discusses the data collection methods used in the current study.

3.4.1 Sampling design

According to Cooper and Schindler (2003) and Black (2004), a sample is a representative part of the target population that is selected using special methods to yield some knowledge about the whole population. Purposive/Judgmental sampling (Cooper & Schindler, 2003) was used in the current study. According to Corbetta (2003), the sampling procedure that involves sampling units that are not chosen in a random manner but on the basis of some of their characteristics is called purposive or judgmental sampling. In concurrence, Babbie (2005) added that judgment sampling entails the selection of the units to be observed on the basis of one’s own judgment about which ones will be the most useful or representative.

The current study is based on a single organisation in the telecommunications industry of South Africa as its unit of analysis. Both the telecommunications company and its employees were purposively sampled to participate in the study. The criterion used to select the company that participated in the study was as follows:

- The company is based in Gauteng, which makes the work of the research to collect the data much easier due to time constrains to finalise the research.
- The company operates within the telecommunications industry.
- The researcher is an ex-employee of the company. Access to the company and the staff was easier.

As shown in the bullet points above, the company that participated in the study was carefully selected to ensure that the study could be conducted and completed on time.
As shown in the bullet points above, the respondents that participated in the study were carefully selected to ensure that the study could be conducted and completed on time. The researcher had an advantage since she previously worked for the telecommunications company and the collection of data required minimal effort in getting approval from management in the organisation.

3.4.2 Participants

A sample in Tustin et al. (2005:337) is defined as a subset of a population or the universe or a total group of people or entities from which information is required. In the study, the universe was considered to be all the employees in the telecommunications organisation under study at head office, while the sample population consisted of the IT department employees. A total of 30 participants were selected from the sample population. Two sampling methods are identified by Tustin et al. (2005:344), probability and non-probability sampling. With probability sampling each element in the population has a known, non-zero probability of being included in the sample. Non-probability sampling on the other hand relies on the discretion of the researcher; for this sampling form, the degree of sampling error cannot be determined. The key difference between probability and non-probability sampling is not that probability sampling will always produce more representative sample. Rather, with probability sampling a statistical evaluation of sampling error can be undertaken, thus enabling the researcher to assess how the sample is likely to be unrepresentative, and by how much. Non-probability purposive sampling was applied in the study, twenty three (23) participants were selected for questionnaires and seven (7) participants were identified for interviews.

Table 1: Research participants

<table>
<thead>
<tr>
<th>Role Categories</th>
<th>Questionnaires</th>
<th>Interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development staff (Business Analysts, Developers, Testers)</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>Team Leader</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Development SME/ Consultant</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Technology Head</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Business Users</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

3.5 DATA COLLECTION METHODS

As discussed in the previous section, the current research used a single case study strategy. Multiple methods for data collection were employed to ensure that the accuracy of the data being collected could be validated. The study employed a combination of literature reviews, questionnaires, interviews and observations as data collection instruments to aid fulfilment of
the study objectives. Details of the data collection instruments and how they were employed in the study are discussed in the following sub-sections.

3.5.1 Interviews (semi-structured)

This study used semi-structured interviews as another method of data collection. Interviews involved verbal questioning and responding (Denscombe, 2003). According to Opdenakker (2006), interviews have always dominated the field of qualitative research in that they take advantage of social cues, such as voice, body language, and so forth, of the interviewee and the interviewer can get a lot of information that can be added to the verbal answers of the interviewee on a questionnaire. Interviews are categorised into three different structures, namely: structured interviews, semi-structured interviews, and unstructured interviews (Fontana and Frey, 2005). Fontana and Frey (2005) and Zhang and Wildemuth (2006) define the three categories of interviews as follows:

- **Structured interviews**: have a set of pre-defined questions that would be asked in the same order for all participants. They are more similar to survey questionnaire, except that they are administered orally rather than in writing.
- **Semi-structured interviews**: Are more flexible in that the interviewer has room to adjust the sequence of questions to be asked and to add more questions based on the context of the participants’ responses.
- **Unstructured interviews**: there are no predefined questions, nor a theoretical framework to guide the enquiry. Unstructured interviews rely on social interactions between the researcher and the participant/informant.

To serve the purpose of the study, semi-structured interviews were employed and the McKinsey 7-S framework was used to guide the enquiry. After the results of the questionnaires have been evaluated, the participants were asked to attend one-on-one semi-structured interview session with the author to answer the questions outlined in the interview section of the study. Seven (7) of the 23 participants who responded to the questionnaires also took part in the interview process. A sample of the interview questions is attached at the end of the document in APPENDIX B. During the interviews, the participants were asked to explain, in greater detail, their responses to the questionnaires and to qualitatively relate their experience with agile methods in IT projects. The interviews helped the author to interpret the questionnaire data through deeper insights into agile software methods and factors affecting the successful adoption of these methods when implementing the IT projects faced by the telecommunication organisation in the study. Responses from both the pilot and the actual
study were not revealed to any of the participants or to anyone in the telecommunication organisation.

### 3.5.2 Questionnaires

The questionnaire can be defined, as a document comprising questions and other types of items designed to solicit information applicable to analysis (Babbie, 1998). The questionnaire was preferred as the data-gathering instrument because it could be distributed to a wide audience, provide definite answers to questions and could be tested before being distributed. A questionnaire was designed and administered to both managers and employees at the telecommunications company. A questionnaire divided into five sections was constructed. Likert scales (Donald, et al., 1990) were used to compare the responses of the participants. The questions are composed of five Likert scale multiple choice answers in which participants were only required to select a single option.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

The purpose of the questionnaires was to seek employees and manager’s individual opinions with regards to the factors that affect the adoption of agile software methods in their organisation. This form of data collection allowed for a number of people to be involved in the study and thus complete the questionnaire at a time convenient to them. Having such closed-ended questions dominating the questionnaire was also beneficial in that the overall questionnaire looked more appealing to the participants because it took them a few minutes to complete. The design of the questionnaire included sections, and the rationale for each section is discussed below:

**Section A: Demographics**

The first section ‘Section A’ aims to determine the demographics of the case study, including company size, participants’ positions and overall experience in the company and industry in order to ensure validity of the sample. This section also ensures that the questionnaire is distributed only to the participants that fall under the sample category defined in the study so that relevant feedback can be used to achieve the study objectives.

The first question in this section was about the role the participant plays in the telecoms company. Different roles were listed in the questionnaire and a blank space was also provided allowing participants to state their roles in the telecoms company should they feel that their specific role was not listed in the questionnaire.
**Section B: agile practices in the telecoms organisation**

This section aimed to determine the agile practices necessary for the adoption of the agile software methods in organisations. A literature review was conducted to investigate about some relevant practices deemed critical for the successful adoption of software methods in a telecommunication organisation (*cf* Chapter 2). A list of agile practices was provided in the questionnaire together with the option to add others that may not have been provided on the questionnaire so that participants could feel at liberty to add them and scale their importance.

The agile practices are scaled from 'not important' to 'highly important' on a five Likert scale to elicit their importance. The aim of the section was also to allow the researcher to have an idea of critical practices that are performed within the telecommunications organisation for adoption and implementation of agile software methods.

**Section C: Value and Impact of agile**

This section aimed to elicit whether or not the study participants understood the value and impact of agile software initiatives in their organisation. One of the questions asked was about whether project success has improved since the introduction of agile in the organisation (*cf* Questionnaire: Section C, Nr. 5). This question was aimed at eliciting whether participants understood the benefits that emanate from implementing the agile way of software development when implementing projects. This question was scaled from 'strongly disagree' to 'strongly agree'.

**Section D: Organisational Factors and Success in implementation**

This section aimed to elicit the participants’ awareness and understanding of organisational factors that might affect the implementation of IT projects in their organisation. Participants were asked questions that allowed the author to have a clear indication of whether the organisational strategy and structure support the adoption of agile methods. Here, also five Likert scale multiple choice questions from ‘strongly agree’ to ‘strongly disagree’ were used to measure the responses given by participants.

Participants were also asked for their opinions on whether the staff complement and their skills in the organisation were sufficient to be able to deliver IT projects using the agile method. This question aimed to elicit the extent to which the staff understood their role in the agile method adoption and whether they had the necessary skills to implement projects using the agile method. Literature has provided some of the common hurdles for effective implementation of agile methods organisations (*cf* Chapter 2). Participants were asked to identify these common
challenges using a scale of ‘strongly disagree’ to ‘strongly agree’. An option to state other hurdles that were not listed in the questionnaire was provided to allow the participants to state and scale them.

Section E: Overall agile adoption in the organisation IT Projects

This section aimed to elicit the participants’ awareness and understanding of organisational factors that might affect the implementation of IT projects in their organisation. Participants were asked questions that allowed the researcher to have a clear indication of whether the organisational strategy and structure support the adoption of agile methods. Here also, five Likert scale multiple choice questions from ‘strongly agree’ to ‘strongly disagree’ were used to measure the responses given by participants.

Participants were also asked for their opinions on whether the staff complement and their skills in the organisation were sufficient to be able to deliver IT projects using the agile method. This question aimed to elicit the extent to which the staff understood their role in the agile method adoption, and whether they had the necessary skills to implement projects using the agile method.

3.6 DATA ANALYSIS

Cooper and Schindler (2006) state that data analysis is the integral part of research and it refers to the process of collecting, reducing and summarizing the data collected in the study. The nature of this study is qualitative, as qualitative research techniques are useful to capture people’s viewpoints, subjective explanations and observations in an environment, emotions and dynamics. This study followed the guidelines of qualitative research data analysis as described by Creswell (2007), with the focus being on Thematic Analysis using the prior-themes as indicated in the research model in attempting to assess the factors that affect the successful adoption of agile software methods in telecoms organisations. This was further supported by the descriptive statistics from the questionnaires. In qualitative research, data collection and analysis can occur simultaneously (Baxter & Jack, 2008). Creswell (2013) describes a common procedure for qualitative data analysis which consists of steps that need to be followed to reach a conclusion about the collected data.

3.6.1 Thematic analysis

Thematic analysis is a qualitative analysis method used to analyse and present themes or patterns that relate to the data (Boyatzis, 1998). ‘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’ (Braun & Clarke, 2006). Thematic analysis deals with diverse
subjects through interpretations. Qualitative approaches are diverse, complex, and nuanced (Holloway & Todres, 2003); and thematic analysis is most appropriate for a study seeking to discover using interpretations (Alhojailan, 2012).

Some researchers argue that thematic analysis is not a method but a tool to be used across different methods or within major 'analytic' traditions (Boyatzis, 1998; Ryan & Bernard, 2000). Attride-Sterling (2001) in particular proposes that ‘thematic analyses can be usefully aided by and presented as thematic networks: web-like illustrations (networks) that summarize the main themes constituting a piece of text’. However, Braun and Clarke (2006) believe that it should be considered a method on its own. One major example of thematic analysis is its flexibility (Braun & Clarke, 2006), and what researchers do with the themes once they uncover them differs based on intentions of the research and the process of analysis. Thematic analysis is not tied up to any particular epistemology or discipline (Boyatzis, 1998).

The process of thematic analysis begins when the analyst notices and looks for patterns of meaning and issues of potential interest in the data set, and this may be even during data collection. Unlike with statistical analysis, writing may begin during collection and after. Interview questions are not to be converted to themes. Thematic analysis is used in the following situations as summarised by Alhojailan (2012):

- **Data interpretation** – qualitative research requires drawing interpretations that are consistent with the collected data. Participant’s interpretations are significant in giving honest explanations for their behaviours, thoughts, and actions - and thematic analysis is able to identify just those variables that influence participant’s actions, behaviours or thoughts. Thematic analysis was applied to interpret data collected from participant’s responses during the interview because the amount of data collected was big. Thematic analysis is understood to help in interpreting big amounts of data as has been explained.

- **Deductive and inductive approaches** – thematic analysis’ flexible character enables it to be used in both inductive ‘bottom-up’ and deductive ‘top-down’ methodologies (Boyatzis, 1998; Frith & Gleeson, 2004).

- **Analysis of two different phases of data** – when the study intends to understand current practices of any individual, thematic analysis is most appropriate. It assists the researcher in analysing different phases of data collection, e.g. pre-/post-data.

- **Coding and categorizing** – thematic analysis codes and categorises data into themes. It allows processed data to be categorised and displayed according to its similarities and differences.
- **Semantic and latent approaches** – the level at which themes can be used is either at the semantic ‘explicit’ level or at the latent ‘interpretative’ level. With semantic approaches, themes are identified on the surface and the researcher focuses on what the participant said or wrote; whereas with latent approaches the researcher examines underlying ideas, assumptions and conceptualisations (Braun & Clarke, 2006).

The study followed Braun and Clarke’s (2006) guide to an effective thematic analysis process shown in the table below.

### Table 2: Phases of Thematic Analysis

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description of process</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Familiarise yourself with the data</td>
<td>Transcribing data (if necessary), reading, and re-reading the data, noting down initial ideas. During interview sessions, participants were recorded and the data was transcribed into written notes of unarranged pieces of data.</td>
</tr>
<tr>
<td>2. Generating initial codes</td>
<td>Coding interesting features of the data in systemic fashion across the entire data set, collating data related to each code. Once the data had been transcribed it was then arranged according to related data. For example, data related to technology was organized in one set and data related to the organisation was organized in another.</td>
</tr>
<tr>
<td>3. Searching for themes</td>
<td>Collating codes into potential themes, and gathering all data relevant to each potential theme. Upon noting the codes of data related to technology and organisation, initial themes were developed.</td>
</tr>
<tr>
<td>4. Reviewing themes</td>
<td>Checking in the themes works in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic ‘map’ of the analysis. A review of the generated themes was then done comparing them to the entire data set. This was done following the initial idea to generate themes in relation to those elements of McKinsey 7-S such as strategy, structure, skills, staff, shared value, style, and systems to determine the agile adoption factors.</td>
</tr>
<tr>
<td>5. Defining and naming of themes</td>
<td>Ongoing analysis to refine specifics of each theme, and the overall analysis; generating clear definitions and names for each theme. Analysis of the generated themes was then performed in detail giving each theme specific names and defining what each theme represented.</td>
</tr>
<tr>
<td>6. Producing the report</td>
<td>The final opportunity for analysis. Selection of vivid, compelling extract examples, relating back of the analysis to the research question and literature, producing scholarly report of analysis. In depth analysis was then done in relation to the research question and literature using the themes that ought to determine factors affecting agile adoption in South African telecoms industry.</td>
</tr>
</tbody>
</table>

This study adhered to these phases in analysing data from interviews and created codes that when processed became themes.

### 3.7 ETHICAL CONSIDERATIONS

Ethical considerations were discussed briefly in Chapter 1. This section expands the discussion and provides more details as applied in the current study. According to Cooper and Schindler (2003), ethics can be described as norms or standards of behaviours that guide moral choices about our behaviours and our relationships with others. As this study involves human participants, non-ethical behaviours or questions were avoided in the questionnaires.
and interviews (cf Appendix A and B), considering the diverse culture and believes of the participants. The Tshwane University of Technology information leaflet (cf Appendix C) which describes ethical standards governing research was provided to all participants to familiarise themselves with so they could decide whether to participate in the study or not. The leaflet was also used to obtain consent from each participant to collect the data and to use the data being collected in the study.

Anonymity of the participants and non-disclosure of proprietary information of participating the telecommunications organisation were applied, thus names of individuals participating in this study were identified by 'respondent' followed by a respective number (example: Respondent 1). The name of the company was also not revealed, it was referred to as the 'Telecommunications organisation'. All ethical considerations, as well as the consent form are provided in the TUT information leaflet (cf Appendix C). The institution (TUT) and the participating telecoms organisation would not have allowed the research to continue if there had been any ethical issues involved.

3.8 CHAPTER SUMMARY

This chapter gave an overview of the methodologies employed to form the basis of this research study. The chapter discussed methodologies used to elicit information appropriate to achieve the study objectives and to answer the research questions. Qualitative and quantitative methods were mixed in a single case study to support the study to collect relevant and valid information to increase the credibility of the study. A thematic analysis was applied to strengthen the validity and credibility of the study.

The rationale of the methodology was also provided, including the strategy, sample, participants, and data collection tools, and how the data collection tools were structured to facilitate the data collection process. To ensure that non-ethical issues were prevented from arising and the confidentiality assured, all the ethical considerations were addressed faithfully. This chapter also discussed the data analysis process through a diagram showing how the research findings and results were reached. The next chapter discusses the findings and results in more detail.
4. RESEARCH ANALYSIS AND RESULTS

4.1 INTRODUCTION

The previous chapter discussed the research methodology and design, and the selected participants and data collection instruments employed in the study. In this chapter, the data that was collected by means of interviews and questionnaires is analysed and interpreted.

The data were analysed and interpreted to address the research sub-questions stated in Chapter 1, which will later be used to answer the main research question, resulting in the development of the framework for factors affecting agile adoption in the organisation under study.

4.2 RESEARCH SETTING

The telecommunications company in Gauteng Province was selected and used as a case study. The telecoms company is a wireline and wireless telecommunications provider in South Africa, operating in more than 38 countries across the African continent. It is a semi-privatised, 39% state-owned company. The three mobile telephone networks in South Africa, listed in terms of numbers of subscribers, are Vodacom (currently 65% owned by the United Kingdom's Vodafone, but until November 2008 jointly with Telkom SA), MTN and Cell C. There are several service providers, such as Virgin Mobile and Nashua Mobile, which subscribers can use to access the networks and there are approximately six times as many cell phone subscribers than land line subscribers in South Africa (30 million versus 5 million.

To be able to collect data from this telecoms organisation, the research proposal had to be approved by the TUT Research Ethics Committee. The proposal indicated that a telecoms company in Gauteng was going to be used as a case study and that all relevant data to the study was to be collected from participants in this organisation.

4.3 RESEARCH RESULTS

Multiple data collection instruments were used in the form of questionnaires and interviews to collect data, and thematic analysis was applied for results validity and credibility. The research results presented in the next section are for the three sections that make up the questionnaire.

4.3.1 Demographics

A total of 23 participants were used in questionnaires and the figure below outlines the demographical information of the study participants.
The results in Figure 7 above show that out of the 23 participants, 78% were development staff which comprised of business analysts, testers and developers, while 9% were business users, 5% were the subject matter experts; while 4% was management. Results indicated that the participants were a good representation from the project management perspective. According to Keyes (2009) the highest-level goal of the project team is to successfully implement the system as specified in the project plan; and a typical project team is as follows:

**Systems analyst**: Systems analyst is responsible for working with the end users to determine system feasibility and then develop the scope, requirements, design, and other documents; they are also then responsible for implementing, testing, and then turning over a completed, working system.

**Developer**: The developer is usually the most technical person on the systems who is responsible for taking the specifications from the systems analyst and turn these specifications into working programs, and ultimately, complete systems.

**End users**: The end-user department is composed of experts who do a particular task. A single system may have many end users who hail from many different departments. Some end users might not work for the company at all. Each end user will have a different set of requirements.
It is the role of the end user to work with the business and systems analyst to uncover and then document these requirements. It is also the job of the end user to assist in other phases of the SDLC, such as the testing component of the implementation stage.

### 4.3.2 Research results for Section A – General questions

The participants were asked about their experience working with agile. Figure 8 indicates their responses. A wide variety of people other than managers are involved in the process of project management and participants are active in other roles, such as quality assurance engineers (or testers), business stakeholders, data professionals and analysts. The fact that the majority of participants have a direct involvement in the development process is an advantage for the accuracy of the results. Concerning the participants knowledge in working with agile techniques most are quite knowledgeable, with 56% of the participants citing moderately knowledgeable and 35% being knowledgeable about agile methods. Concerning the experience in working with agile, the results show that 4% of participants are below 1 year in terms of agile experience. This indicates that agile methodologies are increasingly gaining popularity with more organisations adopting them. 44% of participants have an experience of 3-4 years, indicating mid-level experience while only 22% have experience of between 4-5 years. The results also show that none of the participants have really gained enough agile experience of five years and beyond. This is understandable; given that agile is still a relatively new software development paradigm.

![Agile Knowledge](image)

**Figure 8: Agile knowledge and understanding**
4.4 ANSWERS TO RESEARCH QUESTIONS

This section discusses research results that answer the two research sub-questions. The first part of the discussion focuses on interview results and the second part focuses on questionnaire results. Below are the interview results for Sub-Question 1.

4.4.1 Interview Results for Sub-Question 1

Sub-Question 1: What is the current state of agile adoption within the organisation?

To determine the state of agile adoption within the telecoms organisation, organisational members had to be prepared and willing to use agile software method based on the perceived benefits of the methodology. Organisational members in this case refers to the software development team: manager as well as the business users. The stipulated number of participants to be interviewed from each was three per category. However, during the interview process less participants were interested in having their opinions and views heard and the number decreased to seven employees of the telecoms organisation.

The state of the agile method adoption was analysed as the question suggests that IT development organisations should assess their current agile practice maturity at technical, project management and organisational levels. Practices should be assessed for, among other things, their effectiveness and adoption levels in the organisation. Findings revealed that the telecoms company has partially adopted the agile method of software development. The findings suggest that there is still use of traditional ways of software development within the organisation. The waterfall method, which is structured in nature, is still being used in the requirements gathering and documentation of the requirements. The findings also revealed that the company is dedicated in implementing agile methods; they have contracted agile coaches to guide, coach and support the internal staff in the adoption of the method.

This summation comes after an analysis of responses to some of the interview questions that participants had to answer in support of Sub-Question 1. Below are some of the responses taken from different interview leaflets of participating groups, and discussion of results:

‘Yes, agile is adopted in the organisation. However, it is not institutionalized per se but it is embedded in the organisation’s ICT Project Management policy and governance framework. Agile is allowed as an implementation method within the ambit of the said policy and project governance framework, given relevance and fitness evaluated to a specific project or projects.’ (Respondent One).
‘Agile adoption in the organisation is gaining momentum; other teams are ahead with the understanding and implementation of the method while others are in inception phase and are relying on the agile coaches for guidance and support’. (Respondent Two)

‘The Project we are working on was established in order to adopt an agile methodology of implementing projects within organisation. At the moment we are using agile principles especially during System Development and Testing; however for requirements gathering we still used structured and a formal way’. (Respondent Three)

Responses provided in the interviews showed that the telecoms company has adopted agile, even though agile adoption is still in the infant stages. These results corroborate previous findings that agile methodologies are becoming increasingly popular, with a number of international organisations embracing them increasing (Salo and Abrahamsson 2008; Zhang et al., 2010; Laanti et al., 2011). According to Vanker 2015, an international survey conducted amongst software development companies shows that 80% of respondents indicated that they have practised agile.

4.4.1.1 Questionnaire results for Sub-Question 1

To further address Sub-Question 1 in order to determine the overall adoption of agile method, concepts on IT project management had to be established. Upon analysing the element of willingness to adopt, results show that participants are willing and prepared to adopt agile based on the perceived benefits of the method.

![Figure 9: Agile Maturity in the organisations](image)

However, the results indicate that the participants put agile maturity in the organisation at between Level 1 and 2, with the Level 1 response, which indicated no consistency and agile
being used on ad-hoc basis, receiving an over 50% response rate. This further confirms that even though the Telecoms is using the agile method in the IT projects; the waterfall methodology is still the mostly used method in the Telecoms Company.

4.4.2 Interview results for Sub-Question 2

What is the perceived value and impact of agile use on IT project success?

To determine the value of agile within the telecoms organisation, organisational members had to be prepared and willing to use the agile software method based on the perceived benefits of the methodology. The following are some of the questions asked:

Q: Do you think using agile has any impact on project success?

The research respondents indicated that the adoption of agile methods and the principles used in the agile, which include daily stand-up meetings and customer involvement in requirement prioritization, have produced a lot of benefits for the customers and have improved delivery of software to the customer advantage. Interview responses regarding the challenges of these mechanisms are presented as follows:

‘Yes, especially business requirements can be gathered and analysed in sprints or smaller chunks to accelerate development or project deliverables (Respondent one).

‘There has been improvement in turn-around timelines regarding development,’ (Respondent two).

‘Results for agile are visible during the System Development and having the team involved at the initial stage of the project.’ (Respondent three)

These interview findings suggest that the employees of the telecoms company are noticing results yielded by the implementation of agile methods in their organisation. This is because working software is delivered to customers faster than usual; and the teams are working in collaboration and are constantly communicating more than they used to. This has then assisted in improving of customer satisfaction. Fergis( 2012) cites that customers who receive an end product that is very aligned with their needs and are willing to pay a premium for such quality, which increases revenues and Return on Investment. Since customers are more likely to purchase the product due to its alignment with their needs, they associate a positive experience with the company and are incentivized to purchase future products from the same company.
Q: Would you say using agile is of any value to project success?

Interview results show that there is immediate value and benefits to the customer when agile is adopted. Realization of customer benefits has been quicker. Agile adoption has not always been easy and seamless within an organisation. In comparison to traditional approaches, adaptive methodologies are considered to perform better in terms of increase in productivity, quality improvement, cost reduction, maintainable and extensible code, collaboration, and customer satisfaction. Participants cited that they have seen positive results of agile over Waterfall, such as in the adoption that led to a significant increase in developer’s productivity. There was an improvement in the four elements of: productivity, quality, cost of development and stakeholder satisfaction. The majority of participants indicated a more or less significant increase in productivity, much higher or somewhat higher quality of the product, much lower or somewhat lower development costs and much higher or somewhat higher stakeholder satisfaction.

‘Yes, business benefits are realized early.’ (Respondent one).

‘Yes. Using agile management approach is of value to project success, because it encourages teams to develop small versions of the system hence encourage the frequency of deliverables.’ (Respondent two).

‘The benefits of agile adoption in projects are quicker implementation of projects and business involvement and participation is key for successful implementation.’ (Respondent three).

It appears that the implementation of agile methods in the organisation has started to yield positive results with all the respondents agreeing that the customer has been able to realise benefits quicker than towards the end of the project.

Q: What was the perceived value and impact of agile use on IT project success?

This section contains the findings on the impact that was created in the organisation under study, as a result of introduction or adoption of the agile method. One of the key outcomes of agile method implementation is customer satisfaction resulting from delivery of quality working products. According to Sidky and Arthur (2010) the success of a software development effort is based on the extent to which it helps deliver customer value.

The top benefit was improved communication and coordination among team members. Specifically, the daily stand-ups were seen as instrumental, and were especially useful in bringing testers and developers together. Improved awareness of team members’
activities was another benefit. One respondent said: ‘Team members are aware of what each of the others is working on.’ Another cited the benefits of earlier discovery and handling of development issues: ‘Better overall communication.’

The second most cited benefit was quick releases. Developers create releases that are demonstrable to the business users every few weeks instead of every few months or years with the Waterfall Method. This makes it easier to keep track of progress and monitor software quality, as one respondent said: ‘We have been able to deploy valuable pieces of the final product early; normally we would wait till the end to produce a finished product and in some cases by then the customer’s needs and requirements would have changed.’ It makes it easier to evaluate the value of features and the product, provides feedback to improve the product, and improves turnaround time for fixing bad bugs. A tester commented: ‘When you integrate early and often, the product can be tested early and often, too.’

In third place is Flexibility of Design. Developers noted that short sprints combined with more emphasis on customer feedback led to better agility and efficiency in responding to changing requirements, internal processes, reorganisations or politics, and flushed out bad designs more quickly. ‘You don’t have to commit prematurely (for example, to design decisions).’ An agile process ‘anticipates changes to requirements so that they do not destroy a schedule.’ Flexibility was not solely based on the product, but the development process itself, i.e: ‘Ability to change direction quickly i.e. cancel a sprint and start another.’ Another said: ‘Quick results lead to iteration which helps us to fail cheaply instead of in an expensive way (if we fail).’ ‘Agile embraces change, which is a fact and part of software development.’

The fourth most popular benefit of ASD is a More Reasonable Process. Many developers complained about rigid development processes that were relaxed in an agile environment. Developers wasted less time on tasks they perceived as irrelevant, such as ‘large specs that are out of date before they are finished.’ Some of this perception may be a reaction to earlier more waterfall-like processes, but some may come from the haphazard adoption of agile methodologies by various groups, very few of which would characterize themselves as agile experts.

Documentation and planning are viewed as just-in time and just-enough for the next sprint. One developer notes that ‘process improvement is built into the process.’ A program manager said that running the process is more manageable and less bureaucratic than earlier processes. The process supports ‘real-time tracking of progress and ability to adjust
future forecasts based on real data.’ agile methodologies are more dynamic and incur less overheads. One manager said the agile process costs less.

Not far behind was Improved Quality. The quality of the software is a strong concern for developers. The effects were manifested in fewer bugs, and a more stable set of features. Test-driven development and test automation were seen as factors that contributed to higher code quality. All aspects of software are improved, from design and architecture to performance of the products of each sprint. Improved communication leads to faster turnaround time for blocking bugs. One developer said: ‘Ongoing refactoring leads to higher code re-use and better quality.’ Rounding up, the top ten benefits of agile development were: better focus on customers, better prioritization of development and focus on the product, improved productivity, increased morale (often tied to continuous integration with deliverables at the end of each sprint), and more reliance on test-driven development.

4.4.1.2 Questionnaire results for Sub-Question 2

Since the introduction of agile the team functions as a coherent unit: A total response rate of 74% indicated agreement with the statement, 17% responses were neutral and 4% responses showed disagreement with the statement.

There is consistent delivery of working product to the benefit of customers when using agile method: 56% responses agreed with the statement, 39% were neutral and 4% indicated that respondents strongly agreed with the statement. In total the ‘agree’ response rate was 60%.

Customer satisfaction has improved or shown improvement due to agile adoption: The view of respondents as indicated by the 48% response rate, was that customer satisfaction had improved in the organisation under study as a result of agile adoption; 30% of the responses were neutral; 17% responses indicated disagreement with the statement while 4% indicated that respondents strongly agreed with the statement. The total ‘agree’ response rate was 52%.

Agile team successes are celebrated and communicated to the rest of the organisation: A total response rate of 52% indicated neutrality of respondents to the statement, 39% responses indicated disagreement and 9% responses showed agreement with the statement.

The number of implementations has increased since the introduction of agile: Neutral responses to this statement stood at 52% while ‘agree’ responses made up 48% of the total responses.
The product owner is always actively involved in all sprints: A total response rate of 61% indicated agreement with the statement, the total was made up of 57% ‘agree’ and 4% ‘strongly agree’ responses; 22% responses indicated disagreement with the statement and 17% were neutral responses.

Teams have clear direction and know what they have to deliver: There was 61% responses that indicated agreement with the statement, 26% responses indicated neutrality of respondents to the statement and 9% responses showed disagreement with the statement.

Agile introduction has resulted in less waste of time and money: Over half of the total responses (52%) were neutral to the statement, 30% responses indicated agreement with the statement and 13% of the responses indicated disagreement from respondents.

Teams learn from successful cases of other agile teams: A total response rate of 65% was attributable to neutral responses, 35% of the responses indicated agreement with the statement.

Elevated levels of trust in product teams are starting to emerge from management: A total response rate of 48% indicated neutrality to the statement, 30% responses indicated disagreement while 22% indicated agreement with the statement.

4.4.1.3 Interview results for research Sub-Question 3

What are the key factors that you think affect agile especially with regards to strategy, structure, systems, shared values, style, staff and skills?

Results of the interviews show that the factor that affects the agile adoption is the staff complement which is reluctant to change due to ‘fear of change’ and due to lack of skills and knowledge.

The structure of the organisation is hierarchical, one where the communication is usually top down and not the other way round. The teams are not empowered to make the decisions and have to wait long for a decision to be taken.

The McKinsey 7-S model is used to determine factors that affect the agile method adoption. McKinsey 7-S model assesses the current state of the organisation as well as explore the different elements that contribute to transformational change in the organisation. According to (Peters and Waterman, 1982) the benefit of such an approach is that it allows direct comparison between the envisioned and existing state of affairs, allowing organisation leaders to understand where the differences lie and to work out how to smooth the transition.
McKinsey 7-S framework includes the hard S’s (strategy, structure and systems), which are ingredients of organisational theory, as well as the soft S’s (shared values, skill, staff and style), which are more cultural by nature and therefore important ingredients of organisational behaviour. The key point of the model is that all the seven areas are interconnected and a change in one area requires change in the rest of the organisation for it to function effectively (Ravanfar, 2015). The seven areas that were assessed were strategy, structure, style, staff, skill, shared value and systems.

In the next section the findings on the organisational elements which need to be assessed are discussed.

✔️ **Strategy**

Strategy is a plan developed by a firm to achieve sustained competitive advantage and successfully compete in the market. Though teams had some support from their project manager or the agile coach, they were not confident of getting any support from the management until they were able to demonstrate the benefits of using agile practices. *Even though the organisation’s strategy is to move towards agile and agile adoption has been communicated to the bigger audience within the organisation, due to the culture of the organisation it will be very difficult to implement agile in the telecoms company.*

Agile adoption employs a different way of doing things and can be a difficult process especially when the organisation is not supporting change, and change is not driven top-down. However, an external agile coach has been instrumental in introducing agile practices by convincing management and pushing over or around approval and implementation hurdles, and played a critical role in facilitating their ongoing use throughout the organisation. The manager said: ‘*the organisation is positioning itself as a learning organisation, meaning that the organisational culture and the practice are strategically focused on the organisational learning…. adoption of agile is conducive to continual improvement that the organisation is striving and working towards.*’

These findings concur with Ambler’s (2011) claim that support from an executive level is a success factor in agile project delivery, while Chow and Cao (2008) discuss the benefits of a committed sponsor or manager in an agile project environment. Vijayasarathy and Turk (2008) argue that managerial apathy towards agile is a sure way of project failure. Chow and Cao (2008) further mention a lack of executive sponsorship and management commitment as formulas to attract agile project failure.
‘The prioritized project deliverables are prioritized according to organisational strategic objectives and key performance indicators, thus the projects at hand are strategically supported’ (Respondent one)

✓ **Structure**

Respondents pointed out that each team member should be dedicated and focused on the task at hand and take accountability and ownership of completing their tasks during normal working hours. They also noted problems within the organisational structure which include staff members who are working in silos, with one respondent mentioning that:

‘We are much hierarchical here…if speed of delivery is required then something needs to change.’ (Respondent one)

‘The reporting lines and ranks are very challenging because you can’t just communicate with the ‘key SME’ without consulting with their manager. Ranking is big within the organisation and very strict at times.’ (Respondent two)

Respondents also mentioned the lack of communications among senior management, and the long and bureaucratic process of decision-making and approval for projects to be undertaken; this was confirmed: ‘The organisational structure is hierarchical one where the senior person can dictate to a ‘junior personnel’ and I feel that this is an impediment to the adoption of agile. Mostly we have had to wait for junior personnel to go consult the senior management for decision making purposes. This is turn has resulted in a slower turnaround times.’

Ambler (2011) comments that smaller teams succeed more often in agile settings, and project members should be dedicated to one project at a time. Lindvall *et al.* (2002) state that teams should be allowed to adapt the workspace as required, and that they should be able to negotiate project deliverables. Chow and Cao (2008) contend that coherent, self-organizing teamwork, as well as teams honouring regular working schedules with no overtime for instance, succeed more often than not.

✓ **Skills**

People in the team were inexperienced in agile method software development, but technically very competent. The team was familiar with agile practices and successful implementations were being celebrated. Most of them had a positive attitude and the willingness to learn and change, and were very interested and self-motivated in learning agile methods. However, the
team was not familiar with the business domain, and it was interesting to find that this did not have any significant effect on agile usage. The rationale was that if you have technical expertise you can usually understand new business domains quickly.

Competent team members directly impact successful agile project delivery and lack of the necessary skill set will affect the delivery of the project adversely. Team attitude plays an important role in team dynamics, but also in project outcomes and results, it seems. Having the right attitude and being positive makes a difference in the way the team members interact with each other as well as the iteration outcome, according to the agile coach. ‘The lack of clear direction, support or expertise from a coach or mentor hinders the agile team’s ‘ability to span boundaries’ often resulting in a return to the more familiar Waterfall approach that conformed to wider organisational standards.

Chow and Cao (2008) argue that lack of the necessary skill set, lack of team work, and resistance from groups or individuals are failure factors in delivering agile projects. Vijayasararthy and Turk (2008) offer lack of peer support and individuals’ resistance to agile as failure factors.

✓ **Staff**

Staff worked together by learning from each other and ensured that the strengths and expertise of different members were well reflected in the choice of their tasks and decisions (for example, some members of the team were very strong on test driven development). They had a common understanding of what the team thought good practices were. The team enjoyed a lot of autonomy in the choice of tasks, relevant tools, and making decisions relating to breaking quite a high level problem into smaller chunks. The agile coach acted as a mentor who facilitated the effective use of Kanban practices, and guided the team in the right direction whenever there were major problems or issues. Different suggestions for changing the personal characteristics of the team members were also received. It was suggested that individual team members should be self-motivated to make continuous changes as and when required, they should be knowledgeable about the business, they should be courageous, they should develop the habit of collectively owning the solutions, they should earn the trust of the customers and other stakeholders, and they should have high degrees of tenacity. It was also suggested by a respondent that the technical folks in the teams should have sales skills. However, the reason for that is not apparent, but it is worth capturing.

‘There is a lack of dedicated human resources in projects. Currently team members are currently working across more than one project.’ (Respondent One)
‘Staff is open to trying new methods to improve efficiencies and productivity but the outcome often results in them reverting to more familiar ways to get the job done, leaving developers feeling stressed and frustrated.’ (Respondent Two)

‘Junior staff is not empowered to make crucial decisions and senior staff is not available.’ (Respondent Three)

✓ **Style**

Changes in the management style for agile approaches was also suggested by respondents through the open-ended questions. Changes suggested include having management accommodating changes, having the openness in management activities, trusting their developers, shifting away from large-scale scope management to continuous scope management, risk and uncertainty acceptance by the management, having transparent radiators of project status and information, being honest while communicating about the progress of the project, and having non-dictating or non-micro-managing management.

According to the view of one of the respondents: ‘*Drive to agile has to come from within the team – allow team to control not managers dictating method*.’ It was suggested that, in agile practices, the business analysts should be engaged from the early stages by the management. One of the respondents also cautioned that (since the agile approaches part away from quantitative measures of control) it can be disastrous for the project if there is a significantly diminished level of focus on progress measurement:

‘Agile adoption has encouraged more communication between team members and the ability to share ideas and discuss problems in an effective and efficient manner.’ (Respondent One)

‘The environment is bureaucratic, with staff that has been around the organisation for years….change is not easy to people who are not open to new ways of doing things.’ (Respondent Two)

Given the responses above, it can be concluded that there is various factors that affect the successful adoption of agile in the telecoms company. Respondents confirmed that strategic intent, organisational style, lack of correct skills, structure and inexperienced staff are factors that are affecting successful agile implementation.

#### 4.4.1.4 Questionnaire results for Sub-Question 3

This section is the result of application of Mc Kinsey’s 7-S model to the study; from the findings we can identify the organisation’s areas of strengths and weaknesses in the 7-S model. Below is a scatterplot of the findings in line with the 7-S Model.
The above scatterplot indicates positive responses expressed in percentages, to show the results of the McKinsey's 7-S factors as assessed in the organisation under study. The above shows that the strength of the organisation as assessed through the McKinsey 7-S model was in aspects related to staff; the lowest scoring of the positive responses were related to skills.

**Strategy**

**Knowledge of reasons behind agile introduction:** Reasons for introduction of agile in organisations can vary; however, the objective could be the same, quicker delivery of working software. The study wanted to establish if the respondents knew the reasons why agile was introduced in the organisation under study; 79% responses gave an indication that respondents were aware or knew why agile was introduced in the organisation compared to 22% ‘unsure’ or ‘don’t know’ responses.

**Measurement of agile adoption:** The review of agile adoption or measurement in the organisation received 52% ‘don’t know’ and 35% ‘disagree’ response rates respectively; this indicated a huge percentage of respondents’ unawareness coupled with disagreement that agile adoption in the organisation was measured.

**Agile introduction will result in improved delivery:** 61% responses indicated that respondents believed that improved delivery will result from introduction of agile methods in the organisation, 30% responses were ‘don’t know’. The responses indicated the confidence that respondents had in agile method introduction in the organisation to improve delivery.

**Involvement in agile process:** Management’s involvement in agile process adoption was viewed to be weak; 43% responses indicated disagreement that management was actively involved in agile adoption process, 35% responses indicated no knowledge of management’s involvement, while 17% responses indicated agreement that management was actively involved in the agile adoption process.
**Introduction of new ways of working**: There was a 70% response rate that indicated agreement that the introduction of agile or adoption had resulted in new ways of working, 17% responses indicated that respondents were not aware or did not know, while 13% responses indicated disagreement with the account.

**Constant and sufficient communication from management**: Communication by management on agile was found not to be constant and sufficient, as revealed by 48% responses that disagreed with this view; 39% responses indicated that respondents did not know if communication was sufficient and constant; 13% responses agreed with the statement.

**Environment allows individuals and teams to take risks**: Over half of the responses (52%) indicated that respondents did not know if the environment allowed risk taking by individuals and teams, 35% responses indicated disagreement.

**Agile viewed as supporting strategy**: Agree and disagree responses shared an equal split of responses of 39% each, thereby indicating a 50/50 or balance in terms of negative and positive responses; the statement received 22% neutral responses.

**The adoption of agile is supported by and aligns to strategies**: Consistent with the results above, this statement also showed an equal split of ‘agree’ and ‘disagree’ responses of 26%, although the combined total ‘agree’ response category were 30% (split of 26% ‘agree’ and 4% ‘strongly agree’). There was a total of 39% neutral responses.

✔️ **Structure**

**Required expertise in product teams**: 65% responses indicated agreement that the product teams had the necessary expertise to deliver on requirements, 26% response rate was attributable to the ‘don’t know’ category.

**Product owner as the central point**: A total response rate of 61% agreed that role definition started with the product owner as the central point, 35% responses indicated that respondents were not aware or did not know, while 4% indicated that respondents fully agreed with the statement.

**Accountability of teams to product owner**: There was a response rate of 48% showing agreement that teams were accountable to the product owner, 39% responses indicated disagreement of respondents with the statement.
Delivery accountability in teams: Product teams took accountability for delivery as it is evident in the response rate of 79% indicating agreement with the statement, with a split of 70% attributable to the ‘agree’ and 9% ‘fully agree’ responses, respectively; 9% responses indicated disagreement.

Focus on delivery of a working product: A total response rate of 61% indicated agreement that product teams’ focus was on delivery of a working product, the total response rate was made up of 49% ‘agree’ and 13% ‘fully agree’ responses, respectively; 39% responses were neutral.

Knowledge of team deliverables by Management: The statement received 52% responses indicating agreement, 22% neutral responses and 26% disagree responses.

Managers invited to demo sessions: It transpired that 43% of the responses indicated that respondents did not know if managers were invited to product demo sessions, 35% of responses indicated disagreement with the statement while 17% responses agreed that managers were invited to product demo sessions.

No interference from management: 48% responses indicated neutrality regarding the statement, 39% indicated disagreement with the statement while 13% of responses indicated agreement that there was no interference from management regarding team deliverables.

Team shielded from external interference: The statement received a split of neutral and disagree responses, 52% responses were neutral and 48% responses indicated disagreement with the statement; the 48% was made of 39% ‘disagree’ and 9% ‘strongly disagree’ responses.

No leader, each team member a contributor: A total of 69% responses made up of 56% disagree and 13% ‘strongly disagree’ differed with the statement that each member in the teams were a contributor, 13 % responses indicated neutrality while 17% indicated agreement with the statement.

✔ Staff

One of the crucial aspects in agile implementation is purpose in the team, the below tables served as an indicator of where the teams were at the time of the study, with regards to perceived clarity of purpose as well as independence of the teams to organise themselves.
Roles in teams are clear but relationships are blurry

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Per cent</th>
<th>Valid Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Don’t Know</td>
<td>10</td>
<td>43.5</td>
<td>43.5</td>
</tr>
<tr>
<td>Agree</td>
<td>4</td>
<td>17.4</td>
<td>17.4</td>
</tr>
<tr>
<td>Disagree</td>
<td>9</td>
<td>39.1</td>
<td>39.1</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The degree of guidance required from the coaches’ of agile was:

A high degree of guidance is required from the agile coach

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Per cent</th>
<th>Valid Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Disagree</td>
<td>6</td>
<td>26.1</td>
<td>26.1</td>
</tr>
<tr>
<td>Agree</td>
<td>15</td>
<td>65.2</td>
<td>65.2</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>2</td>
<td>8.7</td>
<td>8.7</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**High degree of guidance needed**: The responses on this statement indicated that a high degree of guidance was needed from an agile coach, a total of 74% of responses made up of 65% ‘agree’ and 9% ‘strongly agree’ respectively, were positive; 26% of the responses indicated disagreement with the statement.

**Roles in teams clear**: 43% of the responses disagreed that the roles in various agile teams were clear, compared to 39% responses that indicated agreement with the statement.

**Agile process well established**: A total response rate of 56% indicated neutrality to the statement that agile processes were well established in the organisation, 30% responses indicated agreement, while 13% responses were in disagreement with the statement.

**Understanding of how team decisions were made**: The ‘agree’ response rate on this statement was 61%, followed by 26% neutral and 13% ‘disagree’ response rates.

**Team purpose clear but relationships blurry**: Almost half of the responses (43%) indicated the degree of agreement with the statement from respondents, 35% of the responses were
‘don’t know’ while 22% indicated disagreement that the team purpose was clear but relationships among team members were blurry.

**Commitment to team goals:** The positive or ‘agree’ response rate of 78% on this statement indicated that respondents believed that there was commitment to team goals, there was a split of 74% and 4% between ‘agree’ and ‘strongly agree’ responses respectively. Neutral or ‘don’t know’ responses accounted for 22%.

**Teams worked well with little oversight:** Over half of the total responses (52%) indicated that respondents did not know if the team worked well with little oversight. There was a 30% response rate in agreement with the statement, which was made up of 26% ‘agree’ and 4% ‘strongly agree’ responses.

**Focus on being strategic by teams:** There was a positive or ‘agree’ response rate of 43% against the statement, followed by 35% response rate of detachment and 9% ‘disagree’ response rate.

**Commitment to performing well:** There was commitment in the teams to perform well, the survey revealed 83% of the responses indicated agreement with the statement, and 4% responses indicated detachment from the statement.

**Sharing of constructive feedback:** A total response rate of 60% indicated agreement, the total agree response rate was made up of 56% ‘agree’ and 4% ‘strongly agree’ responses. About 13% of responses were neutral and 26% indicated disagreement with the statement.

✓ **Style**

The below are findings that focuses on management support with agile adoption, the style of management prevalent in the organisation as well as how the team is allowed to operate given agile adoption or values in the organisation under study.

**Management set a tone on agile adoption:** Over half of the responses (52%) indicated that respondents were dispassionate about the statement regarding management setting a tone on agile adoption, 26% responses indicated disagreement with the statement while 22% indicated agreement; the split between ‘agree’ and ‘strongly ‘agree’ was 17% and 4%, respectively.

**Teams allowed to make mistakes and recover quickly:** A total response rate of 52% indicated disagreement that the teams were allowed to make mistakes and recover quickly, the total was made up of 35% ‘disagree’ and 17% ‘strongly disagree’ responses. Neutral
responses or ‘don’t know’ response rate was 30%, while 13% responses indicated agreement with the statement; Table 4.3.4.4.9 in Appendix 2 contains the frequency of responses.

Management drives and supports culture of responsiveness: The statement received an overall positive response rate of 70%, split into 61% ‘agree’ and 9% ‘strongly agree’ responses; 17% responses were neutral and 9% indicated disagreement with the statement.

Agile aligned to organisational values: 52% response rate indicated the degree of respondents’ detachment to the statement while 48% responses indicated agreement with the statement.

Understanding link between values and agile: The statement received 69% positive response rate which was broken down into 65% ‘agree’ and 4% ‘strongly agree’ responses. There was a neutral response rate of 22% and 9% ‘disagree’ responses.

Management and team inputs/ impediments: Positive or ‘agree’ responses on the statement that management listens to team inputs accounted for 48% while ‘disagree’ responses accounted for 30% and neutral responses were at 22%.

Communication a two-way process: A total response rate of 39% were dispassionate responses by respondents to the statement that communication was a two-way process, a total 35% responses indicated disagreement, the total was made up of 31% ‘disagree’ and 4% ‘completely disagree’ responses. The positive or ‘agree’ responses received a total of 26%, broken down into 22% ‘agree’ and 4% ‘strongly agree’ responses.

No apparent/ experienced resistance on agile adoption: The statement received a total of 48% ‘agree’ responses, 35% neutral responses and 17% ‘disagree’ responses.

4.4.1.5 Summary of the questionnaire results

The results of the questionnaire revealed that there is a need for a uniform system for agile adoption in the telecoms company. The telecoms company is progressing in adopting agile methods as a way of software development and the respondents agree that customers are yielding agile benefits and as such customer satisfaction has improved as result of the delivery of quality working product. The respondents also mentioned that agile successes are celebrated and the number of implementations has increased. Agile method adoption is dependent on committed support from executive sponsors and when support is lagging then effective and substantial change like agile method adoption in the organisation is unlikely to occur.
4.4.1.6 Interview results for research Sub-Question 4

‘What are other challenges of agile adoption in your organisation?’

Agile challenges were found in the need for constant customer participation, the difficulty to scale in large projects and the need for training on the agile use. This lack of experience with agile methods and the company culture are indicated as project failure reasons. ‘Having a team with a lack of agile adoption and also underestimation the amount of planning in agile projects’; and ‘Organisational structure that is not conducive and aligned to strategic objectives’. The lack of skilled people who can follow the agile method is one important reason for failure, according to interviews. Indeed motivated people are needed, since agile in general requires discipline in order to be successful. In order to motivate their employees, organisations undertake educational activities; for instance the telecoms organisation has employed an agile coach in order to educate staff members on the use of agile. Project size/complexity is also a problem. It is true that as project size grows, so does the need for people participation, which introduces more complexity in communication among team members. Other participants saw the lack of customer collaboration as a major problem, with one participant saying: ‘None really, except perhaps for limited knowledge, or lack thereof, of project management methodologies and best practices amongst most business and technical stakeholders.’ Customers may find it hard to comply with agile principles that state the importance of the active participation of the customer throughout the development process. Customer involvement is, however, vital in order to have guarantees that the correct product will be delivered. Other problems noted are the lack of top management support and the project team size: ‘having executives that do not drive the change for agile adoption.”’ Team size is also linked with project complexity, although in many cases agile teams are structured hierarchically when large projects are considered. With large team sizes used to cover the needs of large projects non-neglecting communication overhead is added to the software process.

‘Lack of training, lack of buy-in from the teams or business (fear of change). Lack of understanding business requirements and solution to implement. Sometimes if the timelines are too tight and requirements are not done properly there is a possibility of leaving out fundamental requirements’ (Respondent Four)

Q: Which of these factors presents challenges that influence the successful implementation of agile IT projects?
Nerur et al. (2005) have presented a literature study on organisations’ challenges when they transform software development methods to agile. They describe that leadership style should be ‘that of facilitator or coordinator’ (Nerur et al., 2005:75). It’s noteworthy that the leadership style must be transformed in a way ‘to get the project manager to relinquish the authority he/she previously enjoyed’ (Nerur et al., 2005:76).

‘Change Management is key for introducing and implementing agile this will prepare the organisations to the idea of agile adoption.’ (Respondent Two)

Teams do not work in isolation from the larger organisation, so the choice of which agile components an organisation will adopt depends, in part, on organisational characteristics. For example, interviews and survey data show important differences in agile adoption between technology industry firms - where the development team’s output is a product that the company sells - and IT departments in other types of organisations - where the software delivery output affects how the organisation’s employees, partners, or customers. In general, we see that: IT departments adopt techniques that improve project deliverables. IT organisations struggle to get requirements right and test effectively, so they emphasize techniques - such as story-based requirements, daily Scrum meetings, and rapid feedback mechanisms - that help keep project deliverables on track to meet business needs.

‘Prioritization and alignment of project deliverables to strategic objectives and key performance indicators.’ (Respondent Three)

4.4.1.7 Interview results for research Sub-Question 5

What were the perceived counter measures that can aid successful adoption of agile in the organisation?

Q: What do they think can be done to eliminate the stated agile adoption challenges?

‘Increase awareness to project methodologies and best practices and inform and educate stakeholders about agile adoption in projects.’ (Respondent One)

At first, the team questioned why their velocity was inconsistent, and searched for reasons their productivity would fluctuate. However, they discovered that the problem was not an inconsistent rate of development. In reality, the team was quite productive in terms of producing functionality each day. What the team noticed was that their feature estimates were often inaccurate. Further, the estimation inaccuracies were not systemic, that is, the team
could not simply apply an adjustment factor to compensate. The team typically performed feature estimation when planning releases that encompassed around ten iterations spanning several months in duration. In order to accomplish the estimation and planning work in a reasonable amount of time, the amount of analysis done prior to estimating was just enough to estimate the feature into general categories of large, medium and small, approximately corresponding to a week, half-week and day’s duration. Through further retrospection, the team noticed that many features were sized such that the feature estimate was very close to the iteration length of one week. This allowed little leeway in the event the feature required:

‘I think the best way to adopt agile is to identify a small key project and roll it out and involve Business Sponsors from the beginning and ensuring the key stakeholders are involved from the initial stages.’ (Respondent Two)

‘Ensure that there will be transfer of knowledge from the team, come up with plan of implementing agile within the organisation.’ (Respondent Three)

‘Change Management must be involved all the way to rollout.’ (Respondent Four)

‘Have executives that will champion agile adoption’ (Respondent Four)

‘The entire team needs to be on board with agile culture change’ (Respondent Five)

Provide teams with the support to adopt the right agile mix: Teams need agile coaches to help them adopt the right agile methods for their needs. Different situations warrant different degrees of Agility; therefore, teams that engage an experienced agile coach are more likely to select the right practices and apply them in the right way. This success can form the basis of organisational implementation patterns over time:

“Have a team with an agile experience. This will increase the quick turnaround times with regards to the evolving requirements’

‘Plans for agile projects by nature are very flexible, and are a continuous exercise because requirements evolve. Therefore planning requires discipline to execute an agile project well.’ (Respondent Seven)

Q: What do you think can be done to improve the agile adoption success?

‘Start with small projects and make use of lessons learned. Ensure that key people are involved from the initiation of the project.’
‘The organisation must include and emphasise the agile methodology in the organisation’s project management policy and governance framework.’ (Respondent Two)

Empowering the team: Teams that have to wait for stakeholders to give them their time and attention must re-negotiate their relationship with those stakeholders. Executives must have the power to set general direction but in all other matters step aside, giving the development team the ability to define the problem space, craft the solution, and deliver the results — for which the team will be held accountable:

‘….ensure the project management office is enabled and empowered to enforce compliance to agile.’ (Respondent Three)

Defining project roles based on complexity and stakeholder characteristics: As the complexity of a project increases, teams need to look to outside resources, such as business analysts or product managers, to handle research tasks and to mediate with stakeholders, particularly when there are many stakeholders with limited availability.

4.4.1.8 Summary of the interview results

The results of the interviews reveal that agile is adopted in the organisation, however several factors were mentioned as those that are challenging the implementation of agile methods in the organisation. Lack of customer involvement was also seen as one of the challenges the organisation has while implementing the agile method. The manifesto for agile software Development mentions the “customer collaboration over contract negotiation” as a core principle, so it is vital to have customers involved in order to have guarantees that the correct product will be delivered. The lack of skilled people was also cited as the challenge even though the telecoms organisation has employed an agile coach in order to educate staff members on the use of agile. Other problems noted are the lack of top management support and the project team size. The organisation has contracted agile coaches to help them adopt the right agile methods for their needs which the respondents mention improves the agile adoption. The agile teams need executive support and empowerment to be able to make decisions as well as to enforce compliance to agile.
4.5 ANSWER TO THE MAIN QUESTION

The purpose of the main question was to determine whether the agile software method can be implemented to effectively enhance successful implementation of IT projects in a South African company.

The research sub-question is presented below:

**What were the organisational factors that impeded the successful adoption of agile or that contributed to success of implementation of IT projects within the organisation under study?**

To answer the primary research question, it was necessary to gain an in-depth understanding of the phenomena under investigation; therefore, the study split the main question into a number of sub-questions. To develop a model for agile adoption method for software development, it was necessary to identify the organisational factors that are imperative for the successful adoption of agile software methods, as well as those that hinder the successful adoption of the agile methods.

4.6 THE THEORETICAL FRAMEWORK

The purpose of this section is to describe the adopted framework for the adoption method for software development. The framework consists of the following constructs: Strategy, Structure, Systems, Skills, Staff and Style.

These constructs that are the key factors for the implementation of the agile method for software development are presented in Figure 10 below:

![Figure 10: Adopted Framework (McKenzie’s 7S Model)](image)

The following constructs were identified as success and failure factors in agile project delivery:
✓ **Strategy**

Based on the results of the overall analysis, the research model for this contains constructs that assist in determining the factors that affect the adoption of agile methods in the South African telecoms organisation. The construct *strategy* ensures alignment of the organisational strategy with the agile adoption to ensure the successful implementation of agile methods in IT projects regardless of support from top management.

**Changes in knowledge management strategies:** Traditionally, in heavy process-centric organisations there is a high emphasis on documentation as a medium for knowledge management. Organisational leadership’s behaviour and communication should include the role of innovation within the organisation’s overall strategy, indicate the importance of innovation to subordinates, reward innovation both formally and informally, emphasize the history of innovation within a firm, and build a skilled executive team that is able to support a compelling vision of the organisation’s future (Dwivedi et al., 2012).

✓ **Systems (Processes)**

This construct remains relevant in the assessment of the agile adoption in the South African telecoms industry. Agile methods depend on new principles, processes activities, and sub-goals, they have an impact on many of an organisation’s processes; therefore, old processes (e.g., planning, development, delivery, operations) must be replaced by agile ones. Cultural shifts in the organisation towards agile methods turn old ways of thinking on their head, inducing resistance. Agile processes often encourage principles that dramatically change the process. While many of these are not limited to agile methods, agile development encourages, if not require, their usage. Key development processes of interest are refactoring, minimalist development, code reviews, and continuous integration. Applying agile processes to legacy systems, whether within maintenance or as new development, raises numerous issues. Legacy systems generally aren’t easy to refactor or disassemble to accommodate agile replacements that need to build capability in increments. Legacy systems might also institutionalize awkward and often sclerotic business processes that are embedded in the culture and are not easy to refactor away.

✓ **Style**

The IT infrastructure of an organisation needs to be always on standard to be able to support the daily operations and sustain demand. As revealed in the findings, managing a project at a distance needs various forms of managing and leadership abilities to keep track of the project and use communication technology to motivate teams working on the project.
Another challenge under the field of management problems is how to build a trust and moral environment to motivate the work while at the same time satisfy both the customer and the team, this can be achieved through interaction using mechanisms such as partner site visits (Procter et al., 2011). One more management challenge is how to empower user’s involvement as actual features of daily project work, not only as interesting slogans (Procter et al., 2011).

**Skills**

Findings revealed that competent team members are important for speedy project delivery, but also to avert stress because of team members having to carry or train more junior team members. Regular reflection throughout, to inform and improve the process, is important in agile adoption and successful agile project delivery. Also, team members should have a positive attitude, as this is better for project performance and overall energy and well-being of the team. When agile principles are impractical or not conducive to project conditions or an organisation’s context, it can be adjusted, or omitted if it is possible to continue without it. It is not a good thing to have team members who are too specialised and don’t have general, balanced experience and business acumen. Team members who lack general business acumen struggle to assist with functions outside of their specific area of competence, and it is important that team members be able to assist when necessary.

**Staff**

Agile Projects depend on strong developers – they must be amicable, talented, skilled, and able to communicate well. Developers must be willing to work as a team, able to handle constant change, and resourceful enough to solve problems. Project managers are also more involved with the customer collaboration, instead of the usual focusing on defining deliverables and contracts. Customers in agile methods are instead involved much more frequently and with more influence. Many agile methods assume, or at least highly recommend, a full-time customer presence on site, working directly with the development organisation. Testers must work closely with the developers as code is being written. In agile methods such as XP, tests are changed before code is modified by the developers and the role of a tester is significantly reduced. Since agile teams involve experienced staff with sizeable responsibility, a mentor or coach leadership approach is most effective. Team leads must be willing to enable members to take initiative. Leadership is done via collaboration rather than command and control type of leadership.
These project-staff related aspects are critical in ensuring the success of agile adoption in IT projects in the South African telecoms space.

**Structure**

Through statistical analysis, the following change items belonging to ‘changes in organisation culture’ were ranked (according to their decreasing order of importance):

1. From solitary development attitudes of team members to that of working in teams.
2. From non-customer-centric to customer-centric development.
3. From individually assigned roles to that of teamwork (note: based on the discussions above, although this change item has been ranked below the immediately preceding one (with Rank 2 above) purely on the basis of their respective means, there is no statistically significant difference of their means, as indicated by pair wise-test).
4. From policy and procedure based development culture to freedom of development and management by team members.
5. From non-customer-centric to customer-centric development.

### 4.7 CHAPTER SUMMARY

The findings confirmed much of the knowledge discussed in the literature about the concept of agile methods. Structured questionnaires were used in the collection of structured data, while semi-structured interviews were used in the collection of the rest of the data. The analysis of the collected data was based on qualitative methods.

Since the study sought to determine those factors that impact the agile adoption in IT projects, the organisational factors have to be established first. A telecommunications organisation in this study is ready for the agile method adoption when the changes in the strategy, structure, systems, staff, and systems have been implemented. In terms of the adoption level of the South African telecoms company to successfully implement agile projects, the findings reveal that the organisation is not ready. The study summary, recommendations and conclusion, are presented in the next chapter.
5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The previous two chapters discussed findings of the study through quantitative and qualitative methods and through the use of McKinsey 7-S theory by Peters & Waterman (1982). Based on the findings of the study, a framework for agile software method adoption was adopted in order to answer the main research question of the study.

This chapter concludes the report by providing a summary of the study findings, presenting recommendations, suggesting future research to address areas that still need to be researched, and describing the research limitations and conclusions. The chapter starts by providing a summary of the study in the next section.

5.2 SUMMARY OF THE STUDY

This study followed the interpretivism research philosophy to design the McKinsey 7-S for agile method adoption as a software development method in the telecoms company in Gauteng, South Africa. The main aim of the study was to find what the organisational factors that impeded the successful adoption of agile were; or that contributed to success of implementation of IT projects within the organisation under study. To establish this, a thematic analysis of methods was used (cf Chapter 3) where empirical questionnaires and interview data was collected together with an in-depth literature survey into different aspects of agile methods, factors affecting agile adoption as well as the McKinsey 7-S theory.

The McKinsey 7-S theory was found suitable for this study because McKinsey 7-S will serve as a guide to achieve the objectives of this study; it explains that an organisation is not just the structure but consists of seven integrated and related elements.

The fundamental of the McKinsey 7-S model is that organisations are successful when they achieve an integrated harmony among all 7 elements –shared value, strategy, structure, systems, skills, staff and style.

This study is a case of a single company in the telecommunications industry which was planned and executed in four phases to achieve the objectives within a reasonable duration of time provided by the Tshwane University of Technology. These phases were inter-linked to answer the main research question and to develop a conceptual framework for agile software methods adoption for implementation in the telecoms company.
The first phase involved an in-depth literature study of different aspects of agile software methodology, benefits of agile methods, factors affecting successful agile implementation as well as McKinsey 7-S in order to set the basis for the study (cf Chapter 2 and Chapter 3). In the second phase, 23 employees in the telecoms company were selected to serve as study participants and the collection of data through questionnaires and interviews proceeded (cf Chapter 4). The study participants included those in positions that have an influence on business decisions such as IT manager, project manager, business analysts and developers.

In the third phase, the collected data was split between qualitative and quantitative methods to ease the analysis process (cf Chapter 5). The findings from both the qualitative and quantitative data were then analysed, where key themes were identified to lead to the development of a conceptual framework for agile software method adoption. Based on the findings of both qualitative and quantitative analysis in the third phase (cf Chapter 5), a framework for agile software method adoption was developed in the fourth phase of the study (cf Chapter 6).

Different methods were used to collect the data. Data was collected through the questionnaires, interviews and observations. A detailed account of study findings is presented in Chapter 5, while findings specific to elements of McKinsey 7-S essential to the model are presented in Chapter 6.

### 5.3.1 Objectives of the study and methods adopted

The main objective of this study was to investigate the factors that influence the successful implementation of agile in IT projects in the South African telecommunications industry, using a telecommunications organisation as a case study. The study was descriptive and explanatory in nature. A phenomenological approach was adopted to identify the phenomena. A single case study approach was taken and used to understand the attitudes, intentions and perceptions about the phenomena under study. Multiple methods such as interviews and questionnaires were used to answer the research questions.

Methodological data source thematic analysis was used in the study because the study used both qualitative and quantitative research methods to help the researcher ensure that the study measured what it set out to measure, and to improve the validity of the findings in the study and, lastly, to allow the researcher to examine the study from more than one perspective. For the main purpose to be achieved, it was essential to determine the following:

1. Current state of agile adoption within the Telecoms Company.
Findings from the study found that majority of the respondents (52%) do have experience in the agile based software development citing that the organization is at Level 2 (Doing Agile Maturity Level). This indicates that the organization has partially adopted the agile method of software development and it is increasingly being implemented in IT projects. However, there were still among them (44%) who mentioned that they are using agile on ad-hoc basis which then means that the waterfall method is still being used. Furthermore, the result highlights that the organisation is dedicated to adopting agile methods with the employment of an external agile coaches to guide the agile implementations. The number of participants using agile on ad-hoc basis is high, and according to Misra et al (2009), it would be useful for the organisation to stick to one type of method in its most part to avoid confusions in the adoption of a particular type of method over another during the course of the project. Thus if the Telecoms company intends to transform the IT projects method into Agile, they must identify the most important factors that are unique to the organization, and then focus on only those that are critical for the success of projects and make changes only to those.

2. Perceived value and impact of agile use on IT project success.

Agile methods are yielding great benefits and value to the Telecoms Company. Even though agile uptake is still generally low as pointed out in the previous discussion, the respondents cited improved customer satisfaction and quicker delivery of working software. Furthermore, team are working in collaboration and are communicating more during the requirement elicitation, with minimal documentation. These practices are identified as very important practices by the respondents of this study that aligned with the previous studies by Williams et al (2010), Ramesh et al. (2010), as well as Cao and Ramesh (2008).

In order to verify the requirements and show the progress to customers after completing each iteration, the working software (releases) are demonstrated to the customers. These practices have been rated as important agile requirement engineering practices for ensuring software quality by the respondents of this study. Similar results were obtained in the studies of by Williams et al (2010), Ramesh et al. (2010).

Specifically, the daily stand-ups were seen as instrumental, and were especially useful in bringing testers and developers together. Improved awareness of team members’ activities was another benefit. One benefit was quick releases, whereby developers are creating releases that are demonstrable to the business users every few weeks instead of every few months or years with the Waterfall Method. Another benefit
noted was that of short sprints combined with more emphasis on customer feedback led to better agility and efficiency in responding to changing requirements, internal processes, reorganisations or politics, and flushed out bad designs more quickly. Another benefit is productivity with agile as more time on prioritized tasks the teams perceived as relevant and important to the successful implementation of the IT project.

5.3.2 Agile adoption success factors

The implementation of agile methods presented the success factors to improve the IT projects implementation success in the telecoms company. The following key success factors were identified:

- Increase awareness of project methodologies and best practices
- Identify a small key project and start small
- Ensure that there is transfer of knowledge
- Involve change Management team
- Cultural change
- Improve skills.

It was found that the system was easy to understand and the participants were able to follow the instructions.

5.3.3 Challenges of agile adoption

There were a number of challenges that were experienced by the participants during the implementation of the agile method as a software development methodology in the telecoms company. The challenges experienced were the following:

- Lack of agile knowledge
- Lack of executive support
- Lack of awareness
- Lack of advocacy
- Lack of the right skills.

While success factors were identified regarding the implementation of agile methods, there were also some challenges that the participants experienced. Respondents cited limited
knowledge of agile methodologies and not having executives as the driving factors of agile adoption change.

Moreover, some of the participants were concerned that agile is opening the teams to scope creep as management of changing requirements is not well defined. Lack of training, lack of business buy-in and fear of change were also mentioned as some challenges that teams are facing with the adoption of the method. These challenges will lead to the failure of the agile adoption in the organisation if they are not addressed.

5.3.4 Benefits of the implemented agile method

The implementation of the agile software method adoption was found to have a potential bring about change by providing a number of benefits, some of which are listed below:

- Improved customer satisfaction
- Increased turn-around times
- Number of deployments has increased
- Product owner involvement.

One of the benefits of systems is improved customer and increased software implementation turn-around times, which is essential for the industry being studied.

5.3 Delineations and limitations

The scope of this work is only limited to one telecoms company in South Africa, situated in Gauteng Province. Although the study is limited to a single telecoms company, it is hoped that the findings and recommendations of this study may be generally applied to telecommunication companies with similar contexts. It is also hoped that the results of the study are a good extension to the literature on the study of agile methods adoption for software development.

5.4 Significance of the study

In the body of knowledge, the research contributed by extending the knowledge on those factors that hinder successful adoption of agile methods in organisations. More specifically, the significance of this study is that it sought to reveal those South Africa specific factors that contribute to the lagging adoption of agile methods in IT projects, thus helping to understand the overall IT project failure problem from the developing countries’ viewpoint.
Additionally, the study was not only contributing to the body of knowledge with the context-specific enquiry but also adopt the McKinsey’s 7s theory to elicit the organisational factors stemming from strategy, structures, systems, culture, values system, skills, and leadership style that could impact and hinder agile adoption in IT projects; this has not been considered in previously related studies in any context.

In practice the research helps the telecommunications industry not only to identify these factors but provides means on how to eliminate or mitigate such, in ensuring IT project success by facilitating the adoption of agile methods within their IT project lifecycle. This would in turn bring about costs savings associated with failing projects due to the continuous use of traditional methods, over agile.

5.5 SUGGESTED FUTURE STUDIES

It is further suggested that further studies are essential to look at the following:

✓ The actual effect of agile in project success and constraints
✓ Agile adoption influencers in strategic levels and the its use as a strategic approach for competitive edge
✓ The approaches used in agile and how those impact on project success in South African organisations
✓ The financial implications of agile adoption for developing companies and SME’s

5.6 CONCLUSION

The telecoms company investigated in this study has implemented agile method of software development for their IT projects. They have decided to implement agile to stay competitive since their core business mostly relies on innovative methods of doing business; and implementing IT projects efficiently and being quick to the customer’s changing needs is one way of staying abreast of the competitors. However, these indicate that agile software development adoption is still not common.

The study pointed out that even though the telecoms company lack of executive support; awareness and advocacy of the method is also lagging behind and the organisation also lacks the right skill needed for successfully implementing IT projects the agile way. Nevertheless, efforts at the Telecoms Company are being made to adopt the agile method within the IT projects.
Furthermore, the company has had challenges regarding delays in implementation of IT projects, resulting to products hitting the market after the competitors have launched their products. Some of the key challenges that they face regarding implementation of IT projects is the rigidity when handling requirements of the traditional software methods; the cost of change to handle the customer’s changing needs; the time it takes to deliver products to satisfy customer needs and a lack of top management involvement and support. Since the implementation of the agile method; improvements were noted as a result and the teams involved cited that working software is delivered to customers faster than usual; and the teams are working in collaboration and are constantly communicating more than they used to.

The following factors that would assist in the agile method adoption were identified: increase awareness of project methodologies and best practices; ensure that there is transfer of knowledge; involve change management team; change organizational culture and improve skills. It is hoped that if these issues can be addressed, it will lead to the positive and successful adoption of the agile method of software development in IT projects and thereby also assist the Telecoms company to improve its rate of delivering successful IT projects.

The model that was adopted in the study shows that the adoption of agile method in Telecoms Company will improve when the organisation achieves an integrated harmony between the following organisational elements – strategy, structure, systems, skills, staff and style. This suggests that the company needs to align its organisational strategy with the agile adoption; develop new principles, processes activities, and sub-goals that are aligned with agile method; have a structure that is fluid to support agile activities; empower the staff in agile methodology use and application.
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APPENDICES

Appendix A: Study Questionnaire

Appendix B: Interview schedule

Interview questions

1. How far they are in terms of agile adoption, do they have it institutionalized or some project or teams use it? Are there policies, strategies or things that guide agile adoption?

2. What would you say are the benefits of agile adoption in projects?

3. Would you say using agile is of any value to project success?

4. Do you think using agile has any impact on project success?

5. What are the key factors that you think affect agile especially with regards to strategy, structure, systems, shared values, style, staff and skills?

6. What are other challenges of agile adoption in your organization?

7. Which of these factors (strategy, structure, systems, values, style, staff, and skills) presents challenges that influence the successful implementation of agile IT projects?

8. What do you think can be done to eliminate the stated agile adoption challenges?

9. What do you think can be done to improve the agile adoption success?

Appendix C: Informed Consent and Ethical Clearance