

**Critical Success Factors (CSFs) of Agile ERP Development
and Implementation Projects**

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Abstract

Agile methods are becoming a successful solution for ERP development and implementation compared to traditional waterfall methods, which constantly focus on technical excellence and support constant requirement changes. Although agile ERP development and implementation have obvious advantages, many software developers and project managers still lack a comprehensive understanding of the CSFs of agile ERP. This research invited six participants from IT services firms and consultancies in New Zealand and Singapore to conduct semi-structured interviews and generate CSFs codes from the data they provided. The pre-interview literature review summarized the CSFs from previous ERP or agile software development projects and categorized them into five dimensions: organizational, process, system, people, and technology. Each dimension contains main CSFs, and the main CSFs are further decomposed into sub-CSFs, setting up a frame of reference for later answering the questions of this study. Finally, the findings explain the 10 most important success factors for agile ERP development and implementation, with the highest proportion being the human factor. Some of these success factors duplicate or are similar to success factors from the past literature (for example, acceptance of agile methodologies and top-down coaching) and also generate entirely new factors such as the Cloud ERP trend.

Keywords: ERP, Agile Methods, Critical Success Factors

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material of which a substantial extent has been submitted for the award of any other degree or diploma of a university or other institute of higher learning.

Signed:

29 March 2022

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Chapter 1. Introduction

1.1 Background

As a mature plan-driven software development methodology, the waterfall method can still be seen in many traditional enterprise ERP systems. The waterfall development methodology is interlocked and unfolds in a series of sequential phases, from requirements, design, development, testing to deployment (Kramer, 2018), with each of which generates circular feedback. That is to say that all requirements of the previous stage must be completed before proceeding to the next stage (Kramer, 2018). During the development process, the waterfall model can function effectively in environments in which steady requirements and risks are well identified and understood. (Heeager & Nielsen, 2018). However, in the software market where ERP is prevalent, while market-driven changes in requirements, unclear requirements descriptions by many customers early in the project bring difficulties for teams using the waterfall process. The development team must return to the previous step to make appropriate adjustments as any problems arise and have outputs in each stage before moving on to the next.

In this context, the rise of agile ERP has brought some mitigation and optimization to the above issues. It follows an incremental approach to task completion, emphasizing adaptive learning for users, developers, and the market (Heeager & Nielsen, 2018). Agile methods break down projects into smaller iterations and allow for requirement changes during the development cycle, providing flexibility to monitor project progress (Wijaya et al., 2018), thereby reducing the risk of failure.

The choice of an agile approach alone will not ensure the ultimate success of an ERP project (Wijaya et al., 2019). The next section of this dissertation will investigate the CSFs that facilitate agile ERP development and implementation using the literature review approach. Broadly speaking, an enterprise must do what is critical in a given area to create value and thrive (Darwish & Rizk, 2015), and by "critical", which means selecting the most representative core elements among the factors that contribute to business success. In the case of agile ERP, this dissertation will divide the CSFs into organizational, process, system, people, and technology dimensions. And then further divided into main and sub success factors to identify the key information required to achieve the business goals, aiming to prioritize the project development and implementation focus.

1.2 Research scope

Much of the existing works of literature have examined the positive impact and success factors of agile methods on software development projects (For example, see Chow & Cao,

2008; Misra et al., 2009; Kronbichler et al., 2009; Françoise et al., 2009; Stoica et al., 2013; Darwish & Rizk, 2015; Serrador & Pinto, 2015). Although some scholars have begun to focus on the critical success factors of agile ERP implementations in recent years (Tarhini et al., 2015; Baig et al., 2017; Wijaya et al., 2018; Wijaya et al., 2019), these studies are often based on literature reviews and lack experimental confirmation.

It is of great interest as this dissertation incorporates the qualitative interview method to data collection. The participants were drawn from both the systems integration providers and the strategic consultant side of the agile ERP projects. This research combines their perceptions to derive CSFs regarding the agile ERP development and implementation, followed by identifying the most important factors in the set of success factors according to the frequency of mentions by the participants.

1.3 Objectives and Outline

To improve the quality of ERP development and implementation projects, the purpose of this research is to identify:

RQ1. What are CSFs of agile ERP development and implementation projects?

RQ2. How to rank the most important CSFs?

This dissertation will first review some existing literature on agile methods and agile ERP CSFs. Some of the main and sub-CSFs are summarized to provide a theoretical basis for my research. It will then describe the methodology used and detail the data collection and analysis process. Afterwards, the research will analyze and evaluate the findings before drawing important conclusions and recommendations.

Chapter 2. Literature Review

2.1 Introduction

Enterprise resource planning (ERP) has become an essential strategy for large companies to achieve performance improvement and decision optimization (Wijaya et al., 2019). Many organizations invest significant human and financial resources into ERP projects intending to improve the efficiency of organizational operations by managing and improving the way in which corporate resources are utilized. Traditionally, ERP projects were followed waterfall methodology for implementation. (Wijaya et al., 2018). The lifecycle is divided sequentially into requirements gathering and identification, software design and programming, and system testing (Heeager & Nielsen, 2018). Its lifecycle is a rational development process that emphasizes advanced planning of system functionality and a strict chronology of each phase. Firstly, sound requirements gathering, and identification is an important factor in the success or failure of an ERP project. Software design will clarify the modular structure, followed by programming to convert the design into a computer-readable program. Ultimately testing the overall system functionality will ensure that it meets user requirements. As the name suggests, the waterfall approach specifies a fixed sequence of top-down, interlocking steps, like a cascading waterfall descending one step at a time.

Development environments using the waterfall model require stable requirements, which means that system functionality and use must be defined in advance. In other words, completion of the activities of the previous phase is a prerequisite for the start of the next phase (Ahituv et al., 2002). Therefore, any change in the expected requirements may result in the delivered functionality not meeting the business requirements. The waterfall process requires that decisions in the initial phase of the project are distinct and proper. If project stakeholders continue to draw on new knowledge at various stages of development, it is expected that requirements may change accordingly (Heeager & Nielsen, 2018). For instance, assuming that one project has a development cycle of one year, decision-makers need to consider whether the product being developed will still be competitive after one year.

It thus appears that the traditional waterfall approach to development and implementation does not meet the objectives and expectations of organizations relative to the rapid growth in demand for ERP systems (Helo et al., 2008). Risks such as schedule delays and budget overruns are prevalent during ERP implementations (Baig et al., 2017). The Standish Group reports that ERP implementation projects, on average, cost 178% over budget, take 2.5 times longer than promised and deliver only 30% of the expected benefits (Krumbholz & Maiden, 2001). In particular, some organizations that use standardized ERP packages implement system maintenance and upgrades by making minor functional adjustments to the finalized software, but the leading architecture of the system remains unchanged. Standardized ERP packages may not be adapted to the company's specific circumstances and do not address the in-depth management needs of the business. Despite the tendency of software vendors to

emphasize the versatility and flexibility of software packages, the challenge of meeting the different levels of requirements between customized and standardized systems remains (Helo et al., 2008).

Agile methods are becoming a popular trend in ERP development and implementation to compensate for the shortcomings of traditional methods. The objective of the literature review is to systematically present several agile methods that have been widely used in recent years, which further answers the question of how agile methods can drive the success of ERP project development and implementation. In addition to identifying CSFs for agile ERP, the developmental goal of this dissertation is to explain how to tap into the most important CSFs in pursuit of the greatest likelihood of project success.

2.2 About Agile

Agile is the ability to succeed in an uncertain environment by creating and responding to change, a concept that first appeared in the Agile Manifesto to describe software development methods (Highsmith & Cockburn, 2001). The manifesto has four key characteristics:

- <individuals and interactions> over <processes and tools>
- <working software> over <comprehensive documentation>
- <customer collaboration> over <contract negotiation>
- <responding to change> over <following a plan>

All the above have value; the matters on the left are more reflective of the focus and direction of development concerns than those on the right but should not simply be interpreted as issues on the left and ignoring the right side.

Agile development emphasizes individual potential and effective teamwork as its number one value. Next, the goal of agile development is usable working software rather than all-encompassing documentation, which means less planning. Hence, agile projects have more flexibility (Serrador & Pinto, 2015). Then there is the third value of agile development. Putting the customer first does not stand that the organization does whatever the customer asks but focuses on customer involvement in the planning process (Antlova, 2014), working together to achieve a win-win situation. The last point is to respond appropriately to expected and unexpected changes. Agile development welcomes change, embraces change and responds to change to create value (Qumer & Henderson-Sellers, 2008).

During the development and implementation of an ERP project, either left or right-side matters can arise, and those involved should emphasize the concerns that affect the left side rather than the right side. As the core idea of agile, this manifesto has guided the process of the subsequent practice of Agile methods. At present, agile has become a widely recognized

mainstream approach to planning and executing projects in organizations (Serrador & Pinto, 2015).

2.3 Agile Methods Overview

This sub-section will briefly introduce the most commonly used agile methodologies. There are various methods to agile project management such as Scrum, XP, Lean, Kanban, DSDM, Crystal and others (Chow & Cao, 2008)(Paetsch et al., 2017). All of these agile models follow the values and principles of the Agile Manifesto. This dissertation realizes that it is challenging to cover all existing agile methods comprehensively, but the literature review lays the foundation for my later collection and analysis of data to understand the purposes and considerations of different types of companies choosing agile methodologies.

2.3.1 Scrum

Scrum is an empirical approach based on flexibility, adaptability, and productivity that allows the development process to identify obstacles or defects through multiple iterative activities (Abrahamsson et al., 2003). Scrum is a term derived from rugby used to restart the game after a short interruption (Antlova, 2014). Rugby teams have a sprint plan before the game, but it is up to the players to improvise on the original plan once the sprint starts. This concept is highly respected after being applied to project management. It is very suitable for teams to work collaboratively to deliver high-quality products in scenarios where internal and external requirements change frequently and require rapid delivery and verification (Paetsch et al., 2017).

The Scrum approach is distinguished from other agile processes through specific concepts and practices, and its detailed explanation involves several basic terms about scrum. Scrum is an iterative, incremental development process that consists of several short iterative cycles. One iteration is called a sprint, and each sprint is typically four weeks long but can be shorter or longer (Paasivaara et al., 2009). In addition, the team assesses the progress of the project through daily scrums.

First, to start the scrum process, the product owner (customer) creates a priority wish list called the product backlog, which contains the ever-changing information needed for development. Next, the product owner and development team plan to add the backlog of requirements with high commercial value to the customer to the sprints backlog, that is, select the highest priority requirements for development. It is worth noting that the content of the sprint is not allowed to be changed after the start of the sprint; however, the customer can flexibly rearrange the requirements for the next sprint (Paetsch et al., 2017). Finally, the team holds a review meeting at the end of the sprint to present the product to the product owner and seek feedback on whether it should be taken forward in the next sprint or needs to be improved, and then repeat the above process in a loop.

2.3.2 Extreme Programming (XP)

As one of the most popular agile methods in recent years, XP is characterized by short iterations, minor releases and rapid feedback, continuous refactoring, integration, and testing, ensuring successful software development even when requirements are ambiguous or volatile (Abrahamsson et al., 2003). Through close customer involvement, continuous communication, and coordination (Abrahamsson et al., 2003), developers and customers keep well informed of development progress, changes, pending issues and potential difficulties, and the development process is adjusted to the actual situation.

The replacement of paper-based documentation with face-to-face communication has undoubtedly made the collaboration between developers more intense, making this method ideal for small development teams (5 to 15 people). Maurer & Martel (2002) converted a small web company's development method to XP, but otherwise, all other aspects of the project remained the same. The data from the study showed an increase in the productivity gain indicator from 66.3% to 302.1%, indicating that XP had a positive impact on productivity improvements. Furthermore, XP effectively improves software quality (Ilieva et al., 2004; Maurer & Martel, 2002), and its application ensures that development teams produce high-quality results while maintaining the schedule.

2.3.3 Crystal

The crystal method is an effective agile process invented for development teams of differentiated projects, depending on their size, complexity, criticality, and team size (Paetsch et al., 2017). Generally, the number of people involved in a project is categorized by the different colors of the crystals, from small to large in the clear, yellow, orange, red and blue (Stoica et al., 2013): clear crystals usually apply to lightweight projects, yellow for medium size, orange for large and red for very large (Paetsch et al., 2017). Regardless of the color, the crystal method defines the team's roles, work and outputs, core practices etc. (Qumer & Henderson-Sellers, 2008) and consequently allows screening the best approach for each project. Besides, the approach is open to any development practice, tool, or work product, thus allowing for integration, such as XP and Scrum practices (Abrahamsson et al., 2003).

2.3.4 Dynamic software development method (DSDM)

DSDM is an approach that prioritizes planning and quality over functionality and is derived from the earliest agile control frameworks of Rapid Application Development (RAD), which is arguably the first truly agile software development method (Abrahamsson et al., 2003). It focused on the rapid delivery of products and complemented the guiding principles of how to apply these controls (Plonka, L., Sharp, H., Gregory, P., & Taylor, 2014). In contrast to traditional approaches that fix requirements while time and resources are variable, DSDM

advocates striving to maximize business requirements with a pre-fixed schedule and available resources (Abrahamsson et al., 2003).

DSDM is suitable for the iterative and rapid development of small to large commercial applications (Qumer & Henderson-Sellers, 2008). Since the DSDM framework includes software development content and practices and covers various aspects such as organizational structure, project management, configuration, and risk management, it can be adapted to a series of project types (Plonka, L., Sharp, H., Gregory, P., & Taylor, 2014). The DSDM project development process can provide a reference for this dissertation to determine the priority of CSFs for agile ERP projects. Initially, the project proposals priority was established based on the pre-project phase's organizational strategic objectives. After analyzing the commercial and technical feasibility of the project, the organization will conduct high-level research on feasible solutions, cost estimates, and timeframes. In the next foundation phase of the project, the organization will reasonably allocate the identified requirements and resources (Abrahamsson et al., 2003).

Most agile methods can improve quality control and assurance during ERP implementation, including phases such as process re-engineering, configuration, customization, integration, data conversion and maintenance (Baig et al., 2017). It effectively enhances the system adaptability of ERP development and implementation projects and increases communication, collaboration, and visibility of progress between developers and customers (Baig et al., 2017). Agile methods allow for partial success of the project, thereby reducing the risk of failure. It prioritizes processes according to value, which requires that valuable features are implemented first, thus minimizing the risk of significant losses (Stoica et al., 2013). However, many software developers and project managers lack a comprehensive understanding of the application of agile ERP. This dissertation will provide broader insights on the CSFs of agile ERP development and implementation by looking at the five dimensions of organizational, people, process, technical, and project.

2.4 Challenges related to Agile ERP projects

Despite the apparent advantages of Agile ERP, there are still some challenges confront in the practical development and implementation projects, such as the significant reduction in the documentation and some of the source code itself is in document form. Traditional approaches focus on creating documentation on project direction and clarification. Even developers who do not know the details of the project or are inexperienced can take over the work (Stoica et al., 2013). Instead, agile methods emphasize the use of minimal documentation to cope with changing conditions (Serrador & Pinto, 2015). Therefore, agile ERP developers may insert more comments in the source code for clarification and explanation. Suppose a new or novice team member lacks an overall grasp of the agile ERP project. In that case, more communication time will inevitably be spent between members or even cause delays in iterations, thus increasing development costs (Stoica et al., 2013).

Also, in terms of customer engagement, the traditional approach focuses on communicating with the customer early in the project to obtain as clear and detailed requirements as possible. Once in the development phase, the development team works on completing the system until the final product is presented to the customer (Stoica et al., 2013). In contrast, agile methods rely on frequent stakeholder interaction (Serrador & Pinto, 2015). For complex projects with unclear requirements, the client and development team must work together to validate requirements in a shorter period and within a lower budget. In each iteration delivery meeting, the development team presents the work done in the current iteration. At the same time, the client gives feedback on whether new features need to be modified or added (Stoica et al., 2013). Repeated presentations of project modules and confirmation of requirements by developers are often tedious and exhausting, and either too much or too little time and effort spent planning can negatively impact the success of an agile project (Serrador & Pinto, 2015), so establishing efficient and effective communication is another challenge for agile ERP projects.

2.5 CSFs for Agile ERP

There have been several previous studies on CSFs for ERP development and implementation (For example, see Françoise et al., 2009; Sowan, I., & Tahboub, 2015; Madanian et al., 2021), but few studies have specifically identified CSFs for agile ERP development and implementation. The CSFs approach is a systematic approach that identifies information needs in a target domain based on critical factors (Ram & Corkindale, 2014). In fact, CSFs have been widely used and recognized in the field of information systems (Finney & Corbett, 2007). By identifying CSFs, organizations can collect the typical information set needed to achieve their goals and determine the priority of system development to ensure that the organization maximizes the project's benefits.

As factors such as system development and implementation environment change, the CSFs change accordingly, so their development is ongoing. Therefore, this is also consistent with the dynamic requirements of the systems supported by the agile approach, enhancing the likelihood of success in applying the theory to the practice of agile ERP projects.

Furthermore, as each organization or team has limited resources, it is of interest to prioritize how to balance resources with goal achievement in the face of various requirements in the requirements pool. Darwish and Rizk (2015) provide a conceptual framework for agile software development, collecting the five main success factors in the areas of organizational, people, process, project and technical. For the purpose of improving the adaptability and understandability of the study, some of the main success factors were broken down into secondary factors for analysis. Similarly, Chow and Cao's (2008) exploration of agile software development projects found that the critical success factors as 1) correct delivery strategy, 2) correct practice of agile software techniques, and 3) a high-quality team. In terms of other success dimensions, three other critical success factors are 4) good agile project management processes, 5) agile-friendly team environment, and 6) customer involvement

(Chow & Cao, 2008). The authors also emphasized that software development projects require high-quality teamwork and that practicing agile engineering techniques and implementing the right agile delivery strategies have a high probability of success. The results of (Wijaya et al., 2019) on agile ERP framework implementation indicated that the CSFs that identify the agile ERP model have an essential role in supporting quality improvement in ERP implementations, with the percentages of these factors being organizational (42%), process (19%), system (19%), people (17%) and technology (3%).

More specifically, Table 1 provides a list of the main relevant literature. By summarizing the key findings from the following four pieces of literature, it is determined that the CSFs for this study are identified as the five broad dimensions of organization, process, system, people and technology.

Table 1. List of main relevant literature to support the identification of CSFs

Study	Context	Method	Theory	Main Findings	Citation
<p>A conceptual framework on agile software development is presented, collecting five main success factors in terms of organization, people, process, project, and technical. For the purpose of improving the adaptability and understandability of the study, some of the main success factors are decomposed into subfactors for analysis. For example, the main success factor for the organizational dimension is corporate culture, and its subfactors include support from top management and team environment.</p>	<p>Compared to the total number of software development projects, about 60% of software projects faced challenges or failed during 2004-2012. Since agile methods provide more flexibility in the development process over time, this paper aims to build more adaptive solutions for organizations from a multidimensional view of the success factors of agile software development projects.</p>	<p>The survey method is used to collect data, and the target population is the agile approach project.</p>	<p>CSFs are ordinarily defined as identifying and measuring organizational performance to ensure that an individual, department, or organization achieves its development goals. In conjunction with the research objectives, this paper will concentrate on the success factors of agile software development projects.</p>	<p>The study proposes a flow chart for assessing compliance with success factors in agile projects. However, with only a theoretical approach, there is still a need for practical implementation in agile software development projects to minimize the number of success factors and achieve CSFs.</p>	<p>(Darwish & Rizk, 2015)</p>

<p>Using multiple regression methods, this study analyzed data from 109 agile software project responses from 25 countries/regions worldwide. It ultimately summarized the success factors into five categories: organization, people, process, technology, and project.</p>	<p>To address the challenge of managing software development to avoid wasted resources and inefficiencies, such as software development delays, failures, abandonment and so on, this study identifies the CSFs of agile methods to facilitate the success of software development projects using agile methods.</p>	<p>Survey study using quantitative approach.</p>	<p>Agile method & CSFs. In the context of this research, CSFs can be defined as the factors that must be present for an agile project to be successful.</p>	<p>The CSFs included 1) correct delivery strategy, 2) correct practice of agile software techniques, and 3) a high-quality team. In terms of other success dimensions, three other CSFs are 4) good agile project management processes, 5) agile-friendly team environment, and 6) customer involvement. Moreover, software development projects with high-quality teamwork, practicing agile engineering techniques and implementing the right agile delivery strategies have a high probability of success.</p>	<p>(Chow & Cao, 2008)</p>
<p>The goal of the study is to develop an agile ERP model as a way to improve the quality of ERP project implementation. The three main research questions are 1) explain the agile model used for ERP systems, 2) the framework required to</p>	<p>Although agile methods have been widely used in ERP implementation projects to increase efficiency, responsiveness, and relative simplicity in</p>	<p>Systematic literature review (SLR) method.</p>	<p>N/A</p>	<p>The results of the study indicate that identifying the CSFs of the agile ERP model has a crucial role in supporting quality improvement in ERP implementations, with the percentage of these factors being: organizational (42%), process (19%), system (19%), people (17%), and technology (3%). Thus,</p>	<p>(Wijaya et al., 2019)</p>

<p>complete the ERP system 3) the CSFs of the agile framework for ERP systems.</p>	<p>achieving managed business processes, most companies still follow traditional methods. This study proposes to identify the CSFs for developing an agile ERP model to improve the success of ERP implementations.</p>			<p>organizational factors are the most important strategy to support agile ERP implementation.</p>	
<p>The research describes the hypothetical success factor framework developed to identify ASD (Agile software development) critical success factors from the ASD practitioner's perspective. In general, time reduction, cost reduction and quality improvement can be used as criteria to determine the success of an agile software project.</p>	<p>The ASD paradigm has gained widespread acceptance in recent years, with many organizations turning to the agile method in their software development projects. However, there is a lack of large-scale empirical studies to evaluate the CSFs of ASD, and this study</p>	<p>The study used a large-scale survey-based approach with participants practicing ASD and experience practicing program-driven</p>	<p>N/A</p>	<p>The results of the study data analysis pointed out that 9 of the hypothesized success factors: customer satisfaction, customer collaboration, customer commitment, decision time, corporate culture, control, personal characteristics, social culture, and training and learning.</p>	<p>(Misra et al., 2009)</p>

	aims to fill this research gap.	software development.			
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Based on the study of agile development methodologies, this dissertation addresses how ERP systems can adapt to the development of an agile information system industry and meet the changing and growing customer needs. Case studies are conducted in five dimensions: organizational, process, system, people, and technology to identify critical success factors for agile ERP project development and implementation. While past related studies have mainly used systematic literature reviews or survey methods (For example, see Chow & Cao, 2008; Heeager & Nielsen, 2018; Wijaya et al., 2018; Wijaya et al., 2019), the findings of this research are noteworthy. As the interviews have a more robust industry focus and tap into the in-depth participants' minds, which may provide new insights for practitioners of agile ERP projects or interested teams. Moreover, identifying the most important CSFs in agile ERP projects can maximize project success within a limited budget and delivery time, contributing to the adaptability of an agile ERP projects to the ever-changing business environment.

Table 2 summarizes CSFs for agile development and implementation drawn from the literature, which breaks down all the CSFs into main and subfactors from the above five dimensions.

Table 2. CSFs from literature

Sub CSFs	References	Main CSFs	Dimensions
Top management support	(Kronbichler et al., 2009) (Darwish & Rizk, 2015)	Corporate culture	Organizational
Agile-friendly team environment	(Kronbichler et al., 2009) (Darwish & Rizk, 2015)		
Customer involvement	(Wijaya et al., 2019) (Kronbichler et al., 2009)		
Incentives mechanism for applying agile	(Kronbichler et al., 2009)	Corporate system	
Simplicity process	(Wijaya et al., 2019) (Darwish & Rizk, 2015)	Project management process	Process
Business process reengineering	(Wijaya et al., 2019) (Kronbichler et al., 2009)		
Risk management	(Kronbichler et al., 2009) (Darwish & Rizk, 2015)	Project definition process	
Time and resource allocation	(Wijaya et al., 2019) (Darwish & Rizk, 2015)		

Good system design	(Wijaya et al., 2019)	System technology	System
System quality	(Wijaya et al., 2019)		
Software development	(Wijaya et al., 2019)		
System integrating	(Wijaya et al., 2019)		
Reporting and monitoring	(Kronbichler et al., 2009) (Wijaya et al., 2019)	System management	
Minimum change requirement	(Wijaya et al., 2019) (Darwish & Rizk, 2015)		
Team members with high competence and expertise	(Chow & Cao, 2008)	Team competence	People
Coordination between different teams	(Kronbichler et al., 2009)		
Effective communication and feedback	(Kronbichler et al., 2009) (Wijaya et al., 2019) (Misra et al., 2009) (Darwish & Rizk, 2015)		
Training and learning	(Kronbichler et al., 2009) (Wijaya et al., 2019) (Misra et al., 2009)		
Ability to handle business pressures	(Wijaya et al., 2019) (Darwish & Rizk, 2015)	Stakeholder involvement	
Stakeholder politics	(Darwish & Rizk, 2015)		
Technological infrastructure	(Kronbichler et al., 2009) (Darwish & Rizk, 2015)	Selecting proper agile method	Technology
Technical familiarity	(Misra et al., 2009)	Using advanced technology	
Legacy systems management	(Kronbichler et al., 2009)		

Chapter 3. Methodology

3.1 Introduction

This chapter establishes the research paradigm, design, and ethical considerations for this dissertation. Section 3.2 explains the research paradigm and how it guided the conduct of the study. Section 3.3 describes the research methodology in detail, including the case selection and recruitment process. The next step is a detailed description of the data collection and analysis methods, down to the precise advancement of each step. The final section 3.4 deals with the ethical considerations of the research.

3.2 Research Paradigm: Interpretivism

This dissertation has chosen post-positivism as the research paradigm that advocates seek to understand causal relationships. In addition to collecting data, it also focuses on the participants' perspectives (Kankam, 2019). Positivists pursue objectivity by recognizing the possible effects of bias. While positivism emphasizes quantitative methods, post-positivism considers both quantitative and qualitative methods as valid approaches (Kankam, 2019). For this reason, the views of the target interview population collected in this research cannot be quantified, and the author use qualitative methods to establish interactions with the respondents to construct a generally reliable conclusion.

Deductive qualitative content analysis is employed and is applicable when there are some opinions, previous research findings, theoretical or conceptual frameworks about the phenomenon of interest (Armat et al., 2018). The dissertation started the analysis from the category of pre-existing CSFs in prior theories about agile development projects (Armat et al., 2018). In other words, reasoning from the known parts that fit the theme of this research, based on past theoretical understandings that react to objective laws, to answer the research question.

3.3 Research Methodology: Qualitative Case Study

This dissertation has adopted the qualitative case study design, which serves an instrumental purpose in identifying problems, events, or phenomena in their natural context. It is very applicable for obtaining information on the 'why' and 'how' questions (Crowe et al., 2011), such as RQ2, how to rank the most important CSFs. The focus of this research was to gain a more understanding of the two research questions through the interviewees' experiences rather than the intervention (Crowe et al., 2011), hence the choice of a case study design. The case study approach can reveal how adopting an agile method has contributed to the development and implementation of ERP projects and uncover what gaps exist between its process and the traditional waterfall approach (Crowe et al., 2011). It also helps to develop or refine the theoretical framework of the CSFs for agile ERP projects.

Stages of Case Study

3.3.1 Case Selection and Recruitment

I invited information system domain workers engaged in agile ERP development and implementation methods as the target sample. Six participants were recruited based on two inclusion criterion (1) the organizations which are developing and implementing ERP systems and (2) those organizations that should use agile ERP development and implementation methods. Employees with more than three months of experience working on agile ERP projects were invited to the research. I talked with several people in the field, including ERP implementation consultants, ERP software implementation engineers and ERP account managers, so I can analyse the feasibility of setting up an agile ERP system from the internal and external environment and resources of the enterprise. I have learnt that the level of understanding of an ERP project's CSFs is inadequate when employees do not have at least three months of work experience.

Potential participants were initially contacted via LinkedIn. The participant information sheet (Appendix 2), which provides extensive details about the study, will be emailed to potential participants interested in participating along with the consent form (Appendix 3). In addition, indicative interview questions (Appendix 4) have been formulated by combing through the research questions and literature review. The above three attachments are included in the ethics approval application form submitted to the Auckland University of Technology Ethics Committee (AUTEK). After obtaining number 21/374 approval of AUTEK (Appendix 5), the research collects signed consent forms from willing participants and then schedules the interview according to the availability and convenience of both parties.

3.3.2 Ethical Considerations

The participant information sheet (Appendix 2) outlines all necessary elements of the dissertation, including the general process of how the researcher collects data from participants. Respondents are required to sign a consent form (Appendix 3) to ensure voluntary participation in the research. During the interview process, participants have the right to refuse to reply to any indicative questions they do not wish to answer. They can withdraw from the research at any time without being deceived, hurt, or coerced. Finally, the researcher has shared a debriefing of the research findings at the request of the participants to thank them for their valuable contribution and time.

All information provided by the participants was used for research purposes only and is merely the use and communication of researchers and supervisors. Although the primary researcher knows who the participants are, the data will be recorded under pseudonyms instead of real names. Other identifiable information, such as the name of the organization and the identity of the participant, was also separated from the name of the interviewee, thus

fully safeguarding the privacy and anonymity of the participant. Moreover, all recordings were recorded with the participants' authorization, and the data was stored securely in a password protected team folder under the responsibility of the primary supervisor. At the end of the research, all electronic data and interviewee lists were destroyed to implement the principle of anonymity and confidentiality.

3.3.3 Data Collection: Semi-Structured Interviews

Semi-structured interviews were chosen as the qualitative research design for this dissertation. It allowed the participants to vividly describe their feelings, experiences and perspectives on the critical success factors of the agile ERP projects (Azungah, 2018). The interviews were conducted in an online video format and lasted approximately one hour each. With the consent of the participants, I screen-recorded the entire interview to play it back at the end of the interview and transcribe it into written material. Some of the interview's indicative questions were based on my pre-understanding of CSFs for agile ERP projects in the context of the literature review (Hove & Anda, 2005). Hence, the participants shared their experiences mainly on the same trajectory. For example, participants were asked to give their perceived CSFs in agile ERP projects in terms of giving five dimensions: organization, process, system, personnel, and technology, which will also serve as the five themes in the findings section.

My primary supervisor also asked questions from the participants with me, I did not play a subordinate role in conducting the interviews. In addition to asking the open-ended indicative questions in the participant information sheet, we modified and added new questions based on the interview to ensure the flow of the process. Additionally, we asked what challenges and limitations they had at this stage of developing and implementing agile ERP. During the interview, participants were also given the opportunity to ask questions, comment, or add any questions that were not addressed.

3.3.4 Data Analysis: Deductive Thematic Analysis

Thematic analysis is a common form of qualitative research that emphasizes locating, examining, and documenting themes within the data (Braun & Clarke, 2006). Thematic analysis illustrates the data in detail and addresses different themes through interpretations (Alhojailan & Ibrahim, 2012). The data at the heart of this dissertation are participants' explanations of their perceptions and actions regarding the CSFs of the agile ERP projects, which fits well with the characteristics of research supported by thematic analysis as it applies to efforts to find and use explanations (Alhojailan & Ibrahim, 2012). I adopted a 'top-down' deductive approach to data analysis (Braun & Clarke, 2006). The themes needed to support this research were first summarized from existing theories and then coded by examining similar quotations from interview data to test the applicability of the resulting CSFs to the agile ERP projects (Hyde, 2000).

The research applies the following six phases to identify and analyse the data.

1) Familiarizing with data

In the first stage, I transferred the primary interviews into written form by playing back the interview recordings several times, and then repeatedly reading the transcripts to familiarize myself with the raw data. Highlighting the sections relevant to the research question helped me cut out a considerable amount of context. Also, marking anything codes ideas that come to mind is crucial for the initial analysis of the data and discovering commonalities and connections between them (Braun & Clarke, 2014).

2) Systematic coding of data

Interview data for each participant was recorded in a separate Microsoft Word document. As in Table 4, the codes summarised from the literature on CSFs for ERP or agile projects informed from the literature provide a crucial reference for the coding and analysis in this research. The specific codes generated and the content of the associated interviews are presented in tabular form, with the interview content in the left-hand column and the codes generated in the right-hand column. To make the participants' narratives easier to understand, I transformed the interview content appropriately on the basis of verbatim transcriptions, that is, removing verbiage like "you know", "like", "yes", and other verbal or insubstantial repetitive statements. See Appendix 1 for specific codes generated from the content of six participants' interviews, resulting in a total of 35 codes.

3) Identifying initial themes

I have generated five candidate themes from the literature, so the main task at this stage is the development and induction of sub-themes. Table 3 provides examples of the themes and sub-themes generated from the codes, which is an ongoing process of thinking about the relationships between the sub-themes and their attribution to the themes. To ensure as much as possible that the themes represent the comprehensive view of the participants, I did not discard any data even if some extracts did not appear to be highly relevant to the research aims (Braun & Clarke, 2006).

Table 3. Example of generating themes and sub-themes from codes

Codes	Sub-themes	Themes
Customer involvement Consistent team goals Top management drive and support Initial top-down mandatory adoption Change management Agile ceremonies	Corporate culture	Organizational
Cloud ERP trend Setting KPIs, reporting and monitoring Incentives mechanism for applying agile	Corporate system	

4) Reviewing themes

The fourth stage involved a review of the candidate themes, which had to be explicitly related to the coded data extracts and reflect a distinctive feature of a part of the data (Braun & Clarke, 2014). When the candidate themes were not sufficiently representative of the extracted data, I devised new and more appropriate themes. Theme review is undoubtedly not done overnight but rather a gradual recursive process. I have repeatedly confirmed the plausibility of the evolution of candidate themes and sub-themes to ensure the effective selection and application of all data of value to the research question.

5) Defining themes

I have provided a detailed explanation of each sub-theme, showing how they relate to the research questions in this dissertation. Not only did this step help me to revisit that there is no overlap between the sub-themes, but it gives the reader a better understanding of the significance of the existence of each sub-themes in explaining the research questions.

6) Report Writing

The results of the sixth stage, or data analysis, was reflected in chapter 4 of this dissertation. All analytical narratives follow a logical format that provides a plausible explanation for the research questions (Braun & Clarke, 2006). It begins with discussing the generated findings, followed by quotes from interviews on the same or similar themes to support the analysis results.

Chapter 4. Findings

4.1 Introduction

This chapter provides the results of a thematic analysis of the responses of the six participants interviewed in the field of agile ERP. Three of them were from IT services companies in New Zealand, and the other three were from consulting firms in Singapore. There are often four parties involved in the ERP development and implementation process: the company (customers), the ERP vendors, the systems integration providers, and the consulting firms. As a result, the participants' experience and perspectives cover a rich spectrum, including system integrators and strategic consulting parties for agile ERP projects. Different fonts are used when citing the participants' opinions, and pseudonyms are added at the end for easier reading.

4.2 Generated code

Table 4 shows the themes and sub-themes constructed on account of the participants' perspectives.

Table 4. Themes and sub-themes derived from the codes

Codes [Freq] (Pseudonym)	Sub-themes	Themes
Customer involvement [2] * (PS) ** (GR) Consistent team goals [1] (CC) Top management drive and support [1] (SJ) Initial top-down mandatory adoption [1] (SJ) Change management [1] (ST) Agile ceremonies [1] (ST)	Corporate culture	Organizational
Cloud ERP trend [2] (PS) (GR) Setting KPIs, reporting and monitoring [1] (PS) Incentives mechanism for applying agile [1] (CC)	Corporate system	
Early MVP [1] (PS) Time and HR allocation [1] (CC) Expected financial burn rate [1] (CC) Using story points [1] (SJ) Zero or low documentation makes accountability difficult [1] (GR)	Project definition process	Process
Management planning [1] (PS) Executive Management [1] (PS)	Project management process	

Build and maintain core systems [1] (CC)	System technology	System
Acceptance of agile methodologies [2] (PS) (SJ) Mindset management [2] (PS) (JS) Coordination with vendors [1] (CC) Expertise knowledge requirements [1] (CC) Top-down coaching [1] (SJ) Team in step [1] (SJ) Coordination between different teams [2] (SJ) (GR) Equal communication and collaboration [1] (ST) Full responsible for feature delivery [1] (SJ) Agile iterative model drives collaboration [1] (SJ) Training and the certification [1] (SJ)	Team competence	People
Human centricity or user-centricity [1] (JS) Vendors driven [1] (SJ) External success cases inspiration [2] (PS) (CC) Continuous feedback [1] (ST) Early feedback [1] (GR)	Stakeholder involvement	
Technological infrastructure [1] (SJ)	Selecting proper agile method	Technology

* **Frequency of codes mentioned by participants**

** **Pseudonyms of participants**

Explanation of Sub-themes

Corporate Culture

The operational mechanism of the ERP system offers the possibility of improved management, but it must be operated and applied by people to generate value. A particular ideology governs each person's behavior, long-term behavior will form a habit, and years of practice will form a unique corporate culture. Reformation is inevitable if the corporate culture does not enable the company to adapt to the requirements of this global market competition.

Implementing agile ERP systems in enterprise information technology projects is a reform of the traditional management model. It involves all aspects of the enterprise and permeates all enterprise levels, from senior leaders to grassroots staff. Technical problems are easier to solve, but the ideology cast in people's minds for a long time can never be changed in the short term, which is the key to the enormity of information management. The development and implementation of agile ERP is the reconstruction process of corporate culture; adapting to agile management style and ideas is a powerful force affecting business operations.

Therefore, agile ERP development and implementation success is closely linked to corporate culture.

Corporate system

During the implementation of the agile ERP management system project, the enterprise should set up department and post responsibilities, management systems, and operating procedures that are compatible with the implementation of the system. All enterprise levels should have a competition mechanism, an incentive mechanism and a restraint mechanism and formulate a comprehensive and complete performance evaluation system. An excellent corporate system not only unites talents but circumvents many management loopholes or drawbacks.

Project definition process

The project definition process aims to define the project objectives, understand the business environment, and reach a consensus on optimizing business processes and structures. The core business processes are defined by analyzing the existing production processes, business structure and customer requirements. After gathering more and more information and designing a conceptual process model, the project team documents and translates it into a document. These documents may define the scope and delivery of the project, timelines, responsibilities, day-to-day management, and changes to the quality plan. The project definition process analyses and understands the legacy systems in context and defines items that may lead to real improvements in the business, rather than only filling existing management gaps and structures by implementing a new system.

Project management process

The project management process is an integral part of agile ERP implementation and clarifying the importance of each aspect of project management is the key to successful project implementation. In addition to ensuring that the project is delivered on time, the project team must use the limited resources, technology, and tools to design and develop an agile ERP product that fully meets the needs of the project stakeholders. Successful, practical, and reasonable system products should have the following characteristics: can be highly compatible with the organization's business operations; can fully meet the user's usage habits; can fully guarantee the security of enterprise information; can meet the analytical needs of corporate decision-makers.

System technology

The configuration phase involves customizing the ERP following the process descriptions, setting up the technical and operational environment, as well as validating the overall business solution and gaining corporate acceptance. As the project progresses to this point, the technical requirements become particularly important. The supplier builds the core system and makes customized adjustments and modifications by validating the process descriptions and interviewing professionals on the organization side. The servers, the corporate network

and the ERP system software are then installed. The operating system supporting the entire software solution is also put in place. Once the hardware is up and running, the configuration work is complete, and most enterprise modifications have been tested and installed correctly, members of the project team can start using the entire system.

Team competence

Team competence can be a measure of a team or an evaluation of an individual. When developing and implementing an agile ERP project, it is first necessary to set a target for the team so that each member is clear on what the project development goal is and what the vision is. In this way, it creates a strong attraction to the members and enhances cohesion, thus making the team much more productive. The next step is to continuously educate and train members to embrace agile methods in terms of mindset, expertise, and skills. Finally, the quality of execution is directly related to the team's capabilities and will ultimately determine whether a satisfactory project product is delivered.

Stakeholder (key users) involvement

Key users play a pivotal role in the entire process of an agile ERP project. They act as a bridge between the system implementation consultant and the company, as well as between the upper and lower levels of the company, department heads and higher levels of the enterprise.

The advantage of key users lies in their solid professional background, familiarity with corporate culture, business process, business content, management style, etc. They cooperate with implementation consultants to complete essential business research, customization, master data preparation, and documentation. They are also responsible for coordinating the relationship between end-users and implementation consultants to optimize system functions to meet business needs. Once the system is live, key users continue to undertake tasks related to master data maintenance, knowledge transfer and system optimization.

Selecting proper agile method

Agile is not a specific method; it can be Scrum, XP, Kanban, DSDN, Crystal, etc. Agile is a set of values and principles. When choosing an agile method for a project, enterprises need to conduct rigorous research, study, and analysis. Replicating other success cases will not necessarily lead to your success, so don't have the preconception that if one project wants to be agile, it has to use Scrum or XP.

Evaluate the strengths and limitations of each agile method before applying them to decide whether they are suitable for the project. For instance, when an organization is unsure whether adopting Scrum is the best approach, there are several things to consider such as: What are the problems in the organization currently? Can Scrum solve these problems? Does Scrum fit with the management system and corporate culture? And if not, how much change

is required and can it be tolerated? If Scrum is not the optimal agile approach for the business, are there other or hybrid agile methods?

After clarifying the problems and improvement goals of the enterprise and roughly selecting the agile method that can deliver on expectations, it is then a matter of determining which tools to use. Even within the same type of agile methods, there are many agile management and development tools from multiple vendors to choose from. Mastering the correct ideas and selecting the appropriate agile method will significantly improve the success rate of agile ERP projects.

4.3 The 10 Most Important Critical Success Factors

The following 10 factors are the most CSFs sifted from the 34 interview codes. Different participants mentioned 6 of these factors twice (see Table 4, with the corresponding frequency after each code). Some participants emphasized the other 4 factors, and others provided quotes on similar themes. For example, although early feedback and continuous feedback were proposed by different participants and formed a unique code, due to their high similarity, this dissertation discusses them together to find the universality of the CSFs of agile ERP.

4.3.1 Themes – Organizational

1) Customer involvement

The service and customer sides are relatively isolated for traditional ERP development and application projects, often with limited business communication through several meetings. This makes it difficult for customers to truly understand that it takes more time and effort to realize some challenging requirements. In contrast, the agile approach is more successful because it actively involves the customers in the development and application process and seeks constant feedback.

“The third thing most ERPs are looking for nowadays is customer engagement or customer experience. Therefore, you’ll often see Salesforce is doing very well because their focus is on customer and customer experience, SAP has done that, Microsoft has done that, Adobe has done that, Google has done that.” (GR)

“We did very well to propose to clients that we will take your people into a rotation program with us, and you’ll learn with our teams. We’ll work with them and say, you know, if you want to set up something like that, come and see how we do it.” (PS)

The customer, or the product owner on their behalf, is continuously involved throughout the project. During the initial planning iteration, the customer and the project team work together to identify and prioritize user stories that form the initial product development roadmap.

Unlike traditional functional requirements, user stories are often less detailed and require clarification from the client during the iteration for design and build work. A good user story consists of three elements that describe the feature that the user desires from their perspective:

1. Role: who is going to use the feature.
2. Activity: what function needs to be done.
3. business value: why the feature is needed and what value it will bring.

In recent years user stories have often been expressed in the following standardized format: As a <role> I can <activity> so that <business value> (Zeaaraoui et al., 2013). Once the build phase of the iteration is complete, customers also test and provide feedback on the newly developed features.

“You're compensated based on the story points; you have a baseline and a way of calculating story points. That's another CSFs is measuring through story points and being very rigorous with story points and letting the estimation of story points be driven from the engineers themselves. (Because of the prioritization, that comes from the business, the product owner, the estimation of what it takes to deliver from not a project manager from the developers themselves.)” (SJ)

In terms of cost, project time, scope and quality, agile projects are more about delivering a high-quality product of value to customers. Project scope and delivery time are negotiable if customers agree and willing to cooperate. Some customers even accept to dedicate an extra budget for possible additional requirements. If the new requirements are valuable, the customer is also willing to extend the project time. And are happy to replace outdated provisions with new emerging needs in the iterative process.

“Human centrality or user-centrality is changing the way we have been implementing things in past, and the reason for that is that we expected users to change everything they have been doing in the past. What we are trying to do is give all the information all the stuff they need. To carry out their day-to-day activities in the format they were looking for in an easily digestible format.” (JS)

2) ERP cloud trend

From ERP selection to development and then to the specific implementation, consulting companies provide a full range of consulting and advisory services for ERP. They are independent of the enterprise and the ERP vendors, objectively and impartially helping customers gain a more comprehensive and in-depth understanding of ERP products and providing professional advice for selecting and implementing ERP. When a company's management lacks knowledge of IT technology but urgently needs to introduce ERP, taking heed and adopting the recommendation of a consulting firm can avoid more risks and hassles.

With globalization and technological change, organizations are increasingly inclined to transition to cloud ERP, such as Oracle Cloud and SAP S/4HANA, to manage project delivery of increasing complexity and stay ahead of the competition.

“I would say that eight to ten years is the cloud ERPs that are coming upright. And especially you may have seen players like SAP was covered with the S4/HANA cloud, public cloud edition, and Oracle as its fusion cloud and all that stuff. So, these ERPs are giving you best practices embedded inside the ERP itself and ask you to adopt that. That has changed the way customers think about ERP implementation itself.” (PS)

Especially with the impact of COVID-19, more businesses are being forced to switch to an online operating model where core systems are not flexible enough to meet remote working demands. Therefore, a critical factor in improving ERP agility is the move to the cloud.

“For most customers who deploy ERP, one of the key success factors is to move it into the cloud. And the reason why agile is seen as a good way to go is that every cloud company works agile. But it's doing is putting your infrastructure in the cloud unless you're using the platform as a service.” (GR)

With the rapid development of mobile internet, cloud ERP software can help companies keep in close contact and communication with their customers and partners anytime and anywhere. In addition to being used on mobile phones and other terminals, it also enables real-time synchronization of data information with the PC side. Even when business personnel are away or on business trips, they can easily and efficiently use ERP to advance their work, which is self-evident to the value of the enterprise.

“Cloud capability is very high because of the increased compute power, backup capacity, security.” (GR)

It is foreseeable that integrating cloud thinking and information technology into the ERP management system will become an essential tool for enterprises to transform and upgrade agile ERP. The mainstream ERP vendors in the market, such as SAP, have taken this approach in a forward-looking manner to help companies meet market demands faster, improve operational and management efficiency across the board and reshape their core competitiveness.

4.3.2 Themes – System

3) Build and maintain core systems

From the current ERP market usage, most companies tend to use three types of ERP software. The traditional packaged ERP product adopts a fixed system main structure by making a few functional adjustments to the software to address some of the new demands. The pain point of

its use is that it does not have a high degree of flexibility; the system is slow to update and cannot solve the more in-depth management needs of the business.

The second is ERP software provided by a third-party software company. It is designed and developed according to the user's functional requirements, including various functions such as finance, cost, project, and human resource management. This type of customized ERP is slow to build and relatively expensive to develop, and the quality is subject to the business understanding and industry experience of the R&D team.

In addition to purchasing ready-made packages or customizing ERP from third-party software companies, enterprises can also form their R&D team to develop ERP software that suits their development needs. However, this approach is challenging to build a team, but the development process can also be lengthy. In response to all these challenges, the rapid agile development model has gradually become the mainstream model for ERP development today, for instance:

“Windows went from having a lot of individual ERPs for each company to a single standalone ERP, which covered all their companies. Now their focus is to maintain that core at some time and then have all these bolt-on applications coming on top of it to maximize each business's potential.” (CC)

Companies can prioritize the most needed modules based on their current management model and budget.

“Most businesses deploy the first module is the finance module, the billing module, or something to do with cash or cash flow or revenue. Some businesses deploy HR or CRM or what we will call people software.” (GR)

4.3.3 Themes – People

4) Acceptance of agile methodologies

People are driven by values, and agile ERP project management is therefore driven by values. Changing from a traditional, sequential waterfall approach to an agile iterative framework, many organizations underestimate the barriers that must be overcome to achieve it. A team can adopt agile practices, but failure to embrace agile values may directly contribute to the loss of an agile ERP implementation.

“There's still a bit of scepticism in adopting agile even within sort of the consulting community. People have been delivering ERP under a waterfall with a very much set like business process and methodology for many years. So pivoting that into working in an agile way, which some might perceive as less structured, has been a challenge.” (SJ)

New systems or management styles often trigger resistance from employees, and successful implementation of change requires employees to adapt quickly to developments and changes. There is a general lack of agile knowledge and awareness, particularly in organizations with a relatively backward IT implementation base. They are satisfied with their current roles and are firmly resistant to change, fearing that adopting agile will result in changes or additions to their job responsibilities. Therefore, the introduction of agile ERP alone will not achieve the transformation goals of the enterprise. Only when employees truly embrace agile and use it to improve business productivity the efforts of enterprises to spend on agile ERP be meaningful.

“In the clients we spoke to, I would say that many of their internal staff were too experienced with the classical way of thinking, which is more waterfall. So I think the change management is not there. When I was in consulting, we had to show them the success stories to inspire them to say, hey guys; you need to think like this (agile).” (PS)

5) Mindset management

Both interviewees mentioned agile mindset management, a potential CSF that I had never thought about before conducting the interviews. Agile is a mindset or way of doing things based on values, principles, and practices. Even without an agile mindset, teams are able to use agile methods. It may not be a prerequisite for applying agile ERP, but functional groups and customers will reap surprising results if this mindset is nurtured.

In fact, organizations have put considerable effort into maintaining an agile mindset. Positive expectations exist for team members to work with, and they will have encouragement and praise for each other. People will adopt this more often in an environment where agile is applied, slowly adapting to the agile mindset. At the same time, behavior that goes against it is discouraged.

“The whole mindset change is the first one, and that mindset is not required to change right at the bottom or right at the top. It is a whole big broad brush that you need to change the mindset. Then it is best driven from the top once you have done the mindset change, including the change management and the whole agile mindset on how you will interact and second is looking at the perfect being enemy of good. You cannot have a perfect solution on day one, but you can return your investment a lot quicker if you were to get energized.” (JS)

From a consultancy perspective, many companies making the transition to agile ERP wonder if agile is simply an industry trend. What exactly is the value of agile ERP? How can success be achieved?

“Work with us and see for yourself; how are you doing, then take this back. I think this kind of load works a lot more than just talking about it and saying, Yeah, this is the best way to do it or the best way to do it. And I think I talked more about mindset management.” (PS)

The above mentions mindset management inspired by external success stories. It must be more intuitive and convincing to show clients other cases where agile ERP projects have been successfully developed and implemented while increasing their benefits. This key success factor will be discussed in more detail in a later section.

6) Top-down coaching

Agile training is ideal for aligning organizational and project team levels based on agile and related implementation methods. Unified agile coaching allows team members to access the same agile information, concepts, and implementation strategies, resulting in similar agile perspectives. This resonance dramatically increases the likelihood that the team will examine and adapt to agile together using a common language and practices, thus reducing potential conflicts.

Project team members are exposed to an agile environment daily, and with training and certification, they are more likely to embrace and adapt to agile thinking quickly. However, while many organizations have decided to move to agile, they have neglected to provide agile management guidance to senior management. Leaders may not understand what agile means and what changes their teams should make for it. Due to the differences in the nature of the work, the organization's upper echelons are often not the center of agile development and implementation, so there is little opportunity to experience how agile works intuitively.

Agile ERP development and implementation require a change in leadership, which must be implemented from the top of the organization downwards.

“Number one is coaching, adoption from the top. Senior leaders were pushing the philosophy of agile, and the coaching was there; large scale certifications were there. And then, there was a mandate that all practitioners and even providers must be certified. And then they brought in coaches that were, of course, certified to train and scaled agile and that had an SAP background.” (SJ)

Management needs to develop a leadership style that drives the enterprise more effectively than traditional models. Reduce downward pressure, allow teams to make mistakes and give them the freedom to improve. Organizations are keen to see leaders leading change with agility and flexibility rather than firmly holding the reins in their hands. Coaching senior management on agile leadership and culture lays the foundation for a successful rollout and agile ERP implementation.

“The training and the certification around the scaled agile framework is obviously a success factor that you have to do. Then, monitoring that and coaching that along the way at a change management level. Partnering with coaches at the senior leadership level and having your agile scrum masters also take on a coaching role for the team in terms of how

they work and observing anti-patterns and putting them along the path of running agile, encouraging higher, less hierarchical ways of working.” (SJ)

7) Coordination between different teams

In traditional waterfall projects, the capabilities and roles of team members and the specific skills corresponding to the positions are always one-to-one. When new tasks are generated in the project or a member leaves, it is costly for the team to wait for external resources to be provided. Unlike traditional competency management, agile teams advocate defining roles by competencies. Competencies are determined based on the team's goals, and members choose different competency labels based on their assigned tasks. There is a many-to-many relationship between members and ability labels; that is, multiple ability labels can be selected for the same role. And several abilities can be built accordingly, and the same capacity can be reflected in various team members.

“I felt that a scaled agile framework bridges the gap of the pure scrum with overall, large scale ERP transformation. Think of it as one level up, but all your various feature teams are structured around interrelated processes solutions. And then, along with that, you need to have enabling teams. Data takes on these teams can be seen as enabling teams that support that feature teams as they build out their features, and prioritize based on, what the feature teams provide, and then all of this is structured under a logical release training. That's a CSFs to logically arrange yourself in feature teams, that you have a concept of feature team versus an enabling team, that these are aligned under a release train, and that there are the dependencies.” (SJ)

The creation of diverse teams facilitates the professional development of team members. The way in which they work together and complement each other dramatically enhances the efficiency of cooperation, and thus the ability to respond quickly to external changes.

“I found culture, massive role in the success factors of what you have in a team. I've tried to involve all the team in the conversation and what it also means is we've got different technical skills with different areas of the business. Those people can weigh in on their area of expertise. So we do we've got to have a diverse team with diverse skills, but we also need that broad knowledge to get a real picture of what's possible.” (GR)

Furthermore, some participants mentioned the impact of setting KPIs, reporting and monitoring on teamwork. The purpose of setting KPIs is to facilitate management to keep track of the work of different teams, which can be deployed daily, weekly, or monthly basis, depending on the organization's needs. It shows how often the Agile ERP team is delivering value, or so to speak, to the end-user. When KPIs show poor performance, organizations can trace back in detail to different functional teams and make targeted changes and adjustments.

“We used to propose something like a value realization team beyond the technical team, a small office that reviews the KPIs (key performance indicators). And every sprint they do, they measure things. Okay, did I hit this KPI? For instance, I promise savings in procurement by doing this. Could I do that or not? And if not, then what should I do to change? That change does a quick decision making and moves there?” (PS)

8) External success cases inspiration

Generally, we don't get the opportunity to spend a lot of time talking to customers about agile. So getting them up to speed on the essence of agile is a common scenario for consultancies when pitching agile ERP to clients. It isn't easy to impress customers with just verbal persuasion. They must understand the benefits of agile and not just the workflow changes.

Inspiring customers with real-world success stories is ideal for making it easy to understand and embrace agile. When customers are looking for an optimized solution, we share the experience with such implementations; we show them the success stories that are most similar to their organization (industry, size, product). That is, we have used agile to help other companies achieve similar goals. It can be explained from the following five aspects through the way of storytelling:

- a) Establish objectives: defining the industry, company, stakeholders, and goals for the enterprise to develop and implement ERP.
- b) The current situation: the current management model of the enterprise, and the obstacles and challenges encountered.
- c) Needs: the precise requirements put forward by customers and how the management problems can be solved using agile ERP.
- d) Enabling: agile ERP can provide the solution.
- e) Benefits: the result of developing and implementing an agile ERP, such as improving management efficiency, reducing operating costs, etc.

“If you tell them anything, they will not get inspired that easily. But if you're talking about let's his follow clients; they get inspired by the likes of other large-scale successful companies. So I think spiritual is critical.” (PS)

“Unfortunately, unless there is proper management and leadership at every level is bought into the idea, it is hard to convert these non-value-added activities to be dropped from the day-to-day work or be even able to accept a new way of working. So the change management aspects can be brought up to a heavy extent from the external party. It has a lot more to do with an internal uplift of capabilities by upskilling the people and showing them how the world-class function will change their lives, etc.” (CC)

9) Early/ continuous feedback

There is only a single flow of information in the waterfall approach, with business experts proposing requirements, analysts creating the design model and developers implementing the code. A significant problem is that the waterfall approach does not anticipate certain flaws in the development model, and essential change requirements may not identify until the design and implementation process. At this time, the development team has been caught in a dilemma. If they want to meet customers' new requirements, they have to time out and invest more development costs.

In contrast, the short-cycle iterative nature of the agile methods allows for frequent stakeholder interaction, with the project team constantly adjusting to gaps between the product and customer expectations. Early and continuous feedback is one of the critical manifestations of customer involvement in agile ERP development and implementation. Throughout the project lifecycle, the customer establishes goals for the project and provides feedback for the progressive prototype (Serrador & Pinto, 2015). While changes can be more frequent in the early stages, the further the project progresses, the clearer the framework becomes and the easier it is to deliver a product that meets customer expectations.

“The difference, I think, is that you're able to release things sooner with agile; see the success factor. There is early feedback. We often hear the language fail early fail, but same time, what we don't hear is success early succeed, often and quite often. One of the takeaways is that we're able to show excellent outcomes very early on.” (GR)

“We have continuous feedback from the end-user that, well, we have these issues. It also helps us even know what they want, understating their needs. The next time we are doing another piece of development, you can relate to the previous deliverable that you did well, even the product backlog.” (ST)

4.3.4 Themes – Technology

10) Technological infrastructure

Before discussing this critical success factor, I would like to explain what an agile ERP technological infrastructure can do and what it can do for the business. Initially, infrastructure operations were based on installing software on physical machines, for example, A for orders and B for logins, with the two working separately and not interrupting each other, thus leading to inefficiencies. Later in the development of infrastructure, technology moved towards semi-automation and even automation, which has primarily driven agile adoption.

“Inbuilt memory, innovated finance, concepts, and processes have been improved because of the technology. Along with that came a push for agile, because the message was looking at the configuration and the setup of the system in the old days. That should be standard; that should be automated.” (SJ)

“Pivoting to that new took a top-down, technology innovation-driven mandate to pivot. At least with our organization, that's one of our, you can say selling points is that agile ERP allows for accelerated development earlier user adoption.” (SJ)

As discussed in the first key factor, more and more organizations are putting their infrastructure in the cloud.

“You can have your traditional ERP on-premises. And then move it to AWS or Azure, or Google Cloud. That's just infrastructure as a service. You can go software as a service like Xero, or any of these other tools that we see out on the market like Salesforce, or you can get a platform as a service where you have a little bit of control and development capability.” (GR)

“You need to focus on defining your, let's say, strategic initiatives around how you build competitive advantage? How do you enable cloud? How do you do that connectivity with ERP? How do you put it as part of the larger ecosystem? And I think at that time, you started to see a push both from the ERP vendors, the software vendors, plus the providers to pivot the market into an agile way. So we started doing enablement sessions. We started having to viz around how ERP fits into agile, and then we built our IP and started sort of sprinkling that within the market.” (SJ)

In addition, some work at the edge has massive potential for agile like RPA (Robotic Process Automation) or Interface development.

“I would say standardization work around the core of the ERP, and a lot of innovation work around the edge in the areas would be like industry 4.0, which includes IoT. You have like your data lakes and ML and AI visualization kind of RPA (Robotic Process Automation) stuff. So, people will do these projects very quickly to get some value out of them.” (PS)

Chapter 5. Discussion

The aim of this study is to identify CSFs for agile ERP development and implementation projects to filter the most important CSFs based on this in conjunction with research data. Of the 10 most CSFs in the findings chapter, one each was 'system' and 'technology', and two were 'organizational'. The most significant proportion is 'people', reaching 6, so it is fair to say that 'people' are the success factors that participants focused on and prioritized the most. The only factor that failed to have a significant impact was the 'process' dimension. Although some participants mentioned several fragmented 'process' factors, including using story points and zero or low documentation makes accountability difficult, etc. This research did not choose to include 'process' factors in the top 10 CSFs for discussion, given the participants' ranking of all factors.

The participants believed that shifting from traditional ERP project development and implementation models to agile was extremely challenging. If employees resist the application and implementation of agile methods, it may lead directly to the failure of an agile ERP project. In their role as external consultants, participants show other successful agile ERP cases to their customers and gradually guide them to think in an agile way. However, the literature has found through regression analysis that even in the absence of an enabling environment for general acceptance of agile, as long as the team is competent and has the correct delivery strategy, agile projects can still be completed on time and within cost (Chow & Cao, 2008).

As far as training on agile is concerned, participants supported the practice of the approach from senior leaders to junior staff, which facilitates increased agile acceptance and facilitates projects within the organization (Kronbichler et al., 2009). The training approach supported by the findings was formal training, with coaches often being certified like Scrum Masters. In contrast, agile practitioners in another study felt that continuous, informal learning was more conducive to the dissemination of agile knowledge in the organization (Misra et al., 2009).

The two CSFs newly identified in this research are the ERP cloud trend and external success cases inspiration. Due to the lack of success stories from other companies, many SMEs were still not planning to implement or were on the fence about cloud ERP. They expect to hear positive feedback from external users to increase their confidence and chances of success in adopting cloud ERP (Razzaq et al., 2020). In addition to what participants believe, moving to the cloud will increase the agility of ERP. Compared with the licenses, servers, software and hardware, and operation, installation and maintenance costs required by traditional ERP, cloud ERP can significantly save the funding of enterprises (Razzaq et al., 2020).

The tremendous market share increase has validated cloud ERP's upward trend. Statistics from a consultancy firm specializing in ERP systems showed that the market share of cloud

ERP climbed from 11% to 27% from 2015 to 2016 (Razzaq et al., 2020). There are growing of organizations are shifting their ERP deployment strategies to the cloud, where real-time cloud ERP can provide more flexibility and satisfaction to customers. Oracle says that around 70% of company CFOs plan to implement cloud ERP for their organizations in the next five years (Razzaq et al., 2020).

5.1 Constraints and Challenges

Many of the CSFs for agile ERP development and implementation, however applying agile is a challenging task, and it's not as easy and quick as installing a piece of software. Some organizations are experiencing more form than practice when transitioning to agile. The fact is that implementing the full range of agile practices does not make enterprises successful at being agile. Organizations value the agile process, they are doing everything right in practice, but the timing and manner of implementation may not be optimal, making them appear to be agile practices when they are not.

“People forget that they have been running on the legacy for probably the longest and I guess he also means that there is an end of time way of doing things, which means people are kind of used to doing things (waterfall) as they are.” (CC)

Parts of senior leaders are in the process of agile change and hope for the organization to maintain its original productivity but do not want to be affected by new things. Nevertheless, the leadership stresses that the team should work in an agile way.

“I think one challenge is, in some ways, my clients align themselves too much based on organizational leadership, traditional hierarchies, and that that that drove, and they just kind of transpose that into agile at the top level. So the challenge was that we've got released trains aligned with traditional leadership positions, which in my mind, it could have been done differently, where we should have structured the release trains based on the value.” (SJ)

Teams need a learning phase as they master each new method, and it is normal for productivity to drop during this phase. But from the perspective of the top of the organization, we always hear the voice of using agile without compromising the current progress. On this premise, when the team conflicts with the principles of agile, the premise of the project will take precedence over the new practice, and the team will feel that the procedure is against agile during the implementation process. It can be seen that agile is only a tool and a new method and has not truly accepted and embraced the agile mindset and culture from the top down to bring about productivity improvements through cultural transformation. Without experiencing the tangible benefits of agile, team members tend to resist agile over time and revert to the waterfall process they are used to.

“One of the critical things of agile is very little learning on the go. Your knowledge is dedicated to understanding the business, but it is not about how you do your job. So an exam process in my mind is always run by multiple experts. I will add to my previous step that numerous experts are running on autopilot in synchronous. Whereas in the waterfall, you still have the dedicated time to learn, figure out how to do things or learn on the job, if I want to call it that way. I have never seen that happen. Therefore, the more expert you are, the more confidence I have as a product owner to get the intended outcomes.” (CC)

Even if the leadership can enforce the definition of an agile project implementation process, we cannot determine in the short term whether it will achieve the desired results, as many companies struggle to do at the beginning of agile implementation. The first essence of the agile manifesto is that people are more important than interaction and tools, advocating the use of human creativity and motivation. The organization should fully trust individual's capabilities and stimulate the creativity of its employees to create value rather than increase productivity by defining work processes and using fixed tools. From a people perspective, many of the challenges in agile implementation can ultimately be attributed to such cultural clashes.

5.2 Hybrid approach (traditional + agile)

Few organizations are now exclusively waterfall or agile, and more adopt a hybrid model that combines the two. In the hybrid model, waterfall methods are used for the easy-to-understand predictive part of the project, while agile approaches are used for the iterative, more uncertain details. According to Samaneh et al.'s (2021) thematic analysis study, the possibility of using different agile methodologies in ERP implementations has been demonstrated, with the highest adoption being a hybrid approach combining traditional with agile methods. Organizations cannot apply methodologies in a one-size-fits-all manner. Instead, they need to formulate exact plans and plans based on actual differences in company culture, project type, team size, team maturity, and product size. Most of the participants in this dissertation have participated in successful hybrid projects.

“In the approach that we give to the clients, I don't think we proposed agile in many of them. Even as far as when I represented my organization, our approach was always a mix. And depending on the complexity of the client, depending on the readiness for cloud and the kind of software, it was a lot more driven by the type of initiative that they're taking and the value they expect.” (PS)

“Because at the end of the day, we're not pushing software, month by month, or release by release to production. Given that it's finance, you know, these are mission-critical processes that have to work together in an integrated way. We have a monthly release schedule. We're going to be pushing these features. It can't be that disruptive to the business, so you

still must plan releases. So in some ways, you can't get away from that. And some might argue that that's still waterfall, and some might argue that's hybrid.” (SJ)

Essentially, the difference between waterfall and agile methods is predictability versus adaptability. The waterfall approach strives for predictability, declaring the completion of the project only when all predetermined functions have been completed and implemented. In the initial stage of the ERP project, a macro grasp of the entire system ensures that there will be no functional omissions. And considering the consistency of logic, it is convenient for the overall optimization of the system in the later stage (Shimoda & Yaguchi, 2017).

On the other hand, agile management pursues adaptability, focusing on delivering an MVP (Minimum Viable Product) and iteratively releasing new features, collecting user feedback to guide improvement.

“Suppose you think about going back to the industry angle and saying that if I have an industry template that I can configure for a client to show in the early design and blueprint phase. To me, that's a good MVP for the client. This is how your system is going to look. And you're ready to adopt these processes. This is how you will do it. And that includes not just the process, but the UI and other feelings about it as well.” (PS)

By experimenting with some agile practices, such as daily stand-ups and more frequent delivery deadlines. Even organizations that are not ready to adopt agile ERP are able to explore their suitability for agile.

“I think the best thing is to have daily stand-ups if they add value and keep them short.” (GR)

Chapter 6. Conclusions

6.1 Theoretical and practical implications

The findings of this study provide answers to the two research questions.

RQ1. What are CSFs of agile ERP projects?

Table 5. A summary of the 10 most important CSFs

The 10 Most Important CSFs	Themes
Customer involvement ERP cloud trend	Organizational
Build and maintain core systems	System
Acceptance of agile methodologies Mindset management Top-down coaching Coordination between different teams External success cases inspiration Early/ continuous feedback	People
Technological infrastructure	Technology

The eight most CSFs mentioned above are supported by the literature (Chow & Cao, 2008; Wijaya et al., 2019; Darwish & Rizk, 2015), except for ERP cloud trends and external success cases inspiration, which are new trends found in this study.

RQ2. How to rank the most important CSFs?

Identifying the most important CSFs depends on the number of times different participants mention each code. The more frequently the participants mentioned, the more critical the success factors are. Therefore, concerning Table 4, the first few CSFs identified in this study (mentioned 2 times) were: customer involvement, cloud ERP trend, acceptance of agile methodologies, mindset management, coordination between different teams, and external success cases inspiration.

The researcher could not assert which was more critical for factors that appear with the same frequency, such as acceptance of agile methodologies and coordination between different teams. It has been suggested that technical dimensions, such as agile software engineering techniques and delivery strategies, are the most critical factors affecting the success of agile projects (Chow & Cao, 2008). While technical factors are not the CSFs of most concern in this research, the configuration of technical infrastructure and tools does fundamentally

improve the success of agile ERP projects (Darwish & Rizk, 2015). In contrast, another study pointed out organizational factors as the most critical strategy to support agile ERP implementation (Wijaya et al., 2019). The selection of build and maintain core systems, top-down coaching, early/ continuous feedback, and technological infrastructure in the most critical ranks was due to the emphasis placed on them by participants during the interview process. While the above four success factors occur once, as elaborated in chapter 4.3, other participants also provided similar views on these four themes.

Nevertheless, the findings of this dissertation show that the people dimension has the greatest impact on the success of agile ERP development and implementation, with secondary themes divided into team competence and stakeholder involvement. The literature supports the above participants' perceptions, in particular the view that some human factors can also be classified as organizational factors, such as team competency, coaching and learning, and social culture (Misra et al., 2009). Socio-cultural factors affect work outcomes; if development teams are highly receptive to agile methods, their active promotion of agile ERP projects is bound to impact the final success positively.

This research provides practical implications for companies when developing and implementing agile ERP strategies. Particularly in the context of limited resources and budgets, corporate managers can take their situation into account and focus first on people factors management. Then progressively advance agile in terms of organizational, system, technology, and process, in this order, effectively increasing the success of agile ERP development and implementation. Furthermore, enterprises need to be prepared for the construction and application of cloud ERP, which is a new trend in the network economy era enterprises to achieve the necessary success conditions for information management.

6.2 Limitations and future research

Qualitative data is intense subjectivity and derived from a single context and is difficult to describe in terms of clear data standards. Therefore, my subjective awareness played a central role in the data analysis, and it is impossible to fully replicate the contextual meanings of the participants when they took part in the interviews. The data covered agile ERP project system integration providers in New Zealand and consulting firms in Singapore. Despite the experiences and perceptions shared by the participants were extracted and coded to make the data quantitative and capable of being counted. Due to the limitations of researcher time, funding, and the number of invited participants, the findings are drawn from this study's qualitative case analysis can be used as a supplement and extension to the existing theories in the previous literature. It would be highly instructive if the findings could be further validated with quantitative methods so that the prioritization of the most CSFs could be made more explicit, thus providing cost savings and productivity improvements for companies in ERP agile environments.

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Appendix:

Appendix 1. Data extracted from participants (Singapore & New Zealand)

Data extracted from participants in Singapore — Consulting perspective

Data extracts (PS)	Codes
<p>In the clients we spoke to, I would say that many of their internal staff were too experienced with the classical way of thinking, which is more waterfall. So I think the change management is not there. When I was in consulting, we had to show them the success stories to inspire them to say, hey guys; you need to think like this (agile).</p>	<p>Acceptance of agile methodologies</p>
<p>If you tell them anything, they will not get inspired that easily. But if you're talking about let's his follow clients; they get inspired by the likes of other large-scale successful companies. So I think spiritual is critical.</p>	<p>External success cases inspiration</p>
<p>We did very well to propose to clients that we will take your people into a rotation program with us, and you'll learn with our teams. We'll work with them and say, you know, if you want to set up something like that, come and see how we do it.</p>	<p>Customer involvement</p>
<p>Work with us and see for yourself; how are you doing, then take this back. I think this kind of load works a lot more than just talking about it and saying, Yeah, this is the best way to do it or the best way to do it. And I think I talked more about mindset management.</p>	<p>Mindset management</p>
<p>We used to propose something like a value realization team beyond the technical team, a small office that reviews the KPIs (key performance indicators). And every sprint they do, they measure things. Okay, did I hit this KPI? For instance, I promise savings in procurement by doing this. Could I do that or not? And if not, then what should I do to change? That change does a quick decision making and moves there?</p>	<p>Setting KPIs, reporting and monitoring</p>
<p>Suppose you think about going back to the industry angle and saying that if I have an industry template that I can configure for a client to show in the early design and blueprint phase. To me, that's a good MVP (Minimum viable product) for the client. This is how your system is going to look. And you're ready to adopt these processes. This is how you will do it. And that includes not just the process, but the UI and other feelings about it as well.</p>	<p>Early MVP</p>
<p>We started a bit late, but I think that is changing now because the public cloud versions have more capability, and everything is cloud-first in the product development cycle. So personally, just for your</p>	<p>Cloud ERP trend</p>

<p>envision for what to tell you what I do now. So you know, with COVID-19, all the topics that are coming up, that is exactly my focus but with my partners. What I was going to say is that with the clients, what we have done is we have at least showed them that there is more flexibility in configuring and stuff, so we have accelerated the roadmap a bit.</p>	
<p>If you plan it better and divide in the process for UPS upfront, have very good interconnected streams at the end. So I think the planning part would be a CSF. Because you can go about it by doing this, as you know, it works very well with custom development. If your project focuses a lot more on the process, you know you need to figure that out. I would call this category as taking the customers. I would say DNA and mapping it to the planning part. So it's like a global customer, multi-industry and mapping it to prime, so that would be the first critical factor.</p>	<p>Management planning</p>
<p>In the past, you have a warehouse, a guy who's doing inventory count in the warehouse. If that can be automated, then that guy gets a different job. So I think design also is key. Maybe it's not valid for all projects, but that could also be a key thing for big ERP projects. But outside chain management, KPIs analytics, the org design, and optional communication with all parties. I think these would be the execution part, the critical things in doing this to projects better.</p>	<p>Executive Management</p>

<p>Data extracts (CC)</p>	<p>Codes</p>
<p>In the last seven years or so, we have seen massive investment both from a clientele perspective and our industry. So when I say our industry, I mean accounting in general, has been upscaling all the participants right from the lowest level to the most senior management to think agile, promote agile, and see the benefits faster.</p>	<p>Incentives mechanism for applying agile</p>
<p>Windows went from having a lot of individual ERPs for each company to a single standalone ERP, which covered all their companies. Now their focus is to maintain that core at some time and then have all these bolt-on applications coming on top of it to maximize each business's potential.</p>	<p>Build and maintain core systems</p>
<p>So scheduling the human time means that if I have one or two resources dedicated to me in that 100% capacity, there is a no brainer, heavy chance, and a heavy success factor linked to that. But when I have these sources, which only come in on time to give their expertise, or they are only required to do X amount of hours a day to give to a project, that's when I see that most of my agile and developments start going haywire.</p>	<p>Time and HR allocation</p>

<p>So when we speak about major core applications going to SAP, they have a predefined timeline or a cycle or vendor release. Now, if you engage SAP to develop something very specific for you at the time, then those agile sprints have to be synced in coordination with the vendors.</p>	<p>Coordination with vendors</p>
<p>The most important thing is that when we start the project, we should spend time getting the management objectives crystallized with a clear outcome and a goal. Now that a clear outcome and a goal is then translated into work packages, work packages or an individual on a team of people working on the same objective, so developers have their work packages defined in such a way that this is what we expect them all to do.</p>	<p>Consistent team goals</p>
<p>For most agile projects, we always have a financial burn rate that we expect to deliver. So once, some of the things that we always ask the clients to be sure about is when they approve the budgets for projects, we ask them to think of Sprint cycles as a base. So every time a business expert is engaged, their time also has to be evaluated, calculated and accounted for outflow disciplines; every vendor that comes onboard has been told the same thing. Once you come on board, you have to make sure that the budgetary assignment that has been done to your piece of work has to be within tolerance.</p>	<p>Expected financial burn rate</p>
<p>Unfortunately, unless there is proper management and leadership at every level is bought into the idea, it is hard to convert these non-value-added activities to be dropped from the day-to-day work or be even able to accept a new way of working. So the change management aspects can be brought up to a heavy extent from the external party. It has a lot more to do with an internal uplift of capabilities by upskilling the people and showing them how the world-class function will change their lives, etc.</p>	<p>External success cases inspiration</p>
<p>One of the key things about agile there is very little learning on the go. Your learning is dedicated towards understanding the business, but it is not about how you do your job. Whereas in waterfall, you still have the dedicated time to learn, figure out how to do things or learn on the job if I want to call it that way. So the more expert you are, the more confidence I have as a product owner to get the outcomes which I intended.</p>	<p>Expertise knowledge requirements</p>

Data extracts (SJ)	Codes
<p>There's still a bit of scepticism in adopting agile even within sort of the consulting community. People have been delivering ERP under a waterfall with a very much set like business process and methodology</p>	<p>Acceptance of agile methodologies</p>

for many years. So pivoting that into working in an agile way, which some might perceive as less structured, has been a challenge.	
With my current clients, there was a top-down push, driven by the CIO, the CTO of the bank, for all of the technology to run every single project based on agile.	Top management drive and support
So pivoting to that new (agile ERP) took a top-down, technology innovation-driven mandate to pivot. Inbuilt memory, innovated finance, concepts, and processes have been improved because of the technology. Along with that came a push for agile, because the message was looking at the configuration and the setup of the system in the old days. That should be standard; that should be automated.	Technological infrastructure
You need to focus on defining your, let's say, strategic initiatives around how you build competitive advantage? How do you enable cloud? How do you do that connectivity with ERP? How do you put it as part of the larger ecosystem? And I think at that time, you started to see a push both from the ERP vendors, the software vendors, plus the providers to pivot the market into an agile way.	Vendors driven
Number one is coaching, adoption from the top. Senior leaders were pushing the philosophy of agile, and the coaching was there; large scale certifications were there. And then, there was a mandate that all practitioners and even providers must be certified. And then they brought in coaches that were, of course, certified to train and scaled agile and that had an SAP background.	Top-down coaching
I had challenges at first because it was like agile shouldn't be something that's forced, but it should be natural, but in a way, it had to be forced, in the beginning, to be adopted. I think one of our selling points of the extension was that putting in people that would uphold the agile manifesto. So to say, and ensure that that was adopted throughout, you know, from the early you know, planning to the ceremonies, we call it program increment, signing to instilling the ceremonies to engaging people to speak up. Everyone speaks up in the daily stand up so that it's not top-down at that level, within the team level.	Initial top-down mandatory adoption
I think with ERP; you can't just have, self-formed agile teams, running and running at their own pace. Everything, in many ways, has to be still kind of coordinated.	Team in step
I felt that a scaled agile framework bridges the gap of the pure scrum with overall, large scale ERP transformation. Think of it as one level up, but all your various feature teams are structured around interrelated processes solutions. And then, along with that, you need to have enabling teams. Data take on these teams can be seen as enabling	Coordination between different teams

<p>teams that support that feature teams as they build out their features, and prioritize based on, what the feature teams provide, and then all of this is structured under a logical release training. That's a CSFs to logically arrange yourself in feature teams, that you have a concept of feature team versus an enabling team, that these are aligned under a release train, and that there are the dependencies.</p>	
<p>We're talking about agile-based contracting. If you want to drive accountability based on completely, you know, outside providers, then it makes sense to have a feature team that is completely or majority run by within one team. So we have this concept of lead feature teams, where we're fully accountable for the delivery of the features within that team.</p>	<p>Full responsible for feature delivery</p>
<p>You're compensated based on the story points; you have a baseline and a way of calculating story points. That's another CSFs is measuring through story points and being very rigorous with story points and letting the estimation of story points be driven from the engineers themselves. (Because of the prioritization, that comes from the business, the product owner, the estimation of what it takes to deliver from not a project manager from the developers themselves.)</p>	<p>Using story points</p>
<p>You're really forced to deliver objects within video to expense with agile. So I think that's worked out ideal because you need to show something of value to the product owner within two weeks at the end of the sprint. That's a CSFs of adoption, forcing that collaboration between product owners and the development or configuration, if you will.</p>	<p>Agile iterative model drives collaboration</p>
<p>The training and the certification around the scaled agile framework is obviously a success factor that you have to do. Then, monitoring that and coaching that along the way at a change management level. Partnering with coaches at the senior leadership level and having your agile scrum masters also take on a coaching role for the team in terms of how they work and observing anti-patterns and putting them along the path of running agile, encouraging higher, less hierarchical ways of working.</p>	<p>Training and the certification</p>

Data extracted from participants in New Zealand — IT services perspective

Data extracts (JS)	Codes
<p>The whole mindset change is the first one, and that mindset is not required to change right at the bottom or right at the top. It is a whole big broad brush that you need to change the mindset. Then it is best driven from the top once you have done the mindset change, including the change management and the whole agile mindset on how you will interact and second is looking at the perfect being enemy of good. You cannot have a perfect solution on day one.</p>	<p>Mindset management</p>
<p>Human centricity or user-centricity is changing the way we have been implementing things in past, and the reason for that is that we expected users to change everything they have been doing in the past. What we are trying to do is give all the information all the stuff they need. To carry out their day-to-day activities in the format they were looking for in an easily digestible format.</p>	<p>Human centricity or user-centricity</p>
<p>Agile is being able to give them what they need for their organization based on their needs. Not thing that we think we must do that, we have different customers. At different maturity levels, I work differently with them.</p>	<p>Customer involvement</p>

Data extracts (ST)	Codes
<p>Another one that I mentioned is the agile concept of work coming in change. I think it's very critical that you want to deliver something that the customer can use. So the feature the aspect of being able to take change is very important.</p>	<p>Change management</p>
<p>I also think the agile ceremonies are equally important as our daily stand-up; we have our sprint review. I don't know we will stay with our sprint retrospective this week. Then with our sprint planning this week as well, that's why I remember I thought is I can only do it next week because we're going to sprint planning and at least we left a sprint planning I will not be so busy then we can have this interview. So those ceremonies keep the communication flowing.</p>	<p>Agile ceremonies</p>
<p>And I love the level of collaboration that we have in an agile setup. They are not those levels that are putting people away from each other. There are no barriers to communication. I can talk to my product manager anytime; I can speak to developers and business analysts anytime. So that level of communication and collaboration is I didn't have it from the traditional setup. We were like different games, almost competing or fighting at some point, fighting each. But in an agile environment, we are a team. There's this level of teamwork. We want</p>	<p>Equal communication and collaboration</p>

to complement each other; we want to win together. So it's also very critical.	
In a way, like I've taught the management, stakeholder involvement is already involved. The end-user is already involved. Though even I don't work with the end-user directly. But the business analyst, the process, the product manager, they are the end-user to me. So they are involved throughout the whole cycle. Even in sprint planning, we have them. They're the ones who are prioritizing and saying these are our priorities. This is what we want to achieve in this sprint. So that involvement is also critical.	Stakeholder (the end-user) involvement
The continuous feedback that we have from the end-user that well, we have these bags we have you know these issues. It also helps us even know what they want, understating their needs. The next time we are doing another piece of development, you can relate to the previous deliverable that you did well, even the product backlog.	Continuous feedback

Data extracts (GR)	Codes
The difference, I think, is that you're able to release things sooner with agile. See the success factor; there is early feedback. We often hear the language fail early fail often, but same time what we don't hear is success early succeed often and quite often. That's one of the takeaways is we're able to show really good outcomes very early on.	Early feedback
I found culture, massive role in the success factors of what you have in a team. I've tried to involve all the team in the conversation and what it also means is we've got different technical skills with different areas of the business. Those people can weigh in on their area of expertise. So we do we've got to have a diverse team with diverse skills, but we also need that broad knowledge to get a real picture of what's possible.	Coordination between different teams
For me, there's a CSF in agile we can often say stop, don't do this anymore, or in Lean, that's waste. It's skipped doing that. And I find that quite liberating versus traditional project management and waterfall would be doing it anyway.	Timely stop loss
Everyone goes for a zero or low document or document an outcome. Every project (agile) I've walked into where there's no documentation, there's no ownership. There's no accountability. So when I join projects, I get a little bit rigid. Someone has to drive some of the documentation around the project, whether she does all the work on the requirements and the rules and all that stuff. That's not. So that's still there. But I find many other projects people immediately switched from waterfall highly documented to agile, zero documentation,	Zero or low documentation makes accountability difficult

<p>responsibility, and I think that's a shortfall depending on the type of people you're working with.</p>	
<p>For most customers who deploy ERP, one of the key success factors is to move it into the cloud. And the reason why agile is seen as a good way to go is that every cloud company works agile. But it's doing is putting your infrastructure in the cloud unless you're using the platform as a service.</p>	<p>Cloud ERP trend</p>
<p>The third thing most ERPs are looking for nowadays is customer engagement or customer experience. So you'll often see Salesforce is doing very well because their focus is on customer and customer experience, SAP has done that, Microsoft has done that, Adobe has done that, Google has done that.</p>	<p>Customer involvement</p>

Participant Information Sheet

- **Date Information Sheet Produced:**

July 22, 2021

- **Project Title**

Critical Success Factors (CSFs) of Agile ERP Development and Implementation Projects.

- **An Invitation**

My name is Lifan Zhang and I invite you to participate in my research which is being conducted as part of my Masters in Business degree at Auckland University of Technology (AUT). The interview will last approximately one hour and will be conducted at a time and place convenient to you, either face-to-face or via a video conferencing platform such as Zoom or Skype. I would greatly appreciate your participation in this research and look forward to learning about your experiences and gaining new insights.

- **What is the purpose of this research?**

Although agile ERP development and implementation have obvious advantages, many people in the Business Information Systems (BIS) field still lack a comprehensive understanding of the CSFs of agile ERP. Therefore, to improve the quality of ERP development and implementation projects, the purpose of this research is to identify:

RQ1. What are the CSFs of agile ERP projects?

RQ2. How to prioritize the CSFs identified in the agile ERP projects?

The results of this research will be published in my dissertation, academic and practitioner journals. The research will not disclose your real names, and by default, all identifiable information will be disguised using pseudonyms or codes to ensure confidentiality.

- **How was I identified and why am I being invited to participate in this research?**

You were identified as a potential participant because your organisation is developing and implementing an ERP system while using agile methods. You were invited to become a participant because this research would benefit greatly from your involvement.

- **How do I agree to participate in this research?**

You will agree to participate in this research by emailing a signed copy of the attached consent form to the primary researcher at trt8106@aut.ac.nz. The interview content will be noted and recorded.

Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

- **What will happen in this research?**

During the approximately one hour interview, the interviewer (Dr Maduka Subasinghage & Lifan Zhang) will ask you the following questions: (a) what are your main responsibilities in your current job and provide a typical day's activities, (b) what do you think are the advantages of agile ERP compared to traditional ERP, (c) how do you think agile methods have improved the success of ERP projects, (d) what do you consider to be the CSFs in an agile ERP project, (e) how would you prioritize these CSFs in an agile ERP project to ensure the highest level of project success and why, and (f) what are the challenges of implementing and developing an agile ERP project? For example, expertise, change of project management methodology, or acceptance of personnel.

- **What are the discomforts and risks?**

You are not expected to experience any discomforts or risks. All indicative questions are not compulsory, and participants are free to stop the interview at any time if they experience any discomfort. The data collected from interviews about what you share is for research purposes only, and it does not pose a risk in any way to you.

- **How will these discomforts and risks be alleviated?**

You are not required to answer all the questions and can withdraw from the interview at any time without taking a risk. Furthermore, all information you provide will be kept confidential.

- **What are the benefits?**

Sometimes you may be caught in a stop-stand situation at work and do not have much time to reflect on the way to develop and improve project delivery efficiency more quickly and consistently. Taking part in this research is a great opportunity to prompt you to think critically about your career development, choices, and adjustments to the way you work. Looking forward that your participation will inspire you to make positive changes and add value to yourself.

Meanwhile, your participation will benefit the research by providing valuable insights into BIS domain knowledge from the professional perspective of an agile ERP practitioner. This research will also contribute to my achievement of a Master of Business degree at AUT. Your participation will drive more practitioners to focus on agile ERP. Prioritizing CSFs in agile ERP projects can maximize project success within limited budgets and delivery times,

which can also benefit the BIS community by increasing adaptation to changing business environments.

- **How will my privacy be protected?**

All information you provide will be used for research purposes only. The data will be stored in a password protected Teams group. The primary researcher and primary supervisor have access to the data. This project is a part of the ongoing search project of the primary researcher. Therefore, data will be shared with the primary researcher's research collaborator Dr Sam Madanian – a lecturer at AUT. If there is a requirement to share the data with other research collaborators in future, the data will be shared in the same way through a password protected Teams group. Your privacy will be protected by the use of a pseudonym or code. However, you could choose to be identifiable in publications. If you have any questions during the interview, please feel free to ask.

- **What are the costs time and place of participating in this research?**

There is no cost to participate in this study, and it will only take up an hour of your valuable time.

- **What opportunity do I have to consider this invitation?**

It would be great if you could respond to the invitation as soon as possible, or at the latest within a week of receiving this email. The researcher will schedule interviews according to the availability and convenience of the participant. Interviews can be face-to-face or via an online meeting platform such as Zoom or Skype.

- **Will I receive feedback on the results of this research?**

Yes. Participants will receive the results of this research if they wish, by emailing from trt8106@aut.ac.nz.

- **What do I do if I have concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Dr Maduka Subasinghage, maduka.subasinghage@aut.ac.nz, (+64)921 9999 ext. 5048.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTECH, ethics@aut.ac.nz, (+649) 921 9999 ext. 6038.

- **Whom do I contact for further information about this research?**

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

Researcher Contact Details:

Lifan Zhang, trt8106@aut.ac.nz, (+64)21 088 21182

Project Supervisor Contact Details:

Dr Maduka Subasinghage, maduka.subasinghage@aut.ac.nz, (+64)921 9999 ext. 5048

Appendix 3. Consent Form

The logo for Auckland University of Technology (AUT) is displayed in white text on a black rectangular background.

TE WĀNANGA ARONUI
O TĀMAKI MAKĀU RAU

Consent Form

Project title: Critical Success Factors (CSFs) of Agile ERP Development and Implementation Projects.

Project Supervisor: Maduka Subasinghage

Researcher: Lifan Zhang

- I have read and understood the information provided about this research project in the Information Sheet dated 26 July 2021.
- I have had an opportunity to ask questions and to have them answered.
- I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without being disadvantaged in any way.
- I understand that if I withdraw from the study then I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.
- I agree to take part in this research.
- I wish to receive a summary of the research findings (please tick one): Yes No

Participant's signature :

.....

Participant's name:

.....

Participant's Contact Details (if appropriate):

.....

.....

.....

Date :

Approved by the Auckland University of Technology Ethics Committee on **type the date on which the final approval was granted** AUTEK Reference number **type the AUTEK reference number**

Note: The Participant should retain a copy of this form.

Indicative Questions for Interviews

1. How many years of experience do you have in the field of ERP systems?

- a) Less than 2 years b) 2 - 5 years c) more than 5 years

2. Please briefly describe:

- Your main responsibilities in the current job
- Your activities in a typical day

3. Who is the current ERP provider of organization?

4. What do you think are the advantages of agile ERP over traditional ERP?

5. How do you think agile methods have improved the success of ERP projects?

6. What do you consider to be the CSFs in an agile ERP project?

You can elaborate on various aspects, such as:

- a) organization b) process c) system d) personnel e) technology

7. Based on your work experience, how would you prioritize these CSFs in an agile ERP project to ensure the highest level of project success? And why?

8. What are the challenges of implementing and developing an agile ERP project? For example, expertise, change of project management methodology, or acceptance of personnel.

Appendix 5. Ethics Approval



Auckland University of Technology Ethics Committee (AUTEC)✉

Auckland University of Technology✉
D-88, Private Bag 92006, Auckland 1142, NZ✉
T: +64 9 921 9999 ext. 8316✉
E: ethics@aut.ac.nz✉
www.aut.ac.nz/researchethics✉

TE WĀHANGA ARONUI
O TĀMAKI MAKĀU RAU

21 October 2021✉

Maduka Subasinghage✉
Faculty of Business Economics and Law✉

Dear Maduka✉

Re Ethics Application: **21/374 Critical Success Factors (CSFs) of Agile ERP Development and Implementation Projects**✉

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).✉

Your ethics application has been approved for three years until 21 October 2024.✉

Standard Conditions of Approval✉

1. The research is to be undertaken in accordance with the [Auckland University of Technology Code of Conduct for Research](#) and as approved by AUTEC in this application.✉
2. A progress report is due annually on the anniversary of the approval date, using the EA2 form.✉
3. A final report is due at the expiration of the approval period, or, upon completion of project, using the EA3 form.✉
4. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form.✉
5. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.✉
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.✉
7. It is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard and that all the dates on the documents are updated.✉
8. AUTEC grants ethical approval only. You are responsible for obtaining management approval for access for your research from any institution or organisation at which your research is being conducted and you need to meet all ethical, legal, public health, and locality obligations or requirements for the jurisdictions in which the research is being undertaken.✉

Please quote the application number and title on all future correspondence related to this project.✉

For any enquiries please contact ethics@aut.ac.nz. The forms mentioned above are available online through <http://www.aut.ac.nz/research/researchethics>✉

✉

(This is a computer-generated letter for which no signature is required)✉

The AUTEC Secretariat✉
Auckland University of Technology Ethics Committee✉

Cc: trt8106@autuni.ac.nz✉