# AN INVESTIGATION OF THE CRITICAL SUCCESS FACTORS FOR ADOPTING AGILE PROJECT MANAGEMENT APPROACH IN IT FIRMS IN SRI LANKA

Thanthri Waththage Kanishka Karunasena

(138413K)

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Department of Building Economics

University of Moratuwa

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# DECLARATION OF THE CANDIDATE AND SUPERVISOR

"I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text".

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Name of the supervisor: Ch.Qs. Indunil Senevirathne

Signature of the supervisor: Date:

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## Abstract

Many Information Technology projects worldwide fail due to failures in project management. Most commonly used traditional project management approaches such as Project in Controlled Environment 2 and Project Management Body of Knowledge are widely criticised due to their limitations in accommodating changing business environments, frequently changing customer needs, unclear project objectives, poor communication among team members, and inappropriate project planning. As a result, many Information Technology (IT) project managers nowadays attempt to adopt agile project management practices in managing Information Technology projects.

Agile project management has proven to overcome many problems associated with traditional project management approaches. Ability to better cope with changes to the project environment, increased efficiency in project communication, not requiring development of detailed project plans upfront, and ability to handle project risks effectively, for example, are seen as the merits of agile project management. Increasing adoption of agile project management approach in IT field creates a need to identify the best practices that influence the successful adoption of agile project management in IT firms.

This research, therefore, aims to investigate the critical success factors for adopting agile project management practices in the IT firms in Sri Lanka. To fulfill the aim of the research several objectives of the research are formulated. They are to, examine the difference between the agile and traditional project management approaches, identify critical factors that affect the adoption of agile project management approach worldwide, develop a theoretical framework by hypothesizing the critical factors for adopting agile project management approach, and providing recommendations for IT organizations for successfully implementing agile project management practices.

To fulfil the research objectives, based on the comprehensive review of the literature a theoretical framework is hypothesised by identifying the critical factors discussed, and by using the theories on technology adoption. The hypothesised framework is tested using the Structural Equation Modeling techniques with the use of survey data collected in Sri Lanka. The research findings reveal that organizational and cultural factors, team readiness, management readiness, relative advantage of using agile, agile project management compatible existing practices in the organization, and observability of the results of agile are the most critical factors for adopting agile project management in Sri Lanka.

Keywords: Agile Project Management, Structured Project Management, IT Projects, Structural Equation Modelling

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# LIST OF ABBREVIATIONS

| Abbreviation | Description |
|---|---|
| A_ADOPT | Adoption of Agile Project Management |
| AMOS | Analysis of Moment Structures |
| APM | Agile Project Management |
| AVE | Average variance extracted |
| COMPATI | Compatibility |
| COMPLE | Complexity |
| CHIN/DF | normed chi-square |
| CR | Critical Ratio |
| DOI | Diffusion of innovation theory (DOI) |
| ENV_RED | Environmental Readiness |
| GOF | Goodness of Fit |
| ICTs | Information and communications technologies |
| IT | Information Technology |
| K-S | Kolmogorov-Smirnov |
| MGT_RED | Management Readiness |
| ML | maximum likelihood |
| OBSERVE | Observability |
| ORG_CUL | Organizational Readiness |
| P-value | Probability value |
| PMBOK | Project Management Body of Knowledge |
| PMI | Project Management Institute |
| PRINCE2 | Projects in Controlled Environment |
| PRO_RED | Process Readiness |
| REL_ADV | Relative Advantage |
| RMSEA | Root mean square error of approximation |
| SE | Standard Error |
| SFL | Standardized factor loading |
| SEM | Structural Equation Modelling |
| SPSS | Statistical Package for Social Sciences |

| | |
|---|---|
| TEM_RED | Team Readiness |
| TOE | technology-organization-environment theory |
| TOO_RED | Tools Readiness |
| UK | United Kingdom |
| US | United States |
| USA | United States of America |
| X2 | Chi-square |
| X2/df | Normed chi-square |

# CHAPTER 1: INTRODUCTION

## 1.1. Research background

With the rapid development of information and communications technologies (ICTs), many organizations worldwide heavily invest on adopting such technologies into their business processes (Apulu & Latham, 2011). One study (Schwalbe, 2014) reveals that, the world as a whole spends nearly 10 trillion dollars from its 40.7 trillion dollars gross product on information technology (IT) projects. The United States' (US) annual investment on IT projects is 2.3 trillion dollars, which is equal to 25% of the nation's gross domestic product (Schwalbe, 2014). Such investment on IT projects is due to the tremendous benefits that IT projects promise to organizations including reducing operational cost, increasing operational efficiency, improving decision making, providing competitive advantages, improving communication, improving connectivity, and maximizing speed (Irani, Al-Sebie, & Elliman, 2006).

Although trillions of dollars are being spent on IT projects worldwide, many projects fail to fulfill their desired objectives (Gareis, 2006; Hass, 2007; Sauser, Reilly, & Shenhar, 2009). Such failures are exemplified by the falling of projects to accomplish the fundamental project management objectives expressed in terms of time, cost, scope, and quality dimensions (Maylor, Vidgen & Carver, 2008). In the US, for example, nearly two-third of IT projects run into trouble. Among them 19% failed completely, while 65% failed partially due to over time or over budget (Hass, 2007). Furthermore, another studies (Standish-Group, 1995; Gareis, 2006) reveal that in the US large companies have received only 42% of the specified features and functions in the end product which has led to a significant degradation of the quality and the scope of the end product. Managing IT projects is, therefore, always considered worldwide as a tedious and problematic process (Maylor et al., 2008).

The failure to meet time, cost, scope and quality objectives of IT projects is due the various issues in the project management. Among many other reasons, changing business environments, frequently changing customer needs, lack of user involvement,

unclear project objectives, poor communication among team members, lack of coordination, inadequate reuse of past experiences and lessons learnt, and inappropriate project planning are widely seen as critical (Standish-Group, 1995; Gholami & Murugesan, 2011; Altuwaijri, & Khorsheed, 2012; Stankovic, Nikolic, Djordjevic, & Cao, 2013). Traditional project management approaches commonly used are heavily criticized due to their limitations in managing complex IT projects (Highsmith, 2008; Ruël, Bondarouk, & Smink, 2010; Spundaka, 2014).

Many IT project managers worldwide adopt traditional project management approaches such as Projects in Controlled Environment (PRINCE2) and Project Management Body of Knowledge (PMBOK) for managing IT projects (Spundaka, 2014). Such approaches are underpinned by the Waterfall model which treats a project as a linear and sequential set of stages where each stage needs to be formally validated before moving on to the next stage (Sommerville, 2001; Ruël et al., 2010; Binder, Aillaud, & Schilli, 2014). Due to this linear nature, all the business requirements must be precisely defined and signed off at the very early stages of the project so that rigid time, resource and cost estimations can be done (Ruël el al., 2010; Spundaka, 2014). However, in the modern world, frequently changing business needs, requirements uncertainty, and rapidly changing technology significantly affect IT projects. It is, therefore, not feasible for end-users to plan their expected objectives of IT systems precisely in advance (Ruël et al., 2010). Since, traditional project management approaches do not welcome numerous changes after locking down the requirements in early stages, falling to define requirements accurately at the early stages means failure of projects in time, cost, scope and quality dimensions. Therefore, traditional project management approaches are often criticized for failing to reflect structural complexity and dynamics of modern IT projects (Williams, 2004; Spundaka, 2014).

Due to the limitations of the traditional project management approaches for managing IT projects, a new project management approach has emerged since the late 1990s, named Agile Project Management (APM) (Ruël et al., 2010). APM is “a set of values, principles, and practices that assist project teams in coming to grips with challenging environment” (Highsmith, 2008, p. 16). It emphasizes the importance of developing

agile and adaptable products which are intended to be used in the dynamic environments with constant and unpredictable change (Highsmith, 2008; Conforto & Amaral, 2008; Goodpasture, 2011). APM, therefore, focuses on accelerating product development through short delivery iterations (6-8 weeks) which facilitate software engineers to react more easily to changing needs of the end-users (Goodpasture, 2011). APM further emphasizes working deliverables over comprehensive documentation, customer collaboration over contract negotiation, and the embracing of change over following a rigid plan (Highsmith, 2008). Moreover, APM values 'people' factor rather than process and tools (Senapathi & Srinivasan, 2012). It focuses on self-discipline and self-organizing teams, participatory decision making, and active end-user involvement (Conforto & Amaral, 2008; Stankovic et al., 2013). Such an approach provides a simple, flexible, value driven and less bureaucratic approach for project management.

Over the years agile approach for project management has proven to overcome many problems associated with traditional project management approach (Stankovic et al., 2013). As a result, organizations worldwide are increasingly adopting agile practices for IT project management (Senapathi & Srinivasan, 2012; Oellgaard, 2013; Morris, 2013). With the rapid adoption of APM, there is much research on agile project management from different perspectives. Chow and Cao (2008), for example, investigate the critical success factors for perceived success of agile software projects in the US and Europe. Senanayake (2009) applied Chow and Cao (2008) model to investigate the effectiveness of scrum in Project Management in the Sri Lanka. Senapathi and Srinivasan (2012) investigate the post-adoptive agile usage in New Zealand. However, such research fail to take into account critical agile values such as iterative feature delivery, customer value, champion technical excellence, build adaptive teams, encourage exploration, and simplicity (Highsmith, 2008). Moreover, such research fail to consider the key guiding principles of APM such as leadership and management factors although such factors are critical for the adoption of APM in IT projects (Highsmith, 2008). Furthermore, existing research has failed to take into account various concepts on technology adoption theories which are extremely critical for adopting a new technology in an organization.

This research, therefore, aims to fill the research gap by investigating the critical factors for adopting agile project management approach by taking into account a full inventory of critical agile values and key guiding principles of agile project management. For this purpose a primary research question is developed as follows: *What are the critical factors for adopting agile project management techniques in private sector IT projects in Sri Lanka?* To answer the research question adequately, a theoretical framework will be hypothesized based on the critical factors identified through a comprehensive review of the literature. The hypothesized theoretical framework will be tested using the survey data collected from Sri Lanka to identify the critical factors for adopting APM in Sri Lanka.

## 1.2. Motivation for the research

The motivation for undertaking this research is three fold. Firstly, lack of rigorous assessment of the critical factors for adopting agile project management approach in IT projects in Sri Lanka is the primary motivation for undertaking this research. Although there are a few studies in Sri Lanka on agile project management approach from different perspectives, such research fail to take into account a comprehensive inventory of critical factors for adopting agile project management approach in Sri Lanka. Moreover, those studies do not consider critical agile values discussed in the literature (Highsmith, 2008). Therefore, a comprehensive study on critical success factors for adopting agile project management would not only help IT project management practitioners to better understand the success factors for adopting agile project management techniques, but also help to avoid costly mistakes in implementing IT projects.

Lack of published literature on agile project management practices in the Asian region is another motivation for undertaking this research. A study done by Chuang, Luor, and Lu (2014) reveals that majority of agile project management research is done in economically developed regions such as Americas, Europe and Oceania. Only six published research are reported in the Asian region among 110 of total published

research. A study conducted in the Asian region would, therefore, significantly contribute to academic community to better understand the factors affecting the adoption of agile project management practices in an Asian country like Sri Lanka.

### 1.3. Research questions, research aim and objectives

The primary research question to be answered in this research is:

> *What are the critical success factors for adopting project agile project management techniques in IT projects in Sri Lanka?*

To facilitate answering the above primary research question, several secondary research questions have been formulated as follows:

a. *How do the agile project management practices differ from traditional project management practices?*
b. *What factors are considered in the literature as the critical factors for successful adoption of agile project management techniques?*
c. *What is the appropriate framework for adopting agile project management techniques in IT companies in Sri Lanka?*
d. *What recommendations can be made for successful adoption of agile project management techniques in IT firms?*

To address the research questions formulated above, an aim for the research, and a set of objectives are defined. Therefore, the primary aim of this research is to investigate the critical success factors for adopting agile project management practices in the private sector IT projects in Sri Lanka. To fulfill the aim of the research several objectives of the research are formulated as follows:

a. To identify the difference between the agile and traditional project management approaches
b. To identify the most influencing factors affect the adoption of agile project management approach worldwide

c. To develop a theoretical framework by identifying the critical factors for adopting agile project management approach
d. To provide recommendations for IT organizations for successfully implementing agile project management practices

## 1.4. Research approach

To fulfil the aim and objectives of the research, a specific research approach is followed. First, a comprehensive review of the literature is carried out on areas of traditional and agile project management concepts, existing research on the agile project management approach (specifically research on the critical success factors for successful adoption of agile project management), and theories of diffusion of innovation. This leads to identification of the research gap to be addressed in this research. Moreover, from the review of the literature, research objective (a) and (b) are fulfilled, and secondary research questions (a) and (b) are also answered.

Based on the critical factors identified through the literature, and with the use of diffusion of innovation theory, a new theoretical framework is hypothesized. Based on the hypothesized framework, a research instrument is developed. The research instrument developed in this research underpins quantitative research methodology. The selection of quantitative methodology for this research is due to the nature of the research questions formulated in this research. The research questions formulated in this research are confirmatory (Onwuegbuzie & Leech, 2005). Confirmatory research usually focuses on testing theories for answering the research questions (Teddlie & Tashakkori, 2006; Creswell & Plano Clark, 2011).

Hence, the hypothesized theoretical framework is tested using the data collected through a survey for identifying the critical factors for adopting the agile project management approach in Sri Lankan IT firms. Tested framework is used to fulfil the research objective (c) and to answer the research question (c). To test and validate the framework Structural Equation Modelling Technique (SEM) is used in this research.

Finally, recommendations (research objective ‘d’ and research question ‘d’) are made based on the findings. Figure 1.1 summarizes the overview of the research approach.

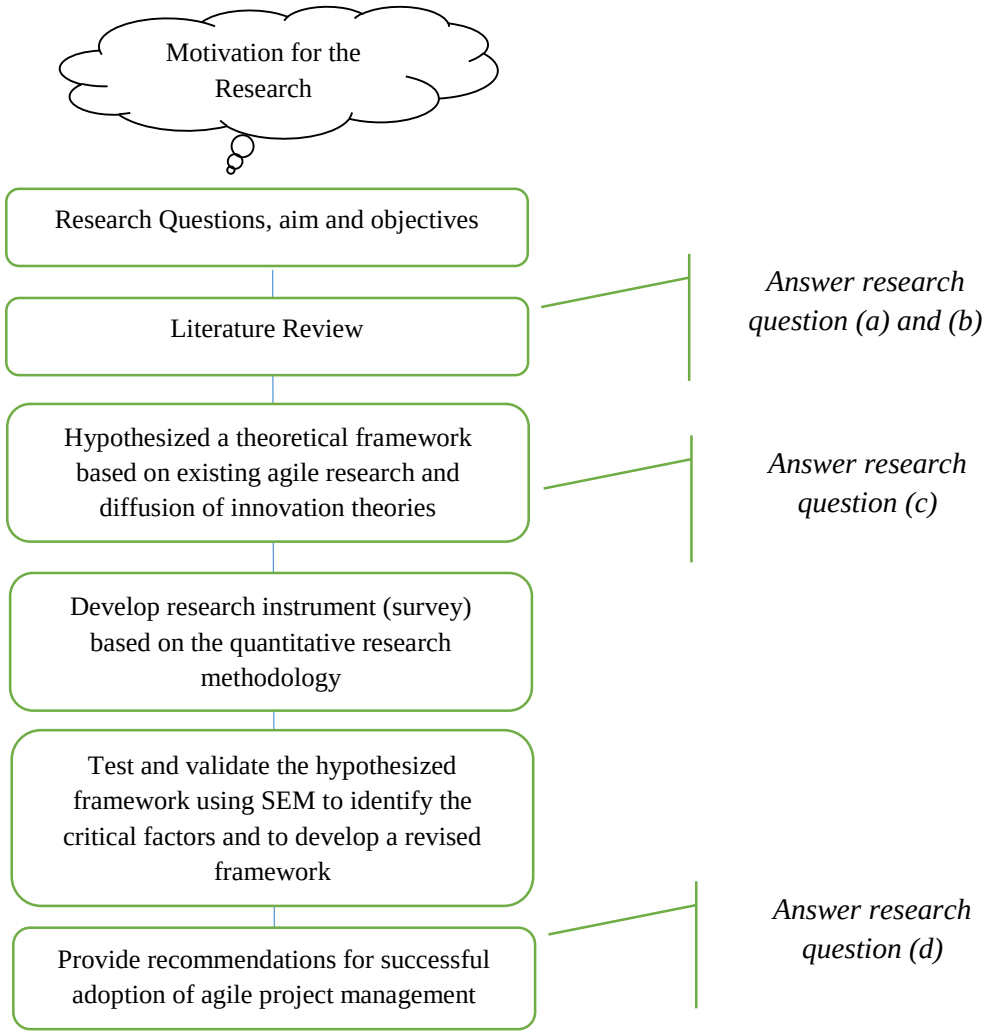


*Figure 1.1:* An overview of the research approach

## 1.5. Limitations of the research

The scope of this research is limited to the adoption of agile approach in IT field. This is a limitation of this research. Applicability of the research findings to other industries is not considered in this research. However, the research can be further extended to other industries by modifying the survey questions to examine whether agile project management approach can be adopted effectively.

The research approach adopted in this research is confirmatory. Therefore, this research uses a quantitative research methodology to answer the research questions. Due to the limitations of the quantitative research methodology the findings obtained in this research are less descriptive. Findings of quantitative research methodology, however, can be elaborated through deploying a series of interviews on the critical factors identified in this research.

## 1.6. Structure of the dissertation

Chapter 1: Chapter One is the introductory chapter. It presents an overview of the research background, motivation for the research, aim and objectives, research questions, and an overview of the research methodology.

Chapter 2: Presents a review of the related literature with a focus on structured project management approach, limitations of the structured approach, agile project management approach and its merits, post adaptive usage of agile methods, and limitations of the existing project management research. A review of the theories on technology adoption is also presented.

Chapter 3: This Chapter presents the theoretical framework of this research. The chapter also presents the hypotheses formulated in this research.

Chapter 4: Chapter Four presents the research methodology adopted in this research. It presents a discussion on the selection of suitable research methodology and the implementation of quantitative research methodology of this research.

Chapter 5: This is the Data Analysis chapter. Data collected through the survey is analyzed using SEM and is presented in this chapter.

Chapter 6: Chapter Six presents a discussion on the research findings based on the testing of hypotheses.

Chapter 7: Chapter Seven is the Conclusion. Research questions formulated in Chapter One are revisited and answered in this chapter. The chapter also provides recommendations for successful adoption of agile techniques in IT firms in Sri Lanka.

# CHAPTER 2: THE LITERATURE REVIEW

## 2.1. Introduction

Agile project management approach is being rapidly adopted by organizations worldwide for managing IT projects (Goodpasture, 2011; Oellgaard, 2013). With this development, a growing body of scholarly literature on agile project management in IT projects has also emerged. Such research include identification of critical factors for adopting agile approaches (Chow & Cao, 2008), identification of challenges to agile adoption (Chow & Cao, 2008; Gunasena, 2012), post adoptive usage of agile project management in IT projects (Senapathi & Srinivasan, 2012), and assessing agile project management awareness among employees (Jayawardena & Ekanayake, 2010). Such research, however, suffer from various shortcomings when it comes to effectively identifying the critical factors for adopting agile project management approach in IT projects in the Sri Lankan context. Lack of solid theoretical foundations for those research, and ignorance of important aspects of agile project management approach, for example, hinder the credibility of such research.

This research, therefore, aims to fill this research gap by developing a revised theoretical framework that addresses the limitations of the existing research. Based on the comprehensive review of the relevant literature presented in this chapter, a theoretical framework will be developed by hypothesizing the critical factors for adopting agile project management in IT projects in Sri Lanka. The proposed framework will be tested using survey data collected from employees of Sri Lankan IT companies which have adopted agile project management practices. Based on the findings of this research, some policy recommendations will be made to private sector firms for effectively adopting agile project management practices in IT projects.

The rest of the chapter is organized as follows. First, a comprehensive review of the structured project management approach is presented followed by a discussion of the limitations that prevent the effective adoption of the structured approach in IT projects.

A review of the agile project management approach is then presented with its respective merits. A comprehensive review of the existing research on the use and adoption of agile project management in IT projects is then presented followed by a discussion of the well established technology adoption theories commonly used in the information systems literature. Finally, a summary of the literature reviewed in this chapter is presented.

## 2.2. An overview of the structured project management approach

A project is a 'temporary endeavor undertaken to create a unique product, service or result' (PMBOK, 2013, p.3). A project differs from a steady on-going private organization due to the specific characteristics of its own (Wideman, 1989). Well defined objectives designed to create unique products (or services or results), and the temporary nature exemplified by definite start and end dates are the distinguishing characteristics of a project (Wideman, 1989; PMBOK, 2013). Construction of a sustainable building, development of an information system to automate the manual operations of a financial institution, and changing the organizational structure or existing inefficient processes through a business process reengineering exercise, for example, are considered as modern day projects (Dinsmore, 1990; PMBOK, 2013). Investments on such kinds of projects have clearly become a central activity of most organizations nowadays (Soderlund, 2004; Sauser et al, 2009).

With the huge investments made on projects, ensuring the attainment of desired results becomes necessary. In this regards, project management plays a key role in modern day businesses for driving projects towards success. The term 'project management' commonly refers to the 'application of knowledge, skills, tools, and techniques to project activities to meet the project requirements' (PMBOK, 2013, p.4). Identifying customers' requirements, addressing the customers' requirements through achieving project deliverables, developing time, cost, and resource schedules, assessing project risks, and managing stakeholders, for example, are the activities overseen through project management (PMBOK, 2013). Project management is a complex process which is built around the cornerstones of accomplishing desired project goals by

adhering to the quality standards, and time and budget constraints (Wit, 1988; Dinsmore, 1990).

Various project management approaches have been developed over the years for managing projects. Among them, the structured approach for project management is widely used in various industries around the world (Garel, 2013; Seymour & Hussein, 2014). This approach is based on the assumption that events affecting a project are predictable, and that the tools and activities are well understood in the early stages of the project (Hass, 2007; Ruel et al., 2010). In this approach, tasks are completed in a sequential manner and distinct lifecycle phases are clearly identifiable (Spundak, 2014). Moreover, in this approach the tasks need to be formally validated before moving on to the next phase and therefore, once a phase is completed, it is assumed that it will not be revisited (Khalifa & Verner, 2000; Hass, 2007; Ruel et al., 2010). Due to this specific nature of the structured approach it is widely viewed as a waterfall approach of project management (Harrison, 2003).

Modern-day project management methodologies such as PMBOK and PRINCE have evolved from the structured approach (Harrison, 2003). They are the most widely used project management methodologies in Europe, North America, and other countries (Ruël et al., 2010). PRINCE originated in the UK and it is a de facto standard for managing government projects in the UK (Graham, 2010; PRNICE2, 2015). While PRINCE is the dominant project management methodology in Europe, the American nations and their followers adopt PMBOK proposed by the PMI of the USA.

## 2.3. Limitations of the structured approach for effective IT project management

Structured project management methodologies such as PMBOK and PRNICE are commonly adopted in many companies to manage complex IT projects (Garel, 2013; Seymour & Hussein, 2014). Although such widely recognized methodologies have been applied, many research reveal that most IT projects have been failures (Maylor et al., 2008; Ruël et al., 2010; Gholami & Murugesan, 2011). Globally, for example,

80-145 billions of dollars per year are spent on failed and cancelled projects (Hass, 2007). In the US particularly, only 35% of IT projects are successes, 19% are complete failures, and 65% have led to time or cost overruns (Hass, 2007). Rapidly changing customer needs, technological changes, use of rigid project management plans which cannot accommodate unanticipated changes, increasing pressure to deliver results in the shortest possible time, poor interaction between customers and project teams, and failure to learn lessons from past experience, for example, pose many challenges to effective management of IT project (Gholami & Murugesan, 2011; Altuwaijri & Khorsheed, 2012; Stankovic et al., 2013).

The structured project management approach has been subject to heavy criticisms over the years due to its limitations (Ruël et al., 2010). As noted before, the fundamental principle of the structured project management approach is the simplicity, predictability, and linearity (Spundak, 2014). Such an approach emphasizes the planning of the project in detail at the commencement of the project, and refraining from incorporating substantial changes during the execution phase of the plan (Spundak, 2014). Followers of the structured approach are advocated to apply this fundamental principle for every project in a uniform manner regardless of the size, nature, or the complexity (Spundak, 2014). Modern project management scholars, however, heavily criticize this approach stating that a 'single size does not accommodate every project' (Chin, 2004; Spundak, 2014). It is further argued that 'same as business environments in general, projects become progressively complex, with higher number of tasks and complex interrelations, while structured project management approach is based on mostly hierarchical and linear task relations and cannot properly reflect all complexity and dynamics of today's projects' (Spundak, 2014, p 941).

The rigid character of the structured approach is further criticized due its incapacity to accommodate environmental changes (Nerur & Balijepally, 2007). Change in any form is the reality of today's business environments and this is also common to the projects executed within those environments (Aguanno, 2004). Moreover, in many IT projects the requirements of the solution cannot be entirely known before completion

(McConnell, 2003). Thus it is impossible to create a complete project plan at the early stages of the project (Chin, 2004; Spundak, 2014). The rigid nature of the structured approach does not suit the uncertainty associated with early planning, and changes in requirements in response to the growing environmental changes (Nerur & Balijepally, 2007; Ruël et al., 2010). Since the underpinning philosophy of the structured approach is to incorporate the risk by the time a system is built, such an approach fails take into account changes that the environment brings during the project implementation, and therefore, could result in a wrong product (Austin & Devin, 2003; Ruël et al., 2010). In other words, the structured approach is more focused on managing the project right rather than developing the right product which is accepted by the end users (Ruël et al., 2010). It is therefore, concluded that 'in the present big, complex, and speedy projects in rapidly changing business environments, structured project management is simply counterproductive; it creates self-inflicted problems that seriously undermine performance' (Williams, 2005, p. 498).

## 2.4. Agile project management approach and its merits

To overcome the many drawbacks of the structured project management approach, a new form of project management approach has emerged since late 1990s, called the agile approach (Ruël et al., 2010). Over the recent years, agile practices have become increasing popular among IT companies (Goodpasture, 2011; Oellgaard, 2013; Morris, 2013; Oellgaard, 2013). Such popularity is due its potential benefits such as facilities for improving customer satisfaction, decreasing failure rates, shortening development time, and for accommodating frequently changing customer requirements (Boehm & Turner, 2004). Due to such benefits that the agile project management approach can offer many IT firms rapidly adopt agile practices (Senapathi & Srinivasan, 2012; Stankovic et al., 2013) and today agile project management approach has significantly transformed the project management practices, and caused a silent revolution in the way projects are organized and managed (Stettina & Hörz, 2013).

Agile project management is “a set of values, principles, and practices that assist project teams in coming to grips with this challenging environment” (Highsmith, 2004, p.16). It integrates the values, guiding principles and practices, and forms a collaborative development team (Zhi-gen & Quan, 2009). Such an approach has proven to overcome many of the problems associated with IT project management through creating agile values (Stankovic et al., 2013). The agile values are (1) delivery of customer value through innovative products, (2) championing of technical excellence, (3) employment of iterative, feature based delivery, (4) encouraging of exploration, (5) building of adaptive teams – self organizing and self-disciplined, and (6) simplicity (Highsmith, 2004).

In the agile project management approach, delivering customer value is about designing innovative products (or services) that meet not only today’s needs but also the future needs of the businesses (Highsmith, 2004). Through the project management process, special attention is paid to designing products (or services) which can be adapted to future customer needs, and constant technological changes due to unpredictable changes (Goodpasture, 2011; Highsmith, 2004). Moreover, customer-client partnership is also encouraged in the management process to deliver outstanding product value (Highsmith, 2004).

Championing technical excellence is the second core value of agile project management approach (Highsmith, 2004). Championing technical excellence is not only focused on creating a product which satisfies customers’ today’s needs within the resource constrains but also on reducing future maintenance cost (Puri, 2009). Project managers, therefore, must be champions of technical excellence to support and advocate technical excellence while not losing sight of the other project objectives (Highsmith, 2004; Puri, 2009).

Employment of iterative, feature-based delivery is the third core value of the agile project management approach (Highsmith, 2004). Agile approach focuses on nimbleness or quick movement (Goodpasture, 2011). Short and iterative delivery cycles enable software developers to respond more easily to changing demands of

clients and the marketplace (Goodpasture, 2011). It facilitates the team to build a prototype (or a partial version) of a product and then improve that prototype version through successive short time periods followed by reviews and adaptations (Highsmith, 2004). Such an iterative approach enables earlier testing of the key attributes of the product, and thus, helps progressive risk reduction (Highsmith, 2004).

Encouraging exploration is the fourth core value of the agile approach (Highsmith, 2004). Unlike the structured approach, the agile approach stresses that responding to change is more important than following a rigid plan, that a working software is more crucial than comprehensive documentation, and that embracing change even at a later stage is important rather than resisting change (Puri, 2009). A team with such attitudes has the ability to develop innovative products as well as the willingness to work in highly volatile environments (Highsmith, 2004). Moreover, agile project managers encourage and inspire team to work through the difficulties of a volatile environment, and encourage the team do experiments and learn from both successes and mistakes (Highsmith, 2004; Puri, 2009).

Building an adaptive (self-disciplined) team is the fifth critical value of agile project management (Highsmith, 2004). In the structured project management processes, work is coordinated by managers and there is a clear separation of roles which leads to organizational bureaucracy (Stankovic et al., 2013). Unlike the structured approach, the agile approach focuses on getting the right people, building the capacity of people, facilitating participatory decision making, and encouraging interaction and information flow between teams. Therefore, it is regarded as a less bureaucratic approach (Conforto & Amaral, 2008). Self-disciplined individuals in such an environment accept accountability for results, confront reality through rigorous thinking, engage in intense interactions and debate, work willingly within a self-organizing framework, and respect colleagues (Highsmith, 2004).

Simplicity is the sixth and the final core value of agile project management (Highsmith, 2004). It stresses the importance of keeping things simple to develop products or services fast. It is argued that simplicity enables speed (Highsmith, 2004).

If the processes are simplified by taking out detailed tasks and compliance, people will think and interact (Highsmith, 2004).

## 2.5. Summary of related research

### 2.5.1. Critical success factors for adopting agile project management approach

There is much research on identifying the critical success factors for adopting agile project management. Chow and Cao (2008), for example, investigate the critical success factors for perceived success of agile projects with the use of survey data collected from 109 agile projects across 25 countries. As shown in Figure 3.1, the critical factors for the success of agile project are classified into five major domains, namely, (1) organizational factors, (2) people factors, (3) process factors, (4) technical factors, and (5) project factors. The success of an agile project is evaluated with respect to the cost, time, scope, and quality dimensions.

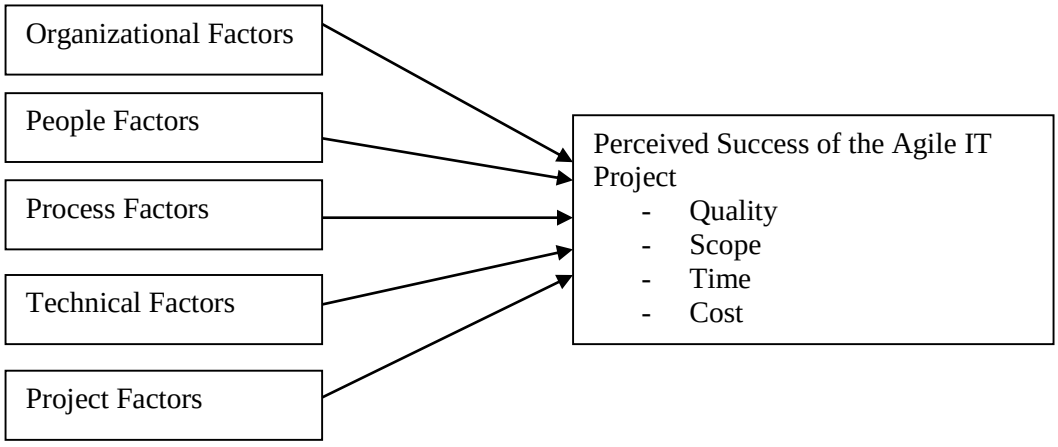


*Figure 2.1:* An overview of Chow and Cao (2008) model

In this approach, the organizational factors focus on management commitment, organizational environment, and team environment. In this regard, strong executive support, existence of committed sponsors or managers, availability of a cooperative organizational culture instead of a hierarchal culture, existence of an oral culture that places high value on face-to-face communication, collocation of the whole team, use

of widely accepted agile methods, facilitation for agile-style work environment, and a reward system for successful adoption of such approach are considered as critical (Chow & Cao, 2008).

In Chow and Cao's (2008) approach the people factor is about the team's capability and customer involvement. Highly experienced, competent, and self-motivated team members, availability of knowledgeable managers, availability of an adaptive management style, coherent and self-organizing teams, and maintaining better customer relationships are critical people factors essential for the successful adoption of agile project management practices (Chow & Cao, 2008).

The process factors are focused on the project management process and the project definition process. Following an agile-oriented requirement management process, an agile-oriented project management process, and an agile-oriented configuration management process are essential. Moreover, strong communication focus with daily face-to-face meetings, sticking to a regular work schedule with no overtime work, strong customer commitment, and customers having full authority are identified as positively influencing the successful adoption of agile project management (Chow & Cao, 2008).

The technical factors focus more on the overall architecture of the product (Chow & Cao, 2008). Well-defined coding standards up front, pursuing simple designs, rigorous refactoring activities, right amount of documentation, regular delivery of software, delivering most important features first, correct integration testing, and provision of appropriate technical training to team are identified as critical for the successful adoption of agile project management (Chow & Cao, 2008).

Finally, the project factors focus on the nature, type, and the schedules of the project (Chow & Cao, 2008). In this regard non-life-critical projects having variable scope with emergent requirements, projects with dynamic and accelerated schedules, projects with a small team, projects with no multiple independent teams, projects with

up-front cost evaluation, and projects with up-front risk analysis done are considered as critical.

Chow and Cao (2008) also identify challenges to the successful adoption of agile project management approach. Lack of executive sponsorship, lack of management commitment, existence of a to traditional and political organizational culture, lack of agile logistical arrangements, lack of necessary skills set, lack of project management competence, lack of team work, resistance from groups or individuals, bad customer relationships, ill-defined project scope, ill-defined project requirements, ill-defined project planning, lack of agile progress tracking mechanism, lack of customer presence, ill-defined customer role, lack of a complete set of correct agile practices, and inappropriateness of technology and tools are identified as challenging the successful adoption of agile project management approach (Chow & Cao, 2008). Table 2.1 summarizes success and challenging factors for adopting agile project management approach.

Table 2.1: A summary of critical factors for adopting agile project management approach

| **Dimension** | **Success Factors** | **Challenging Factors** |
|---|---|---|
| Organizational | ○ Strong executive support<br>○ Committed sponsor or manager<br>○ Cooperative organizational culture instead of a hierarchal culture<br>○ Oral culture placing high value on face-to-face communication<br>○ Organizations where agile methodology is universally accepted<br>○ Collocation of the whole team<br>○ Facility with proper agile-style work environment | ○ Lack of executive sponsorship<br>○ Lack of management commitment<br>○ Organizational culture too traditional and political<br>○ Organizational size too large<br>○ Lack of agile logistical arrangements |

| Dimension | Success Factors | Challenging Factors |
|---|---|---|
| People | ○ Team members with high competence and expertise<br>○ Team members with great motivation<br>○ Managers knowledgeable in agile process<br>○ Managers who have light-touch or adaptive management style<br>○ Coherent, self-organizing teamwork<br>○ Good customer relationship | ○ Lack of necessary skill-set<br>○ Lack of project management competence<br>○ Lack of team work<br>○ Resistance from groups or individuals<br>○ Bad customer relationship |
| Process | ○ Following agile-oriented requirement management process<br>○ Following agile-oriented project management process<br>○ Following agile-oriented configuration management process<br>○ Strong communication focus with daily face-to-face meetings<br>○ Honoring regular working schedule – no overtime<br>○ Strong customer commitment and presence<br>Customer having full authority | ○ Ill-defined project scope<br>○ Ill-defined project requirements<br>○ Ill-defined project planning<br>○ Lack of agile progress tracking mechanism<br>○ Lack of customer presence<br>○ Ill-defined customer role |
| Technical | ○ Well-defined coding standards up front<br>○ Pursuing a simple design<br>○ Rigorous refactoring activities<br>○ Right amount of documentation<br>○ Regular delivery of software | ○ Lack of complete set of correct agile practices<br>○ Inappropriateness of technology and tools |

| Dimension | Success Factors | Challenging Factors |
|---|---|---|
| Project | ○ Project nature being non-life-critical<br>○ Project type being of variable scope with emergent requirement<br>○ Projects with dynamic, accelerated schedule<br>○ Projects with small team<br>○ Projects with no multiple independent teams<br>○ Projects with up-front cost evaluation done<br>○ Projects with up-front risk analysis done | ○ Using for life-critical projects<br>○ Incompetent project staff |

Source: (adapted from Chow & Cao, 2008)

Chow and Cao's (2008) approach has been applied in different contexts. Gunasena (2012), for example, conducts a study on the adoption of agile project management methods to drive software projects in non-IT based enterprises in Sri Lanka with the use of Chow and Cao's (2008) framework. The study reveals that organizational, people, process, technical, and project specific factors positively influence the adoption of successful agile project management in the Sri Lanka context. This study further reveals that less emphasis on communication, requirements, scope, and testing would lead to failures of agile project management processes.

Jayawardena and Ekanayake (2010) conduct an analysis of agile project management for managing IT projects in Sri Lanka. Their study conceptualizes that (1) organizational culture and attitude, (2) nature of the business requirements, (3) management practices and initiatives, (4) employee skills, (5) customer influence, and (6) existing project management practices lead to agile project management

awareness. Figure 3.2 presents an overview the framework proposed by Jayawardena and Ekanayake (2010).

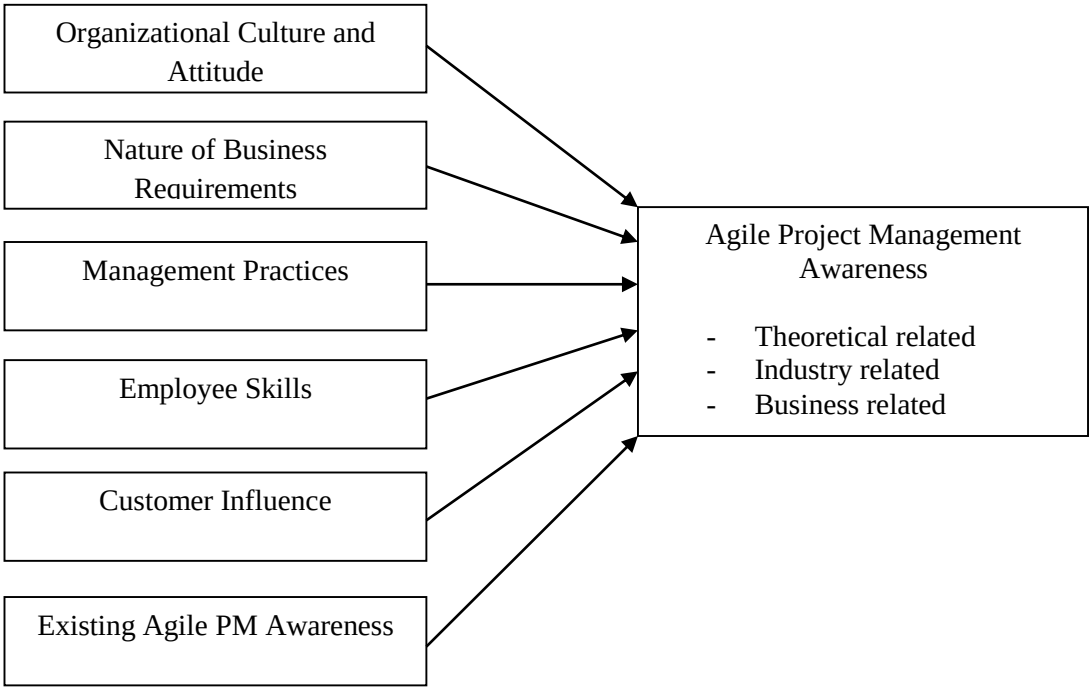


*Figure 2.2:* An overview of Jayawardena and Ekanayake's (2010) model

In this research agile project management awareness is measured with respect to business related awareness, theory related awareness, and industry related awareness. The independent variable, organizational culture and attitude is focused on the attitudes towards new project management technologies, internal drive for new project management technologies, reaction of staff to new project management technologies, and business receptivity to change. Nature of the business requirements refers to the rate of business requirement changes, nature, complexity and stability of the project. Management practices and initiatives are about the employee training and development, encouragement of new practices and continuous process development. The factor employee skill is focused on the professional qualifications of the team and industry experience. Customer influence is about customers' awareness of the processes, relationship with the customers, and effective communication with

customers. Existing project management practices are about the suitability of the technology, problems with the existing technology, and the teams' theoretical awareness of the practices (Jayawardena & Ekanayake, 2010). Table 2.2 summarizes the above mentioned indicators in the framework.

Table 2.2: A summary of the critical factors agile project management awareness

| **Dimension** | **Success Factors** |
|---|---|
| Organizational culture and attitude | ○ Attitudes towards new project management technologies<br>○ Internal drive for new project management technologies<br>○ Reaction of staff for new project management technologies<br>○ Business receptive to change |
| Nature of the business requirements | ○ Rate of business requirement changes<br>○ Nature complexity<br>○ Stability of the project |
| Management practices and initiatives | ○ Employee training and development<br>○ Encourage new practices<br>○ Continuous process development |
| Employee skills | ○ Professional qualifications<br>○ Industry experience |
| Customer influence | ○ Customers awareness of the processes<br>○ Relationship with the customers<br>○ Communication with the customer |
| Existing project management practices | ○ Suitability of the technology<br>○ Problems with the existing technology |

### 2.5.2. Post adoptive usage of agile methods

Post adoptive usage of agile method is another dimension of research on agile project management. In this context, Senapathi and Srinivasan (2012) develop a framework to investigate the post-adoptive usage of agile methods in IT firms in New Zealand. The framework is based on three theoretical concepts, namely, (1) diffusion and innovation theory, (2) information systems implementation model, and (3) agile evaluation framework of Williams et al. (2004). The framework hypothesizes that, (1) innovation factors, (2) sociological factors, (3) technological factors, and (4) organizational factors influence effective usage of agile methods. Figure 2.3 presents an overview of the framework proposed by Senapathi and Srinivasan's (2012).

The first factor of the framework is the innovation factor which is adopted from Roger's (2003) diffusion of innovation theory. it is argued that organizations will adopt agile approach if it (a) offers specific advantages (relative advantage) in comparison with its previously adopted method, and (b) is compatible (compatibility) with existing values, past experiences, practices within the organization, and the needs of the potential adopters (Sahin, 2006; Senapathi & Srinivasan, 2012).

Sociological and Technology factors are another two important factors that influence continuous usage of agile methods in an organization. They are adapted from the agile projects evaluation framework of Williams et al (2004). In respect of social factors, the framework hypothesizes that individuals' experience, the team's attitudes – positive or negative beliefs – about the willingness to change, and continuous use of innovation, and technical competency (business domain expertise, and technical expertise) influence the continued adoption of agile project management (Senapathi & Srinivasan, 2012). With respect to the technological factors, usage of agile development practices, and tool support (use of Project Management tools such as VersionOne, RallyDev) influence the continuous adoption of agile methods (Senapathi & Srinivasan, 2012).

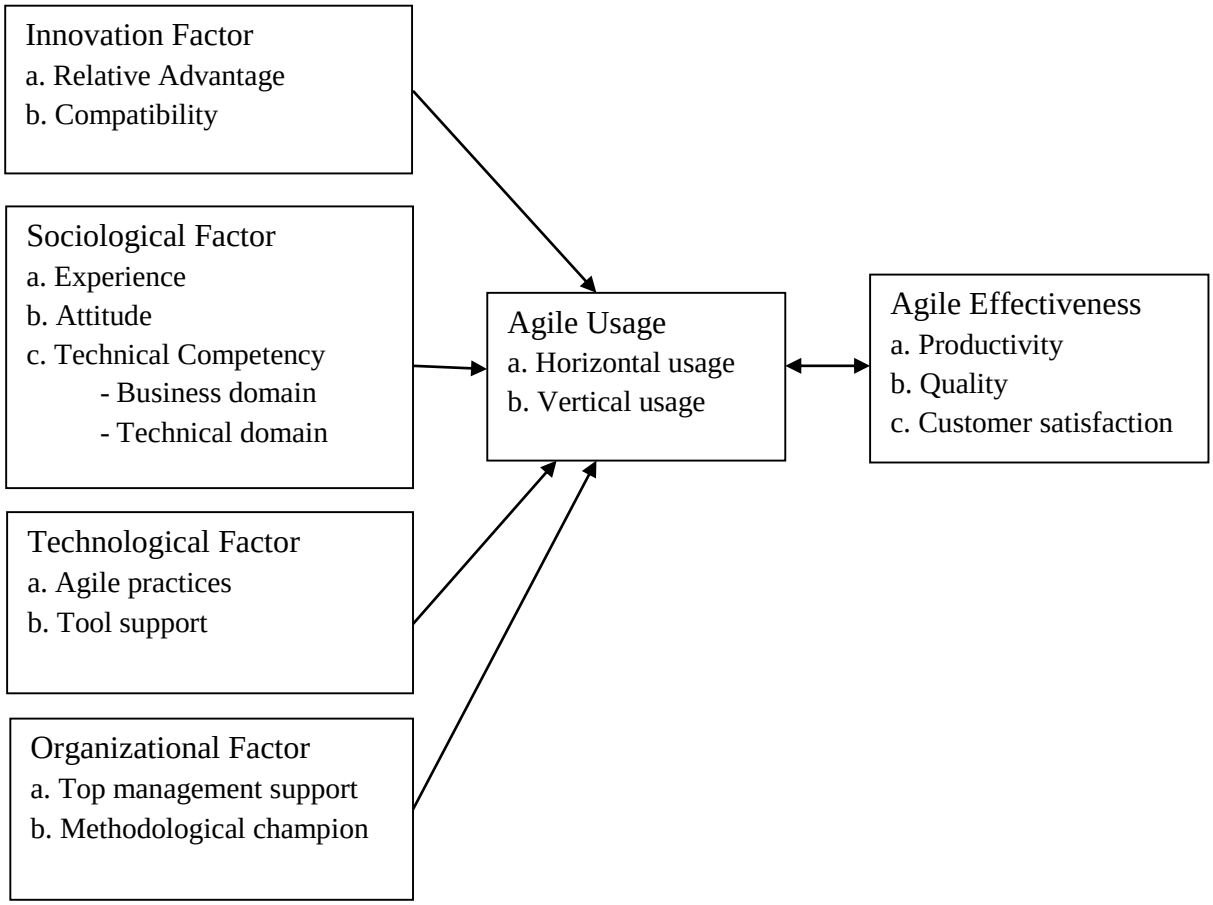


*Figure 2.3:* An overview of Senapathia and Srinivasan's (2012) framework

Organizational factors are adopted from the information systems implementation model (Senapathi & Srinivasan, 2012). Organizational factors include top management support, and methodological champion. Top management support is about obtaining ongoing continual support and encouragement of the top level management for the adoption and implementation of innovation (Senapathi & Srinivasan, 2012). Methodological champion is about convincing management, pushing through implementation hurdles, mentoring, and ensuring that agile practices are correctly adhered to by team members (Senapathi & Srinivasan, 2012).

As shown in the framework presented in the Figure 3.3, the agile usage is assessed with respect to two dimensions, namely, (1) horizontal usage, and (2) vertical usage.

The horizontal usage is concerned with the use of innovation across the organizations (that is the breadth of use) such as the percentage of projects, and the number of agile teams within the organization (Senapathi & Srinivasan, 2012). The vertical usage is concerned with maximum intensity of an organization's use of specific agile practices (that is the depth of use) (Senapathi & Srinivasan, 2012).

Finally, in this research agile effectiveness is measured by assessing post-implementation effectiveness of agile methodologies (Senapathi & Srinivasan, 2012). In this regard, three evaluative criteria, namely, (1) improved productivity in the development process, (2) improved quality of the development process, and (3) customer satisfaction are considered. In this research, customer satisfaction is assessed by considering how well the agile practices deliver customer value through innovation. Table 2.3, summarizes the critical factors for post adoptive usage of the agile methods.

Table 2.3: Critical factors for post adoptive usage of agile methods

| **Dimension** | **Critical Success Factor** |
|---|---|
| Innovation | o Relative advantage in comparison with its previously adopted method<br>o Compatible with existing values, past experiences, practices |
| Social | o Individuals' experience<br>o Attitudes to change<br>o Attitudes for continuing to use<br>o Competency on business domain<br>o Competency on technical domain |
| Technology | o Agile development practices<br>o Tool support |
| Organizational | o Top management support for continuous usage of agile practices<br>o Encouragement of the top level management<br>o Pushing through implementation hurdles<br>o Mentoring<br>o Ensuring that agile practices are correctly implemented |

## 2.6. An overview of the theories of technology adoption

There are a number of theories that explain the adoption of the technology at organizational level. Among them, Tornatzky and Fleisher's (1990) technology-organization-environment theory (TOE), and Roger's (2003) diffusion of innovation theory (DOI) and are widely used by researchers to explain the adoption of technology innovation within an organization (Oliveira & Martins, 2011). The theory of TOE identifies three critical aspects of technology adoption, namely, (1) technological aspects, (2) organizational aspects, and (3) environmental aspects (Tornatzky & Fleisher, 1990). According to DOI, different innovation attributes, namely, (1) relative advantage, (2) comparability, (3) complexity, (4) trialability, and (5) observability, influence the adoption of technology in an organization (Roger, 2003). In these theories, 'technology' does not refer only to equipment such as computer hardware, or software, but also to practices, processes or methodologies such as project management, which the organization is interested in adopting for gaining innovation (Tornatzky & Fleisher, 1990; Oliveira & Martins, 2011).

### 2.6.1. The theory of technology-organization-environment (TOE)

These three elements of the TOE, namely, technology, organization, and environment present both constraints and opportunities for technological innovation within an organization (Tornatzky & Fleisher 1990, p. 154). Thus, these three elements influence the way an organization sees the need for, searches for, and adopts new technology. In the TOE, the technological context refers to the internal and external technologies relevant to an organization. The organizational context refers to the characteristics of the organization such as organizational structures, management styles, organizational culture, and the linkages among employees. It also encompasses the policies, resources of the firm such as human capital, and attributes of the organization such as the scope and size (Tornatzky & Fleisher, 1990). The environmental context is the arena in which the firm operates its business. This includes customers, competitors, industry, and the government (Tornatzky & Fleisher, 1990). As shown in the Figure 2.4, these

three factors influence the technological innovation and decision making in an organization.

Applicability of the TOE theory for explaining technology adoption is demonstrated by many researchers worldwide. Kuan and Chau (2001), for example, use TOE theory to explain the adoption of electronic data interchange. Teo, Ranganathan, and Dhaliwal (2006) use TOE for e-commerce adoption, Lee, Wang, Lim and Peng (2009) for knowledge management adoption, and Chau and Tam (1997) for open system adoption within an organization. The Figure 2.4 presents an overview of the Technology-Organizational-Environment theory.

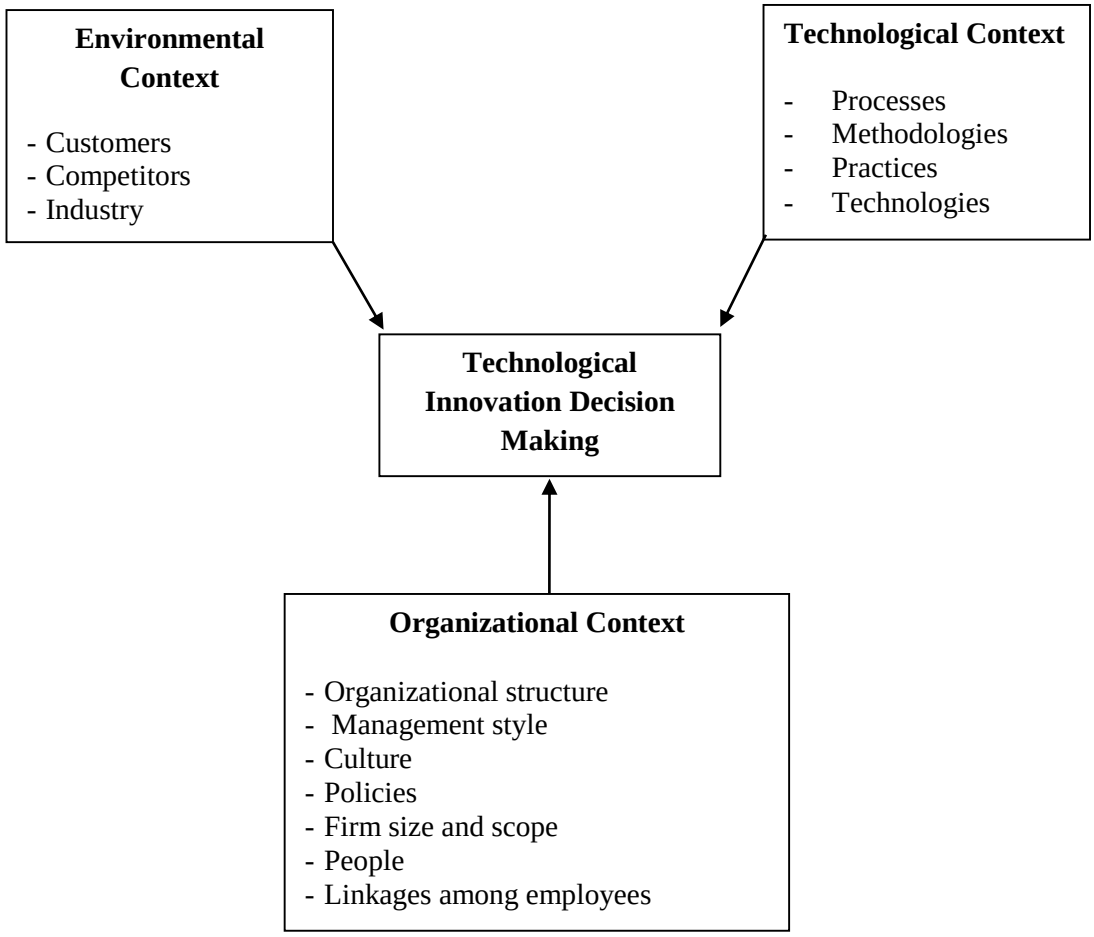


*Figure 2.4:* An overview of TOE theory (Tornatzky & Fleisher, 1990)

### 2.6.2. The theory of diffusion of innovation (DOI)

DOI is a theory which explains how, why, and at what rate new ideas and technology spread through cultures, individual, and organizations (Roger, 2003; Oliveira, & Martins, 2011). It addresses individual's motivations and behaviors pertaining to technology adoption (Oliveira, & Martins, 2011). More specifically, this theory serves as a comprehensive framework for understanding the spread of innovation and its driving factors that accelerate the rate of adoption (Roger, 2003). Diffusion is a special type of communication concerned with spread of messages that are perceived as new ideas (Rogers, 2003; Sahin, 2006). In this theory the term 'innovation' refers to technology (such as IT), ideas, objects, or practices (such as project management approach) that are perceived as new by an individual or other unit of adoption (Rogers, 2003; Sahin, 2006; Panuwatwanich & Peansupap, 2013). Rogers (2003) identifies several attributes of innovations in his well-known book "Diffusion of Innovations". They are (1) relative advantage, (2) compatibility, (3) complexity, and (4) observability (Roger, 2003). These attributes are used to determine rate of innovation adoption (Al-Jabri & Sohail, 2012; Panuwatwanich & Peansupap, 2013).

In this theory, relative advantage is defined as the degree to which an innovation is perceived as being better than its predecessor (Roger, 2003). Past research suggests that when users perceive the relative advantage or usefulness of a new technology over an old one, they tend to adopt it (Al-Jabri & Sohail, 2012). In other words, the potential adopters usually make comparisons between novel and existent conditions when they are exposed to innovation (Ye, 2012). It is argued that the greater the perceived relative advantage of an innovation, the higher the rate of adoption is likely to be (Panuwatwanich & Peansupap, 2013). The degree of relative advantage is often measured through indicators such as economic advantage, process improvement, social prestige, convenience, satisfaction or other benefits (Roger, 2003; Al-Jabri & Sohail, 2012; Panuwatwanich & Peansupap, 2013).

Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences (existing knowledge), and day-to-day needs of potential adopters (Roger, 2003; Ye, 2012). More specifically, an innovation can be

compatible or incompatible, with socio-cultural values and beliefs, with previously introduced ideas, or with client needs for innovations (Roger, 2003, p 223). It is argued that if an innovation is not compatible with an individual's needs, norms or practices, it will increase the level of uncertainty and the rate of adoption of the innovation will decrease (Roger, 2003; Panuwatwanich & Peansupap, 2013).

Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use (Roger, 2003, p. 231). Any new idea may be classified on the complexity-simplicity continuum. It is argued that, complexity is negatively correlated with the rate of adoption. In other words, the less complicated and easy to use an innovation is the more likely it is to be adopted by individuals (Panuwatwanich & Peansupap, 2013).

Observability is the degree to which the results of an innovation are easy to observe and easy to communicate with others (Roger, 2003). The observability of an innovation, as perceived by members of a social system, is positively related to its rate of adoption. That is, the easier it is for individuals to see the results of an innovation, the more likely they are to adopt it (Panuwatwanich & Peansupap, 2013). Figure 2.5 demonstrates the attributes that influence the diffusion of innovation.

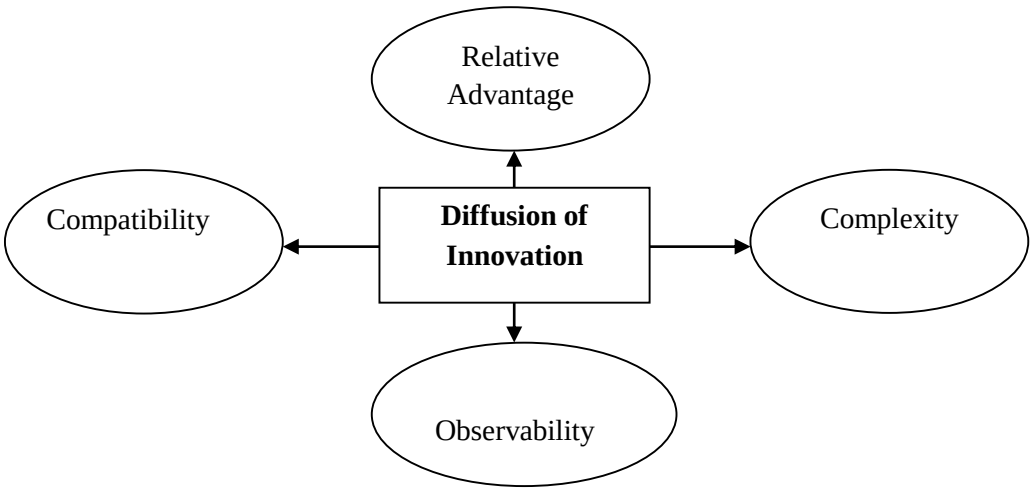


*Figure 2.5:* Attributes of diffusion of innovation

## 2.7. Limitations of the agile project management research

The existing research on the adoption of agile project management has various shortcomings for effective identification of the critical factors for adopting agile project management in an organization. The approaches proposed by Chow and Cao (2008), and Senapathi and Srinivasan (2012), for example, are designed to identify the critical factors for adoption of agile approach in developed countries. Such countries are regarded as the early adopters of the agile practices. The factors identified in those countries would be different from those applicable to developing countries where the usage and the adoption of agile practices are relatively immature.

Moreover, much research on the adoption of agile project management (Chow & Cao, 2008; Jayawardena & Ekanayake, 2010; Gunasena, 2012) does not take into account the factors that influence technology adoption. Innovation of diffusion theory (Roger, 2003), and the technology adoption theory (Tornatzky & Fleisher, 1990) suggest the influence of the critical success factors is not sufficient for technology (innovation) adoption. Many other specific factors that influence technology adoption (environmental, organizational, and technological), and diffusion of innovation factors (relative advantage, complexity, comparability, and observability) are necessary for technology adoption within an organization. It, therefore, is necessary to propose a revised theoretical framework for effectively identifying the critical factors for agile project management adoption in Sri Lanka.

## 2.8. Summary

This chapter presents a review of the literature on structured project management approach, agile project management approach, and the theories on technology adoption. A review of the existing research that identifies the critical factors for successful adoption of agile practices is also done in order to identify the research gap. The literature review reveals that organizational factors, human factors, technological factors, customer related factors, and process factors are critical for the adoption of agile project management in an organization. However, the theories of technology adoption such as technology-organization-environment, and the diffusion of

innovation theory suggest that having critical factors such as organizational, human, customer, process, and technology are not sufficient for effective adoption of agile project management approach within an organization. Diffusion of innovation factors such as relative advantage, comparability, complexity, and observability, and other specific technology adoption factors such as organizational, technological, and environmental factors are also essential for the successful adoption of agile project management approach within an organization. As a result, the need for developing a revised theoretical framework for effectively identifying the critical factors is emerged. Based on the literature reviewed in this chapter, a revised theoretical framework is proposed in next chapter for effectively identifying the critical factors for adopting agile project management in Sri Lankan IT firms.

# CHAPTER 3: THE THEORETICAL FRAMEWORK

## 3.1. Introduction

This research aims to investigate the critical factors for adopting agile project management approach in Sri Lankan IT firms with the use of a quantitative survey. To fulfill the aim of this research, a theoretical framework is required for providing the foundation to the implementation of the survey. In this regard, the theoretical framework helps to hypothesis the critical factors for adopting agile project management approach in Sri Lanka while guiding the development of the survey instrument.

This chapter is organised as follows. First a discussion of the theoretical background underpinning the research is presented based on the review of the related literature presented in the previous chapter. Then, section two describes the theoretical framework which consists of two main dimensions of agile project management adoption in Sri Lankan IT firms, namely, (a) critical success factors, and (b) diffusion of innovation. A set of indicators are proposed for evaluating each dimension. The last section summarizes the theoretical framework in this research.

## 3.2. The theoretical background of the framework

The theoretical framework of this research is developed based on three theoretical concepts, namely, (1) critical factors for adopting agile project management approach, (2) the theory of technology, organization and environment (TOE), and (3) the theory of diffusion of innovation (DOI) as shown in the Figure 3.1. In developing this framework, strengths and limitations of existing research on evaluating the performance of agile project management are considered in order to ensure that the developed framework is comprehensive and adequate for investigating the critical factors for adopting agile project management approach in IT firms in Sri Lanka.

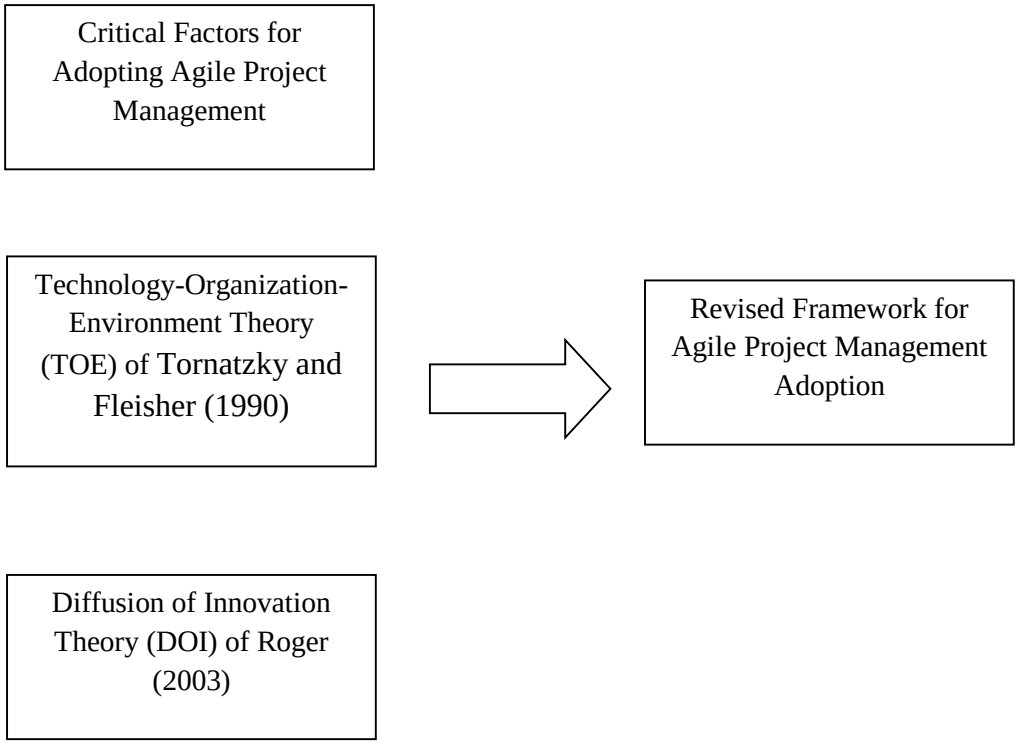


*Figure 3.1:* The theoretical background of the framework

The first fundamental concept underpinning this research is the critical success factor for adopting agile project management identified from the exiting research (Chaw & Cao, 2008; Jayawardena & Ekanayake, 2010; Senapathi & Srinivasan, 2012). Organizational, cultural, people, process, and technology are critical factors commonly discussed in the existing research as critical success factors for adopting agile project management. New critical success factors that influence the agile project management are also identified during the literature review stage of this research.

The second theory underpinning the research is the TOE theory (Tornatzky & Fleisher 1990). As discussed in the previous chapter, TOE argues that organizational, technological, and environmental factors influence the way an organization sees the need for adopting new technology (Tornatzky & Fleisher 1990). In the TOE, technology does not refer only to computer equipment but also to practices, processes or methodologies such agile project management (Tornatzky & Fleisher, 1990).

The third theory underpinning the research is the DOI (Roger, 2003). DOI addresses an individual's or any social group's motivations and behaviors pertaining to the diffusion of innovation (Roger, 2003; Sahin, 2006; Oliveira, & Martins, 2011). As discussed in the previous chapter, relative advantage, comparability, complexity and observability are four factors that influence diffusion of innovation within an organization. In this theory the term 'innovation' does not necessarily have to be a technology but can also be an idea, an object, or a practice that is perceived as new by the relevant individual or other unit of adoption (Rogers, 2003).

This research brings TOE, DOI, and critical factors together for developing a better theoretical framework for identifying the critical success factors for adopting agile project management among Sri Lankan IT firms. In order to develop the framework, three steps are followed. First, the critical factors identified from the existing research (Chaw & Cao, 2008; Jayawardena & Ekanayake, 2010; Senapathi & Srinivasan, 2012) are revised and strengthen with the fundamental principles of the agile project management proposed by Highsmith (2004) in his seminal book titled "Agile Project Management".

Secondly, the revised critical factors are further refined with respect to the three theoretical concepts proposed in the TOE namely, technological context, organizational context, and environmental context. This refining process infuses the technological, organizational, and environmental features of technology adoption to the revised critical factors. During this process the revised critical factors are renamed as 'readiness factors' and grouped into three categories, namely, technological context, organizational context, and environmental context as shown in the theoretical framework presented in Figure 3.2 of the next section.

As the final step of the framework development process, DOI attributes are added to the framework for better identifying the critical factors for adopting agile project management approach in IT firms in Sri Lanka. Diffusion of innovation theory (Roger, 2003) argues that the influence of critical success factors is not sufficient to successfully adopt any innovation. There are some other attributes such as relative

advantage, comparability, complexity, and observability which are necessary for successful adoption of agile project management practices within an organization (Roger, 2003).

### 3.3. A new theoretical framework

The theoretical framework proposed in this section has two main dimensions, namely, (1) the TOE dimension which includes the readiness factors for agile project management adoption, and (2) the DOI dimension which includes innovation attributes that influence diffusion of innovation. As shown in Figure 3.1, the TOE dimension consists of seven agile readiness factors which are classified into three sub-dimensions, namely, (i) technological context, (ii) organizational context, and (iii) environment context.

In the framework (a) process readiness and (b) tools readiness are classified under the technological context, (c) organizational and cultural readiness, (d) management readiness and (e) team readiness are classified under the organizational context, and (f) environmental readiness and (g) product owner readiness are classified under the environmental context. As shown in the framework, the four attributes of diffusion of innovation, namely, (a) relative advantage, (b) comparability, (c) complexity, and (d) observability are classified under the DOI dimension.

The theoretical framework hypothesizes that all those eleven independent factors (seven readiness, and four innovation attributes) positively influence the successful adoption of agile project management (AAPM). In the theoretical framework, independent factors are shown within rectangles. Unidirectional arrows emitting from independent factors represent the hypotheses and they are labeled from H1 to H11. Figure 3.2 presents the theoretical framework proposed in this research.

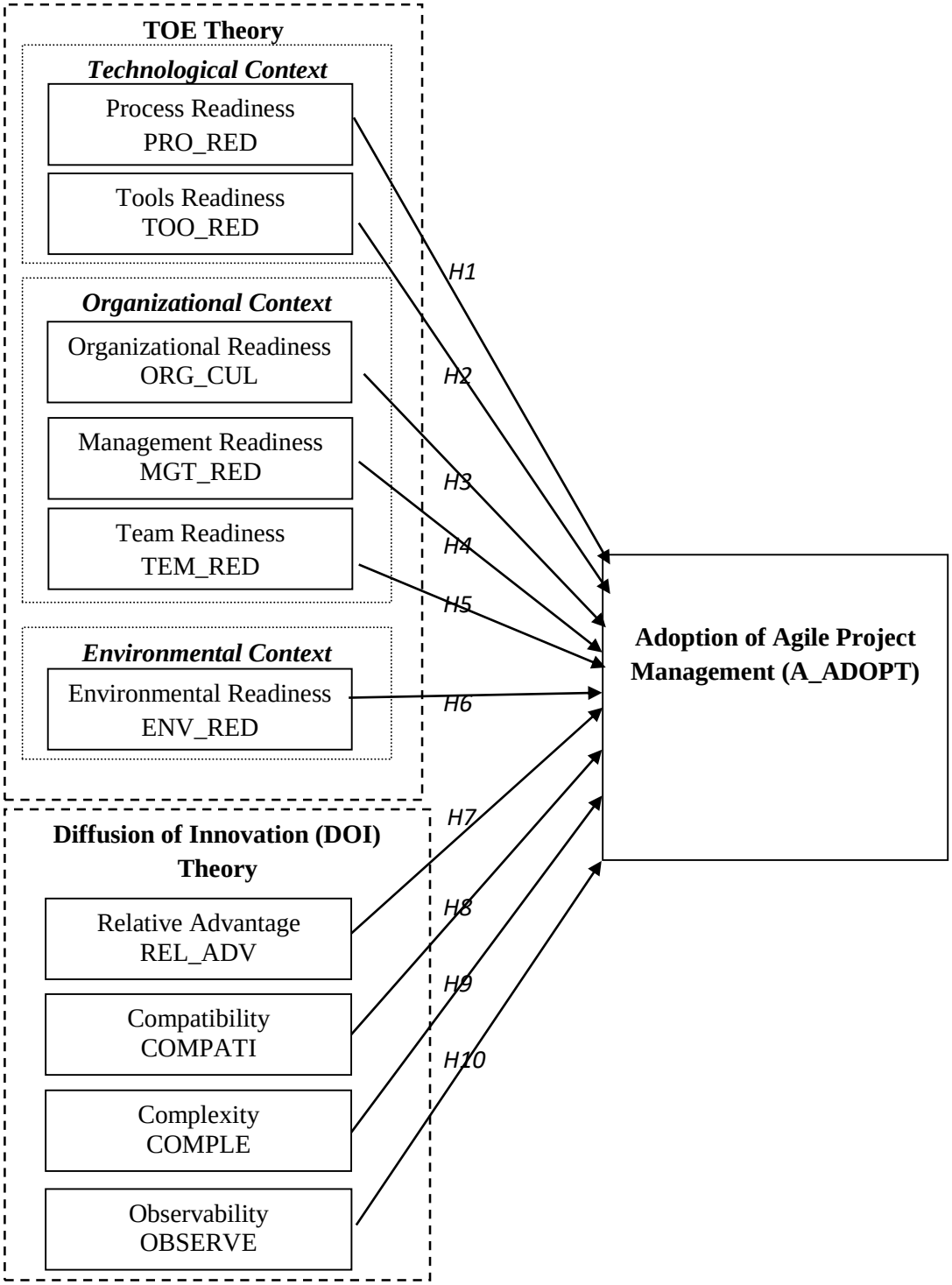


*Figure 3.2:* Hypothesized theoretical framework

### 3.3.1. Agile readiness constructs

The first agile readiness factor (hereinafter 'factors' are referred to as 'constructs') hypothesizes that process readiness positively influence the successful adoption of agile project management approach (H1). Process readiness (PRO_RED) is about the readiness of the organization for adopting the agile process framework. An agile process framework proposes a project management lifecycle which includes five steps, namely, envision, speculate, explore, adapt, and close (Highsmith, 2004). Proposed indictors to test the hypothesis (H1) therefore includes, (i) implementing envision phase by formulating a vision for the product, customer, and team, (ii) implementing speculate phase by developing a feature based release, and iteration plan to deliver on the vision, (iii) executing explore phase by delivering tested features in a short timeframe while constantly seeking to reduce risk and uncertainty of the project, (iv) implementing adapt stage by reviewing delivered results, current situation, and team performance while adapting, and finally (v) implementing the closing stage by handing over the project and passing along key lessons (Highsmith, 2004).

> *$H1_0$: Process readiness positively influences the adoption of agile project management*
>
> *$H1_a$: Process readiness does not positively influence the adoption of agile project management*

The second agile readiness construct hypothesizes that agile tools readiness (TOO_RED) positively influences the successful adoption of agile project management approach (H2). Agile tools encompass specific methodologies or technologies (such as software packages) used to practice agile project management. Tools readiness can be measured by using the following indicators (i) use of agile project management methodologies such as Scrum, extreme project management, or dynamic project management methods (Cervone, 2010), (ii) using agile project management software packages such as VersionOne and RallyDev (Senapathi & Srinivasan, 2012), (iii) using burn down charts such as sprint burn down, product burn down, and release burn down to measure the performance of meeting customer needs, (iv) maintaining product and sprint backlogs (Cervone, 2010), (v) using agile software

development methodologies such as Lean Software Development, Dynamic Systems Development Method, Extreme Programming, or Feature Driven Development aligning with agile project management, and (vi) use of agile configuration management techniques (Koskela, 2003).

*$H2_0$: Tools readiness positively influences the adoption of agile project management*

*$H2_a$: Tools readiness does not positively influence the adoption of agile project management*

The third construct hypotheses that organizational and cultural readiness (ORG_CUL) positively influences the adoption of agile project management (H3). Organizational readiness refers to the nature of the organizational structure and the culture of the organization where agile project management practices are adopted. To test the hypothesis, H3, indicators such as, (i) the existence of a more supportive and cooperative organizational environment rather than a hierarchical and bureaucratic environment, (ii) clearly defined roles for staff including Methodological Champions, Scrum Masters, and Scrum Team individuals, (iii) availability of an oral culture placing high value on face-to-face communication, (iv) the existence of a flexible and adaptive organizational culture that reflects a proper agile-style work environment, (v) an organizational culture that encourages experiment and exploration, (vi) organization that encourages learning, and learning through mistakes, (vii) agile methodology is universally accepted within the organization, and (viii) availability of a rewarding system for agile achievers (Highsmith, 2004; Chao & Cho, 2008; Cervone, 2010) are used.

*$H3_0$: Organizational and cultural readiness positively influences the adoption of agile project management*

*$H3_a$: Organizational and cultural readiness does not positively influence the adoption of agile project management*

The fourth construct, hypothesizes that the top management's readiness (MGT_RED) positively influences the successful adoption of agile methods (H4). It is about the top executives' knowledge, commitment and attitudes towards the adoption of agile

project management practices. To test the hypothesis H4, indicators such as (i) managers' knowledge of agile project management, (ii) top executives' commitment to manage innovative products development through agile project management, (iii) managers' willingness to implement a leadership-collaborative management style, (iv) willingness to take risk to promote innovation, (v) lean thinking, (vi) motivating team to work outside norms, (vii) willingness to empower team, (viii) willingness to encourage the interaction and information flow between teams, and (ix) facilitating participatory decision making (Highsmith, 2004; Chow & Cao, 2008) are considered.

*$H4_0$: Top management's readiness positively influences the adoption of agile project management*

*$H4_a$: Top management's readiness does not positively influence the adoption of agile project management*

The fifth construct hypothesizes that team readiness (TEM_RED) positively influences the adoption of agile project management methods (H5). It focuses on building adaptive teams which are self-organized and self-disciplined (Highsmith, 2004). To test the hypothesis, H5, the influence of self-organizing and self-disciplined teams are considered. With respect to self-organizing teams, indicators such as (i) team comprises of right people with motivation and right competency (skills, attitude, and knowledge – business domain, project management), (ii) every individual understands the product vision, and team vision, (iii) project manager (Scrum Master) is willing to lead the team rather than control, (iv) existence of a high level of interaction and corporation among team members, (v) individuals who take responsibility for managing their workload among themselves, (vi) willingness to maintain healthier relationships with product owners, and (vii) team participation in decision making are considered. With respect to self-disciplined team, indicators such (vii) team's accountability for the results produced, (viii) trust and respect of team members ideas, (ix) team members confront reality through rigorous thinking, (x) free information flow and engagement in intense interaction and debate are considered (Highsmith, 2004).

*$H5_0$: Team's readiness positively influences the adoption of agile project management*

*$H5_a$: Team's readiness does not positively influence the adoption of agile project management*

The sixth factor hypothesizes that the environment readiness (ENV_RED) positively influences the agile project management in an organization (H6). In this regard, (i) rapidly changing business needs , (ii) rapidly changing technology, (iv) increasing use of agile software development methods (v) heavy use of agile project management practices by the competitors, (vi) pressure from the customers to use agile project management methods to manage innovative product development, (vii) availability of an increasing number of agile qualified practices in the industry, and (viii) dynamic and accelerated schedules, can be used as indicators to test the hypothesis.

*$H6_0$: Environmental readiness positively influences the adoption of agile project management*

*$H6_a$: Environmental readiness does not positively influence the adoption of agile project management*

### 3.3.2. Diffusion of innovation attributes

This research hypothesizes that relative advantage (REL_ADV) positively influences the adoption of agile project management practices (H7). The term 'relative advantage' refers to the degree to which innovation is perceived as being better than its predecessor (Roger, 2003), such as structured project management approach. To test the hypothesis H8, the staff's perceptions about the relative advantage of the agile project management over previously used approach is assessed. To measure relative advantage, the following indicators can be used: (i) increased customer satisfaction as a result of using agile approach, (ii) flexibility of the approach, (iii) not having to draw up a detailed plan upfront, (iv) less documentations work, (v) honoring regular work schedule – no overtime, (vi) short iterations resulting in working products, (vii) early identification of risk due to iterative development, (viii) self-disciplined teams rather than imposed discipline, and (ix) empowered teams.

*$H7_0$: Relative Advantage positively influences the adoption of agile project management*

*$H7_a$: Relative Advantage does not positively influence the adoption of agile project management*

The second DOI attribute hypothesizes that comparability (COMPATI) positively influences the adoption of agile project management practices (H8). Comparability refers to the degree to which an innovation is perceived as being consistent with the existing values and past experiences of an organization (Rogers, 2003). To test the hypothesis, staff's perceptions on the compatibility of the agile approach with the existing values and practices are considered. To test the hypothesis, staff's perceptions about (i) whether the organizational structure welcomes agile practices, (ii) whether organizational *culture* welcomes agile practices, (iii) development of customer relationships, and (iv) improvement of individuals' relationships are considered

*$H8_0$: Compatibility influences the adoption of agile project management*

*$H8_a$: Compatibility does not positively influence the adoption of agile project management*

The third DOI attribute hypothesizes that complexity (COMPLE) of using agile project management will negatively influence its adoption (H90). Rogers (2003) defines complexity as "the degree to which an innovation is perceived as relatively difficult to understand and use" (p. 15). It is argued that if the innovation is less complex than its predecessor, then individuals will adopt the innovation (Roger, 2003). In this regards staff's perceptions on (i) the easiness to implement the agile approach within the organization, (ii) flexibility of the approach, (iii) suitability of the approach to be used in IT projects, (iv) level of support available (eg: methodological champions) within the organization to implement the agile approach, and (v) the availability of training materials and resources to gain knowledge about agile project management.

*$H9_0$: Complexity negatively influences the adoption of agile project management*

*$H9_a$: Complexity does not positively influence the adoption of agile project management*

The final independent construct hypothesizes that observability (OBSERVE) positively influences the adoption of agile project management approach (H10). Rogers (2003) defines observability as "the degree to which the results of an innovation are visible to others" (p. 16). In this regard, (i) increased customer satisfaction as a result of using agile practices, (ii) increased employee satisfaction as a result of using agile practices, (iii) the number of successful projects completed using agile project management approach, (iv) level of product (or services) achieved through the project management process, (v) development of innovative and adaptable products, (vi) saving of time, cost and effort as a result agile project management approach. Table 3.1 summaries the elements in the framework.

*$H11_0$: Observability positively influences the adoption of agile project management*

*$H10_a$: Observability does not positively influence the adoption of agile project management*

Table 3.1: Summary of the elements in the hypothesized framework

| **Dimension/Sub-dimensions** | **Critical Factor** | **Indicators to Measure the Construct** |
|---|---|---|
| 1. Technological Context | **1.1.** Process Readiness | ○ Vision for the product, customer, and team<br>○ Feature based release, and iteration plan<br>○ Tested features in a short timeframe<br>○ Reviewing delivered results, current situation, and team performance<br>○ Handing over the project and passing along key learning |
| | **1.2.** Tools Readiness | ○ Using agile project management methodologies |

| Dimension/Sub-dimensions | Critical Factor | Indicators to Measure the Construct |
|---|---|---|
| | | ○ Using agile project management software packages<br>○ Using burn down charts to measure the performance<br>○ Maintaining product and sprint backlogs<br>○ Using agile software development methodologies<br>○ Using agile configuration management techniques |
| 2. Organizational Context | **2.1.** Organizational and Cultural readiness | ○ Supportive and cooperative organizational environment<br>○ Clearly defined roles for staff<br>○ Culture placing high value on face-to-face communication<br>○ Flexible and adaptive organizational culture<br>○ Culture that encourages experiments and exploration<br>○ Encouraging learning and learning through mistakes<br>○ Universal acceptance of agile methodology within the organization<br>○ Rewarding system for agile achievers |
| | **2.2.** Top Management Readiness | ○ Managers' knowledge in agile project management<br>○ Commitment to use agile project management<br>○ Implementing a leadership-collaborative management style |

| Dimension/Sub-dimensions | Critical Factor | Indicators to Measure the Construct |
|---|---|---|
| | | ○ Taking risk to promote innovation<br>○ Lean thinking<br>○ Motivating team to work outside norms<br>○ Empowering team<br>○ Encouraging the interaction and information flow between teams<br>○ Participatory decision making |
| | **2.3.** Team Readiness | Self-Organizing Team<br>○ Right people with motivation and competency<br>○ Individuals who understand the product vision, and team vision<br>○ Project managers who lead the team rather than control<br>○ High level of interaction<br>○ Taking responsibility for managing workload<br>○ Maintaining healthy relationships with product owners<br>○ Participation in decision making |
| | | Self-disciplined Team:<br>○ Accountable for the results<br>○ Trusting and respecting team members ideas<br>○ Confronting reality through rigorous thinking |

| Dimension/Sub-dimensions | Critical Factor | Indicators to Measure the Construct |
|---|---|---|
| | | ○ Free information flow and engagement in intense interaction and debate |
| 3. Environmental Context | 3.1. Environmental Readiness | ○ Changing needs of client<br>○ Changing technology<br>○ Use of agile software development methods<br>○ Use agile by competitors<br>○ Pressure from the customers<br>○ Increasing number of agile qualified people |
| 4. Diffusion of Innovation Constructs | 4.1. Compatibility | ○ Organizational structure welcomes agile practices<br>○ Organizational culture welcomes agile practices<br>○ Development of the customer relationships<br>○ Improvements of individuals' relationships. |
| | 4.2. Complexity | ○ Easiness to implement agile within the organization<br>○ Flexibility of the approach<br>○ Suitability of the approach to be used in IT projects<br>○ Level of support in organization |
| | 4.3. Observability | ○ Increased customer satisfaction as result of using agile practices<br>○ Increased employee satisfaction<br>○ Number of successful projects completed using agile project management approach |

| Dimension/Sub-dimensions | Critical Factor | Indicators to Measure the Construct |
|---|---|---|
| | | ○ Level of product (or services) achieved through the project management process<br>○ Development of innovative and adaptable products<br>○ Saving of time, cost and effort as a result agile project management approach. |

## 3.4. Summary

This chapter aims to develop the theoretical framework of the research. Based on the comprehensive review of literature on the critical factors for adopting agile project management, diffusion of innovation theory, and technology-organizational-environmental theory, the theoretical framework of the research is developed by addressing the limitations of existing research. The framework consists of two main dimensions, sub-dimensions, and a set of indicators for better identification of the critical factors adopting agile project management approach among IT firms in Sri Lanka. The theoretical framework developed in this chapter lays the foundation for designing the quantitative research methodology. In respect of the quantitative methodology, the dimensions, sub-dimensions, and indicators of the theoretical framework facilitate the construction of survey questionnaire which then will be used to collect data to test and validate the framework.

# CHAPTER 4: THE RESEARCH METHODOLOGY

## 4.1. Introduction

Research methodology is widely viewed as a systematic approach to addressing the research questions by collecting, analyzing and interpreting data (Hussey & Hussey, 1997). It also acts as a blueprint for the researcher towards achieving research objectives (Creswell, 2009). To facilitate the researcher, the research methodology proposes numerous research methods which can be employed for collecting, analyzing, and interpreting data (Creswell & Clark, 2011). Selecting a suitable research methodology, however, depends on the nature of the research questions to be answered by the researchers (Creswell & Clark, 2011).

This research aims to investigate the critical success factors for adopting agile project management approach in the ICT firms in Sri Lanka. To fulfill the aim of the research confirmatory type primary and secondary research questions are formulated. The confirmatory type research questions are generally answered through testing a theoretical framework hypothesized based on the literature reviewed (Onwuegbuzie & Leech, 2005). The confirmatory type research, therefore, suggests the adoption of a quantitative research methodology for the research (Teddlie & Tashakkori, 2006).

The primary objective of this chapter is to identify and implement a suitable research methodology for this research. For this purpose, first, various research methodologies and their respective research methods are reviewed with the intention of identifying suitable research methodology, followed by a discussion of the appropriateness of adopting a quantitative research methodology for this research. Then a discussion of how the quantitative research methodology would be implemented is presented, followed by a summary of the chapter.

## 4.2. Selection of a suitable research methodology

There are three verities of research methodologies commonly found in the literature. They are (1) qualitative, (2) quantitative, and (3) mixed-methods research methodologies (Creswell & Clark, 2011). Qualitative research methodology aims to obtain an in-depth understanding of the social world (problems) with the help of individuals' experiences, perspectives and histories (Ormston, Spencer, Barnard & Snape, 2013). For obtaining individuals' personal experiences and perspectives, qualitative research methodology employs various research methods such as focus groups, interviews, observations and document reviewing (Creswell & Clark, 2011). Data collected through such methods can be analyzed using content analysis, thematic analysis or grounded theory (Creswell, 2009).

Quantitative research methodologies are often based on theories (Creswell, 2009). It is about testing hypothesized theoretical models for answering research questions. To test these theories numerical data which represent individuals' viewpoints is commonly used. In many occasions, for obtaining individuals' perceptions, the survey research method is used (Teddlie & Tashakkori, 2006). Various statistical analysis techniques such as frequency analysis, regression analysis, and confirmatory factor analysis are commonly used for analyzing quantitative data.

In contrast to the quantitative and qualitative research methodologies, a mixed-methods research methodology uses a combination of the features of quantitative and qualitative research methodologies. It includes testing theoretical frameworks based on theories, and also exploring the reasons behind those theories (Woolley, 2009). In other words, numerical data collected through surveys, and descriptive data collected through interviews (or focus groups) are converged for answering the research questions (Creswell & Clark, 2011).

Qualitative, quantitative, and mixed-methods research methodologies have their own strengths and limitations. For example, on one hand, qualitative research methodology is appraised for its ability to obtain more a detailed view of the research problem with

the use of unstructured interviews. Quantitative research methodology, on other hand, is criticized for its inability to obtain a more detailed view of the research problem with the use of surveys (Creswell & Clark, 2011). However, qualitative research is criticized due to the influence of researcher's biases and personal interpretations on the views of the respondents. Quantitative research, on the contrary, is recognized to before of the researcher's personal biases (Creswell & Clark, 2011). Furthermore, qualitative research is criticized for its inability to produce generalizable findings for a larger population due to the use of a small sample while quantitative research is credited for its ability to produce findings that can be generalized (Creswell & Clark, 2011). Mixed-methods research methodology which combines the strengths of the qualitative and quantitative methodologies, however, relatively requires more time and resources to answer the research questions. This is due to the requirement of implementing both qualitative and quantitative methodologies to answer the research questions.

The primary research question formulated in this research is: *What are the critical success factors for adopting project agile project management techniques in IT projects in Sri Lanka?* The primary research question is an explanatory type research question (Creswell, 2009). Explanatory type research questions usually begin with 'what' (Creswell & Clark, 2011). Explanatory research involves testing a hypothesis to gauge the relationships with variables using statistical testing (Creswell & Clark, 2011). Research which involves testing prior hypothesized theoretical models to answer the research questions are also referred to as confirmatory research (Creswell, 2009). Therefore, the nature of this research is explanatory and confirmatory. Quantitative research methodology is recommended for explanatory and confirmatory type research (Creswell & Clark, 2011). This research therefore, adopts quantitative research methodology for answering the research questions.

## 4.3. Implementation of the quantitative research methodology

As shown in the Figure 4.1 this research beings with formulating the research questions. To adequately answer the research question, based on the comprehensive review of the relevant literature a theoretical framework is hypothesized in Chapter 3. As described in Chapter 3, the theoretical framework hypothesized identifies several critical factors that influence the adoption of agile project management approach in ICT firms in Sri Lanka. The hypothesized framework is further enhanced with the input of industry experts. About six (6) industry experts who are involved in agile projects were consulted for identifying any missing factors.

In order to test the hypothesized theoretical framework, the data will be collected using the quantitative research methods. For this purpose, a close-ended survey will be used. Use of close-ended survey is due to its easiness to code answers, to reduce confusion among the respondents in answering the questions as the possible answers are given, and to reduce unanswered questions due to respondents not knowing the answer (Bailey, 1994). A five point likert-type scale is employed in the survey questionnaire to obtain the responses. In the 5 point scale, 1 represents ‘not important at all’, 2 represents‘ not important’, 3 represents ‘neither important or not important’ (neutral), 4 represents ‘important’, and 5 represents ‘very important’. A sample survey questionnaire is attached in the Appendix I. The developed questionnaire is pre-tested with the help of few working colleges, and employees working in agile projects. Comments given by the participants are taken into account when revising the questionnaire.

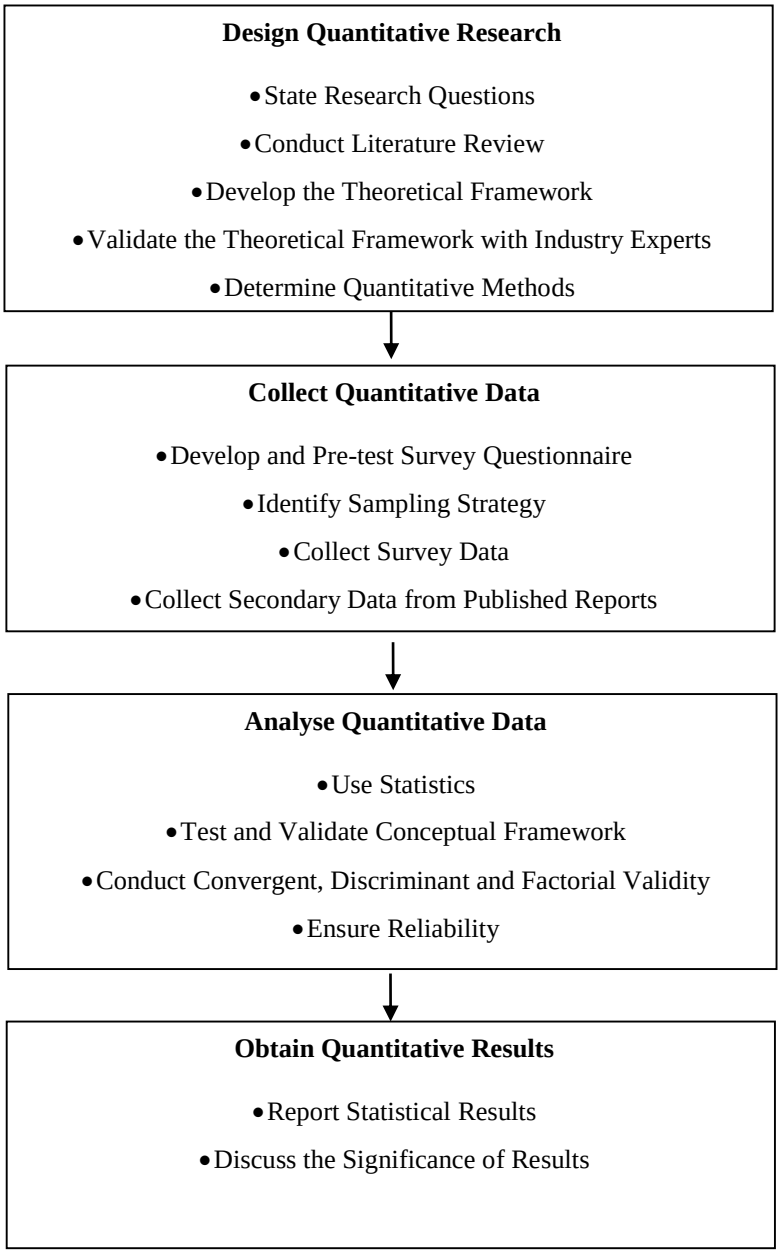


*Figure 4.1:* An overview of the quantitative research methodology

The National Work Force Survey (MGC, 2013), classifies the Sri Lankan ICT sector into three main groups, namely, (1) suppliers of ICT products and services (ICT companies), (2) suppliers of IT-enabled services (ITeS; BPO companies), and (3) ICT training organizations. The target population of this survey represents the first category, which is the firms supplying ICT products and services. Firms that are

involved in providing IT-enabled services and ICT training organizations are excluded from this research. Since in Sri Lanka the use of agile project management approach is relatively low in ICT companies (sources: from the consultation with industry experts), personal contacts are used to identify the firms which are using the agile project management approach. Moreover, the screening criterion for selecting participants for survey is the employees who are or have been involved in at least one agile project. Moreover, the participants represent the projects staff who are involved in analysis, designs, development, project and program management, and top level management staff.

## 4.4. Summary

This chapter aims to identify a suitable research methodology to answer the research questions formulated in the research. Having considered the nature of the research question, a quantitative research methodology is identified as the suitable methodology for answering the research questions. Adoption of this research methodology would help the researcher to identify the critical factors for adopting agile project management approach in Sri Lankan ICT industry by testing the hypothesized theoretical framework proposed in Chapter 3. The survey research method is used to collect data for testing the hypothesized framework. SEM will be used in this research for testing the hypothesized framework.

# CHAPTER 5: ANALYSIS OF DATA

## 5.1. Introduction

This research hypothised a theoretical framework by identifying critical factors for adopting agile project management techniques in Sri Lankan IT firms. The data collected through a survey is used for testing the hypothised theoretical framework for identifying the critical factors for adopting agile project management techniques. Structural Equation Modelling (SEM) techniques are used in this research for testing the hypothised framework.

This chapter presents an analysis of quantitative data which is collected through a survey. First, an implementation of survey is presented followed by a presentation of the overview of the data analysis technique used in this research. Then, an analysis of the demographic data with the use of SPSS is presented followed by a comprehensive analysis of survey data with the use of SEM techniques. Finally a summary of the findings is presented.

## 5.2. Conducting the survey

A paper based survey was deployed between December 2015 and April 2016. Four hundred (400) survey questionnaires were distributed. Researcher personally visited the selected organizations to distribute the survey. Participants were encouraged to fill the questionnaire on the spot. However, in many cases participants were not willing to complete the questionnaire on the spot, hence they were given a self-addressed envelope to return the questionnaire to the researcher. Follow ups were conducted with the help of researcher's personal contacts within those organizations.

For the 400 survey questionnaires distributed, 170 responses were received. Therefore, the response rate of this survey is 42.5% (Response rate is calculated by dividing the number of response by the number of survey questionnaires distributed). Among the responses, 12 responses were considered as incomplete as 50% of the survey questions

were unanswered, and therefore, removed from the analysis. Remaining Survey responses were recorded in SPSS for analysing data.

## 5.3. Overview of SEM

This research uses SPSS software to analyse demographic data of the survey responses. Moreover, SPSS software is used to identify missing values and outliers, and to apply procedures to eliminate them. Furthermore, normality of the data is also assessed with SPSS since normal distribution of the dataset is a precondition for SEM analysis.

SEM is widely regarded as one of the most powerful statistical data analysis techniques which is commonly used in testing hypothesized theoretical models which consist of a set of latent variables (unobservable variables) with relationships (hypothesises) among these variables (Hair, Black, Babin & Anderson, 2010). The pre-specified hypothesized theoretical model as shown in Figure 3.2 in Chapter 3 can be tested to examine to what extent the hypothesised model is supported by the sample data (Shumacker & Lomax, 2004). Using SEM in this research helps researcher to test how individual latent variables in a pre-specified hypothesized theoretical model are related to each other, and thus to examine the validity of the formulated hypotheses (Kaplan, 2009; Hair et al., 2010).

SEM is used in this research for several reasons. Its ability to test theories (which are represented in the form of latent variables and their relationships) is the primary motivation for using SEM in this research. Moreover, unlike most basic statistical packages, SEM can accommodate many latent variables to test complex theories (Shumacker & Lomax, 2004). This research adopts 11 latent variables. Existence of user friendly software packages to use complex SEM analysis is the final reasons for using SEM in this research. Analysis of Movement Structures (AMOS) software package allows researchers to model complex hypothesized theoretical models in graphical format and allow researchers to activate complex Greek and matrix notations in SEM by simply operating from menu options (Byrne, 2010).

SEM analysis commonly uses two models in analysing data. They are (1) measurement model, and (2) structural model (Byrne, 2010). The measurement model consists of a set of latent variables and a set of observed variables and their relationships (Hair et al., 2010). In this context, an observed variable is a variable which can be directly measured through a value obtained from the survey respondents. A latent variable is a variable that cannot be measured directly through a value obtained from the survey but measured through a set of observed variables. In contrast, the structural model depicts the relationships between latent variables.

Data analysis with the use of SEM is done in several stages. First, a measurement model is developed based on the hypothesized theoretical framework depicted in Figure 3.2. Secondly, unobserved (latent) variables are defined with the help of observed variables (indicator variables). Thirdly, the structural model is developed by specifying the paths (hypothesized relationships) between latent variables. Finally, the model is estimated with the use of data collected through the survey to test the validity and reliability of the model. In other words, it is examined to what extent the hypothesized theoretical model fits the sample data. To estimate the model, various Goodness of Fit (GOF) statistics are used.

GOF indices provide how well the model specified by the research reproduces the observed data (Hair et al., 2010). Chi-square (X2), normed X2 or the ratio of X2 to degree of freedom (X2/df), and the root mean square error of approximation (RMSEA) for example are some of the important GOF data used in the research (Brown, 2006; Byrne, 2010). As a rule of thumb, relatively small normed X2 value (<= 5), RMSEA value greater than 0.05 are used as cutoff points in this research.

### 5.4. Preconditions for SEM analysis

SEM assumes that the dataset is complete without any missing values or outliers, and is normally distributed (Byrne, 2010). Manual analysis of the survey questionnaires reveals that some respondent haven't answered a few survey questions, which led to having missing values in the SPSS dataset in a random manner. To address the issue

of missing values, missing values are replaced by performing maximum likelihood (ML) missing value imputation approach of SPSS (Brown, 2006).

With respect to a response given to a question, outliers are the extreme values in comparison to other data items in the dataset (Shumacker & Lomax, 2004). Since outliners can influence normality of the dataset, such extreme cases must be deleted from the analysis. Outliers are identified with the use of Boxplot analysis of SPSS. Outliers are delete and imputed a value with the use of ML approach.

SEM requires the dataset to be normally distributed for accurate results. Hence, the normality of the dataset is also assessed using SPSS by performing the Kolmogorov-Smirnov (K-S) test. For individual question items, K-S test is performed and significance values are generated. K-S significance data for all questionnaire items reveals that significance value are close to 0.000 as shown in Appendix II. It is therefore, concluded that the dataset is not normally distributed, and hence appropriate procedures are to be applied (Hair et al., 2010).

To address the issues of non-normality of the dataset, several procedures are applied, namely, Maximum Likelihood (ML), and Bootstrapping procedures (Bryne, 2010). ML parameter estimation technique is widely regarded as a robust approach for estimating SEM models with non-normally distributed data (Bryne, 2010). Moreover, as another remedy for non-normality of the dataset, bootstrapping procedures are applied. Once applied, bootstrapping generates sub-sample within original sample, and hence facilitates researchers to use SEM with non-normally distributed data (Bryne, 2010). Application of ML and Bootstrapping procedures are done by using AMOS during model estimation.

### 5.5. Analysis of demographic data

Analysis of the demographic data is done with respect to (1) gender, (2) age profile, (3) industry profile, (4) organizational profile, (5) designation profile, (6) educational profile, (7) domain specific knowledge perspective, and (8) domain specific

experience. Figure 5.1 shows the gender profile of the respondents. As shown in the Chart, 67% respondents are male, and 33% are female. Analysis of respondents' age profile, shown in the Figure 5.2, reveals that a majority of the respondents are in the young and middle age groups. That is 51% are in the age group of 20-30 years, 43% are in the age group of 31-40.

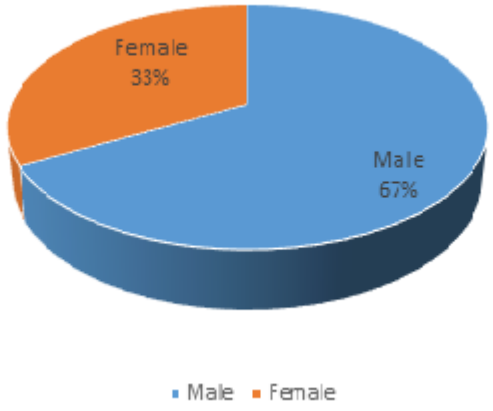


*Figure 5.1:* Gender profile of the respondents

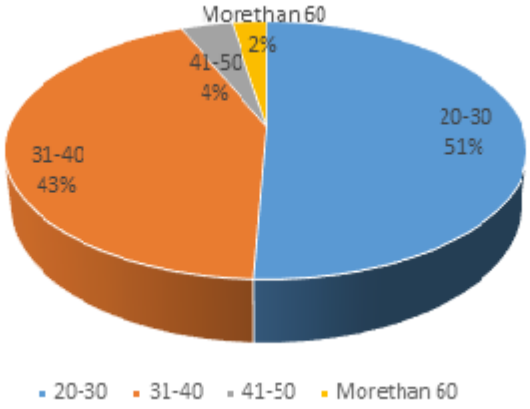


*Figure 5.2:* Age profile of the respondents

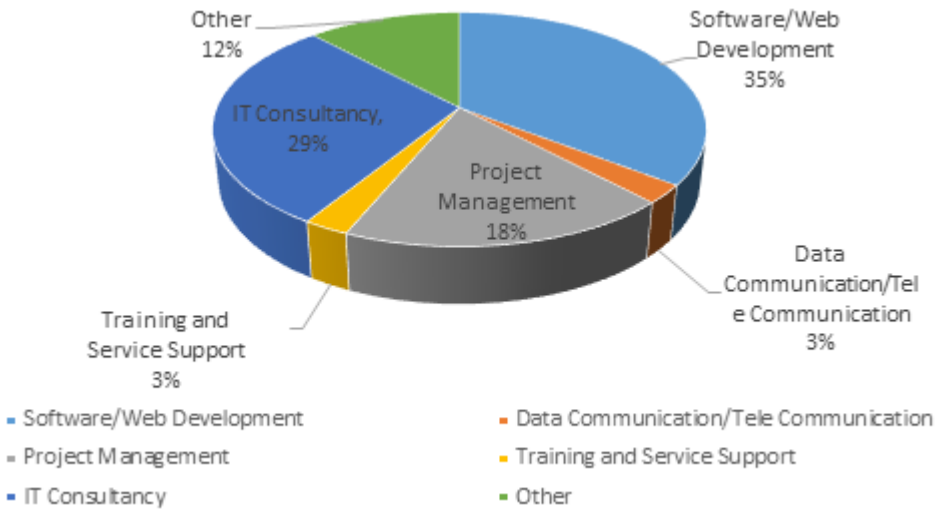


*Figure 5.3:* Industry profile of the respondents

Analysis of respondents' role in their organizations (shown in figures 5.4 and 5.5) reveals that a majority of the respondents are employed as IT Engineers. 15% are designated as project managers, 5% are working as team leaders, and 1% are employed as program managers. An analysis of the respondents' formal educational qualifications reveals that 42% have an undergraduate degree and 39% have post graduate qualifications. 19% have professional qualifications. Figure 5.6 shows respondents' formal educational qualifications.

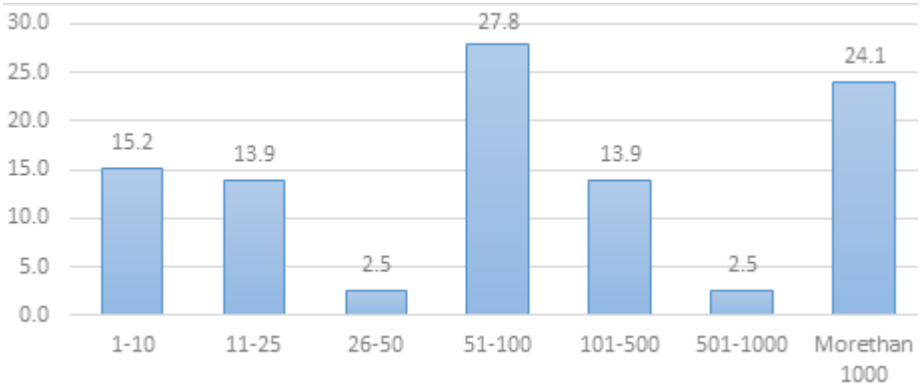


*Figure 5.4:* Organizational profile of the respondents

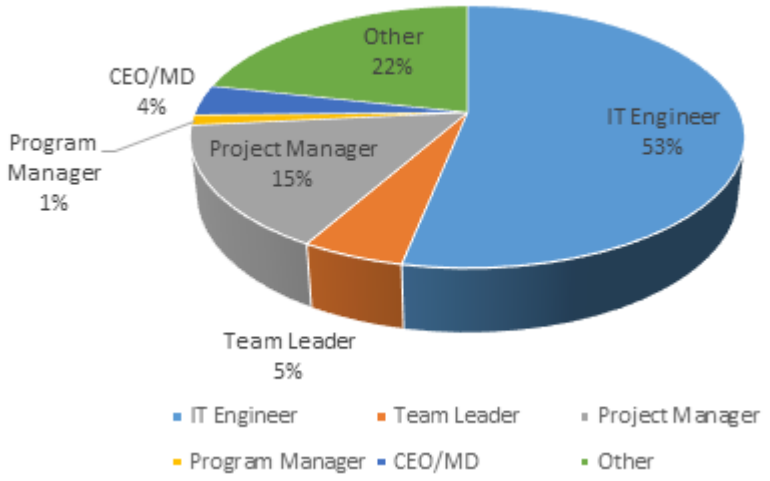


*Figure 5.5:* Designations of the respondents

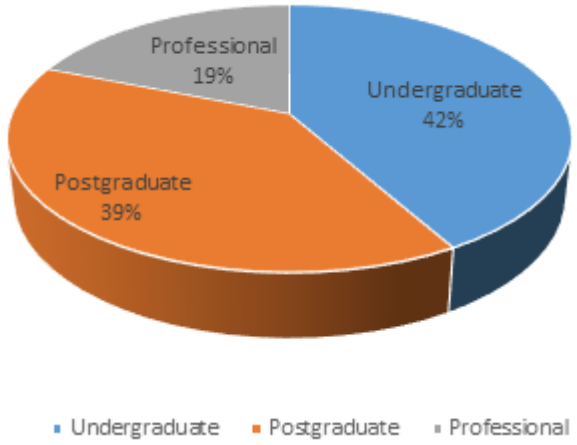


*Figure 5.6:* Educational profile of the respondents

Analysis of respondents' domain specific knowledge and experience reveals respondents' formal training on agile project management techniques. As shown in Figure 5.7, 28% of the survey respondents have been trained on agile project management, and 5% have formal certification as agile practitioners. However, a majority (67%) do not have formal qualifications on agile. Moreover, respondents experience with agile project management methods are analysed and presented in the

Figure 5.8. As shown in the Figure, 86% have 1-5 years of experience in agile, 10% have 5-10 years of experience in agile.

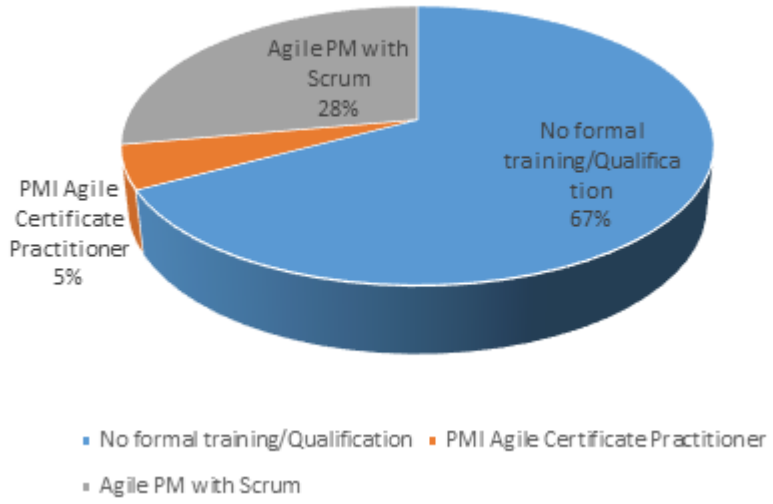


*Figure 5.7:* Domain specific knowledge of respondents

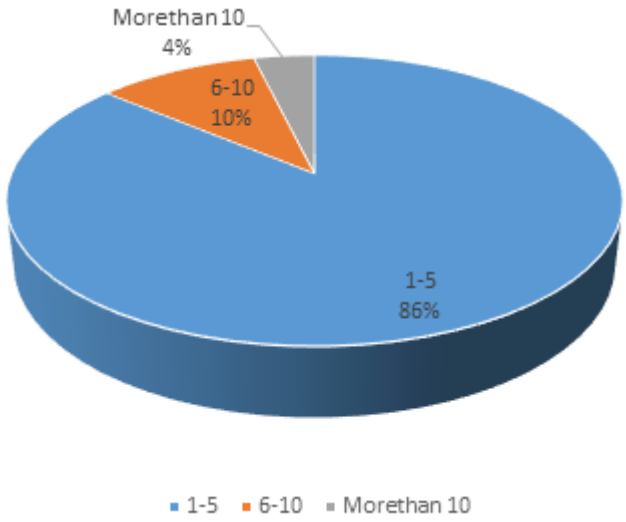


*Figure 5.8:* Domain specific experience of respondents

## 5.6. Reliability of the questionnaire items

Reliability of the questionnaire is a pre-condition for SEM analysis. Reliability generally refers to the internal consistency of a survey questionnaire (Mora, 2016). It

measures the degree to which different questions or statements measure the same characteristic of a survey questionnaire (Mora, 2016). That is, with the use of reliability measurement methods, it can be examined whether a set of observed variables can sufficiently represent an unobserved variable. With the reliability measurement methods, for example, survey questionnaire items Q11a to Q11b can be examined to find out whether these indicators sufficiently represent the Process Readiness factor.

To measure the reliability of the survey, Cronbach's alpha (α) methodology is commonly used (George & Mallery, 2011). Cronbach's α value closer to 1.00 means, unobserved variables of a particular observed variable have a greater consistency, and therefore a greater reliability has been achieved. As a rule of thumb, a Cronbach's α value greater than 0.80 indicates that the questionnaire items of a particular unobservable variable is reliable (Nunnally, 1978). SPSS is used in this research for generating Cronbach's α values. Table 5.1 shows the Cronbach's α values of the survey questionnaires.

Table 5.1: Reliability of the survey questionnaire

| **Unobserved Variable (factor)** | **Questionnaire Items** | **Cronbach's Alpha (α)** | **Reliability (α > 0.800)** |
|---|---|---|---|
| Process Readiness | Q11a – Q11e | 0.551 | Insignificant |
| Tools Readiness | Q12a – Q12e | 0.659 | Insignificant |
| Product Measurement Readiness | Q13a – Q13c | 0.790 | Insignificant |
| Organizational Readiness | Q14a – Q14g | 0.811 | Significant |
| Management Readiness | Q15a – Q15g | 0.836 | Significant |
| Team Readiness | Q16a – Q16h | 0.836 | Significant |
| Environment Readiness | Q17a – Q17e | 0.644 | Insignificant |
| Relative Advantage | Q18a – Q18h | 0.891 | Significant |
| Compatibility | Q19a – Q19d | 0.849 | Significant |
| Complexity | Q20a – Q20e | 0.799 | Insignificant |
| Observability | Q21a – Q21f | 0.868 | Significant |
| Agile Adoption | Q22a – Q22f | 0.846 | Significant |

Analysis of the Cronbach's α value for each unobserved variable (factor) reveals that Process Readiness, Tool Readiness, Product Measurement Readiness, Environment Readiness, and Complexity are insignificant due to insufficient α valued (α < 0.800). This means those unobserved variable are not reliable, hence, need to be dropped from further analysis. Remaining factors are taken for the analysis.

## 5.7. SEM analysis

### 5.7.1. Initial full measurement model

For SEM analysis, the full measurement model is constructed as shown in Figure 5.9. In this model, all observed variables (hereinafter latent factors) are depicted by ovals. The latent factors in the measurement model, namely, management readiness (MGT_READ), organizational cultural readiness (ORG_CUL_READ), observability (OBSERVE), team readiness (TEAM_READI), comparability (COMP_VALUE), relative advantage (RELA_ADVAN), and adoption of agile project management (ADOPTION_OF_AGILE).

As shown in the Figure 5.9, six indicator variables which are shown in rectangles (Q21a, Q21b, Q21c, Q21d, Q21e, and Q21f) are postulated to load on the latent factor OBSERVE. Seven indicator variables (Q14a, Q14b, Q14c, Q14d, Q14e, Q14f, and Q14g) are loaded on the latent factor variable ORG_CUL. Indicator variables Q15a, Q15b, Q15c, Q15d, Q15e, Q15f, and Q15g are loaded on the latent factor MGT_READ. Q16a, Q16b, Q16c, Q16d, Q16e, Q16f, Q16g, and Q16h are loaded the factor TEAM_READ factor. Q18a, Q18b, Q18c, Q18d, Q18e, Q18f, Q18g, and Q18h are loaded on the latent factor RELA_ADVAN. The latent factor COMPATI is loaded with four indicator variables namely, Q19a, Q19b, Q19c, and Q19d. The dependent variable ADOPTION_OF_AGILE is loaded with five indicator variables, namely, Q22a, Q22b, Q22c, Q22d, and Q22e. Moreover, in the measurement model, the factor ADOPTION_OF_AGILE depends on latent variables OBSERVE, ORG_CUL, MGT_RED, TEAM_RED, REL_ADV, and COMPATI.

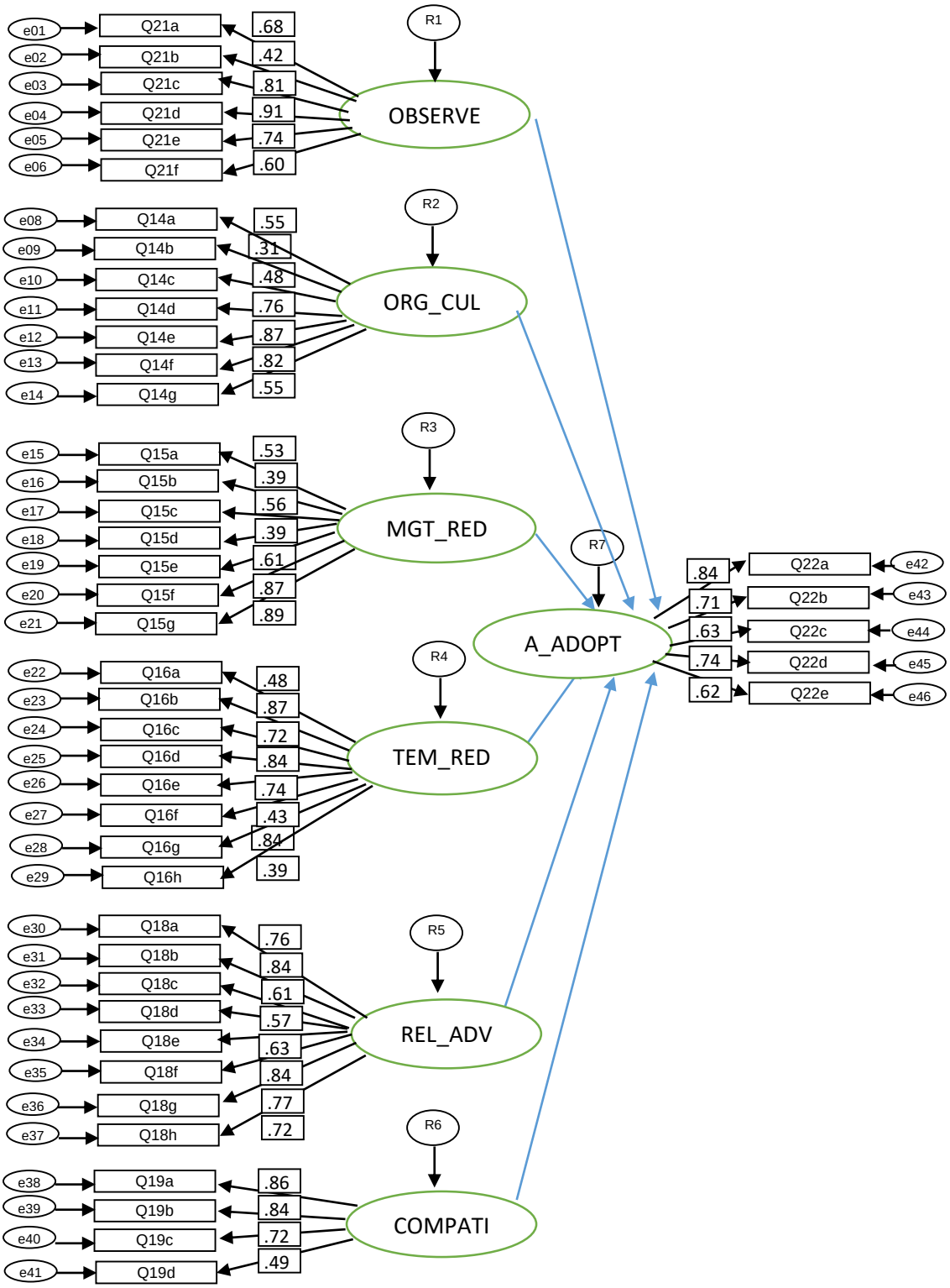


*Figure 5.9:* Initial full measurement model

The initial measurement model is estimated using SEM. The initial measurement model fails to meet adequate GOF measures. It is reflected through poor GOF indicators including CHIN/DF value of 6.954, and RMSEA value of 0.000. In general, relatively small CHIN/DF value (close to 4), and RMSEA value 0.05 indicate an adequate fit (Hair et al., 2010). It is therefore, concluded that initial measurement model required revisions.

### 5.7.2. Model revision

The model revision begins with decomposing initial measurement model to seven (7) one factor congeneric measurement models. One-factor congeneric measurement model consists of an unobservable variable and its respective observable variables. First, as shown in Figure 5.10, a one-factor congeneric measurement model is developed for unobserved variable OBSERVE by loading six indicator variables namely, Q21a, Q21b, Q21c, Q21d, Q21e and Q21f.

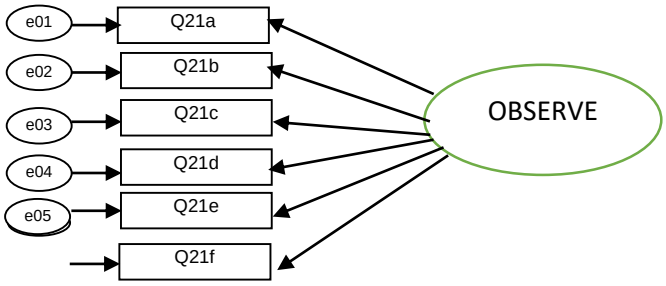


*Figure 5.10:* Initial one factor congeneric measurement model for factor OBSRVE

One-factor congeneric measurement model is estimated and GOF indicators are obtained. The initial one factor congeneric measurement model of OBSERVE has a CHIN/DF value of 7.304, and RMSEA value of 0.284. A higher CHIN/DF indicates inadequate fit and therefore, the model is re-specified by following several model diagnostic techniques. Model diagnostic techniques include standardized factor loading (SFL), modification indexes (MI), and GOF cut off values (Hair et al., 2010). SFL is the first model diagnostic technique used in this research. In general SFL value of 0.5 for an observed variable indicates, that particular variable does not explain the

factor well. In such cases item can be deleted. MI is the second diagnostic tool used in this research. MI shows that to what extent, CHIN/DF can be improved if a particular observed variable is freed from analysis (Hair et al., 2010). In this case, a larger MI value (4) shows that model can be improved if that particular indicator variable is eliminated from the analysis. GOF cut off values are the third model diagnostic technique used in this research. Smaller CHIN/DF value, and RMSEA value greater than 0.5 indicate a sufficient fit.

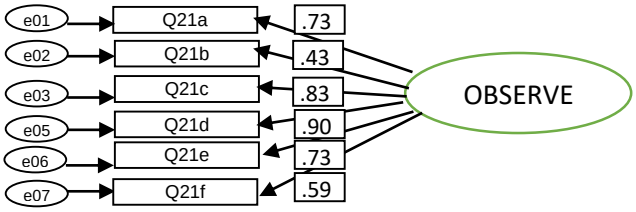


*Figure 5.11:* Estimated one factor congeneric measurement model for factor OBSRVE

As shown in the Figure 5.11, SFL for item Q21b has a relatively low SFL (0.43), which is below the threshold 0.50. Therefore, Q21b is deleted from the model. Model is re-estimated and GOF statistics were obtained as follows. RMSEA value is well above 0.05 and CHIM/DF is approaching 2.0 (5.829) which is much better than original model CHIN/DF (7.304). Therefore, model is not further modified. Revised one-factor congeneric measurement model is depicted in the Figure 5.12.

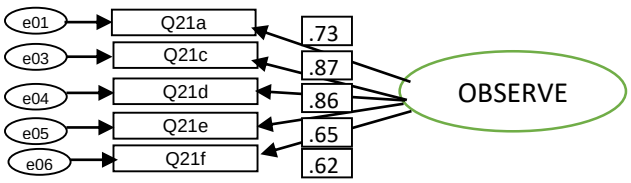


*Figure 5.12:* Revised one factor congeneric measurement model for factor OBSRVE

Similarly, one-factor congeneric measurement model is developed for ORG_CUL factor as follows. Model is estimated and obtained GOF results. The initial one-factor model has sufficient GOF results, reflected through RMSEA value of 0.131, and CMIN/DF value of 2.344. However, as shown in Figure 5.13, Q14b and Q14c have showed inadequate SFLs (0.32 and 0.47 respectively). Therefore, these two items are

deleted from the analysis and GOF results are obtained. Re-specified model has indicated sufficient adequate fit, reflected through RMSEA value > 0.081 and CMIN/DF value of 1.507. Figure 5.14 shows revised one factor measurement model.

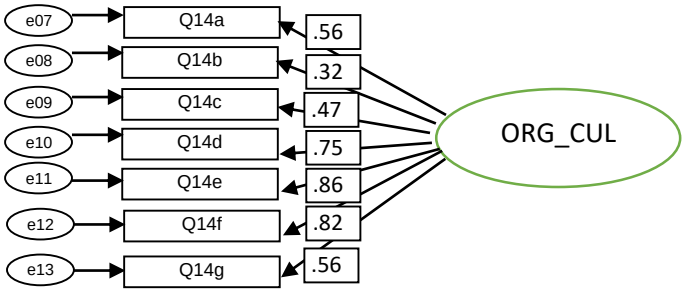


*Figure 5.13:* Initial one factor congeneric measurement model for factor ORG_CUL

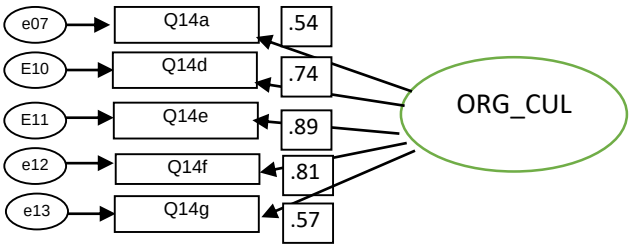


*Figure 5.14:* Revised one factor congeneric measurement model for factor ORG_CUL

Similarly other one-factor congeneric measurement models are developed and examined for their GOF. Table 5.2 provides a comparison of GOF statistics of initial and re-specified models. As shown in the Table, all re-specified one factor models have reach sufficient GOF to the data.

Table 5.2: GOF statistics of initial and revised one factor measurement models

| **Factor** | **Initial Model** | | **Revised Model** | |
|---|---|---|---|---|
| | RMSEA | CHIN/DF | RMSEA | CHIN/DF |
| TEAM_REA | 0.148 | 2.705 | 0.101 | 1.790 |
| REL_ADV | 0.225 | 4.935 | 0.137 | 2.461 |
| COMPATI | 0.455 | 17.179 | 0.239 | 5.466 |
| A_ADOPT | 0.197 | 4.055 | 0.000 | 0.980 |

### 5.7.3. Convergent validity of the factors

The one-factor congeneric measurement models which have demonstrated sufficient GOF are taken for discriminant validity. All the re-specified one-factor congeneric models are tested for convergent validity. Convergent validity examines the extent to which "indicators of a specific construct converge or share a high proportion of variance in common" (Hair et al., 2010, p 670). Convergent validity is commonly examined by examining the average variance extracted (AVE) (Hair et al., 2010). AVE is calculated as the total of squared SFLs divided by the number of variables in the factor (Hair et al., 2010). In general, an AVE at 0.5 or higher is adequate for the convergent validity (Hair et al., 2010).

As shown in the Table 5.3, factors OBSERVE (0.56), ORG_CUL (0.52), MGT_RED (0.56), REL_AD (0.59), COMPATI (0.64), TEAM_RED (0.60), and A_ADOPT (0.52) have sufficient convergent validity reflected through AVE cut off value greater than 0.5. All these factors are therefore taken for defining the final measurement model. Table 5.3 show the convergent validity test results.

Table 5.3: Convergent validity test results

| Factor | Item and SFL | AVE | Factor | Item and SFL | AVE |
|---|---|---|---|---|---|
| OBSERVE | Q21a: 0.73 | 0.56 | REL_ADV | Q18a: 0.71 | 0.59 |
| | Q21c: 0.83 | | | Q18b: 0.79 | |
| | Q21d: 0.87 | | | Q18e: 0.62 | |
| | Q21e: 0.65 | | | Q18g: 0.81 | |
| | Q21f: 0.62 | | | Q18h: 0.75 | |
| ORG_CUL | Q14a; 0.54 | 0.52 | | Q18f: 0.89 | |
| | Q14d: 0.74 | | COMPATI | Q19a: 0.84 | 0.64 |
| | Q14e: 0.89 | | | Q19b: 0.86 | |
| | Q14f: 0.81 | | | Q19c: 0.68 | |
| | Q14g: 0.57 | | A_ADOPT | Q22a: 0.84 | 0.52 |
| MGT_RED | Q15a: 0.50 | 0.56 | | Q22b: 0.71 | |
| | Q15e: 0.56 | | | Q22c: 0.65 | |
| | Q15f: 0.94 | | | Q22d: 0.74 | |
| | Q15g: 0.88 | | | Q22e: 0.64 | |
| | Q15c: 0.54 | | | | |
| TEM_REA | Q16b: 0.89 | 0.60 | | | |
| | Q16c: 0.73 | | | | |
| | Q16d: 0.84 | | | | |
| | Q16e: 0.76 | | | | |
| | Q16h: 0.63 | | | | |

### 5.7.4. Defining the final measurement model

All re-specified one-factor congeneric measurement models which have successfully earned adequate GOF scores, and pass convergent validity test are taken for reconstructing the revised full measurement model. Revised full measurement model is constructed as shown in the Figure 5.15. The revised final measurement model is estimated and GOF data is obtained. The final measurement model shows sufficient validity with a RMSEA value of 0.185 of and a CMIN/DF value of 6.369.

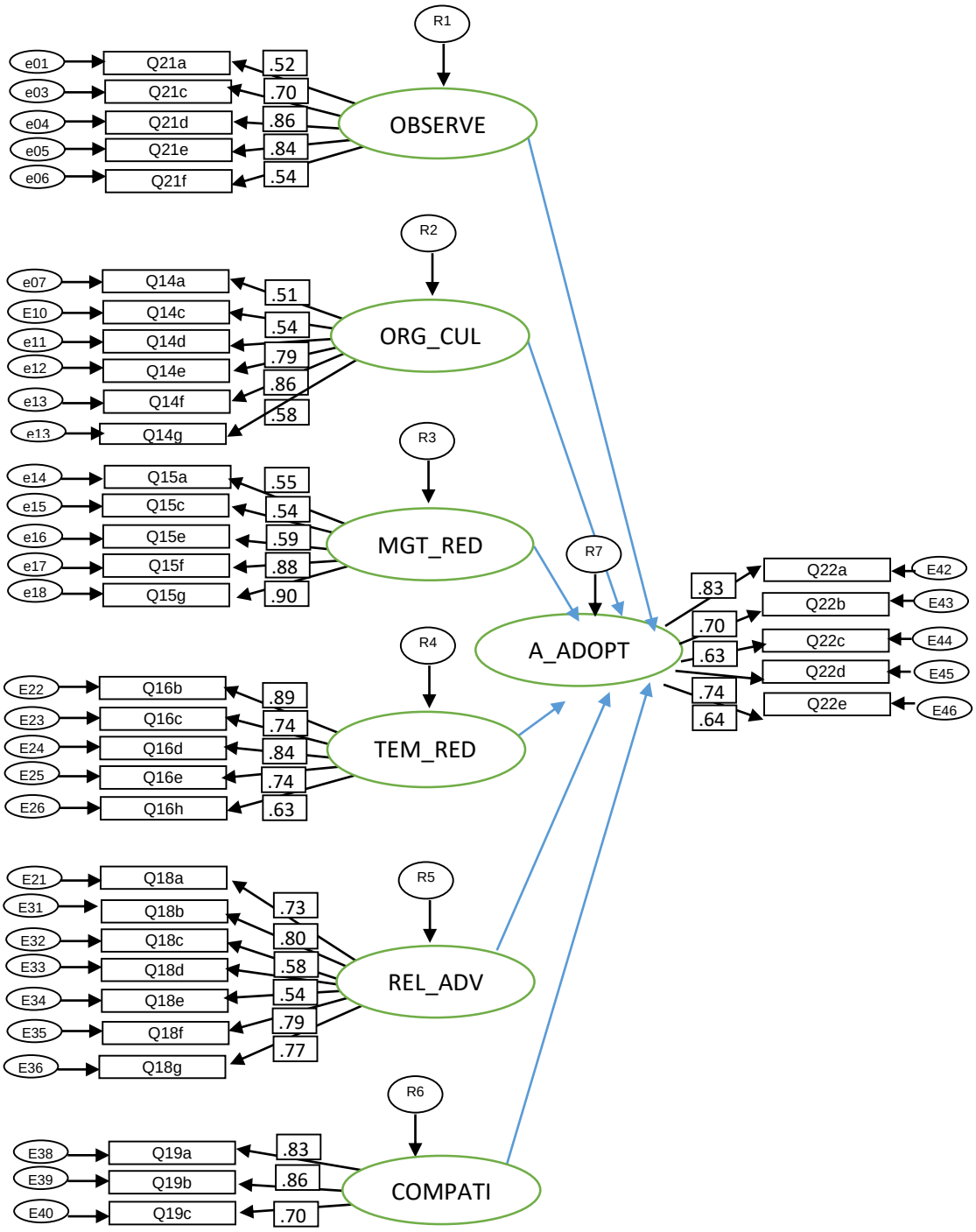


*Figure 5.15:* Final measurement model

## 5.8. Summary

This chapter presented an analysis of the data collected through the survey. Demographic data was analysed first using SPSS, followed by a comprehensive analysis of respondents' perceptions on agile adoption using SEM. SEM analysis is performed in two stages; in the first stage the initial measurement model is developed tested. The second stage of SEM analysis, namely the development of the structural model and analyzing data to test hypotheses is done in the next chapter.

# CHAPTER 6: DISCUSSION OF RESEARCH FINDINGS

## 6.1. Introduction

In the previous Chapter, a theoretical framework was tested using the survey data collected through a survey. GOF statistics reveals that the hypothesised framework fits data sufficiently, and therefore, the validity of the hypotheses can be assessed by examining the statistical significance of the paths of the structural model. The structural model shows the relationships between different variables, which are formulated in terms of hypotheses.

This Chapter aims to present a discussion of the findings. For this purpose, the validity of the hypotheses formulated in this research are critically examined by developing a structural model using AMOS. With the use of statistics generated through the AMOS software, hypotheses are tested for their validity and conclusions are arrived based on the hypothesis test results. Finally, key research questions are answered and recommendations are made.

## 6.2. Testing hypotheses

Hypotheses in the theoretical model depicted in Figure 3.2 of Chapter 3 are examined with the help of the structural model. The structural model shows the relationships between factors (formulated as hypotheses in Chapter 3) and their significance. As shown in the Figure 6.1, there are six structural paths between six independent variables (OBSERVE, ORG_CUL, MGT_RED, TEM_RED, REL_ADV, and COMPATI) and the dependent variable A_ADOPT. The six structural paths are OBSERVE → A_ADOPT, ORG_CUL → A_ADOPT, MGT_RED → A_ADOPT, TEM_RED → A_ADOPT, REL_ADV → A_ADOPT, and COMPATI → A_ADOPT. Statistical significance of paths are examined with the help of statistics generated from AMOS. Figure 6.1 shows the Structural model.

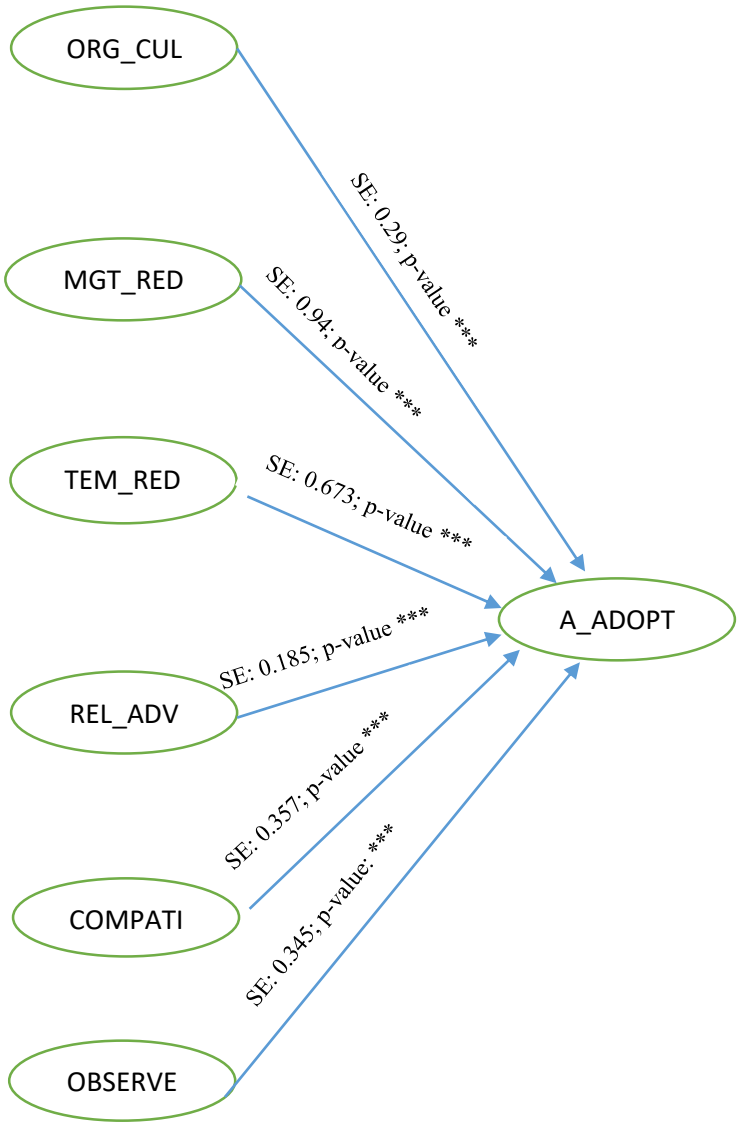


*Figure 6.1:* Structural model

To validate the hypotheses, Critical Ratio (CR) and P-values (P) are examined. To prove a hypothesis CR values higher than ± 1.96, and P-values less than 0.05 are considered as adequate (Bryne, 2010). In Table 6.1, P-values less than 0.05 and close to 0.00 are denoted by three stars (***). Estimate shows the strength in relationship between two factors. Table 6.1 summarizes the structural paths and their statistical significance.

Table 6.1: Significance of the structural paths

| Structural Path | Estimate (Degree of the Relationship) | Critical Ratio (C.R). | P > 0.05 | Significance |
|---|---|---|---|---|
| ORG_CUL → A_ADOPT | .293 | 3.511 | *** | Yes |
| MGT_READ → A_ADOPT | .940 | 9.387 | *** | Yes |
| TEM_RED → A_ADOPT | .673 | 4.869 | *** | Yes |
| REL_AD → A_ADOPT | .185 | 3.581 | *** | Yes |
| COMPATI → A_ADOPT | .357 | 6.134 | *** | Yes |
| OBSERVE → A_ADOPT | .345 | 4.176 | *** | Yes |

The hypotheses H1, H2, H6, and H9 which predict process readiness, tools readiness, environment readiness, and complexity have an effect on the adoption of agile project management in IT firms, were neither proved nor rejected in this research. This is due to the poor reliability of the factors as noted in Table 5.1 of Chapter 5. During the analysis of the reliability of the survey questions these factors are dropped from the analysis. Remaining hypotheses, H3, H4, H5, H7, H8, and H10 are tested in this Chapter to derive conclusions.

Hypothesis H3 is as follows; *$H3_0$: Organizational readiness positively influences the adoption of agile project management.*

AMOS statistics reveal that there is a positive and statistically significant relationship between organizational cultural readiness and agile adoption. As shown in Table 6.1, and in path ORG_CUL → A_ADOPT shown in the structural (Figure 6.1), CR value (3.511) is greater than ± 1.96 with a P-value of < 0.05 (which is denoted by ***). This reflects a statistically significant relationship. This reveals that organizational cultural readiness positively influence the adoption of agile project management, and therefore, this research fails to reject the null hypothesis *H30*.

*$H4_0$* is as follows; *Top management's readiness positively influences the adoption of agile project management.*

Statistics for path MGT→ A_ADOPT shows a statistically significant relationship. It is reflected through a CR value higher than ± 1.96 (9.387), and a P-value of less than 0.05. Therefore, this research also fails to reject the null hypothesis *$H4_0$*. This reveals that top management's readiness positively influences the adoption of agile project management in an organization.

*$H5_0$* hypotheses that *a Team's readiness positively influences the adoption of agile project management.*

Statistics for the structural path TEM_RED → A_ADOP shows a CR value of 4.869 which is greater ± 1.96 with a P-value greater than 0.05. This indicates a strong statistical significant relationship. This research, therefore, fails to reject *H50* as well and leads to the conclusion that team readiness positively influence the adoption of agile project management.

*$H7_0$* hypotheses that r*elative advantage positively influences the adoption of agile project management.*

Statistics show a statistically significant relationship for the structural path REL_AD → A_ADOP. A significant CR value (3.581), and a P-value greater than 0.05 reveal that the research fails to reject *$H7_0$*. Thus, this research reveals that people tend to use agile approach due to its ability to provide more benefits over the traditional approach.

*H80* hypotheses that people tend to adopt agile approach if this approach is compatible with existing values and practices. Thus, *H80 is Compatibility influences the adoption of agile project management*

Statistics for structural path COMPATI → A_ADOP shows a CR value of 6.134 which is greater than 1.96 and a P-value greater than 0.05. This indicates strong statistical

support for $H8_0$ and therefore, this research fails to reject *H80* as well. This leads to the conclusion that people tend to use agile approach because it is compatible with existing values and practices in the organization.

$H10_0$ is as follows: *Observability positively influences the adoption of agile project management*

Statistics for structural path OBSERVE → A_ADOP shows a CR value of 4.176 that is greater 1.96 and a P-value greater than 0.05. This indicates strong statistical support for $H10_0$, and therefore, the research also fails to reject $H10_0$. Thus, it can be concluded that people tend to use agile approach if the result of the adoption of agile approach can be easily observed and communicated to others. Table 6.2 summarizes the hypothesis test results.

Table 6.2: Hypothesis test results

| **Hypothesis** | **Structural Path** | **Null Hypothesis (*H0*) Supported** |
|---|---|---|
| $H3_0$ | ORG_CUL → A_ADOPT | Yes |
| $H4_0$ | MGT_READ → A_ADOPT | Yes |
| $H5_0$ | TEM_RED → A_ADOP | Yes |
| $H7_0$ | REL_AD → A_ADOP | Yes |
| $H8_0$ | COMPATI → A_ADOP | Yes |
| $H10_0$ | OBSERVE → A_ADOP | Yes |
| $H1_0$ | N/A | Nether supported nor rejected * |
| $H2_0$ | N/A | Nether supported nor rejected * |
| $H6_0$ | N/A | Nether supported nor rejected * |
| $H9_0$ | N/A | Nether supported nor rejected * |
| * Factor associated with the hypothesis is dropped during the validity assessment of survey questionnaire | | |

## 6.3. Summary

This Chapter presented a discussion of findings. A structural model was developed in this chapter using SEM and the validity of the hypotheses were assessed by examining the statistical significance of the paths in the structural model. In the next chapter research questions formulated in this research will be revisited and answered.

# CHAPTER 7: CONCLUSION

## 7.1. Introduction

The primary aim of this research is to investigate the critical success factors for adopting agile project management practices in the private sector IT projects in Sri Lanka. To fulfil the aim of the research, a primary research question was formulated as follows: *What are the critical success factors for adopting project agile project management techniques in IT projects in Sri Lanka?* To facilitate answering the primary research question, four secondary research questions were developed including (a) *How do agile project management practices differ from traditional project management practices?*, (b) *What factors are considered in the literature as the critical factors for successful adoption of agile project management techniques?*, (c) *What is the appropriate framework for adopting agile project management techniques in IT companies in Sri Lanka?*, and (d) *What recommendations can be made for successful adoption of agile project management techniques in IT firms?*

To answer the research questions adequately, quantitative research methodology was adopted. A theoretical framework which hypothesizes critical factors for adopting the agile project management approach in IT firms was developed based on the review of literature. With the use of SEM, the hypothesized theoretical framework was tested using the survey data collected through a survey. Tested theoretical framework was used in this research to test a set of hypotheses formulated in this research. This enabled to answer which aimed at answering a set of research questions (namely, the primary research question, and subsidiary research question (c) and (d) as formulated above). Research question (a) and (b) are answered in the Literature Review Chapter 2 of this research.

## 7.2. Revisiting research questions

The aim of this study is to identify the critical factors for adopting agile project management practices in IT firms in Sri Lanka. In order to fulfil the aim of the research a set of objectives are defined. They are to (1) examine the difference between the agile and traditional project management approaches, (2) identify most influencing factors that affect the adoption of agile project management approach worldwide, (3) develop a theoretical framework by hypothesizing the critical factors for adopting agile project management approach, and (4) provide recommendations for IT organizations for successfully adopting agile project management practices.

To fulfil the research objectives of the study, first a comprehensive review on the literature is carried out with a focus on identifying the difference between agile and traditional approaches, and identifying the most influencing factors that affect the adoption of agile project management. Based on the factors identified in the literature, a hypothetical framework was developed by hypothesising the critical factors. The hypothesised framework was tested in this research with the use of survey data collected in Sri Lanka to identify the most important factors that influence the adoption of agile project management in Sri Lanka. Based on the findings, recommendations were made for IT organizations in Sri Lanka for successfully adopting agile project management practices in Sri Lanka.

The following sections present a summary of the research finding by revisiting research questions.

### 7.2.1. The difference between agile and traditional project management

(a) *How do the agile project management practices differ from traditional project management practices?*

Section 3 and 4 of the Literature Review (Chapter 2), present a detailed discussion on how agile project management differs from the traditional project management approach. Following section presents a summary of the research finding by answering the research question as formulated above.

In summary, traditional project management is focused more on processes. Traditional project management approaches such as PMBOK and PRINCE consist of clearly defined processes. It is essential to follow these processes for better results. Unlike the traditional approach, agile approach recommends simple processes which takeout detailed and rigid tasks. This enables the product to be developed fast and innovatively. Since processes are simple, people are given more freedom to be innovative, interactive and collaborative. Therefore, the focus of agile is more people centric rather process centric.

Structured project management approach focuses on linearity. That is, it depends on hierarchical and linear task relations. The planning of the project, therefore, discourages incorporating substantial changes during the execution phase of the plan. Changes to the plans are usually recommended at the end of each phase. In contrast, agile approach focusses on an iterative approach. Short and iterative delivery cycles enable managers to respond more easily to changing demands of clients and the marketplace (Goodpasture, 2011). Therefore, it can accommodate changes to plans anytime. Moreover, in this approach project plans are developed in a more collaborative manner, rather than by a project management unit or by a department. Furthermore, tools used by agile teams are based on more visual forms rather than on textual descriptions. Table 7.1 presents a comparison of structured and agile project management approaches (Conforto et al., 2014).

Table 7.1: Agile project management approach vs traditional project management

| Aspect Evaluated | Structured Project Management | Agile Project Management |
|---|---|---|
| Focus | Process centric | People centric |
| Management style | Command and control | Leadership and collaborative |
| Project lifecycle | Structured, sequential steps | Iterative and incremental |
| Project planning approach | Detailed then revised | Developed by iteration |
| Project plan updating frequency | End of each phase | Weekly |
| Project planning responsibility | Created by a department or the project management office | Created collaboratively; shared Responsibility |
| Project plan's progress and updating responsibility | Department or project management office's responsibility | Shared responsibility |
| Tools used to communicate the project plan | Use of project scheduling tools, such as Gantt charts or WBS | Use of visual panels and boards, pictures, drawings, and so forth |
| Project scope description (detailing) | Purely textual and detailed | Minimal textual description |

Source: (Adapted from Conforto et al., 2014)

(b) *What factors are considered in the literature as the critical factors for successful adoption of agile project management techniques?*

Section 5 of the Literature Review Chapter (Chapter 2) presents a detailed discussion of critical factors for the adoption of agile project management approach. In summary, commonly found critical factors are, (1) organizational factors which focus on the management's commitment and the organizational environment where agile project

management is adopted, (2) people factors which focus on team's capability and the customers' involvement, (3) process related factors which focus on agile project management processes, (4) technical factors which focus on the overall architecture of the product, (5) project factors which emphasize the nature of the project, (6) management practices focus on the organizations' effort on employee training and development, (7) employment skills which focus on the professional qualifications of the team and industry experience, and (8) customer information which focuses on the relationship with the customers, and effective communication with them.

(c) *What is the appropriate framework for adopting agile project management techniques in IT companies in Sri Lanka?*

To answer the above research question, in Figure 3.2 of Chapter 3, a theoretical framework is developed by hypothising the critical factors for adoption agile project management approach. In Chapter 3 of this research, it is argued that having critical factors are sufficient only for the adoption of agile project management in an organization. This research suggests that diffusion of innovation factors are also necessary for the successful adoption of agile project management. Hence, hypothised framework depicted in Figure 3.2 of this research takes into account diffusion of innovation factors such as relative advantage, compatibility, complexity, and observability. These factors are framed through Rogers (2003) diffusion of innovation theory, and Technology-Organization-Environment theory (Tornatzky & Fleisher 1990).

The framework hypothised that Technology-organizational-Environmental factors, namely, (1) process readiness, (2) tools readiness, (3) organizational readiness, (4) management readiness, (5) team readiness, and (6) environmental readiness, and diffusion of innovation factors, namely, (7) relative advantage, (8) compatibility, (9) complexity, and (10) observability positively influence the adoption of agile project management approach in IT firms in Sri Lanka. The theoretical framework is tested using survey data to answer the two critical research questions formulated in this research namely, *what are the critical success factors for adopting project agile*

*project management techniques in IT projects in Sri Lanka?*, and *what is the appropriate framework for adopting agile project management techniques in IT companies in Sri Lanka?*

As shown in Chapter 6 of this research, testing the hypothised framework with the use of survey data reveals that, among the Technology-Organizational-Environment factors, (1) organizational and cultural readiness, (2) team readiness, and (3) management readiness are critical for the adoption of agile project management approach in Sri Lankan IT firms. Furthermore, among Diffusion-of-Innovation factors (3) relatively advantage, (4) compatibility, and (5) observability are critical for the adoption of agile project management approach in Sri Lanka.

Although this research initially hypothised that ten individual factors influence the adoption of agile, this research failed to neither prove nor reject whether certain hypothised critical factors such as process readiness, tools readiness, environmental readiness, and complexity influence the adoption of agile project management in Sri Lankan IT firms. This is because, as noted in the Data Analysis Chapter (Chapter 5), those factors are dropped from the analysis due poor reliability of the data collected.

### 7.2.2. Critical factors

In summary, this research reveals that with respect to the factor organizational and cultural readiness, the existence of a more supportive and cooperative organizational environment rather than a hierarchical and bureaucratic environment, availability of an oral culture where high value is placed on face-to-face communication, existence of a flexible and adaptive organizational culture that reflects a proper agile-style work environment, and organization's effort to encourage learning, and learning through mistakes are critical for adoption of agile project management approach.

This study reveals that the following aspects of team readiness are critical for successful adoption of agile approach in IT firms: every team member understanding

the vision of product and the team, project manager's willingness to lead the team rather than control, individuals taking responsibility for managing their workload among themselves, team's willingness to maintain healthy relationships with product owners, and team members trusting and respecting the ideas of each member.

With respect to top management readiness, this study reveals that, existence of highly knowledgeable managers (managers' knowledge of agile project management), committed managers who are willing to implement a leadership-collaborative management style, managers who motivate team to work outside norms, managers' willingness to empower the team, and management's willingness to encourage and facilitate participatory decision making are critical.

With respect to the diffusion of innovation factors, this research reveals that, people tend to use the agile approach as it gives relative advantage over traditional approach. In this regard, due to increased customer satisfaction resulting from the use of agile approach, the flexibility of the approach, not having to draw up a detailed plan upfront, less documentation work, honoring regular work schedule with no overtime work, early identification of risk due to iterative implementation, and self-disciplined teams people tend to use agile approach.

With respect to the compatibility of agile approach with existing values and past experiences of an organization, the study reveals that availability of an organizational structure which welcomes agile practices, an organizational culture that welcomes agile practices, and the ability of agile approach to continuously develop customer relationships are critical for the adoption of agile approach.

According to the factor observability, if the results are visible to others, people adopt agile approach. In this regard, increased customer satisfaction as a result of using agile practices, achievement of higher rates of project successes after using agile, increase product quality, ability to produce innovative and adaptable products, and saving of

time, cost and effort as a result agile project management approach people tend to use this approach in IT firms.

### 7.2.3. The revised framework

The critical factors identified from this research are assembled to develop the framework as shown in the Figure 7.1. The framework shows that organizational readiness, team readiness, and top management readiness are three critical dimensions of the framework. Moreover, the framework suggests that having only the readiness factors are not sufficient for the adoption of agile project management in an organization.

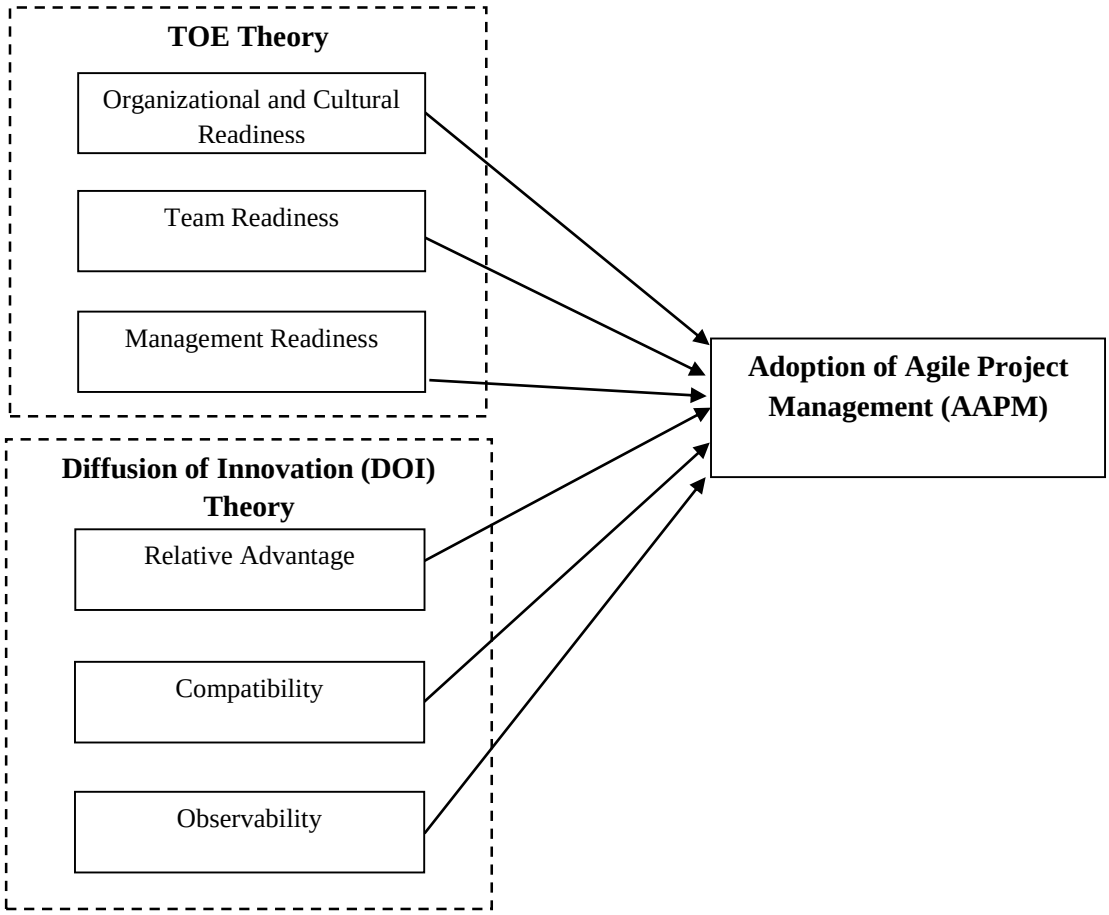


*Figure 7.1:* A revised framework

Diffusion of innovation factors are also necessary for successful adoption of agile project management in an organization. Therefore, as shown in the framework (Figure 7.1), ability of agile approach to bring better benefits over traditional project management approaches, ability of agile approach to converge with the existing organizational values and practices, and clear visibility of results pursuant to the adoption of agile approach also motivates people to adopt agile approaches in IT firms. Figure 7.1 shows the framework.

### 7.2.4. Recommendations

The final research question to be revisited in this research is *What recommendations can be made for successful adoption of agile project management techniques in IT firms?*

Based on the findings of the research following recommendations can be made:

- Making organization ready: To successfully implement agile approach in IT firms it is necessary to create a supportive environment and culture within the organization. Unlike traditional approach, agile approach focuses on getting the right people, building the capacity of people, facilitating participatory decision making, and encouraging interaction and information flow between teams. Therefore, eliminating bureaucracies within the organization is essential. Moreover, setting up a cooperative organizational culture instead of a hierarchal culture, supporting an oral culture that places high value on face-to-face communication, implementing an agile-style work environment, and encourage learning and letting staff learn through mistakes are recommended for creating a supportive environment and culture within the organization to adopt agile approach within the organization.

- Making teams ready: To implement agile approach within an organization, it is recommended to train and educate the teams so that they gain the necessary skills, competence, knowledge and the attitudes.

- Management readiness: To successfully implement agile project management having a group of mangers with sound knowledge on agile approach, having skilful managers who can motivate team to work outside norms, having committed managers who are willing to implement a leadership-collaborative management style and willing to empower team, and having a set of managers who are taking calculated risks are recommended.

As noted before, from the study it is also revealed that diffusion of innovation attributes, namely, relative advantage, compatibility and observability are critical.

- With respect to relative advantage attribute, it is clear that people tend to use agile project approach due to its advantages over the traditional approach. Therefore, prior to implementation of the agile approaches within an organization, it is recommended to make project staff aware of the benefits of adopting agile. In this regards, people should be made aware of the success stories of agile such as its ability to increase customer satisfaction, its flexibility, less effort on front load project plans, less paper work, better risk identification, and less overtime work.

- Observability is another diffusion of innovation factor. It emphasizes the importance of demonstrating success stories of agile among potential agile adopters. Showing the results for potential agile adopters with case examples on how customer satisfaction can be increased, how employee satisfaction can be increased, how agile increased project success rates, how quality of the product can be improved, and how time and cost can be saved as a result of agile would increase the adoption rate of agile within an organization.

- The compatibility attribute requires that the agile project approach should be compatible with the existing values and practices within an organization. In this regards creating an agile friendly environment to implement agile project management, making necessary changes to reduce the complexity in

organizational structures, and increasing the relationships between individuals are recommended.

### 7.3. Future research

As noted before, this research initially hypothesized ten critical factors namely, (1) process readiness, (2) tools readiness, (3) organizational readiness, (4) management readiness, (5) team readiness, and (6) environmental readiness, (7) relative advantage, (8) compatibility, (9) complexity, and (10) observability. However, the research failed to neither prove nor reject the following hypothesised factors due to the poor reliability: (1) process readiness, (2) tools readiness, (6) environmental readiness, and (9) complexity. Therefore, as the future research, those survey questions should be further revised and deploy for better understanding the critical factors.

The scope of this research is limited to the adoption of agile approach in IT sector. As future research, the research can be further extended to other sectors by surveying the other sectors, modifying the survey questioners and distributing in the other sectors to examine whether agile project management approach can be adopted effectively.

The research approach adopted in this research is the quantitative research methodology. Due to the nature of the quantitative methodology, the findings obtained through this approach is less descriptive. To overcome this, as the future research, findings of this research can be explained by taking an explanatory approach through deploying a series of interviews on the critical factors identified in this research.

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## *Appendix I – Survey Instrument*

# Survey on Critical Factors for Adoption Agile Project Management Approach in Sri Lankan IT Firms

Agile project management is an interactive and incremental method of managing the desing and build activities for engineering, information technology, and new product or service development projects in a highly flexible and interactive manner. This research aims to investigate your perceptions of the critical factors of adopting agile project management in IT firms in Sri Lanka.

Thank you very much for agreeing to spend a few minutes of your time to complete this survey. If you have been involved with more than one agile project, please tick the most relevant with regard to critical success factors of such a project.

**This survey contains following sections**

Part I : Demographic and organizational information

Part II : Critical factors for adopting agile project management

Part III : Diffusion of innovation factors and agile project success measures

Your assistance is requested in anonymously answering the questions. Your responses will be strictly confidential. Should you have further questions with regards to the survey please feel free to contact me through email kanishkatwk@gmail.com.

**Part I- Demographic and Organizational Data**

For questions 1–10 please provide some basic information regarding yourself and your organization

1. What is your gender?

☐ Male
☐ Female

2. Which of these age groups are you in?

☐ 20-30
☐ 31-40
☐ 41-50
☐ 51-60
☐ More than 60

3. What is your position at the organization?

☐ Software/Database/Network/IT engineer
☐ Team leader
☐ Project manager
☐ Program manager
☐ Portfolio manager
☐ Assistant/Deputy/General manager
☐ Chief executive officer/Managing director
☐ Other, please specify.....

4. What is your highest level of education?

☐ School
☐ Undergraduate degree
☐ Postgraduate degree
☐ Professional education

5. What is your training/qualification on agile project management?

☐ No formal training/qualification
☐ PMI Agile certificate practitioner
☐ Agile project management with Scrum
☐ Other, please specify .....

6. What is your level of experience in years in agile project management?

☐ 1-5
☐ 6-10
☐ More than 10 years

7. To which category does your company belong?

☐ Software/Web Development
☐ Data Communication/Tele Communication
☐ Hardware
☐ Project Management
☐ Training and Service Support
☐ IT Consultancy
☐ Other, please specify .....

8. What are the agile project management methods used in your organization?

☐ Scrum
☐ Kanban
☐ Scrum ban
☐ Cristal Clear
☐ Extreme Programming
☐ Other, please specify .....

9. What is the size of your organization in terms of the number of people employed?

☐ 1-10
☐ 11-25
☐ 26-50
☐ 51-100
☐ 101-500
☐ 501-1000
☐ More than 1000

10. What is your organization's annual revenue in Rs?

Please specify Rs.....

**Part II – The Critical Factors for Adopting Agile Project Management**

This section includes all the possible success factors for adopting agile project management approach. It seeks to find out how would think those factors are important for adopting agile project management approach within an organization. Please response to each of following statements according the following scale.

*7 = Very important, 6 = Important, 5 =Somewhat important, 4 = Neutral, unsuccessful, 3 = Somewhat not important, 2 = Not important, 1 =Not important at all*

11 To what extent do you think that following process readiness factors are important in adopting agile project management?

*[Tick (√) on the scale below: 7 = Highly important……. 1 = Not important at all]*

| | | ***7*** | ***6*** | ***5*** | ***4*** | ***3*** | ***2*** | ***1*** |
|---|---|---|---|---|---|---|---|---|
| 11a | Set up a vision for the product, customer, and team | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 11b | Feature based release, and iterations | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 11c | Test features in a short timeframe | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 11d | Review delivered results, current situation, and team performance | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 11e | Passing along key lessons to other projects | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

12 To what extent do you think that following tools readiness factors are important in adopting agile project management?

*[Tick (√) on the scale below: 7 = Highly important……. 1 = Not important at all]*

| | | ***7*** | ***6*** | ***5*** | ***4*** | ***3*** | ***2*** | ***1*** |
|---|---|---|---|---|---|---|---|---|
| 12a | Use agile project management methodologies (eg. Scrum, Kanban, XP) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 12b | Use of software packages (eg. VersionOne, RallyDev) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 12c | Use burn down charts to measure performance | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 12d | Maintain product and sprint backlogs | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 12e | Use agile software development methodologies | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

13 To what extent do you think that following product measurement readiness factors are important in adopting agile project management?

| | *[Tick (√) on the scale below: 7 = Highly important……. 1 = Not important at all]* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | ***7*** | ***6*** | ***5*** | ***4*** | ***3*** | ***2*** | ***1*** |
| 13a | Product has a clear vision | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 13b | Product has clearly defined objectives | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 13c | Product has clearly defined measurable outcomes | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

14 To what extent do you think that following <u>organizational and cultural readiness</u> factors are important in adopting agile project management?

*[Tick (√) on the scale below: 7 = Highly important……. 1 = Not important at all]*

| | | ***7*** | ***6*** | ***5*** | ***4*** | ***3*** | ***2*** | ***1*** |
|---|---|---|---|---|---|---|---|---|
| 14a | Supportive and cooperative organizational environment | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 14b | Clearly defined roles for staff | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 14c | Oral culture placing high value on face-to-face communication | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 14d | Flexible and adaptive organizational culture | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 14e | Culture that encourages experiment and exploration | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 14f | Encourages learning and learning through mistakes | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 14g | A rewarding system for agile achievers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

15 To what extent do you think that following <u>management readiness</u> are factors important in adopting agile project management?

*[Tick (√) on the scale below: 7 = Highly important……. 1 = Not important at all]*

| | | ***7*** | ***6*** | ***5*** | ***4*** | ***3*** | ***2*** | ***1*** |
|---|---|---|---|---|---|---|---|---|
| 15a | Managers' sound knowledge in agile project management | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 15b | Top executives' commitment | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 15c | Managers' willingness to implement a leadership-collaborative management style | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 15d | Management's willingness to take risk to promote innovation | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 15e | Management motivating team to work outside norms | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 15f | Management's willingness to empower team | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 15g | Management encouraging participatory decision making | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

16 To what extent do you think that following <u>team readiness</u> factors are important for adopting agile project management approach?

*[Tick (√) on the scale below: 7 = Highly important……. 1 = Not important at all*

***7*** ***6*** ***5*** ***4*** ***3*** ***2*** ***1***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 16a | Right team mates with motivation and right competency | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16b | Every individual understands the product vision, and team vision | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16c | Project manager leads the team rather than control | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16d | Individuals take responsibility for managing the workload among themselves | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16e | Maintain healthier relationships with customers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16f | Team participation in decision making | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16g | Team's accountability for the results produced | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16h | Trust and respect of team members ideas | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

17 To what extent do you think that following <u>business environment readiness</u> factors are important for adopting agile project management?

*[Tick (√) on the scale below: 7 = Highly important…… 1 = Not important at all*

| | | ***7*** | ***6*** | ***5*** | ***4*** | ***3*** | ***2*** | ***1*** |
|---|---|---|---|---|---|---|---|---|
| 17a | Rapidly changing business needs increase the need of using agile project management | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 17b | Pressure from customers to deliver the product faster create the need for using agile project management | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 17c | Heavy use of agile project management by the competitors create the need for using agile project management | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 17d | Pressure from the customers to use agile project management methods create the need for using agile project management | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 17e | Increasing number of agile qualified practices in the industry for recruiting motivate using agile project management | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Part III – The Diffusion of Innovation Factors**

18 To what extent do you think using agile project management brings more advantages than traditional project management approaches such as PRINCE2 or PMBOK?

*[Tick (√) on the scale below: 7 = Highly important……. 1 = Not important at all]*

| | | ***7*** | ***6*** | ***5*** | ***4*** | ***3*** | ***2*** | ***1*** |
|---|---|---|---|---|---|---|---|---|
| 18a | Using agile project management increases customer satisfaction | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 18b | Agile project management is flexible | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 18c | No need to draw up a detailed project plan upfront | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 18d | Less documentations work | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 18e | No overtime - honouring regular work schedule | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 18f | Early identification of risk due to iterative development | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 18g | Self-disciplined teams rather than imposed discipline | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 18h | Empowered teams | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

19 To what extent do you think is agile project management approach is <u>compatible with the existing values and practices</u>?

*[Tick (√) on the scale below: 7 = Highly important……. 1 = Not important at all]*

| | | ***7*** | ***6*** | ***5*** | ***4*** | ***3*** | ***2*** | ***1*** |
|---|---|---|---|---|---|---|---|---|
| 19a | Existing organizational structure welcomes agile practices. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 19b | Existing organizational culture welcomes agile practices | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 19c | Facilitate the organizational effort to the development of customer relationships | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 19d | improvement of individuals' relationships within the organization | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

20 How do you think about the <u>complexity</u> of the agile project management approach?

*[Tick (√) on the scale below: 7 = Highly important……. 1 = Not important at all*

| | | ***7*** | ***6*** | ***5*** | ***4*** | ***3*** | ***2*** | ***1*** |
|---|---|---|---|---|---|---|---|---|
| 20a | Agile project management approach is easy to implement within the organization | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 20c | Agile project management is a flexible approach | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 20d | Adequate support is available for agile methods within the environment | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 20e | Training materials and resources are available to gain knowledge about agile project management. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

21 How do you think about the observability of the agile project management approach?

*[Tick (√) on the scale below: 7 = Highly valuable……. 1 = Not valuable at all]*

| | | ***7*** | ***6*** | ***5*** | ***4*** | ***3*** | ***2*** | ***1*** |
|---|---|---|---|---|---|---|---|---|
| 21a | Increased customer satisfaction is evident after using agile approach | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21b | Increased employee satisfaction is evident after using agile approach | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21c | Success rate of the projects are very high after using agile project management approach | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21d | Quality of the products are higher | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21e | Products are innovative and adaptable | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21f | Time and cost are saved as a result agile project management approach | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

22 What measures should be used to access the success of project managed through agile project management approach?

*[Tick (√) on the scale below: 7 = Highly valuable……. 1 = Not valuable at all]*

| | | ***7*** | ***6*** | ***5*** | ***4*** | ***3*** | ***2*** | ***1*** |
|---|---|---|---|---|---|---|---|---|
| 22a | Successfully achieving financial targets | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 22b | Successfully achieving time targets | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 22c | Successfully achieving quality targets | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 22d | Successfully achieving project scope | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 22e | Successfully delivering desired customer value through innovative products | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 22f | Successfully delivering desired customer value through adaptable products which not just satisfy today's needs but also future needs | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

## *Appendix II – K-S Test Results*

| Factor | Kolmogorov-Smirnov[a] | | |
|---|---|---|---|
| | **Statistic** | **df** | **Sig.** |
| Process Readiness | .350 | 158 | .000 |
| Process Readiness | .313 | 158 | .000 |
| Process Readiness | .327 | 158 | .000 |
| Process Readiness | .315 | 158 | .000 |
| Process Readiness | .226 | 158 | .000 |
| Tools Readiness | .307 | 158 | .000 |
| Tools Readiness | .263 | 158 | .000 |
| Tools Readiness | .234 | 158 | .000 |
| Tools Readiness | .226 | 158 | .000 |
| Tools Readiness | .327 | 158 | .000 |
| Measurement Readiness | .251 | 158 | .000 |
| Measurement Readiness | .259 | 158 | .000 |
| Measurement Readiness | .219 | 158 | .000 |
| Org And Cultural Readiness | .233 | 158 | .000 |
| Org And Cultural Readiness | .284 | 158 | .000 |
| Org And Cultural Readiness | .284 | 158 | .000 |
| Org And Cultural Readiness | .231 | 158 | .000 |
| Org And Cultural Readiness | .238 | 158 | .000 |
| Org And Cultural Readiness | .296 | 158 | .000 |
| Org And Cultural Readiness | .227 | 158 | .000 |
| Management Readiness | .375 | 158 | .000 |
| Management Readiness | .259 | 158 | .000 |
| Management Readiness | .234 | 158 | .000 |
| Management Readiness | .265 | 158 | .000 |
| Management Readiness | .272 | 158 | .000 |
| Management Readiness | .270 | 158 | .000 |
| Management Readiness | .285 | 158 | .000 |
| Team Readiness | .265 | 158 | .000 |
| Team Readiness | .259 | 158 | .000 |
| Team Readiness | .317 | 158 | .000 |
| Team Readiness | .283 | 158 | .000 |
| Team Readiness | .235 | 158 | .000 |
| Team Readiness | .269 | 158 | .000 |
| Team Readiness | .259 | 158 | .000 |
| Team Readiness | .330 | 158 | .000 |
| Environment Readiness | .320 | 158 | .000 |

| | | | |
|---|---|---|---|
| Environment Readiness | .333 | 158 | .000 |
| Environment Readiness | .220 | 158 | .000 |
| Environment Readiness | .223 | 158 | .000 |
| Environment Readiness | .256 | 158 | .000 |
| Usefullness | .319 | 158 | .000 |
| Usefullness | .322 | 158 | .000 |
| Usefullness | .231 | 158 | .000 |
| Usefullness | .193 | 158 | .000 |
| Usefullness | .189 | 158 | .000 |
| Usefullness | .320 | 158 | .000 |
| Usefullness | .271 | 158 | .000 |
| Usefullness | .285 | 158 | .000 |
| Values And Practices | .262 | 158 | .000 |
| Values And Practices | .251 | 158 | .000 |
| Values And Practices | .258 | 158 | .000 |
| Values And Practices | .286 | 158 | .000 |
| Complexity | .263 | 158 | .000 |
| Complexity | .266 | 158 | .000 |
| Complexity | .298 | 158 | .000 |
| Complexity | .316 | 158 | .000 |
| Observability | .259 | 158 | .000 |
| Observability | .297 | 158 | .000 |
| Observability | .255 | 158 | .000 |
| Observability | .276 | 158 | .000 |
| Observability | .267 | 158 | .000 |
| Observability | .228 | 158 | .000 |
| Success | .342 | 158 | .000 |
| Success | .287 | 158 | .000 |
| Success | .255 | 158 | .000 |
| Success | .220 | 158 | .000 |
| Success | .228 | 158 | .000 |
| Success | .229 | 158 | .000 |