Project Managers in Scrum Teams: Software Development Conditions Influencing the Relative Presence of a Project Manager within Agile Scrum Teams in Oceania and Southeast Asia

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A thesis submitted in fulfilment of the degree

Master of Applied Management

at Otago Polytechnic Auckland International Campus, Auckland, New Zealand

15 June 2021

Abstract

The Information and Communication Technology sector is now a pivotal industry in the economies of countries. Recent reports have shown their significant contribution to national wealth and the fact that countries are geared toward more digital adaptation only builds on the sector's importance.

Software development and design are known to be the workhorse of a growing ICT industry. There are many software development project management models that have risen over the past 50 years. These were initially controlled by a Project Manager, who is the central figure for software development using earlier delivery models. Currently, none of these software delivery approaches are more popular than Agile delivery, specifically the Scrum Framework.

The Scrum Framework prescribes that management is owned by the entire team and has done away with the Project Manager role. However, Project Managers still exist within Scrum in industry practice. As such, it is in the interest of this study to explore actual project conditions that would influence the need for a Project Manager in a framework that was designed to do without one. Secondly, this study intends to find out if the perception of success is affected by the presence of a Project Manager in the Scrum Team. At the time of this writing, no such empirical investigation has been done world-wide.

There have been many studies looking at Agile practice and Scrum environments around the world, however, none has done so with a high focus on the Asia-Pacific Region. Therefore, this study will focus on this region, specifically within Oceania and Southeast Asia. A quantitative approach was selected, participant criterion was set, and a database search of LinkedIn was conducted. Among over 9000 results, 1500 randomised samples were determined and contacted to

participate in an online survey. Of these, 938 users responded and expressed their interest to participate. Ultimately, 584 survey samples were collected and underwent analysis.

The study confirmed that a significant number of Scrum Teams (almost half of the survey population) still had Project Managers. It was found that a team members' Scrum experience, mixing Scrum with a traditional project management approach, and projects that work on existing software are conditions that statistically affected the presence of a Project Manager in the Scrum Team. On the other hand, the length of the project, team size, the geographical distribution of the team members, and even having multiple Scrum Teams collaborate on a single project had no influence whatsoever on the Project Manager's presence in the team. Furthermore, the study found that a Project Manager's presence negatively influenced a Scrum Team member's perception of success.

The study was restricted to an online environment due to its scope and border closures because of a global pandemic. Furthermore, the purely quantitative approach limited contextual insight from the findings. It is recommended that further study be carried out to build on the exploratory data found, such as why a significant portion of the respondents are reporting large Scrum Team sizes, and the significant findings of the study, as discussed above. It also merits further investigation to determine why a Scrum Team member's perception of success is lower when a Project Manager is present, ideally using a systematic metric for success and failure.

Acknowledgments

First of all, I offer my gratitude to God, the origin of all things. I see Your hand in this journey and I thank You for blessing me with Your guidance.

My deepest thanks to my wife, Farrah, the source of my strength and whose warmth nurtured me into the man I am today; to our angel, Samuel, who taught me resilience and strength through fierce love and bitter loss; and to our baby Nathaniel, whose naughty smiles and tinkling laughter has always been enough to brighten up my darkest days.

I express my appreciation to Dr. Lorraine Skelton, my research supervisor and the best Project Management professor I have ever had the honour to study under. I came knocking at your door to beg you for mentorship in this endeavour and you welcomed me with open arms. You have taught me much more than I ever thought I could in our time together.

My acknowledgments as well to Dr. Farhad Mehdipour, my research co-supervisor and who was instrumental in the success of this study. Your patience and assistance in each step was a lifeline; your instruction and wisdom will forever be part of my skillset.

My gratefulness to Otago Polytechnic, for the generous student support, a wide range of facilities, and reliable academic systems that have made this entire study possible.

I tip my hat to the wonderful Project Management and Scrum community represented through the survey respondents across Oceania and Southeast Asia, who took time to have a chat with me, share in my interests, and answer the survey. This study would not have been possible with you.

Finally, I give credit to my family and friends, whose unwavering support has helped make this process tenable and enjoyable.

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Chapter 1

Introduction and Background

1.1 Introduction

This chapter intends to cover the significance of this study, initially establish a stable theoretical foundation, and consequently set the purpose of the thesis.

It can be argued that in order to improve a country's agricultural sector, then the nation needs to optimise its farming operations. Similarly, if one would aim to increase revenue from their Information and Communication Technology (ICT) industry, then there is wisdom in looking at how ICT companies are operating.

Organisations providing software design, development, and related services are part of the booming ICT industries. As this sector grows, it naturally stimulates the evolution of different techniques employed in software product delivery. A multitude of individual applications using different forms and combinations of software project management methodologies and frameworks inevitably lead to some performing better than others (Boehm, 1995; Korsaa, et al., 2002).

In this study, we explore one such application that has divided ICT teams roughly into two groups, with a specific focus on Oceania and Southeast Asia. The study intends to investigate the phenomenon of a Project Manager (PM), traditionally the heart of a software project, existing within Agile Scrum Teams, a project management framework that has theoretically done away with traditional Project Managers (Shastri, et al., 2016; Schwaber & Sutherland, 2020). At the time of this

writing and as far as the researcher is aware, this is the first major study of a Scrum-based software development approach specifically for Oceania and Southeast Asia. The following sub-sections of this chapter will look at industry statistics to help establish the significance of this study, scratch the surface of the theoretical background to determine the gaps, and finally highlight the purpose of the thesis through the research questions formulated for the study.

The transition from Traditional Software Development (TSD) to Agile Software Development (ASD) has brought about challenges rooted in the two discipline's vast differences. TSD is centered around a Project Manager taking control and leading the team (Royce, 1987) and ASD is doing away with the "command-and-control" Project Manager role in exchange for coaches or facilitators (Shastri, et al., 2016). In the case of the Agile Scrum, the Scrum Master is not to be confused with a Project Manager, where the former is a coach with team-centered goals and the latter is a manager with organization-centered interests (Ozkan & Kucuk, 2016). Therefore, the variance between both methodologies undoubtedly leads to the situation where some companies that are making the change to Agile Scrum are armed with traditional Project Managers that literature has deemed obsolete (Sutherland, 2010; Schwaber & Sutherland, 2017; Schwaber & Sutherland, 2020). This condition has been supported by Marinho, et al., (2019) when they found that most companies use hybrid forms of project management, where they combine Agile Scrum with Traditional Waterfall, a situation where companies transition to Agile but are still able to use their traditional Project Managers.

The personal modifications to Agile Scrum and challenges of transitioning from TSD to ASD have formed two schools of thought of opposite beliefs. One group asserts that Project Managers are not well-suited in the Agile Scrum environment as

argued by traditional literature (McAvoy & Butler, 2009; Yi, 2011; Mundra, et al., 2013; Taylor, 2016; Noll, et al., 2017; Schwaber & Sutherland, 2017; Gandomani, et al., 2020; Schwaber & Sutherland, 2020). The other group is insisting that Project Managers are necessary even in Scrum based on empirical and industry data (Mansor, et al., 2015; Shastri, et al., 2016; Ozkan and Kucuk, 2016; Holtzhausen & de Klerk, 2018; Shastri, et al., 2021). These two contradictory groups of literature indicate there is a knowledge gap, specifically in exploring what conditions would contribute to the success of an Agile Scrum project where a Project Manager was present or absent. By outlining these conditions, companies can make strategic decisions of when to hire a Project Manager within a Scrum Team or choose to go without one, as literature dictates, to improve perceived project success in ASD.

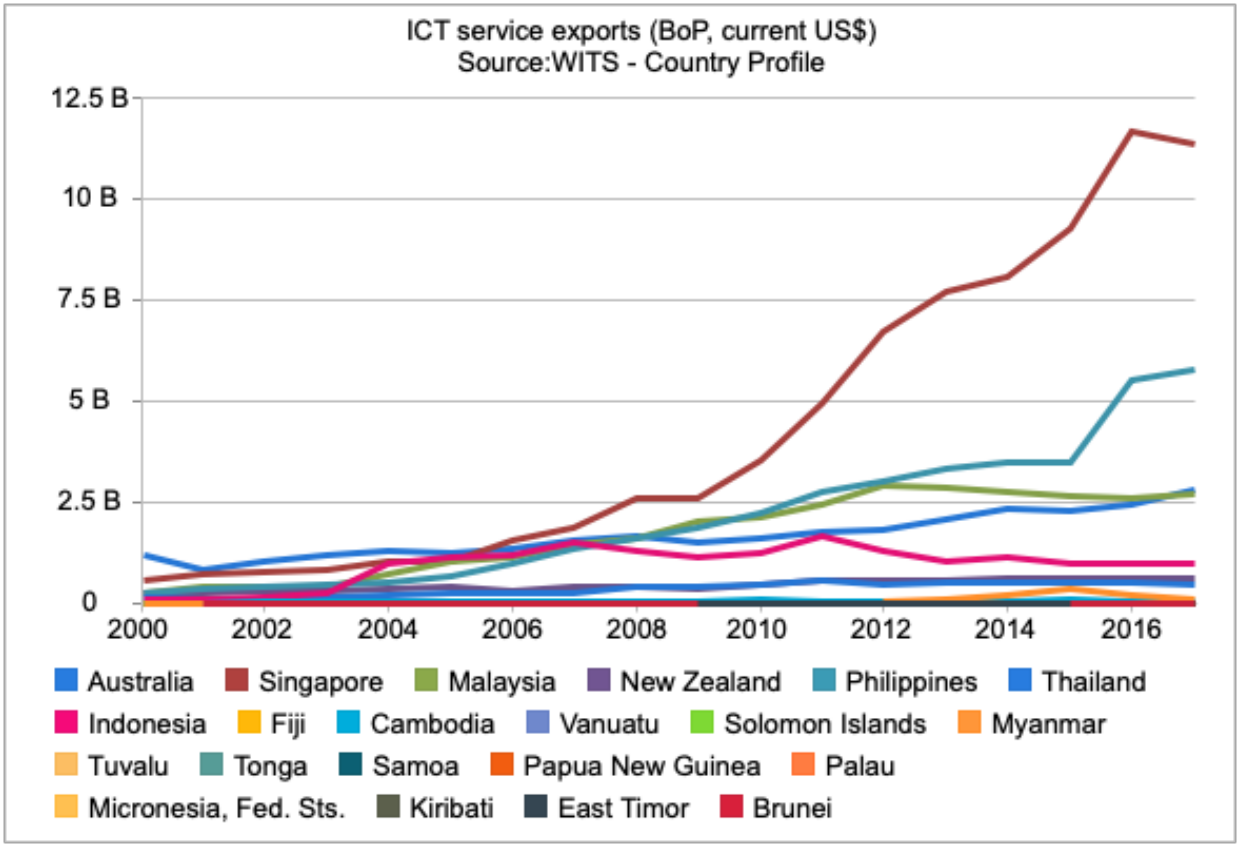
1.2 Background

1.2.1 Overview of the Information Communication Technology Industry

Figure 1.1 illustrates how the ICT industry plays a big role in contributing to the economies of countries in Oceania and Southeast Asia (World Integrated Trade Solution, 2017). For instance, ICT is now part of New Zealand's top 10 exports and in 2017 has overtaken wine, the sector contributing almost NZ$4 billion overall to the country's Gross Domestic Product (GDP) (Cox, 2020; Bridges, 2017). In Southeast Asia, the Philippines ranks second as the highest exporter of ICT services in the region, earning the country US$5 billion and competing with the traditionally dominant agriculture industry (IndexMundi, 2019). In the geographically small country of Singapore, ICT contributes 4.3% to their overall GDP but translates to over US$11 billion of export (Statista, 2019).

Figure 1.1

ICT Service Exports by Country (Oceania & Southeast Asia)



Note. The graph illustrates the amount of ICT service exports from countries in Oceania and Southeast Asia between 2000 to 2017. From *World Integrated Trade Solution (WITS)*. (https://wits.worldbank.org/CountryProfile/en/Country/BY-COUNTRY/StartYear/2000/EndYear/2017/Indicator/BX-GSR-CCIS-CD#). Copyright 2021 by World Trade Organisation.

Work involved in software design and development is a key component of the ICT industry. It comprises over 50% of the ICT sector in New Zealand (Ministry of Business, Innovation, and Employment, 2017). Therefore, taking a look at how software development is handled from the granular level (i.e. the companies and

teams that operate to deliver software) is vital to the bigger picture, which is a country's economy.

1.2.2 Software Development Life Cycle Transition from Sequential (Waterfall) to Iterative (Agile)

The history of the Software Development Life Cycle (SDLC) formed its roots in the 1960s through the traditional sequential Waterfall approach, which is essentially determining everything upfront and delivering the complete product in the end. Then, SDLC went through a series of iterative approach transformations, where a preview of the product is revealed at different parts of the process as opposed to just at the end (Matkovic & Tumbas, 2010). Finally, this led to the way to the emergence of Agile methodologies, post the 20th century, which encourages more interactions and feedback loops between the project team and client (Matkovic & Tumbas, 2010).

Software development's transition from traditional Waterfall to iterative Agile methodologies has grown in popularity over the past couple of decades (Gandomani, et al., 2020; Schwaber & Sutherland, 2017). According to the data distilled from CollabNet VersionOne (2019), Barker (2019) reports that 97% of companies use Agile development methods. On the forefront of these Agile methodologies is the Scrum Framework. The Scrum Alliance (2017) published that nine out of ten Agile practitioners use a form of Scrum in their Agile work processes.

The same report by the Scrum Alliance (2017) shares that instead of using Scrum in its pure form, more than a third of companies that use this framework opt to combine it with other methodologies of their choosing. This indicates that the overwhelming use of Agile and the dominance of Scrum-based frameworks has led

to a lot of questions with regards to the most effective way of practice and individual organisations are making modifications they deem better for their business.

1.2.3 An Overview of Scrum

Schwaber and Sutherland (2017) describe Scrum as a framework best used to handle complicated product development, such as in software engineering, to ensure distribution of high-quality deliverables from a continually improving work environment and team. This continual improvement is founded on empiricism, which is accumulating knowledge through experiences and then forming decision based on them (Schwaber & Sutherland, 2020).

Many variants of Scrum now include specialized roles, such as Product Manager or Project Lead (Noll, et al., 2017; Mundra, et al., 2013). However, Schwaber (2004) states that there are only three roles: the Product Owner, the Development Team, and the Scrum Master. The latest version of The Scrum Guide has updated the “Development Team” to “Developers” (Schwaber & Sutherland, 2020), but for consistency throughout this report, they shall be referred to as “Development Team”.

The Product Owner represents the customer’s wishes and controls how the final product is meant to be through the creation and prioritisation of the Product Backlog, the software product’s requirements (Schwaber & Sutherland, 2020).

The Development Team is a group of professionals (e.g. developers, designers, testers, etc.), who is in charge of converting the Product Backlog into working software by creating small segments of work (iterations) through planned and focused development cycles (Sprints) (Schwaber & Sutherland, 2020).

Scrum Masters support both roles discussed above by ensuring Scrum practices, principles, ceremonies, and guidelines are followed, removing impediments, and improving communication between the Product Owner and members of the Development Team (Schwaber, 2004). However, their title should not be misconstrued as one bearing authority. Ereiz and Music (2019) stress that Scrum Masters play the role of mentors, coaches, or facilitators. This was corroborated by Mundra et al., (2013) by stating the Scrum Master is not a Team Leader, but Development Teams are empowered to manage and organize themselves. Hence, by eliminating the need for a leader and teams being encouraged to lead themselves, traditional leadership roles, such as a Project Manager, are not needed in Scrum. Through its foundations in empiricism, much of Scrum's power comes from the Development Team, who make decisions based on experiential data that affect the development of the overall product (Schwaber & Sutherland, 2017; Schwaber & Sutherland, 2020).

1.2.4 Are there Project Managers in Scrum?

Conventional literature in Agile Scrum does not discuss the existence of a Project Manager role (Schwaber, 2004). The Project Manager's traditional responsibilities are broken up and distributed between the three roles in Scrum (Taylor, 2016), such as scoping, procurement, and resource management going to the Product Owner, communication and coaching going to the Scrum Master, and management and organization going to the Development Team (Rubin, 2018). Furthermore, a Project Manager role brings with it a management structure that relies on hierarchy and rigid planning (Ozkan & Kucuk, 2016). Therefore, a Project

Manager is the antithesis of the Scrum philosophy of success through the team's freedom in self-organisation and self-management. Holtzhausen and de Klerk (2018) agree when they highlighted that an Agile team's key to triumph is its ability to self-organize.

On the other hand, Ozkan and Kucuk (2016) also argue that using Scrum does not limit organisations to only stick with the three roles outlined in Scrum guidelines. This means that teams can go beyond the three roles, leaving the possibility of having a Project Manager open. Moreover, going beyond literature and discussion, Shastri et al. (2016) has proven that, despite publications causing the erosion of Project Managers in ASD, the position still exists in reality within Scrum Teams. In summary, conventional literature and the values of Scrum paint the picture that Project Managers are non-essential to Agile Scrum's operation, but publications also do not explicitly prohibit the use of such a role. Most importantly, evidence is available about the Project Manager's actual existence within real-world ASD Scrum Teams.

1.2.3 What are Project Managers doing in Scrum Teams?

Schwaber (2004) dictates that Scrum Teams shall be self-managing and free from an external direction, thus invalidating the need for a Project Manager. However, Ozkan and Kucuk (2016) assert that even if a Project Manager is not needed to control the management duties that exist within Scrum, it does not erase the fact that management responsibilities still revolve around it through the presence of the greater organisation. Simply put, literature is explicitly clear that Scrum does not need a Project Manager (Schwaber & Sutherland, 2017), but this does not mean

that organisational and client-facing responsibilities are completely devoid in the Scrum environment, since Scrum lives within an organisation, which opens up the need for someone to fill a Project Manager role.

In their study exploring Scrum Teams, Shastri et al. (2016) has proven beyond any doubt that Project Managers still endure in actual Agile Scrum Teams, but what role exactly they played in these teams was not defined. Through an embedded case study of multiple companies, Noll et al. (2017) found that Project Managers often play the role of Scrum Masters in the team. Although, the wisdom of this is challenged by several authors. According to Mundra et al. (2013), a Scrum Master is not a leader, which is one of the hallmarks of being a Project Manager but a servant instead, who plays a crucial role in enabling the Scrum Team to govern themselves by ensuring there is clear communication, removing tensions and obstacles, protecting them from distractions, and providing an ideal environment so the team can make good decisions.

The importance of this distinction made itself clear when Nokia Siemens Networks transitioned to Agile Scrum and combined the roles of existing line managers and Scrum Masters (Yi, 2011). This led to hybrid Scrum Masters managing through practiced authority and the team responding with the pre-transitional hierarchy, ignoring Scrum's edict to hand over control to the team, which would impair the Scrum Team's ability to self-organize and violate the very essence of Agile Scrum (Yi, 2011). Ozkan and Kucuk (2016) agree that it is not wise to have a Project Manager act as a Scrum Master as well since it runs the risk of muddling up the lines between being a Project Manager (organisation-centred) and a Scrum Master (people-centred), causing conflicts of interest. The assumption that Project Managers do not make good Scrum Masters exists from the contradicting idea that

traditional Project Managers assume a command-and-control mantle whereas Scrum Masters surrender power to the Scrum Team by acting as a coach or facilitator (Taylor, 2016). Project Managers will find themselves struggling to transition into or maintain the role of Scrum Master due to the large disparity in their responsibilities and the challenge of giving up control (Kamran & Waheed, 2012).

Moreover, McAvoy and Butler (2009) believe that having an existing Project Manager act as a Scrum Master in a team leads to a perception of authority or deference, which has already been established prior to their transition to Scrum. According to the authors, this influences the team's decision processes by making choices based on assumptions with what the Scrum Master wants. Noll et al. (2017) suggests that Project Managers should play the role of a Product Owner instead since their responsibilities are near-parallel and avoid a clash of motives when performing both roles simultaneously.

However, establishing that a Project Manager does not make an ideal Scrum Master will not invalidate the need for the former in Scrum (Ozkan & Kucuk, 2016). Despite the arguments of where a traditional Project Manager can fit within a Scrum, whether they should be a Scrum Master, Product Owner, or an entirely different role outside of literature, the fact remains that they exist within active Scrum Teams worldwide (Shastri, et al., 2016) and it is a matter of individual practice that organisations make the most out of them. It is of interest in this study to find the conditions where Project Managers in a Scrum Team contribute to success.

1.2.4 Do we need Project Managers in Scrum?

Kamran and Waheed (2012) theorise that as software development organisations move away from traditional sequential Waterfall to iterative Agile Scrum, they are left with Project Managers losing direction but are valuable human resources they are unwilling to let go of, so these Project Managers become integrated into the new Scrum framework instead. This raises the following questions: Do companies blend Project Managers into Scrum just so they can bypass a human resourcing issue? Do we even need Project Managers in Scrum?

Many authors would argue that “Yes, we do!” (Gandomani, et al., 2020; Noll, et al., 2017; McAvoy & Butler, 2009; Ozkan & Kucuk, 2016). In fact, in their systematic literature review regarding the role of a Project Manager in Agile Software teams, Gandomani et al. (2020) ultimately found the Project Manager role does not exist in Scrum literature, but they have concluded that there is a need for one.

In their case study, Noll et al. (2017) discovered that although Agile Scrum is a great framework internally, it poses a huge challenge when customer coordination and cross-team management is required and found having a Project Manager would be an ideal remedy to the situation.

Furthermore, McAvoy and Butler (2009) highlighted how cohesive Agile teams are prone to dysfunctional communication when team members go along with an idea they assume everyone wants, but in reality, everyone silently dislikes, just because they do not wish to cause conflict in their team and risk their work relationship (e.g. Abilene Paradox). To counter this, the authors suggest there is a need to have a Project Manager in the team to act as a devil’s advocate. Hence, a Project Manager within Scrum is ideal in self-organised teams to challenge decisions, draw out arguments, and ensure communication is always in the channel.

This is supplemented by Ozkan and Kucuk (2016) when they asserted that although Scrum literature does not advocate having a Project Manager in Scrum, it has also never prevented having one. Ozkan and Kucuk (2016) cited four reasons why Project Managers are needed in Scrum, despite it not being a formal role, namely:

a. Project Managers bridge the gap between Scrum Teams and other parts of the organisation where Scrum is not practiced.
b. Best role to help transition TSD to Agile.
c. When a client or third-party does not use Scrum, Project Managers can act as the conduit.
d. When multiple teams in the organisation collaborate with a mix of some using Scrum and the others not.

In spite of all the literature that supports the need for having a Project Manager, Taylor (2016) warns of the risk in having Project Managers involved in Scrum because it enables teams to revert back to traditional practice when faced with something unfamiliar. Therefore, this study intends to determine if certain project conditions make it ideal for organisations to integrate Project Managers in their Scrum Team.

1.3 Objectives and Research Questions

As discussed earlier in this chapter, the ICT industry significantly contributes to a country's overall GDP. A huge chunk of the ICT sector relies on services and products that revolve around software delivery (Ministry of Business, Innovation, and Employment, 2017). Various surveys and studies have indicated that Agile

methodologies and Scrum frameworks dominate the teams who deliver this service (Scrum Alliance, 2017; CollabNet VersionOne, 2019; Digital.ai, 2020). A gap has been found between contemporary literature doing away with Project Managers in Scrum environments (Sutherland, 2010; Schwaber & Sutherland, 2017; Schwaber & Sutherland, 2020) and industry practice coupled with related studies that report the continued presence or advocate the need for Project Managers even in Agile Scrum Teams (Shastri, et al., 2016). Therefore, it is significant and appropriate to conduct a study looking at this dynamic in an attempt to bridge that gap. As such, the overarching question of this study is expressed as:

> *What project conditions are true for software projects that use the Scrum Framework with the accompanied presence or absence of a Project Manager?*

As a secondary objective, the researcher has decided to delve into how the relative presence of a Project Manager in an Agile Scrum Team affects the project's success. However, success is very arbitrary in the sense that what could be considered a successful project to a team might be a failure in the eyes of the stakeholder. To stress the point, in their instrumental Agile Manifesto, Fowler and Highsmith (2001) argued how abstract real success is. To illustrate, the Sydney Opera House construction project was a massive failure in the eyes of the project team, considering it was NZ$95 million over-budget, but is successfully considered one of Australia's most frequented tourist attractions to date (Bronte-Stewart, 2015). Since there are no universal metrics to success that are true for all situations, the

researcher will establish the respondents' "perception" of success instead. Therefore, this second question will be asked:

Is there a significant relationship between the presence or absence of a Project Manager and the perception of project success?

As far as the researcher is aware, there have been no major empirical investigations of software delivery approaches using the Scrum Framework and the relative presence of Project Managers. The thesis will be a study of Oceania and Southeast Asia. The ultimate goal of this study is to create a guideline of recommendations by exploring the conditions and situations of software projects while using Agile Scrum and the relative presence of a dedicated Project Manager role within the Scrum Team.

The contributions of this study shall be the following:

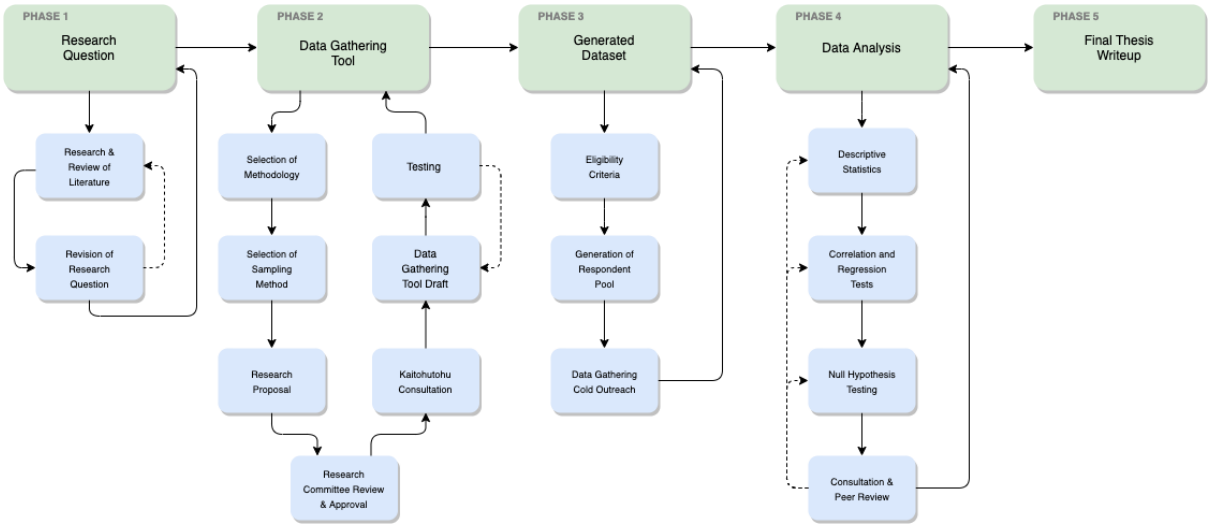
a) For professionals, to have access to new literature they can add to their knowledge body in project management.
b) For organisation stakeholders to make better decisions of when and when not to include a dedicated Project Manager role into an Agile Scrum Team based on their Scrum project conditions.
c) For future researchers to bridge the gap between contradicting literature when it comes to the necessity of having or not having a Project Manager role in Agile Scrum and pave the way for further research.
d) For all project management practitioners, to have baseline guidelines and recommendations based on general practice when deciding whether to include a Project Manager role in an Agile Scrum Team.

1.4 Research Process

The study process progressed through five high level phases, each with a specific goal, and each phase ending in a milestone. Figure 1.2 illustrates the high-level research process and phases.

Figure 1.2

Research Process and Phases



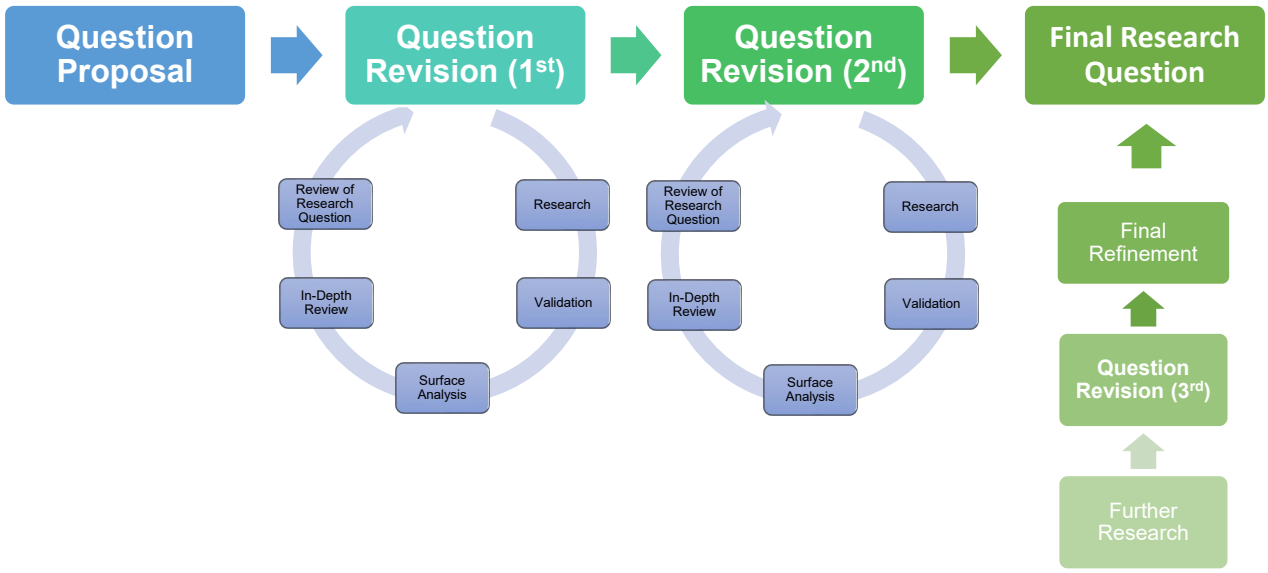
Note. Research process devised by the author. Adapted from *Research Thesis AM902001 Course Outline*. (https://moodle.op.ac.nz/course/view.php?id=8482). Copyright 2021 by Otago Polytechnic.

The first phase was focused on formulating the research question. According to Hon and Kent (2008), a strategic approach for this phase is to begin with a question and read everything you can about it until you are well-informed and

become more confident your study will have a purpose. The final research question was achieved through an iterative approach, where the initial version of the question was formulated through the researcher's existing understanding and informal interviews with industry professionals. Afterwards, research and review of related literature was conducted with the goal of refining the research question. The process was repeated twice and the question underwent three revisions before arriving to the final version. Figure 1.3 outlines the iterative approach used to refine the research question.

Figure 1.3

Research Question Refinement Process



Note. Process created by the author to refine the research question.

As illustrated in Figure 1.3, each version of the question directed the researcher undertake a review of existing literature and previous studies to check if the question itself had already been answered. If it was found that the question had

already been answered, the researcher generated a new question based on the new information distilled from the most recent review. This process is then repeated to confirm if the question has remained open. This process was repeated thrice before the final question has been found unanswered. The question then underwent further refinement, using the correct terminology and proper framing, before this phase was concluded and the milestone achieved. Refer to Chapters 1 and 2 for in-depth discussion and analysis in relation to Phase one.

The second phase followed upon completing the first milestone, where the researcher aimed to select an appropriate methodology and prepare for data gathering. The milestone for this phase was to finalise the tool needed to gather data prior to deployment in a live environment. Further research, consideration, and discussions with research consultants and peers led the researcher to decide a quantitative methodology using a cluster sampling method was the most appropriate approach. Following that decision, the researcher drafted a questionnaire, which underwent two levels of peer review, was revised, and then was tested with a sample group with Scrum experience prior to deployment. Refer to Chapter 3 for an in-depth analysis of Phase two.

The third phase aimed to identify a pool of respondents through cluster sampling and then deploying the completed tool from Phase Two. The milestone for this phase was to gather data with the aim of a ten percent conversion rate. This conversion target was conservative and was set based on a similar study conducted which achieved roughly a 15% response rate (Shastri et al., 2016). A professional social networking platform (LinkedIn) was used to generate a pool of 1500 potential respondents and the goal was to achieve 150 observations from this group. A criterion was first established before generating the pool of respondents, such as

ensuring the respondents were all from Oceania or Southeast Asia and were Scrum professionals of a certain experience level. Potential respondents were contacted through a cold outreach to encourage LinkedIn contacts to fill out the survey tool. The phase was marked complete when nearly 600 samples from the initial group of 1500 potential respondents were gathered. This result overshooting the initial target and achieving almost a 40% conversion rate. Refer to Chapter 3 for more in-depth detail in relation to Phase three.

The fourth phase was focused on data analysis. The milestone for this phase was to complete processing of data end-to-end, from cleanup to hypotheses formulation and testing. The researcher began by scouring the dataset with invalid entries, moved on to an exploratory analysis to generate hypotheses, followed by further descriptive analysis in cross-tabulations to prepare for the next phase, and ended with conducting the actual null hypotheses testing using Chi-Square and Mann-Whitney U tests. Each iteration was presented to research consultants and peers to verify results and discuss further testing and analysis. Phase four is solidified and discussed more in Chapters 4 and 5.

Finally, the fifth phase was focused on completing the writeup of the study. The milestone for this step was a completed manuscript of the study, including findings, discussion, implications, recommendations, and conclusions, which can be found in more detail in Chapter 6.

1.5 Chapter Summary

The ICT industry has become a major contributor to economies in Oceania and Southeast Asia (World Integrated Trade Solution, 2017; Cox, 2020; Bridges,

2017; IndexMundi, 2019; Statista, 2019). Organisations that delve into software development and software service make up a huge portion of this sector (Ministry of Business, Innovation, and Employment, 2017). It makes sense to investigate the ground-level operations of such organisations, especially when there is a knowledge gap since their performance has a direct effect on their country's economy. Software delivery's transition from traditional project management to Agile Scrum frameworks is causing such a gap, wherein contemporary literature is doing away with Project Managers, but the industry practice of Agile Scrum still shows their continued presence (Shastri, et al., 2016; Schwaber & Sutherland, 2017). This study aims to bridge that gap and ascertain project conditions that might influence the trend towards the presence or absence of a Project Manager within an Agile Scrum Team, with a secondary goal of checking whether the relative presence of a Project Manager in such teams affect the perceived project success.

Chapter 2

Literature Review

2.1 Introduction

This chapter aims to understand the difference between the old and new software development models and how they have influenced losing the prescriptive need of having a Project Manager in modern software development models, such as the Scrum Framework.

By reviewing the history of Project Management in the ICT industry, one can understand what traditional software development models were like and how TSD created the need for the central Project Manager role. Reviewing the weaknesses of contemporary development models established the context of what influenced the genesis of more iterative approaches, which eventually led to the dawn of modern Agile methods and their principles. Realising these concepts, one can build on what initiated the move away from a central control figure in the form of a Project Manager. Finally, this chapter reviews current industry statistics and recent academic studies so the researcher can outline the gap between literature and industry.

The following subsections will cover foundational concepts such as discussing what Project Management is and moving on to the evolution of Software Development Models and the Project Manager's role in each one. A focused discussion about the Scrum Framework, which is central to this study, is tackled

next. Lastly, the state of the ICT industry in Oceania and Southeast Asia with the latest studies related to the use of Agile Scrum and its relationship with Project Managers as a role is discussed.

2.2 Project Management

Understanding the concept of Project Management will provide context on what a Project Manager is and the role's responsibilities across the different Project Management models. Covering these concepts first will make it easier to compare how this has changed in the Scrum Framework.

Before the concept of Project Management can be understood, it is important to understand what a "Project" refers to first. This sub-section will cover the standard definition of this concept according to industry leaders, then discuss what Project Management is and how it is significant in organisations.

2.2.1 What is a Project?

When it comes to defining what a project is, three globally recognised Project Management organisations have somewhat similar views. According to the Project Management Institute (PMI) (2013), a "project" is a unique timebound operation which consumes limited resources and follows a pre-defined scope to deliver a novel service, product, or result. The Association of Project Managers (APM) (2012) agrees with this definition and adds that a project is considered a success if the final output adheres to the agreed technical specifications (acceptance criteria) and is delivered within the arranged deadline without going over the resource allocation. On

the other hand, PRINCE2 (2009) defines a project as a temporary coalition that is formed under the goal of producing new business products based on a Business Case consensus. Although PRINCE2's definition slightly deviates from PMI's and APM's, all three groups agree that a project is a non-permanent and non-repeatable endeavour that aims to deliver a novel output.

The definition of a project does not limit its use in a single industry. A project applies to any situation where a new output is derived from a pre-determined amount of resource and time, such as the renovation of the office conference room (construction), devising a new guest check-in process for a ski resort (hospitality), designing a new electric vehicle (automotive), developing an update for a mobile app (information technology), or even launching a new point-of-sale system in a convenience store (retail).

2.2.2 Project Management and the Project Manager

Modern day Project Management contains its own sets of skills and knowledge body, making it a professional specialisation (Aaltola, 2017). This argument is supported by the PMI (2013) by defining Project Management as the application of different competencies that come together and deliver the project's goals in the form of a final deliverable. These competencies are in the form of planning, scoping, resource management, risk management, time management, communication management, and team management (Webster, 1993). By integrating these aspects of Project Management, one can reliably argue that Project Management is a separate discipline that operates with its own philosophies, framework, and a balance of relevant skills.

Project Management is driven by a Project Manager, a highly specialised role that requires a mastery of specific competencies and technical skillsets. By managing the accountabilities discussed in the preceding paragraph, the Project Manager takes the project through the contemporary phases of Initiation, Planning, Execution, Control, and Closure (Westland, 2018). Furthermore, the Project Manager needs to possess higher than average soft skills, such as communication, collaboration, problem solving, or time management, to be effective at their role in leading a team toward successful project delivery (Harrin, 2012). Lastly, complexity in filling the role is furthered through the multiple variations of Project Management Models with each one requiring a different approach and handling. For instance, traditional sequential project management requires the Project Manager to be hands-on in planning, command, and control, whereas iterative Agile project management requires the Project Manager to surrender more control to the team, coach them to be self-reliant, and take on a servant-leader role (Tripathi & Goyal, 2014). However, several authors argue these are unreasonable expectations to look for in a single individual and argue that some of these competencies should be taken on by other forms of managers, such as line managers or operational leads (Loufrani-Fedida & Missonier, 2015; Hodgson & Paton, 2016). Therefore, foundational understanding of the Project Management discipline, coupled with the necessary soft skills, and topped off with specialised practice of different methodologies and frameworks increases the complexity of holding a Project Manager position and concerns have been raised about how this may have evolved into the unrealistic depiction of a single professional.

2.2.3 Significance of Project Management

Project management is everywhere in industry practice and is necessary for organisations to stay afloat in an ever-competitive world through the management of change. Aaltola (2017) argues that every manager has to handle at least one project in their career and so it follows that Project Management has become a core competency. Naybour (2014) highlights that the key difference between "management" and "project management" is that the former is a continually ongoing process, whereas the latter has a valuable final output that needs to be delivered within the defined timebox. This distinction adds to what Webster (1993) discussed about how Project Management is also synonymous with Change Management, which is a stark contrast to technical, operational, and general management with their focus on maintaining balance and operational homeostasis. Change packaged in the form of projects and handled through Project Management is necessary for organisations to stay ahead and thrive in dynamic markets through the production of novelty (Bronte-Stewart, 2015). This allows organisations to adapt processes, deliver new products, improve services, or innovate a new solution, and is therefore vital to the survival of businesses. Therefore, Project Managers, the central figure in Project Management, play a critical role in the continued survival and growth of businesses.

2.3 Project Management in Software Delivery

Project Management lives and breathes in software development. Taking the accepted definition of a project discussed in section 2.2.1, working with software usually entails a level of scope, limited resources in the form of how much time a

designer, developer, or tester can work on the software, and a deadline to keep pace with business needs or market demand. Therefore, Project Management is vital to the delivery of software products or services.

As mentioned in the second paragraph of section 2.2.2, Project Management comes with a host of different models and methodologies. This is especially true in software project management. Matkovic and Tumbas (2010) discussed that software project management went through an evolution of frameworks, where a new model was given birth to address the shortfalls of preceding approaches, sometimes going back to previous models and combining them with new ones to generate more effective frameworks. This evolution has given rise to multiple different models, methodologies, and frameworks alive today.

By understanding the evolutionary changes of software project management first, it will make it easier to grasp the rising popularity of Agile approaches and Scrum as a framework today. Korsaa et al. (2002) classified the different software project management models into either Waterfall or Evolutionary models. On the other hand, Matkovic and Tumbas (2010) group software development between Sequential and Iterative approaches, indicating Sequential's significant precedence to make way for Iterative approaches to blossom. Using Matkovic and Tumbas' (2010) chronology, the following subsections will discuss the two major groups to software project management from Sequential to Iterative, where Agile concepts and Scrum thrive. By going through the next subsections, context will also be made available about the traditional roles of Project Managers and how that will compare to the needs of Scrum, which will be discussed in section 2.4.

2.3.1 Traditional Sequential Approach

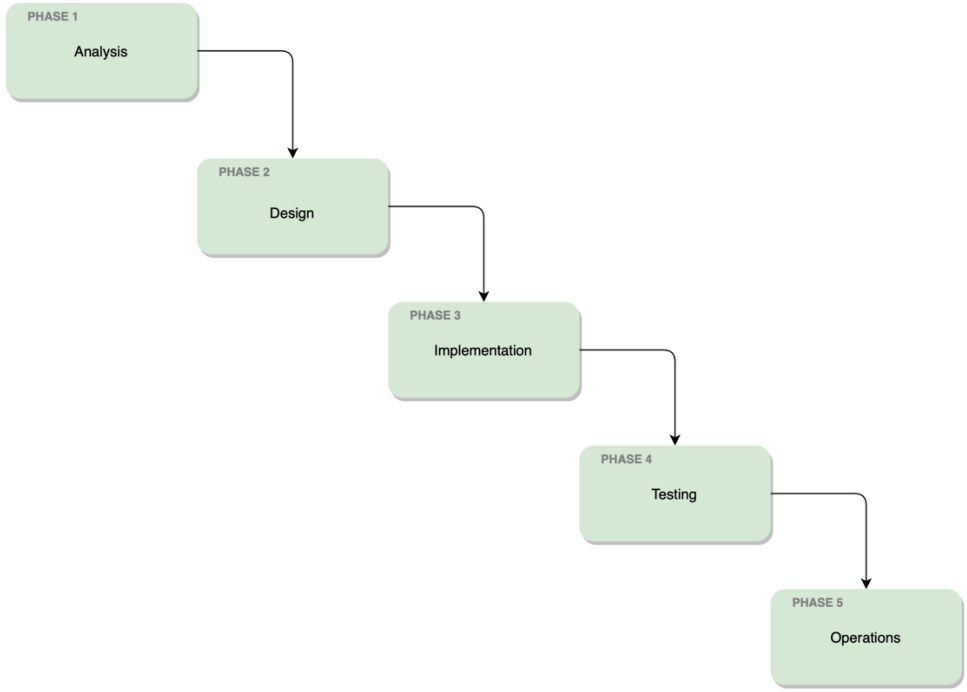
2.3.1.1 Waterfall Methodology

The Waterfall Methodology is the most significant form of the Traditional Sequential Approach and arguably the most commonly used model in the history of software development (Matkovic & Tumbas, 2010). Originally devised in 1970, contemporary literature discusses the Waterfall Methodology as a process that goes through a series of phases and the requirement to moving forward into succeeding phases requires completion of the existing phase (Bassil, 2012). Fair (2012) argues this outlook is not viable for software project management because of the sequential approach and the strict “no-going-back” management style, which fails to address the flexibility needed to compensate for how fast requirements change in software development. However, Petersen, et al. (2009) counter this argument by claiming these kinds of risks have been raised in assumptions and have never been truly tested with empirical data. Nevertheless, the Waterfall Methodology permeates software delivery from the past all the way to the present and has even influenced modern-day frameworks (Matkovic & Tumbas, 2010; Shastri, et al., 2016).

Aptly named, the Waterfall Methodology follows the flow of a waterfall and is a top-down approach starting from Analysis, then Design, followed by Implementation, then going into Testing, and ending in Operations, which limits going back to previous levels once the project has gone through a certain milestone, which is usually at the end of that phase (Bassil, 2012; Petersen, et al., 2009). Figure 2.1 illustrates the Waterfall Model for software delivery.

Figure 2.1

Unmodified Waterfall Model for Software Delivery



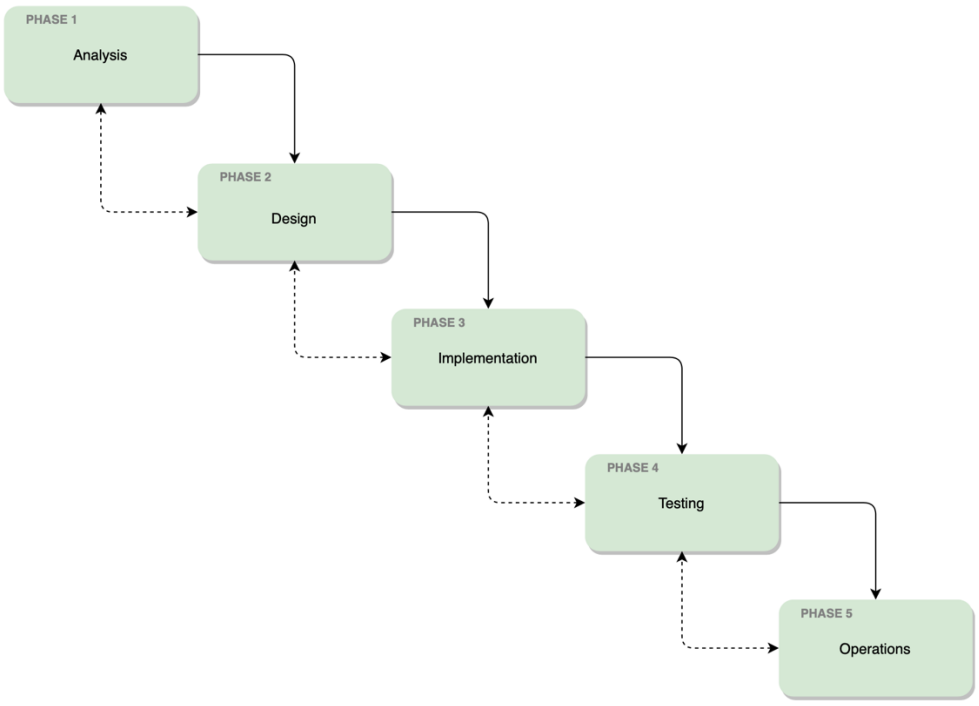
Note. The original Waterfall Model that shows the linear delivery process adapted from Petersen, et al. in 2009. From "The Waterfall Model in Large-Scale Development" by K. Petersen, C. Wohlin, and D. Baca, 2009, *PROFES 2009 Lecture Notes in Business Information Processing, 32*(1), p.386-400 (https://doi.org/10.1007/978-3-642-02152-7_29). Copyright 2009 by Springer-Verlag Berlin Heidelberg.

Others argue it may be possible to go back to a phase, but the effort of doing so is enough to kill the project (McConnell, 1995). This is supported by Kruchten (2001) who wrote that Waterfall Methodology's basic flaw is it makes a complete plan based on assumptions and when those assumptions are proven false in the middle of the project, it becomes too costly or too impractical to do anything about it that it leads to project termination. However, when Winston Royce, the original author of the methodology, attempted to modify the approach, he stressed that a

certain level of feedback should occur between the current and the previous phase to introduce flexibility for a software project as depicted in Figure 2.2 below (Royce, 1987). In practice, this would mean Design revisions requested in the Implementation phase is acceptable, which could be helpful to a certain degree when working with software. However, Design revisions requested in the Testing phase is not acceptable and this is where the pains of a Waterfall Methodology are highlighted.

Figure 2.2

Royce's Modified Waterfall Model for Software Delivery



Note. The modified Waterfall Model that illustrates the delivery process with a feedback loop adapted from Royce in 1987. From "Managing the development of large software systems: concepts and techniques" by W. Royce, 1987, *In Proceedings of the 9th international conference on Software Engineering (ICSE '87)* (http://www-scf.usc.edu/~csci201/lectures/Lecture11/royce1970.pdf). Copyright 1970 by The Institute of Electrical and Electronics Engineers.

More authors support the use of the Waterfall Methodology for software development. Rodov and Teixidó (2016) claims that the methodology (and not Iterative models) was the first to introduce client involvement in a project, which improved feedback. Boehm (1995) discussed how this model was the basis for most software development standards across industries and in governments. Bassil (2012) attempted to promote the methodology's viability in software development by highlighting that a team can go back and forth in a single phase to completely refine plans in the Analysis phase or wireframes in the Design phase, before deciding to move on to the next. This looping motion contained in a phase allowed the team to find flaws in that phase, which can be addressed and polished, before closing the milestone. However, Bassil's argument does not take into consideration the Design issues that can only be found in Implementation (e.g. creating a programmatically impossible design) or improper time estimates in Planning, which may fail to foresee challenges that can only be known once technical exploration has started in Implementation. Having said this, Kruchten (2001) accurately summarised the Waterfall Model as convenient for the manager in planning but a nightmare for the engineers in implementation when mitigating damage by working around unaccounted risks in the plan or design errors can lead to even more impairment in the product.

To summarise, one of the pitfalls of the Waterfall Methodology is bringing forward all the risk in the Analysis phase, which is essentially based on predictive assumptions, and then making a plan against those. Simply speaking, one is not using verified truths to make a plan, so why should one expect the same plan to make sense when the actual truths come out in a project? Often, risks and assumptions identified in planning are proven false in Design or Implementation, and

risks not identified only become known after the Analysis phase. On top of that, the development team has to compensate in Implementation to adjust for unforeseen threats or wrong design, which only leads to more issues down the road. Truly, Kruchten (2001) was correct when he said the Waterfall Methodology makes it easy on the manager but a nightmare for the engineers and in stating it is only good the first half of the way but chaos in the end.

At the forefront of the Traditional Sequential Approach, Waterfall Methodology makes absolute sense when requirements are known and all dependencies can be reliably outlined at the start of software development, and a plan can be religiously followed at each step of the project. However, this is exactly what Boehm (1995) argued against stating the main source of trouble with this methodology is its requirement on comprehensive documentation as the completion standard and is determined at the start of the project where little is known. It will struggle in the face of ambiguity or change, such as when unforeseen technical limitations are discovered outside of the Analysis phase, where all planning has already been done, or a client's business needs change resulting into designs, which have all been wired into code, to be replaced in the middle of the Testing phase. These are very plausible situations in software development. Therefore, this approach has slowly given way to one that favors more maneuverability and flexibility.

2.3.1.2 Project Manager Role in Waterfall Methodology

At the center of a project using Waterfall Methodology sits the Project Manager. Tripathi and Goyal (2014) argued that the Project Manager is directly responsible for the overall outcome of a project based on their performance with

generating, controlling, and following through with the project plan as well as delegating work to the team members. Shastri, et al. (2017) builds on this point and discussed that the Project Manager wears the command-and-control mantle in the Waterfall project team, holding everything together with a mix of hard and soft skills such as communication, decision-making, leadership, communication, and planning.

2.3.2 Iterative Models

Kruchten (2001) claims that Iterative Models compensate for the shortcomings of the Waterfall Methodology by addressing how risk is handled and reducing the time between decision-making and feedback. The Iterative approach believes everything should not be planned upfront because it respects ambiguity and lack of clarity in software development, and so the goal is to continually release segments of work (increments) to gain experience, identify actual risks, and use this new information gained to plan, design, and develop the next increment (Korsaa et al., 2002). Instead of huge chunks of work that are delivered by bulk to the client and are expensive to rework, Iterative Models work on an approach where the work is broken down, shown to the client to confirm it is what they want, and continue to the next small portion for delivery. Figure 2.3 below illustrates the Iterative Development Model as discussed by Kruchten (2001).

Figure 2.3

Iterative Development Model - redacted

Note. The Iterative process approach in software development produced by Kruchten in 2001. From "From Waterfall to Iterative Development -- A Challenging Transition for Project Managers The Good: Benefits of Iterative Development" by P. Kruchten, 2001, *The Rational Edge.* (https://www.researchgate.net/publication/237518074_From_Waterfall_to_Iterative_Development_--_A_Challenging_Transition_for_Project_Managers). Copyright 2001 by Rational Software.

The following subsections will discuss three different types of Iterative Models and the Project Manager's role in each one. Following the chronology of the Iterative Models based on Matkovic and Tumbas's (2010) evolution of software development models discuss the Prototyping Model first, then Boehm's Spiral Model, and finally Agile Development Models, which ultimately gave birth to the Scrum Framework. Understanding these concepts provides an understanding of how software development frameworks have changed based on the need for improvement in delivery and how a Project Manager role has had to adjust for these model changes.

2.3.2.1 Prototyping Development

The first mainly well-received Iterative Model is the Prototyping Development approach, which was published in 1975 by Frederick P. Brooks, Jr., built off the common “I’ll know it when I see it” (IKIWISI) scenarios in software development, where the client is not exactly sure what they want but will have better-outlined requirements once they see a prototype (Brooks, 1995; Boehm, 1995). Otherwise known as the Evolutionary Model (Korsaa et al., 2002), the Prototyping Development approach gathers basic requirements and identifies product goals before going into a quick design and subsequent development of a prototype, which is then presented to the user to get feedback and the process is repeated by upgrading the prototype with the goal of adding refinements in each iteration until the user’s complete requirements have been met (Matkovic & Tumbas, 2010). However, Boehm (1995) highlights the weakness of this model by indicating that although it takes one step forward in addressing Waterfall Methodology’s lack of risk management, it takes two steps back in the low focus it gives planning and that the prototypes being released are not necessarily designed to take on dynamic changes in further iterations.

Many versions of the Prototyping Model have risen since Brooks’ initial publication, and it is impossible to go over them all in this review. However, one of the most synonymous derivatives, the Rapid Application Development, can be highlighted to add context for discussion (Korsaa et al., 2002; Matkovic & Tumbas, 2010).

Rapid Application Development

Rapid Application Development (RAD) was originally coined by James Martin in 1995 as a combination of the Iterative and Sequential approach, where product increments were released following short waterfall phases (Korsaa et al., 2002). As illustrated in Figure 2.4, the RAD method relies heavily on prototyping to completely detail the user requirements (Korsaa et al., 2002). However, it deviates from the original Prototyping Model, where RAD aimed to release fully functional deliverable increments while the Prototyping Model produced 'dummy' releases to help form the exact product requirements (Dhanotia & Goyal, 2012).

Figure 2.4

Rapid Application Development Model - redacted

Note. The figure is a summary of the RAD process, which was adapted from the original model by James Martin in 1995 (as reprinted by Korsaa et al., 2002). From "Iterative Software Development - A Practical View Abridged Version" by M. Korsaa, R. Olesen, & O. Vinter, 2002, *Datateknisk Forum.* (http://www.ottovinter.dk/df-16a.pdf). Copyright 2002 by Software Technology Forum.

RAD is true to its name by enforcing short development cycles with an overall maximum of six months deadline for the finished product, which is achieved through at least three stages of prototype releases that undergo inspection, discussion, and

changes until the users are satisfied with the final delivery (Beynon-Davies et al., 1999). However, despite its name, McQuaid (2001) discusses that although it is labelled “Rapid”, it is not meant as an engineering hack and by delivering a completed product in a short and fixed time frame, then it has a high risk of project failure. Furthermore, Fowler and Highsmith (2001) described the model as “quick and dirty”, highlighting that although it delivered product at a fast pace and high flexibility, it failed to maintain good design and technical cleanliness. This is then where the role of a Project Manager becomes vital for RAD’s success since it will rely heavily on strong project management to run the project smoothly by understanding the methodology’s weaknesses, balancing the traditional waterfall stages, and adjusting to the feedback loops at each incremental delivery.

Project Manager Role in RAD

As discussed in the previous paragraph, the extreme risk of failure is bartered for timely and user-approved delivery of the final software product. Furthermore, the timeline in RAD is fixed (Beynon-Davies et al., 1999), which implies that if a project runs the risk of overshooting the timeframe, as is common in software development, then functionality is sacrificed instead of extending the deadline. This gives more weight in accountability for the Project Manager, where the role’s responsibilities in Waterfall Methodology are concentrated by the pressure of continuous-release, time, and output. Although some authors alleviate pressure from the Project Manager by indicating that lesser weight should be attributed to preparation and more on the actual engineering work to continually release working prototypes (McManus, 1997; Dhanotia & Goyal, 2012). However, Peterson (2005) contradicts this and argues that

success in RAD relies on the Project Manager's focus on planning and preparation, and execution of the overall project. Therefore, in RAD, the Project Manager still wears the command-and-control mantle but adjusts their management approach through staggering the different phases into smaller sections and repeating the process until the product is delivered by user specifications.

2.3.2.2 Spiral Model

As discussed in subsection 2.3.1, one of the failings of the Waterfall Methodology was its inability to properly account for real risks by smothering them in assumptions and pre-defined plans at the onset of the project. The Iterative Prototyping model that came after was also found to lean less towards planning, which caused software development to lapse back into a pre-Waterfall development era and worked on the impractical presumption that the prototypes being built could accommodate yet-to-be-determined or unknown evolutionary paths (Boehm, 1995). In 1988, Barry Boehm addressed the shortfalls of both these models by marrying the organised linear sequential Waterfall model with the Iterative strengths of Prototyping and coming up with the Spiral Model (Oriogun, 1999). An accurate analysis, which corroborates the points of prior authors mentioned (Boehm, 1995; Oriogun; 1999), states that risk identification is brought at the forefront of the project using a Spiral Model, where it is strategically sound to resolve them through repeated discovery cycles before a major commitment is made for the final implementation of the product (Kruchten, 2001). Lastly, all of this is supported by Nilson and Wilson (2012), who assert how the model is very risk-driven to counter the flaws of its predecessors,

which were mainly implementation-driven (pre-sequential) and document-driven (Traditional Sequential/Waterfall).

With so much focus given to risk identification and making project decisions based on those threat evaluations, the Spiral Model's greatest strength also becomes its biggest weakness. Matkovic and Tumbas (2010) argued that although risk management is Spiral Model's strength, if it fails to identify a risk then it generates a damaging snowball effect for the rest of the project. Furthermore, Gray et al. (2016) also highlighted that the model's requirement to have a wide foundation and continuous risk management also comes with a high level of cost. Therefore, this model is not ideal for small projects and would work best for bigger, more ambiguous, and more complicated software projects.

Figure 2.5

Boehm's Spiral Model - redacted

Note. The figure is a summary of Boehm's original Spiral Model. From "A Spiral Model of Software Development and Enhancement" by B. Boehm, 1995, *Readings in Human–Computer Interaction, 2(*1), p.281-292. (https://doi.org/10.1016/B978-0-08-051574-8.50031-5).

Figure 2.5 depicts the Boehm's Spiral Model in its entirety. Generally, the model is divided into quarters and the diagram begins in the innermost spiral at the upper left quadrant moving in a clockwise direction, with the circular facet of the spiral indicative of the accumulated project cost while the angular facets indicating the headway made for each stage in the model (Nilson & Wilson, 2012). The way the cycles are ordered focus on identifying risks first, moving onto simulations to address

those risks, and wraps up with feedback and approval of comprehensive documentation before the next cycle in the spiral starts to address new risks. The model finally ends in the concluding cycle where all risks have been identified then moves on to the contemporary Waterfall approach for the product delivery (Boehm, 1995).

The Spiral Model, however, is not a lightweight framework that can be applied to all situations. It works remarkably well with big, complicated software projects, but it lacks standards for software development, and it is financially impractical for small projects since risk analysis is intensive and resources to conduct these assessments may be overkill for small-scale projects (Matkovic & Tumbas, 2010). However, it is without a doubt that the Spiral Model has contributed much to the evolution of software development models. As a matter of fact, in their reflection of Boehm's Spiral Model, Nilson and Wilson (2012) highlighted that despite its age, Boehm's Spiral Model is still the basis of many software development approaches, has been cited at least 3500 times in academic journals, pioneered risk-driven approaches, and is the precursor of Agile Development models.

Project Manager Role in the Spiral Model

The Project Manager in a Spiral Model project still holds the command-and-control mantle considering this methodology uses an Iterative approach that concludes through a Waterfall process (Oriogun, 1999). Literature defining the role of the Project Manager in a project using the Spiral Model is sparse. The term "Project Manager" was not even mentioned in Boehm's original Spiral Model article

published in 1988. However, one can easily deduce from the review about the methodology discussed in the previous subsection.

Since the Spiral Model's effectiveness and success lies in correct risk assessment and management (Kruchten, 2001), then it follows that the Project Manager should be proficient in this competency and anticipate drawing out this skillset from his project team as well. With the Spiral Model's focus on going through a Waterfall approach after iterations to identify risks have been outlined (Oriogun, 1999), then the Project Manager's plan-intensive role from traditional sequential projects apply at a certain point. Furthermore, industry discussions talk about how the Project Manager controls how many times phases are used in the spiral (Pal, 2021), which enforces the point that Project Managers are still central to this model.

2.3.2.3 Agile Software Development

ASD became the solution to the significant growth and evolution in technology at the end of the 20th century, which led to an ever-changing requirement for software and projects regularly delivered over budget or past the deadline (Matkovic & Tumbas, 2010). Influenced by the rising popularity of concepts introduced by the Spiral Model, this eventually gave birth to the initial concepts and frameworks that would eventually form the Agile Development Models in the late 1990s (Nilson & Wilson, 2012; Shastri et al., 2017). Ultimately, it was in 2001 when leaders of the previous decade's advocates of using flexible-and-lightweight methodologies, such as Scrum, Extreme Programming, Adaptive Software Development, Dynamic Systems Development Methodology, Feature-Driven Development, and Crystal Methodologies, banded together and came up with the name "Agile" (Fowler &

Highsmith, 2001). They then established the 12 Agile Principles that would hold as the foundation to the different variants of this general Agile approach (Fowler & Highsmith, 2001).

According to Shastri et al. (2021), the ASD Model is an overarching term for the different methodologies and frameworks that use iterative and incremental approaches, which focus on the people in the team and principles that support fluid adaptation to accommodate changes in the project. This point is supported by Matkovic and Tumbas (2010) when they argued that central to a project are the people in the project teams and not the process, so adequate consideration should be given to the individual members that comprise the team ensuring they are well-equipped with the needed competency, skills, and experience to facilitate discussions, formulate decisions, and generate solutions. Therefore, little importance is given to the process because of the concept that no matter how good it is, it will never be able to do anything if people lack the skills. Low priority is also given to management hierarchy because it gets in the way of optimal decision-making. These are all well-supported in the original Agile Manifesto, where the exchanges between proficient project team professionals are given priority over documentation, tools, or processes, as well as three other values of focusing on delivering functional software over too much attention to detailed documentation, encouraging customer engagement over contracts, and accommodating change versus sticking rigidly to the plan (Fowler & Highsmith, 2001).

Apart from these four values, the manifesto also covers the 12 Agile Principles that form the foundation of any Agile Development Methodology, such as Extreme Programming, Scrum, or Feature-Driven Development. Fowler and

Highsmith (2001) discussed these in detail from their original publication and the researcher has summarised each proposition with their rationale in Table 2.1 below.

Table 2.1

The 12 Agile Principles

Principle	Rationale
1. Customer satisfaction through frequent product delivery	Understanding that processes, plans, or tools do not matter to the customer but seeing the product delivered at a steady rate helps the team enforce how the project's progress contributes to the customer's business agenda.
2. Embracing change	By understanding it is more efficient to welcome change rather than prevent it, the Agile team accepts change by arranging for it to be as efficient as possible while being conscious of the impact to the project.
3. Shorter delivery cycles	Related to the first principle, the Agile approach pushes for shortening the time to deliver new increments for frequent customer review.
4. Daily interactions with the business and project teams	As the Agile approach moves away from detailed initial plans and uninterrupted development (Traditional Sequential), the team will need to highlight the need for the customer's commitment to the project through continuous interactions. These will form the details within the project and for the team to share feedback about these interactions. These interactions form realistic plans, identify risks, and shortens the time between making a decision and seeing the results.
5. People-centric focus	Agile practice understands that tools and processes are secondary to the real variable that delivers success: people. Discussions, decisions, and implementation are all done by the people in the project team, so they should be provided with an environment and given support to optimise these activities.
6. Real conversations	Dixon (2000) argues unexpressed knowledge cannot be relayed through writing, but through the interaction of people instead. Written

	transmission (documentation) is suboptimal in terms of communication channels, considering knowledge has to be transcribed, translated through reading, and an assumption is made that the reader understands. Having face-to-face conversations instead will assist with the transfer of knowledge with a chance to validate comprehension.
7. Functioning software as primary Key Performance Indicator (KPI)	Moving away from contemporary thinking of project success based on meeting the parameters of the iron triangle, the Agile approach values delivery of working software instead. It values this as the project's real and tangible indicator of success. Plans can be followed, timelines can be achieved, and the budget can be met, but if the software delivered does not work based on the customer's need, then it is a failure in the eyes of Agile practice.
8. Viable working routines	Software development has been known to portray long nights and working overtime to meet deadlines. However, this pattern is not sustainable for the project team. Therefore, Agile practice requires viable working routines that ensure people can continue with their work rhythms without surrendering to exhaustion.
9. Technical competence and excellent design	The Agile approach attempts to move away from its Prototyping predecessor, where software delivered was "quick and dirty". It focuses on ensuring design tasks and coding implementation work hand-in-hand and not as a separate phase similar to the Waterfall treatment, which improves the quality of design and code as both are tweaked to match each other in the finished product.
10. Simple processes	Supporting simple processes goes in line with Agile's treatment of change. The Agile Manifesto argues that change is easier when processes are simple because it is more efficient to add to a simple procedure compared to removing portions of a complicated framework.
11. Self-organising teams	The Agile Manifesto believes that inventiveness and modernisation are a by-product of the interactions in self-organising teams and not those that follow a hierarchy.

12. Constant retrospection and improvement	The Agile Manifesto highlights nothing can be granted the best form in the first attempt or that a process may be wrong during its initial pilot. Therefore, this Agile Principle highlights the Agile team's need to continually inspect its practices and work to improve the way it conducts development activities.

Note. The table is the author's summary of the 12 Agile Principles adapted from Fowler and Highsmith in 2001. From "The Agile Manifesto" by M. Fowler & J. Highsmith, 2001, *SpringerBriefs in Computer Science, 1(1).* (https://www.agilealliance.org/manifesto-download/). Copyright 2021 by Agile Alliance.

Project Manager Role in the Agile Development Model

As highlighted in Chapter 1, the debate and conflicting literature about the continued presence of traditional Project Manager roles and evolving Agile Models have been a subject of interest over the years. In their study to determine if Project Managers did exist in Agile practice, Shastri et al. (2016) found that nearly 70% of their surveyed Agile teams still hosted a Project Manager job role. In subsequent research on the Project Manager's role in Agile software teams, Shastri et al. (2021) found that they still played the facilitator, mentor, negotiator, protector, and coordinator role in these groups.

Regardless of the proven presence of Project Managers in industry-practiced Agile environments, the Project Manager's accountabilities start being challenged in Agile Model theories. On the back of the comprehensive discussions about Agile Development Models in previous subsections, it is clear that competencies that used to be a staple must-have in Waterfall Project Management (e.g. command-and-control role, planning, management, execution, or decision-making) no longer belong

to one person in the Agile Development Model, but is surrendered mostly to the team. In fact, Agile Principles 5 and 11 in Table 2.1 refer mostly to this point. Although a degree of planning is preserved, the project team now shares accountability in decision-making, risk management, change control, and other responsibilities the contemporary Project Manager used to hold. To augment this argument, certain ASD methodologies have completely written off the Project Manager role, such as Extreme Programming and the predominantly popular Scrum Framework (Schwaber & Sutherland, 2020; Beck & Andres, 2005; Barker, 2019).

2.4 Previous Studies & Industry Findings

In the prior subsections, we have covered the evolution of the software development model, which has provided context and allowed the understanding of how these different approaches affected the role of a Project Manager. At the end of that timeline, we focused on the iterative approach models, specifically within Agile Development models and zeroing in on the theoretical framework of Scrum, which is the focus of this study. Lastly, we covered the significance of the ICT industry is to Oceania and Southeast Asia. At this point, the ideal approach and composition in Agile Models and the Scrum Framework, how a Project Manager fits into these, and the importance of how they contribute to the economy of countries should be clear.

This subsection discusses the state of the industry when it comes to the use of Scrum and prior studies focusing on the different arguments that have identified a gap between the theoretical framework of Scrum and actual industry findings.

2.4.1 Agile Development and Scrum in Industry Settings

Now that the economic weight of the ICT sector across Oceania and Southeast Asia has been established, it is now relevant to further understand the gravity of Agile practice and the Scrum framework through its level of penetration in the industry.

In 2019, a staggering 97% of organisations were reported to be using Agile practices in their operations (Barker, 2019). This information was distilled from CollabNet VersionOne's State of Agile report released in 2019, where a variety of organisations in different industries across the world were surveyed. According to Hastie (2020), mastery of Agile practices was still low this year, with only 17% of the Agile-practising organisations reporting an advanced level of expertise in Agile ways of working. However, 95% of the organisations surveyed claimed that they have had some projects earning success through Agile practices and almost 50% reported that the majority of their projects using Agile were successful (CollabNet VersionOne, 2019).

A year later, 95% of respondents in various organisations across different work sectors worldwide practiced Agile, which is a 2% drop from the 2019 report (Digital.ai, 2020). This change might have been caused by the variation in the location of survey samples since almost 50% of the respondents for the 2019 survey were from North America whereas the 2020 report received more responses from South America and Asia (CollabNet VersionOne, 2019; Digital.ai, 2020). The updated survey indicated roughly the same level of expertise with Agile practice but now included a report that highlighted the state of global ways of working using

Agile, with seven in ten respondents sharing their team were not all located in the same country (Digital.ai, 2020).

Among the Agile approaches, the use of Scrum has demonstrated dominance globally. According to the Scrum Alliance (2017), through the State of Scrum publication, their worldwide survey report yielded 94% of respondents use Scrum in their projects. This figure is slightly different than the State of Agile report in 2019, which showed 72% used pure Scrum and its variants (e.g. Scrum & Kanban or “ScrumBan”) in their Agile practice, and higher in 2020, as shown in Figure 2.12 below, which reported 76% (CollabNet VersionOne, 2019; Digital.ai, 2020). Regardless of the year and source of the report, it is clear that the Scrum framework dominates all other Agile practices and is the default approach for teams using Iterative models. There is a clear indication this Scrum trend is here to stay, especially with 97% of respondents expressing their desire to continue using Scrum in the years to come (Scrum Alliance, 2017).

Figure 2.12

Breakdown of Agile Methodologies Used for 2020 - redacted

Note. The figure illustrates a breakdown of how ICT industries worldwide use Agile methodologies. Approximately 1,100 ICT professionals globally participated in the 2020 survey. *14th Annual State of Agile Report*. From Digital.ai. (https://stateofagile.com/?_ga=2.186885928.1823171340.1616792226-11212933.1616792226#ufh-i-615706098-14th-annual-state-of-agilereport/7027494). Copyright 2020 by Digital.ai.

2.4.2 Project Managers in the Scrum Framework

The latest versions of The Scrum Guide do not contain any mention of a "Project Manager" in the framework, clearly stipulating its averseness to the role (Schwaber & Sutherland, 2017; Schwaber & Sutherland, 2020). When Yi (2011) led

his organisation through a transition from traditional project management to Scrum, he divulged he had to terminate his Project Managers.

A Project Manager role entails a hierarchal model and enforcement of management to assume control and direct movement of team members (Ozkan & Kucuk, 2016). This goes against the people-centric and self-management principles of the Agile approach, which is shared by Scrum philosophies (Fowler & Highsmith, 2001; Schwaber & Sutherland, 2017). However, Holthausen and de Klerk (2018) argue that Scrum Masters acting beyond servant leadership and delving into team leadership, which entails taking some control of management, can pave the way for the team's eventual self-organisation. Yi (2011) reinforced this point when he justified how much leadership and management work is required when you try to transition your teams into self-management. Despite the arguments for and against having a figure of central management (e.g. Project Manager, Team Leader, or Line Manager) in Scrum, when Shastri et al. (2016) surveyed Agile practice in industry setting, it was proven that Project Managers do still exist in Scrum-based projects but they recommended further research to discover why.

Despite the mandate of contemporary literature, multiple authors of this decade have cited the existence of Project Manager within the Scrum environment for various cases. At the forefront of the reasons is the phenomenon where former Project Managers are given Scrum Master roles as organisations transition into Scrum, opening the possibilities for hybrid roles. Kamran and Waheed (2012) explained how this could be caused by organisations moving into Scrum equipped with traditional Project Managers, which they have repurposed to be Scrum Masters, potentially leading to mixed responsibilities. This theory was supported by Bolloju, et al. (2018) and Ereiz and Music (2019) when they found Project Managers also play

the role of Scrum Masters in some Scrum Teams. Noll, et al. (2017) builds on this when they found the inefficiency of having Scrum Masters play the role of Project Managers. Noll, et al. (2017) identified the necessary project management events in Scrum and how they are being inadvertently taken on by the Scrum Master, who is forced to act as a Project Manager as a result, but argues the inefficiency of doing so and suggests the Project Manager role be taken on by the Product Owner instead.

Agile models are doing away with traditional Project Managers and distributing this role's responsibilities across different people in the team. However, there is still a need for a Project Manager within the Agile environment, but this role could potentially be tailored for Agile practice (Gandomani, et al., 2020). Furthermore, Ozkan and Kucuk (2016) critique Scrum's capacity to handle larger-scale projects by stressing how the framework is meant for smaller ones instead and argue that a Project Manager is needed should one attempt to run bigger projects with Scrum. Nowhere in the Scrum Framework does it indicate the role should be disallowed and more literature supports the need for it (Schwaber & Sutherland, 2020; Noll et al., 2017; Gandomani, et al., 2020).

Gandomani, et al. (2020) found project management responsibilities still alive in Scrum, such as stakeholder management, team management, problem-solving, leading, process improvement, and monitoring. Noll, et al. (2017) summarised these into five Project Management responsibilities within the Scrum Framework, which are:

1. Product Direction
2. Return of Investment
3. Work-in-Progress Management
4. Operational Management

5. Release Management

Although these responsibilities are handled between the Scrum Master and Product Owner, this demonstrates that Project Management is never truly dead within Scrum and therefore will the potential for a Project Manager, who excels at these responsibilities, to step into a Scrum environment. Considering how a Scrum Team lives within a larger organisation, there will always be a need for having a dedicated Project Manager within Scrum by accepting the fact that management responsibilities will always exist because of this.

2.4.3 The Evolving Role of the Scrum Master

In prior subsections discussing the theoretical framework of Scrum, one can easily see the prescriptive approach of the model in the sense that certain roles and responsibilities need to be filled and they should be doing certain things at specific times for the approach to work (Schwaber & Sutherland, 2020). According to Yu and Petter (2014), complete observation of Scrum's rules is vital to the Scrum Team's positive performance. However, there have been many variations and deviations that have come out of industry practice, and these are influenced by real-life scenarios not accounted for in The Scrum Guide, such as when an organisation is transitioning from a different framework and into Scrum. Holtzhausen and de Klerk (2018) found the Scrum Masters they surveyed exhibited responses that suggested not following the entire framework could improve a Scrum Team's performance.

During Nokia's transition into Scrum, Yi (2011) led his team of 500 people through the change and highlighted the difficulty of switching from a traditional hierarchal model towards Scrum's self-management approach, which not only came

with organisational considerations but also changing mental perception and years of familiarity. In this industry case study, the transition's success relied on sustaining the changes and it was made possible by altering the Scrum Master's role and making them Line Managers as well (Yi, 2011). In the earlier part of their Scrum reorganisation, Yi (2011) argued the importance of ensuring an existing Line Manager did not take on the role of a Scrum Master for fear that the perceived authority might affect the team's ability to self-manage, but he later overturned his decision and allowed Line Managers to be Scrum Masters. Yi (2011) asserted that it made sense to follow Schwaber's and Sutherland's rules about Scrum Masters remaining as servant leaders, so they can be without assumed or perceived authority and nurture self-management, at the start of reorganisation but once everyone understood their roles and the importance of self-management, the decision had to be reverted so hybrid Line Managers/Scrum Masters can promote sustainability of the change. In their research, Holtzhausen and de Klerk (2018) found empirical evidence that Scrum Team members reacted positively to Scrum Masters who also acted as Team Leaders, which supports Yi's (2011) decision to empower Scrum Masters beyond servant leadership.

Further evidence suggests how the Scrum Master has been evolving outside the intended framework to improve Scrum's performance in industry applications. For instance, Gupta and Reddy (2016) came up with at least three variations of the Scrum Master to match the additional responsibilities they had to take on. Moreover, Noll, et al. (2017) found nine academic papers indicating the Scrum Master's role is changing past its mandate and currently handles responsibilities outside of the prescribed list, such as Product Backlog prioritisation or estimating. By right, the prioritisation of the Product Backlog is a task that belongs to the Product Owner and

the estimation is a Development Team's accountability (Schwaber & Sutherland, 2020). Furthermore, six academic papers were found to report the role is involved in management duties, specifically attributing them to Project Managers or Project Leads (Noll, et al., 2017). Again, this goes against traditional literature, which indicates management accountabilities in Scrum have been divided across the whole team and not to one role alone (Taylor, 2016). However, by taking these findings and cross-referencing them against their case studies, Noll, et al. (2017) accepts that project management responsibilities will remain in Scrum environments and the reality of a role overseeing these accountabilities. Instead of giving those accountabilities to the Scrum Master, the Noll, et al. (2017) recommend it should rather be taken on by the Product Owner, a role that shares the organisational focus as opposed to the Scrum Master's people focus.

In other studies exploring the application of Scrum Masters in the industry setting, Ereiz and Music's (2019) survey and case study solidified his argument that a Scrum Team can never be without a Scrum Master and to lose the role meant failure for the Scrum project. Ereiz and Music's (2019) study compared well with the experiment Bolloju, et al. (2018) conducted and found no difference in the advantages or disadvantages of having a fixed Scrum Master or rotating the role among the Scrum Team members in the duration of the project. Both Bolloju, et al. and Ereiz and Music's (2019) studies reaffirm that it does not matter who holds the role, but it is important to make sure it exists within the team.

Finally, Yi (2011) takes it even a step further and highlighted it was a shame how Scrum Masters were confined to the team level when it made sense that their skills and working culture should be introduced at an organisational level. Ereiz and Music (2019) agree with this sentiment and stress the point that Scrum Masters are

the logical next step in the leadership ladder, right after executive management, to bring about Agile change.

2.5 The Scrum Framework

One of the most popular ASD Models is the Scrum Framework (Cervone, 2011; Barker, 2019). Originally developed in 1995 and implementing continual improvements since then, Scrum is a framework that can be utilised to approach complicated, persistent, and dynamic problems while steadily releasing pieces and parts of valuable work (Schwaber & Sutherland, 2017). In a later publishing, Schwaber and Sutherland (2020) highlighted how Scrum is a simple framework that helps teams create value by producing dynamic solutions for difficult problems. Based on this definition, the Scrum Framework may be classified under Agile Development Models but could potentially be used outside the software industry to develop other products or services.

Schwaber and Sutherland (2020) easily summarised Scrum by stating all you need is a Scrum Master who can create an environment where a Product Owner can define a problem into a Product Backlog and the Scrum Team can repeatedly pick and choose items in the Product Backlog to convert into working increments through “Sprints”. The Scrum Framework uses “Sprints”, timeboxed work cycles that may last between one and four weeks, which aims to deliver small portions of finished work, known as “iterations”, that will eventually make up the whole product as the Scrum Team completes more sprints (Tanner & Mackinnon, 2015). The entire scope of the project is represented in a Scrum Artifact called the “Product Backlog”, which is a living list of achievable goals or themed tasks called “User Stories”, that is groomed, prioritised, continually updated, and feeds work into the Sprint cycles (Schwaber &

Beedle, 2002). Figure 2.6 below simplifies the Scrum Framework and describes its entirety (Scrum.org, 2020). In summary, the Scrum Team bases all of its planning for Sprint by choosing User Stories in the Product Backlog, go through the rest of the Sprint cycle by working on those User Stories, review the End-of-Sprint iteration, send back any new findings to the Product Backlog, and then repeat the process of choosing new User Stories for the next Sprint again.

Figure 2.6

The Scrum Framework - redacted

Note. A summary of the entire Scrum Framework. *What is Scrum?.* From Scrum.org. (https://www.scrum.org/resources/what-is-scrum). Copyright 2021 by Scrum.org.

The following subsections will provide a summary of key Scrum concepts. By understanding what Scrum is and how it is vastly different from previous models discussed, which will subsequently add context through identification of how the Project Manager role managed to lose its position in this framework.

2.5.1 Scrum Philosophies

In order for the Scrum framework to be effective, Scrum relies on specific philosophies and values at the heart of its operation. In their latest edition of The Scrum Guide, Schwaber and Sutherland (2020) stress Scrum's core in empiricism, which is the understanding that hard facts can only be gained through experiences and that decision-making should only come from these empirical insights. Moreover, Scrum has three foundational pillars (Scwhaber & Sutherland, 2017), which are supported by the overall framework, and these are:

a.) Transparency

Through the maintenance of a singular source of truth, such as the Product Backlog, or shared understanding of language, such as defining what the "definition of done" is, the project's status is clear to all involved, and decisions follow the rules of empiricism.

b.) Inspection

The process of assessing artifacts, such as the Product Backlog or Increment during Sprint Reviews, allows the team to detect unwanted developments in the product and proceed with the necessary Adaptation.

c.) Adaptation

As a result of Inspection, Adaptation follows to mitigate unwanted variances that have been detected so the product developed does not further deviate from the desired path.

To complement these pillars, Scrum recommends integrating the values of commitment, courage, focus, openness, and respect into the working environment to

build an atmosphere of trust that improves collaboration and team performance (Schwaber & Sutherland, 2017).

2.5.2 The Scrum Team

The Scrum Team is composed of the three Scrum Roles, namely the Product Owner, Scrum Master, and the Development Team, and they are expected to be self-organising and cross-functional (Sutherland, 2010). By being self-organised, the Scrum Team decides the best course of action to achieve their goals, and by being cross-functional, the Scrum Team can be relied on to complete their work without relying on external resources (Schwaber & Sutherland, 2017). It is clear to see that these roles no longer include the Project Manager and by prescribing that the teams are required to be self-managing, an indication is set that the Project Manager's traditional responsibilities have been reassigned across these three roles. Below, we will discuss each of these roles' definitions and responsibilities and we can further understand where the Project Manager's accountabilities have been delegated to.

2.5.2.1 Product Owner

From a high level, the Product Owner assumes much of the Project Manager's traditional role in a software project. Mundra et al. (2013) described the Product Owner as the pivotal role in a Scrum Team, considering they represent the customer and the users through consideration of the organisation's needs and prioritises the order of which features, in the form of User Stories, are taken into Sprints. Furthermore, the Product Owner is directly responsible for the creation,

grooming, and optimisation of the Product Backlog, and making sure other members of the team understand each item in the artifact so they can build it to the correct specifications (Schwaber & Sutherland, 2017). Mundra et al. (2013) suggested there can be more than one Product Owner, but Schwaber and Sutherland (2020) in their latest edition of The Scrum Guide highlights the importance of only one Product Owner to have a focal role to guide the Product and team. The authors also stress how this role's decisions need to be respected to help the Scrum Team succeed.

2.5.2.2 Scrum Master

As the name implies, the Scrum Master is responsible for making sure the Scrum Team and the organisation where the team resides are guided on the use of Scrum (Adi, 2015). Sutherland (2010) very clearly summarises the Scrum Master's roles and responsibilities as doing everything possible to assist in the Scrum Team's success. Aside from enforcing the proper implementation of Scrum, the role takes on a servant-leader designation, where it focuses on promoting helpful interactions between the team and those outside it while limiting distractions, resolving impediments, and stopping anti-patterns (Schwaber & Sutherland, 2020). Fundamentally, Schwaber (2004) argued that a Scrum Master should be so busy with the support that they no longer have time to act like a Project Manager, which has been highlighted as the likely professionals to take on this role. Schwaber and Sutherland (2017) outlined the main responsibilities of a Scrum Master, which are to support the Product Owner by helping them maximise the return of investment or accomplish goals, support the development team by creating an environment for

productivity, creativity, and empowerment, and supporting the larger organisation by keeping all information transparent and transmitted.

2.5.2.3 Development Team

The latest publication of The Scrum Guide released November 2020 has renamed this role from the “Development Team” to “Developers” (Schwaber & Sutherland, 2020). However, considering all references before this labelled the role as the former title, it has been decided to stay with the old name for consistency and will continue to refer to them as the “Development Team”.

The Development Team is a group of professionals who will handle building the product and Sutherland (2010) reinforces Scrum’s tenet to ensure the team is self-organising and cross-functional, which reiterates its lack of need for a Project Manager. From the first part Sutherland’s (2010) definition, this would indicate the Development Team is not just composed of Developers, but also Technical Leads, Technical Architects, Designers, Testers, or any professional involved in building the product. The Scrum Guide supports this requirement going so far as to even dictate that not even the Scrum Master can intervene with the team’s self-management (Schwaber and Sutherland, 2017).

The Development Team’s size varies. Sutherland (2010) mentions five to nine people is ideal while Mundra et al. (2013) argues eight is the best combination. However, in later publishing, Schwaber and Sutherland (2017) both settle on a Development Team between three to nine members. Despite the ranges provided, it is clear that a team of nine is still small enough to manage collaboration but anything below three diminishes vital interactions that fuel Agile practice (Schwaber &

Sutherland, 2017). It is interesting to note that Mundra et al. (2013) separated the testers from the Development Team, but The Scrum Guide indicates they should be part of that team to maintain the three identified roles of Scrum.

2.5.3 The Scrum Events

Considering that Scrum is an evolving framework that is continually getting updates, this entire section has been referenced directly from the two latest versions of The Scrum Guide (Schwaber & Sutherland, 2017; Schwaber & Sutherland, 2020), to provide the most up-to-date descriptions.

The Scrum Guide describes four granular Scrum events, namely the Sprint Planning, Daily Scrum, Sprint Review, and Sprint Retrospective, which occur inside a larger Scrum event, which is called the Sprint. These events are intended to maintain the three pillars of Scrum's Frameworks, namely Transparency, Inspection, and Adaptation (Schwaber & Sutherland, 2020).

2.5.3.1 Sprint

As described by Schwaber and Sutherland (2020), the Sprint is the core of Scrum and it refers to a one- to four-week timeboxed event that starts the moment a previous Sprint has ended and contains all other Scrum events and is essentially where all the work occurs. As a Sprint is happening, the Product Owner can continue to refine the Product Backlog but the Sprint Goal cannot change, the User Stories in the Sprint Backlog should not be altered, the Development Team should be kept free from external interference to focus on meeting the Sprint Goal, and customers can

only give feedback in the Sprint Review (Schwaber & Beedle, 2002; Schwaber & Sutherland, 2020).

In their latest Scrum Guide, Schwaber and Sutherland (2020) have stipulated that a Sprint may be considered a “project”, which hints at the authors’ desire to make Scrum delineate away from project-based work and more on continuous product delivery.

2.5.3.2 Sprint Planning

Sprint Planning kicks off the start of a new Sprint, usually lasting between two to eight hours depending on the length of the overall Sprint, where the Scrum Team agrees on an overall Sprint Goal and Definition of Done (Schwaber & Sutherland, 2017). After the Product Owner establishes the importance of this Sprint, the Development Team then decides what they can accomplish in this new Sprint and agree on how they can accomplish it (Schwaber & Sutherland, 2020). This is where the Scrum Framework’s and Agile Model’s prescriptive “self-organising” and “self-managing” attributes come into play because the Development Team alone, without interference from the Product Owner and Scrum Master, will decide the “what” and “how” in the Sprint Planning. However, the Product Owner can assist in the form of translating items in the Product Backlog and negotiating with the Development Team (Schwaber & Sutherland, 2020). The Scrum Master ensures Scrum guidelines are followed in the Sprint Planning and that there is clear communication between the Development Team and Product Owner (Schwaber & Sutherland, 2020). At the end of this event, the Development Team should be able to explain to the Product Owner how they can meet the Sprint Goal (Schwaber & Sutherland, 2017).

2.5.3.3 Daily Scrum

The Daily Scrum refers to a 15-minute daily standup that is exclusive for the Development Team, which they should conduct while running a Sprint (Schwaber & Sutherland, 2017). The Scrum Master ensures the meeting happens and it is kept within the 15-minute limit. In this Scrum event, each member of the team should share what has been achieved the day before, the plan for the next 24 hours, and, most importantly, if anything is hindering or blocking their work so that the team has a chance to inspect their progress towards the Sprint Goal (Schwaber & Sutherland, 2017). At the end of this event, the Development Team understands where they stand in relation to the Sprint Goal and have adapted, where necessary, to meet the objective (Schwaber & Sutherland, 2017). However, Schwaber and Sutherland (2020) indicate that the Daily Scrum should not be the only medium to meet and adjust for the day, but the team should still have interactions throughout the day to re-plan where necessary.

2.5.3.4 Sprint Review

The Sprint Review is a one- to four-hour meeting to be attended by the entire Scrum Team, main stakeholders, and possibly others invited by the Product Owner (Schwaber & Sutherland, 2017). This event occurs at the end of the Sprint, where the Scrum Master ensures all attendees understand its purpose by highlighting collaboration, the Product Owner talks about the Product Backlog status, and the Development team reviews what happened in the Sprint and demonstrate the latest increment, which is then followed by a discussion and collaboration about the next steps (Schwaber & Sutherland, 2020). At the end of the Sprint Review, the Product

Backlog will have been updated and a list of potential User Stories is prepared that can go into the next Sprint (Schwaber & Sutherland, 2017).

2.5.3.5 Sprint Retrospective

The Sprint Retrospective happens immediately after the Sprint Review and right before the next Sprint Planning (Schwaber & Sutherland, 2017). Timeboxed to a maximum of three hours, the meeting is attended by all members of the Scrum Team and is meant to review the Sprint's performance in terms of procedure, processes, tools, and working relationships (Schwaber & Sutherland, 2020). The team can then collaborate on how to improve any shortfalls found and, as the outcome of this event, determine an action plan to address the issues raised by adding them to the next Sprint Backlog and the conclusion of the Sprint Retrospective marks the closure of the current Sprint (Schwaber & Sutherland, 2020).

2.5.4 The Scrum Artifacts

According to Schwaber and Sutherland (2020), Scrum has three main artifacts, namely the Product Backlog, Sprint Backlog, and Increment, and these uphold the pillar of Transparency, which feeds into accurate sources for Inspection and translates to correct Adaptation.

2.5.4.1 Product Backlog

The Product Backlog contains all the work required to improve or complete the product and should be the singular point of reference for the Scrum Team for work that needs to happen (Sutherland, 2010). It is a living list that is curated by the Product Owner, where it should be prioritised based on readiness for selection in Sprints and it continues to receive refinement by fleshing out details for ambiguous user stories (Schwaber & Sutherland, 2020).

2.5.4.2 Sprint Backlog

The Sprint Backlog is determined in the Sprint Planning and contains the Sprint Goal, the Product Backlog items that have been chosen for the current Sprint, and the action plan for completing the increment before the Sprint Review (Schwaber & Sutherland, 2020). This artifact belongs to the Development Team and is continually updated as work is completed in the Sprint or items in the Product Backlog become irrelevant so it is always an up-to-date depiction of what work is left to the Development Team to achieve the Sprint Goal (Schwaber & Sutherland, 2017).

2.5.4.3 Increment

The Increment comes in the form of integrating previously completed increments and adding in the Product Backlog items accomplished in the latest Sprint, which meets the agreed Definition of Done (Schwaber & Sutherland, 2017). An increment must be functional to be considered as such (Schwaber & Sutherland,

2020). When presented in Sprint Reviews, this artifact highlights the Transparency of the product by illustrating exactly where it stands against the Product Backlog and offers an opportunity for Inspection (Schwaber & Sutherland, 2017). However, Schwaber and Sutherland (2020) recommend that a team can release increments at any time since Sprint Reviews are not release phases.

2.6 The Information, Communication, and Technology Industry in Oceania and Southeast Asia

This study focused on countries in Oceania and Southeast Asia. This subsection will cover the current state of the ICT Industry in these regions to help understand the economic weight and actual importance this sector contributes in this part of the world, which lends credence to the overall significance of this study. Since software design and development teams are the most basic cells of the entire ICT industry, it is important that we establish the sector's role in an economy (Ministry of Business, Innovation, and Employment, 2017).

Considering there are numerous countries within Oceania and Southeast Asia and it is challenging to cover all in detail within this study, the following subsections will focus on the top two nations, in terms of ICT exports, of Oceania and Southeast Asia. A review of the actual and prospective ICT statuses, their ICT sector's contribution to their economy, measured through GDP. GDP is the total financial or market worth of services produced or goods completed within the perimeters of a country and within a certain time, which is the globally accepted value indicator of a nation's economic status (Fernando, 2020). Lastly, all monetary references in the

following paragraphs will use the United States (US) Dollar currency in the interest of consistency.

According to the World Integrated Trade Solutions (WITS) report (2017) depicted in Figure 1.1 in Chapter 1, Singapore exported the highest amount of ICT service in Southeast Asia, amounting to roughly US$ 11 billion and followed by the Philippines closing above US$ 5 billion for 2017. Based on the same report, Australia led Oceania in ICT exports at approximately US$ 2.5 billion, then New Zealand at US$ 600 million. Figure 2.7 below shows the ICT Service Exports for Australia, New Zealand, Philippines and Singapore in US dollars between the years 2000 to 2017.

Figure 2.7

Australia, New Zealand, Philippines, and Singapore ICT Service Exports in US$ - redacted

Note. The graph illustrates the amount of ICT service exports from Australia, Singapore, New Zealand, and Philippines between 2000 to 2017. From *World Integrated Trade Solution (WITS)*. (https://wits.worldbank.org/CountryProfile/en/Country/BY-COUNTRY/StartYear/2000/EndYear/2017/Indicator/BX-GSR-CCIS-CD#). Copyright 2021 by World Trade Organisation.

2.6.1 Singapore

Singapore's ICT industry has a clear rising trend in its contribution to the city-state's overall GDP and it does not show signs of slowing, reporting US$ 9 billion in 2011 and almost doubling in 2020 (Hirschmann, 2021). Apart from 2015 and 2020,

Figure 2.8 below illustrates Singapore's healthy 6%-11% per year ICT sector growth over the past decade (Statista, 2020). According to Vu (2013), Singapore's strong economic expansion can be attributed to its focus on the ICT sector, which has resulted into roughly a 1% contribution to GDP since 1988. This is supported by the International Trade Administration (2020) when they reported how Singapore equates investments in the ICT industry as tantamount to a direct social and economic development effort, citing the country's plan to invest US$ 2.5 billion in ICT in 2020 and its intent to prepare complete penetration of 5G (fifth generation technology for mobile wireless technology) nationwide. By making the ICT industry central to its economic plan, it is not a surprise that the country leads all others in Southeast Asia and Oceania by a very wide margin (WITS, 2017). In consideration of their previous performance, their philosophy around the ICT industry, and economic planning, it is clear to see that Singapore's domination of the technology sector will continue to persist in the years to come.

Figure 2.8

ICT GDP Contribution Singapore - redacted

Note. The figure illustrates Singapore's ICT sector growth through GDP contribution between 2011 to 2020 in United States Dollars, adapted from Hirschmann's graph, which was in Singapore Dollars. *Gross domestic product (GDP) of the information and communication industry of Singapore from 2011 to 2020*. From *Statista*. (https://www.statista.com/statistics/625739/gdp-of-the-information-and-communication-industry-in-singapore/). Copyright 2021 by Statista.

2.6.2 Philippines

The WITS (2017) reported the Philippines as the second largest exporter of ICT services in Southeast Asia. This account was corroborated by IndexMundi (2019), detailing almost US$6 billion in total ICT services exported, placing the archipelago country in the top 20 globally, ahead of economic giants like Japan and

Russia. Figure 2.9 below depicts how the 7000-island country compared to other nations in the world.

Figure 2.9

Global Top 20 Countries by ICT Service Exports - redacted

Note. The figure illustrates the top 20 nations worldwide in terms of highest ICT service exporters. *ICT service exports (BoP, current US$) - Country Ranking*. From *IndexMundi*. (https://www.indexmundi.com/facts/indicators/BX.GSR.CCIS.CD/rankings). Copyright 2021 by IndexMundi.

Despite Philippines' strong ICT service exports globally, America's International Trade Administration (2020) highlighted the country's appalling lack of

ICT infrastructure, marked the Philippines' internet quality as the worst in Asia, underlined the lack of nationwide coverage brought about by market monopolisation, and a government bent on sticking to paper-based processes. These conditions beg the question as to how much better the Philippines could perform in the global stage of ICT service exports if it had facilities and support in place similar to countries like Singapore? Regardless of the challenges, the Philippine Statistics Authority (2020) published that the country's information and technology companies are getting the ICT support they need indicating nearly 100% of registered ICT organisations have access to the internet and computers. Furthermore, Manhit (2019) reported the country's acknowledgment of its weaknesses in the ICT sector and therefore launched big initiatives for a nationwide digital transformation and conducting a review of its laws to allow more telecommunication companies to enter the Philippine market and address the issue of monopolisation.

2.6.3 Australia

Australia's ICT industry has contributed nearly US$100 billion to the country's GDP since 2005, reporting nearly US$43 billion of Gross Value Added (GVA), a figure that contributes to the overall GDP, in 2019 alone (Deloitte, 2020; Kenton, 2021). Figure 2.10 below shows Australia's ICT sector's contribution to the GVA between 1994 to 2019 (dollar figures in the chart are shown in Australian Dollars, and 1 AUD is roughly 0.75 USD).

Figure 2.10

Contribution to GVA – Australian ICT Industry in AU$ billions (AU$1 = US$ 0.75) - redacted

Note. The figure illustrates the ICT industry's contribution to Australia's Gross Value Added between 1994 to 2019. *Australia's Digital Pulse*. From Deloitte. (https://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloite-au-economics-australias-digital-pulse-2020-230920.pdf). Copyright 2020 by Deloitte Access Economics.

This is a direct result of Australia's rising ICT professionals' headcount, which has exceeded the two percent yearly growth forecast numbering 628,000 in 2015 and was nearly 800,000 in 2019 (Professionals Australia, 2017; Deloitte, 2020). Despite the COVID-19 pandemic and productivity from numerous sectors going into the red, the country's ICT industry continued to thrive reporting a 2.1% growth in production between September 2019, a few months before the pandemic affected the globe, and December 2020, which was after lifting lockdown restrictions

(Australian Bureau of Statistics, 2021; World Health Organisation, 2020; Parliament of Australia, 2020). WITS (2017) reported that the country leads Oceania in ICT service exports. According to the Australian Trade and Investment Commission (n.d.), this success is largely attributed to a highly skilled ICT workforce, large market size, innovational mindset, and a diverse customer base, which makes fertile grounds for creative software production and research and development, attracting ICT giants such as Avaya, Canon, Cisco Systems, Citrix, Fujitsu, Google, IBM, and a host of other ICT corporations to set up bases in the country.

2.6.4 New Zealand

WITS (2017) ranked New Zealand as the second-highest exporter of ICT services in Oceania, hovering around US$600 million between 2014 to 2017. Stats NZ (2020) reported the trend is only going up for the country in terms of exports in ICT services, citing approximately a 30% increase to US$768 million in 2019. Using the Organisation for Economic Cooperation and Development's definition of what is included in the ICT sector, the New Zealand Technology Industry Association (2016) reported New Zealand's service exports, going beyond just services and encompassing goods and profits remitted back to the country from its foreign subsidiaries, was around US$4 billion in 2015. In either report, one can agree that they are definitely more conservative figures compared to its geographically bigger neighbor in the north, Australia. However, New Zealand's ICT performance is actually impressive considering it only has roughly 30,000 ICT professionals compared to Australia's 600,000 (Bridges, 2017; Professionals Australia, 2017).

Figure 2.11

New Zealand Gross ICT Sales in 2019 in NZ$ (NZ$1 = US$0.75) - redacted

Note. The figure illustrates the ICT industry's gross sales and contribution to the New Zealand economy in 2019. *Information and communication technology supply survey: 2019*. From Stats.NZ. (https://www.stats.govt.nz/information-releases/information-and-communication-technology-supply-survey-2019). Copyright 2021 by the Crown.

As illustrated by Figure 2.11 above, the ICT sector contributed a total of approximately US$7 billion in domestic and foreign sales ultimately increasing the country's GDP by roughly US$5 billion in 2019, placing it as the 15th most productive sector and performing better than hospitality (Stats NZ, 2020; Figure NZ, 2019). According to Bridges (2017), the New Zealand government is fully supportive of transforming into a digital country and the performance reported over the past five years is a testament to the nation taking that claim seriously, which only means to say that more can be expected of Aotearoa's budding ICT industry.

2.7 Chapter Summary

An extensive review of relevant literature was done to outline the theoretical framework and related industry findings pertinent to this study. An understanding of the evolution of software development models introduced the context of how a Project Manager's roles and responsibilities changed over time, from being a central role in traditional Sequential approaches to slowly giving up accountabilities to the project team in more Iterative models, specifically the Agile methods. Furthermore, a discussion of Scrum, the focus of this study, was done to understand what the framework is all about, plus the absence of the Project Manager's role in this structure was established.

After the context on the chronological software development models and the theoretical Scrum Framework was discussed, industry findings were presented to demonstrate the importance of the ICT industry in Oceania and Southeast Asia in the past, present, and future. Then, the weight of Agile practices and Scrum as a framework was evidenced through industry data surrounding the almost absolute use of Agile across different industries worldwide and the dominant popularity of Scrum versus other Agile methodologies across organisations using Agile.

After understanding how a Project Manager's traditional role unraveled through the evolution of software development models, especially in its complete absence in the Scrum theoretical framework, academic studies and industry findings were discussed to prove the role's continued presence within Scrum and the significance they hold. Furthermore, studies that argue Scrum is more effective when changes to the framework were done were discussed in an attempt to explore possible reasons why the Project Manager continues to exist within industry-

practiced Scrum. The disconnect between the logical descent of a central Project Manager and the role's continued thriving presence in Scrum has revealed a gap between theory and practice. This study is interested in establishing what conditions are prevalent in Scrum projects that included (or did not include) a Project Manager so it can be used as a guide to support industry practitioners anticipate the role's need in comparison to their project conditions and it will aid future researchers when conducting a study about the phenomenon as well.

Chapter 3

Research Methodology

3.1 Introduction

This chapter aims to describe the school of thought, approach, methods, and tools used to conduct this study. Different authors have used varied terminologies, such as Paradigm, Approach, or Method, and findings indicate some are applied interchangeably. The following subsections commence with a review of the research questions posed from Chapter 1, a quick overview of the research design through a diagram, a discussion on the Paradigm, Approach, and Method based on the author's understanding of each, followed by a brief discussion about the different Paradigms, Approaches, and Methods, the choice, and justification for use in this study. This section will also include an outline on how the research instrument was developed; discussion on sampling and what was used for this study; how the research sample and respondents list was generated; a walkthrough the data collection phase; an overview of the data analysis; the ethical considerations; and finally, a summary of the chapter.

3.2 Research Questions

As discussed in Chapter 1, the primary research question for this study was:

What project conditions are true for software projects that use the Scrum Framework with the accompanied presence or absence of a Project Manager?

Also discussed was the secondary objective that sought to answer the following question:

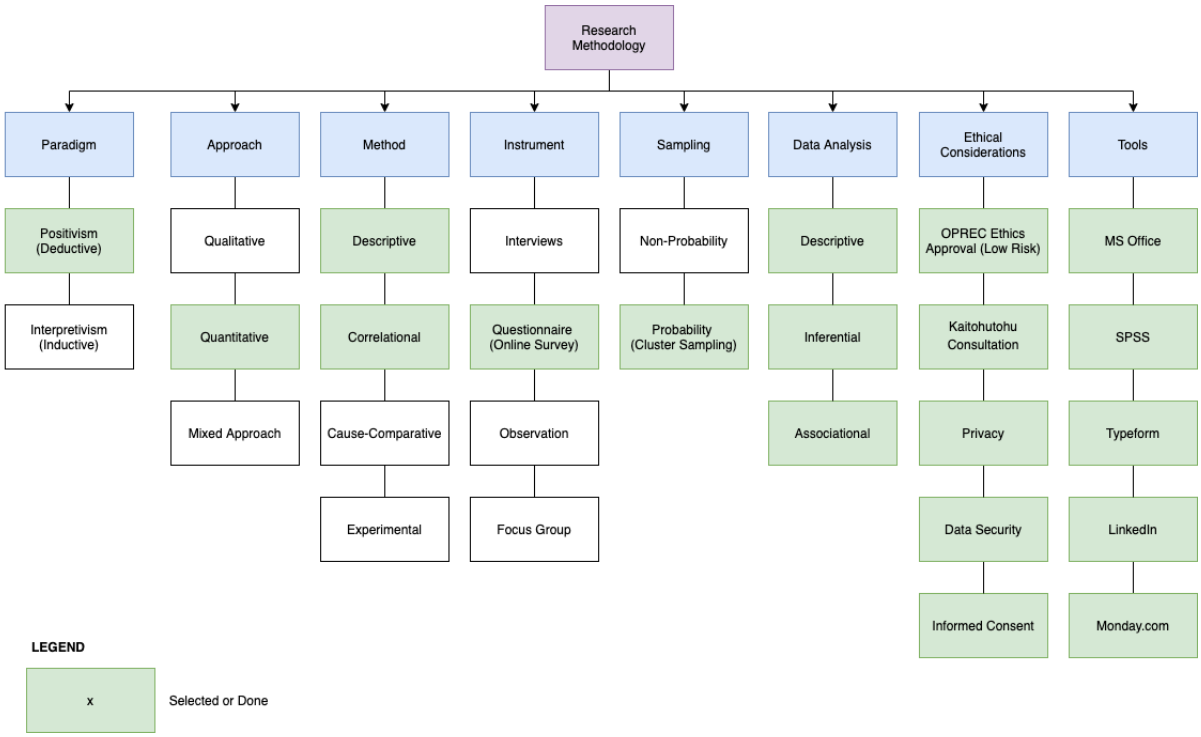
Is there a significant relationship between the presence or absence of a Project Manager and the perception of project success?

3.3 Research Design

The complete research design is illustrated in Figure 3.1. This study followed the Positivism paradigm, a Quantitative approach, with both a Descriptive and Correlational methods, making use of an online survey questionnaire as the research instrument. The sampling method used was Probability Cluster Sampling and the data collected was analysed using a cyclical approach between descriptive and inferential. Lastly, a checklist of ethical considerations and tools used are listed.

Figure 3.1

Research Design



Note. The figure was adapted from Machado and Marten's research design diagram in 2015 and it illustrates the researcher's complete research design. From "Project Management Success: A Bibliometric Analisys", by F. Machado and C. Martens, 2015, *Revista de Gestão e Projetos, 6*(1), p.28-44. *14th Annual State of Agile Report*. Copyright 2021 *Revista de Gestão e Projetos*.

3.4 Research Paradigm (Positivism)

Research Paradigm represents the thought framework that guides the researcher. According to Kivunja and Kuyini (2017), a Paradigm refers to the researcher's personal philosophies, principles, or way of thinking that influences how one sees the world and makes sense of what is seen. It is the way a researcher comprehends the truth of the world around us and how one examines it (Rehman &

Alharthi, 2016). In other words, a Research Paradigm is the researcher's individual set of beliefs or psychological advocacy that affects how they understand reality.

Positivism is a Paradigm that believes in acquiring robust experiential data to explain unbiased reality (Wong, 2014). Kivunja and Kuyini (2017) discuss that Positivism uses a deductive form of logic, where it first generates a hypothesis to test using real information, collected through surveys or polls, that were then processed through established statistical methods before coming to a conclustion. Simply speaking, Positivism focuses on organic and genuine proof to delineate cause and effect relationships and uncover objective truths. Although Positivism seeks to understand reality as it is, Rehman and Alharthi (2016) criticise the Paradigm due to its inability to capture natural social phenomena when people's relationships, characteristics, or higher moral concepts are involved. This would indicate the Paradigm works well when individual emotions and idiosyncrasies are not part of the equation.

On the other hand, Interpretivism is the opposite end of the Research Paradigm spectrum. Interpretivism requires the researcher to step away from their perceptions and shift their focus to the subjective experiences of other individuals and how they see the world around them to construct reality (Kivunja & Kuyini, 2017). Interpretivism uses inductive logic and revolves around the exchanges between the researcher and the subjects that are captured through conversations, surveillance, or personal notes (Wong, 2014). However, due to the researcher's heavy involvement in the way the data is processed and how the Paradigm focuses on subjective information, it has been criticised for lack of credibility and being unable to produce theories that can be accepted by the greater population (Rehman & Alharthi, 2016).

Considering that the researcher will merely act as an observer, no attempt was made to subjectively interpret data, and sought to establish a list of project conditions that prevailed in cases where a Project Manager was present or absent in a Scrum Team, Positivism will be used as the Research Paradigm. Using Positivism's inclination for deductive reasoning, the researcher has posed questions, generated a hypothesis, reviewed literature, and collected data through a close-ended survey for statistical testing, before coming to a conclusion that answered the study questions.

3.5 Research Approach (Quantitative)

Cresswell and Cresswell (2018) highlight three Research Approaches; Qualitative, Quantitative, and Mixed Methods, and discuss instead of looking at the different approaches as separate classifications, they should be seen as opposite ends of a spectrum where research could be described as more of one and less of the other with a Mixed approach somewhere in the middle. The Qualitative approach utilises social interactions, human expression, recollections, notes, and natural observations as a source of data, which is then analysed to come up with a resolution to resolve the research problem (Daniel, 2016). Meanwhile, the Quantitative approach refers to using measurable realities, in the form of numerical data or statistics, to answer research questions through establishing mathematically supported relationships among these "hard" data (Symeou & Lamprianou, 2008).

The researcher used a Quantitative approach for the study considering the primary and secondary research questions required measurable data and statistical analysis. The decision to go for a Quantitative approach pair well with the earlier

selection of Positivism as the paradigm considering how both usually go hand-in-hand (Daniel, 2016). However, Sharma (2018) highlighted that because Quantitative methodology often seeks conclusions to generalise a larger population, this can become costly and laborious as the researcher needs resources to tap into large sampling frames. Therefore, the researcher sought cost-effective means to outline the valid sampling frame and plan out a strategy for the data collection to control the time spent in the process. Furthermore, Symeou and Lamprianou (2008) argue that Quantitative approaches are not able to encapsulate the respondent's emotions and the context of their responses due to the rigidity of the tools available to them, such as surveys. As such, the researcher made sure to accept this limitation in the research approach and ensure the appropriate questions were asked, where lack of human emotion and context would not risk the validity of the study.

3.6 Research Method (Descriptive)

Goundar (2012) discusses that Research Methods are used to retrieve research data while consuming the least possible amount of resources and describes four methods for Quantitative Methodology used in the ICT industry, namely:

Descriptive, which seeks to report on the present-day condition of the research topic;

Correlational, which aims to establish relationships between data but disregards cause-and-effect relationships;

Cause-Comparative, which looks into the cause-and-effect relationship between variables but without manipulating the cause; and

Experimental, which is similar to Cause-Comparative but manipulates the cause.

Different authors use various terminologies when discussing the types of Research Methods. Instead of naming it “Descriptive”, Apuke (2017) describes the first method as the “Survey” Research Method, which is centralised on the development and administration of a questionnaire to a sample group that can statistically represent the wider population. MacDonald and Headlam (2011) label Descriptive as “Quantitative Survey” and describes the method as a tool to collect primary data from a sizeable number of people and applied best in companies, social organisations, or communities.

Since this study is interested in understanding the project conditions that exist in cases where a Project Manager was present or absent in Scrum Teams, outline the current state of the research topic, does not intend to manipulate variables, and does not plan to study cause-and-effect relationships, then this study used the Descriptive Research Method according to Goundar’s (2012) definition. Elements of the Correlational Method were employed to test the hypotheses and generate further information relating to the primary research question and the secondary question.

Using Apuke’s (2017) and MacDonald and Headlam’s (2011) understanding, this study employed the Quantitative Survey tool to collect primary data from a sample population, which will be used to answer the research questions posed. Since this study was a a geographical study, involving Scrum Teams across Southeast Asia and Oceania, the survey tool will be delivered online as opposed to pencil-and-paper, which would take weeks, or face-to-face, which is impossible considering the tremendous cost involved and border restrictions due to the COVID-

19 pandemic. Nayak and Narayan (2019) reported there is no difference in the accuracy of reporting relevant information if a survey is done online, in person, or by post. However, Rice, et al. (2017) warned how online surveys can threaten true randomisation of samples since they rely on who is registered with the online database used for the sampling frame and their availability (i.e. available to receive and review the researcher's online correspondence) at the time the researcher is conducting the survey. To counter this, the researcher will ensure that only countries in relevant regions that display a significant number of possible respondents will be selected as part of the sampling frame and that contact is established to check the respondent's interest prior to releasing the survey to ensure that the respondent can realistically respond. Another disadvantage of online surveys is how people are not inclined to answer them when it is too much of a hassle or takes too long (Nayak & Narayan, 2019). Therefore, the researcher needed to ensure the research tool was simple to use, easy to understand, and could be completed in a few minutes while making sure the relevant data was collected. This was done using a survey tool with an intuitive user interface and structuring the questions and context properly by testing them against an expert group.

3.7 Research Instrument (Survey)

The researcher decided to use a survey to be administered online to reach respondents across different countries in Oceania and Southeast Asia. The researcher ensured the instructions were clear, the questions not leading, clear, simple, and easy to understand, choices were mutually exclusive, and technical language used was to the bare minimum (Taherdoost, 2016a).

It was important for the questionnaire to undergo peer review to identify any aspects that may cause issues. A pilot testing was carried out to validate assumptions and a trial of the questionnaire was carried out with a small and select group to find problems and remedy them before the survey was launched (Stats NZ, 2019). Therefore, the researcher drafted the questions and choices on a Microsoft Word file, met with research consultants and professional peers for discussion and feedback to improve the quality and clarity of the survey tool. The questionnaire underwent three revisions before the final version was approved.

The researcher selected Typeform, an online platform that specialises in creating surveys, to build the actual survey tool. Since the platform also stored the data, virtual security was reviewed and found satisfactory, considering the platform offers 2-factor authentication for login with end-to-end encryption of data that comes in from surveys launched through their platform (Typeform, n.d.). Apart from the ability to store data securely, Typeform was selected for its beautiful user experience and fluid response time, to address the possibility of losing respondents due to difficulty of use, bad user interface, or unreliable loading times (Nayak & Narayan, 2019).

Once the questionnaire was uploaded on Typeform, another peer review was conducted to gather feedback about structure, look, and feel. After three rounds of amendments, the questionnaire was approved and ready for pilot testing. The researcher selected 15 colleagues, who had experience working in the Scrum environment. After briefing them on the context of this study, the researcher shared the research instrument with the test group and sought to illicit feedback about clarity, ease of use, speed of completion, and suggestions for improvements. Their

feedback, mainly about the proper use of terminology, lack of certain choices, and improving context, was collated and changes were implemented into the final survey questionnaire. The final form of the research instrument hosted on Typeform can be found in Appendix 1. Any survey responses from tests were excluded from the study.

3.8 Research Sampling

Sampling is a vital step in the research process as it determines how a researcher can identify the population where their findings can be generalised against and doing it poorly can jeopardise the integrity of the entire project (Datta, 2018). Sampling can come in the form of Probability Sampling, which gives everyone in a population the same possibility of being included in the research sample, whereas Non-Probability Sampling, does not rely on randomising a population, as samples are chosen using clear criteria determined by the researcher (Taherdoost, 2016b).

Non-Probability Sampling is a conveniently inexpensive approach and works well with Qualitative Methodologies in that it seeks to generate context for a better understanding of a population by investigating social phenomenon, but this technique is prone to biases and does not guarantee findings will represent an entire population (Datta, 2018). This sampling technique can come in the form of the Quota, Snowball, Convenience, and Purposive methods, which all rely on the researcher's subjective criteria or respondent's availability to determine a sample (Taherdoost, 2016b). Since this study will be using a Quantitative Methodology and seeks to draw conclusions that can be generalised against the population, the researcher will not be using Non-Probability Sampling.

Symeou and Lamprianou (2008) support the earlier argument that selecting the correct sampling method is crucial to the Quantitative research project, otherwise, the results will not mean anything to the population when the research sample does not share the same essential attributes as the larger population. Therefore, the Probability Sampling technique, which aims to give everyone in the population the same chance of being included in the study, will be ideal for this project as it will allow the researcher to draw conclusions from the randomised sample to represent the Scrum software development teams in Oceania and Southeast Asia. Showkat and Parveen (2017) discuss five different types of Probabilistic Sampling:

a. **Simple Random Sampling**: a sampling frame is generated and all potential respondents are given an equal chance to join the sample using pure randomness (e.g. coin toss or dice roll), regardless of any sub-group elements or attributes.
b. **Systematic Random Sampling:** similar to Simple Random Sampling, but uses a systematic approach to determine the respondents (e.g. every 5th name on the list).
c. **Stratified Sampling:** unlike the previous two approaches which disregard sub-group elements, Stratified Sampling requires dividing the sample frame into exclusive attributes (e.g. male or female), then applying random sampling up to a predefined number in each of the small groups.
d. **Cluster Sampling:** using a similar approach to Stratified Sampling, Cluster Sampling divides the sampling frame into “clusters” but ensures each cluster contains diverse attributes, unlike Stratified which grouped them by mutually exclusive elements, then taking a random sample from each cluster.

e. **Multi-Stage Sampling:** requires breaking down a large sampling frame into a smaller group and repeating the process until the result is the smallest group possible.

Considering that this study aimed to look at Scrum Teams working with software development in Oceania and Southeast Asia, the researcher decided to use Cluster Sampling. This way, the researcher ensures that adequate representation can be made for each region by ensuring an equal random sample size can be taken from the Oceanic cluster and Southeast Asian cluster.

3.9 Research Respondents

Following MacDonald and Headlam's (2011) suggestion for preparing research samples for the Quantitative Survey method, the researcher first identified who each of the potential respondents were and created a sampling frame. Using LinkedIn's Sales Navigator tool, the appropriate filters were used to match the potential respondent and a database search of all countries within Oceania and Southeast Asia.

Specifically, the filters used were:

a.) **Country** – all countries in Oceania and Southeast Asia were selected (Beltekian, 2015; Nations Online, n.d.)

b.) **Language** – English was the selected filter since the survey tool was only available in the English language and the researcher can only communicate using this language.

c.) **Industry** – related ICT industries, such as "Computer Software" or "Information Technology and Services" were selected

d.) **Job Title** – relevant Scrum titles were chosen, such as “Scrum Master”, “Product Owner”, or “Scrum Developer”.

The last step was to ensure all potential respondents had the proper experience with Scrum. Since LinkedIn is not able to filter by months of experience, the researcher manually removed search results with less than 4 months of Scrum experience, considering the average length of a Scrum project is 3 months (Scrum Alliance, 2017) and the researcher wanted to ensure that potential respondents have been involved in at least one full Scrum Project.

After the automated LinkedIn search and manual processing, the researcher found that only Australia and New Zealand in Oceania and Singapore, Philippines, Malaysia, Indonesia, and Vietnam in Southeast Asia had a significant presence of potential respondents.

Using Cluster Sampling as a technique, the researcher divided the two regions, Oceania and Southeast Asia, into two clusters and then divided each cluster by country as sub-clusters. All potential respondent names found from LinkedIn’s Sales Navigator tool were listed out in Microsoft Excel by region (cluster) and then broken down by country (sub-cluster).

Using Excel’s RAND formula, a random number was assigned to each name. Once each name had a random number, the RAND formula was removed, and the random number saved. This step was important because sorting the columns and moving the names around would keep changing the random numbers, so removing the formula and retaining their random value is vital to ensuring the integrity of the list. Next, the researcher sorted all numbers and their attributed names by ascending order. Finally, the researcher selected the top 375 names each from Australia and New Zealand to represent Oceania and the top 150 names each from Singapore,

Philippines, Malaysia, Indonesia, and Vietnam to represent Southeast Asia. This gave each cluster, Oceania and Southeast Asia, an equal random sample size of 750 with a combined total of 1500 respondents.

3.10 Data Collection

Data collection was cross-sectional and sought to understand project conditions and the relative presence of a Project Manager at the time of this study (MacDonald & Headlam, 2011). The researcher employed a systematic approach for the data collection phase, which spanned approximately 16 weeks between October 2020 and February 2021, including determining the sample, generation of the research instrument, administration, and final closure of the survey. After the sample of 1500 respondents were drawn from the sampling frame, the researcher imported all of their names, LinkedIn URL, and job title into a two-factor authenticated, secure, and cloud-based tool called Monday.com to assist the researcher in organising the data collection process (Monday.com, 2021).

Monday.com is a project management platform that offers tools, usually in the form of a project board, to help a user organise data by groups, set statuses, automate workflow, and generate reports (Monday.com, 2021). In the case of data collection, the researcher used a funneling process to take all respondents through a cold outreach campaign and the tool was used to organise all respondents by groups, where they started in “New”, then moved through the funnel depending on their progress in the data collection campaign, specifically, “Waiting”, “Connected”, “Engaged”, “Survey Sent”, “Follow Up”, “Survey Completed”, and “Cannot Connect / Inactive”.

As a respondent fulfills a step in the process, their status is updated and Monday.com automatically moves them to the next group. The tool also sends reminders to the researcher such as when messages are due for sending. The services offered by the platform reduces a lot of mental strain from the researcher and lowering the risk of human error. However, all chats and communications to respondents were done personally and manually by the researcher. Automations were only used to help the researcher organise the respondents and remember when to reach out to specific groups.

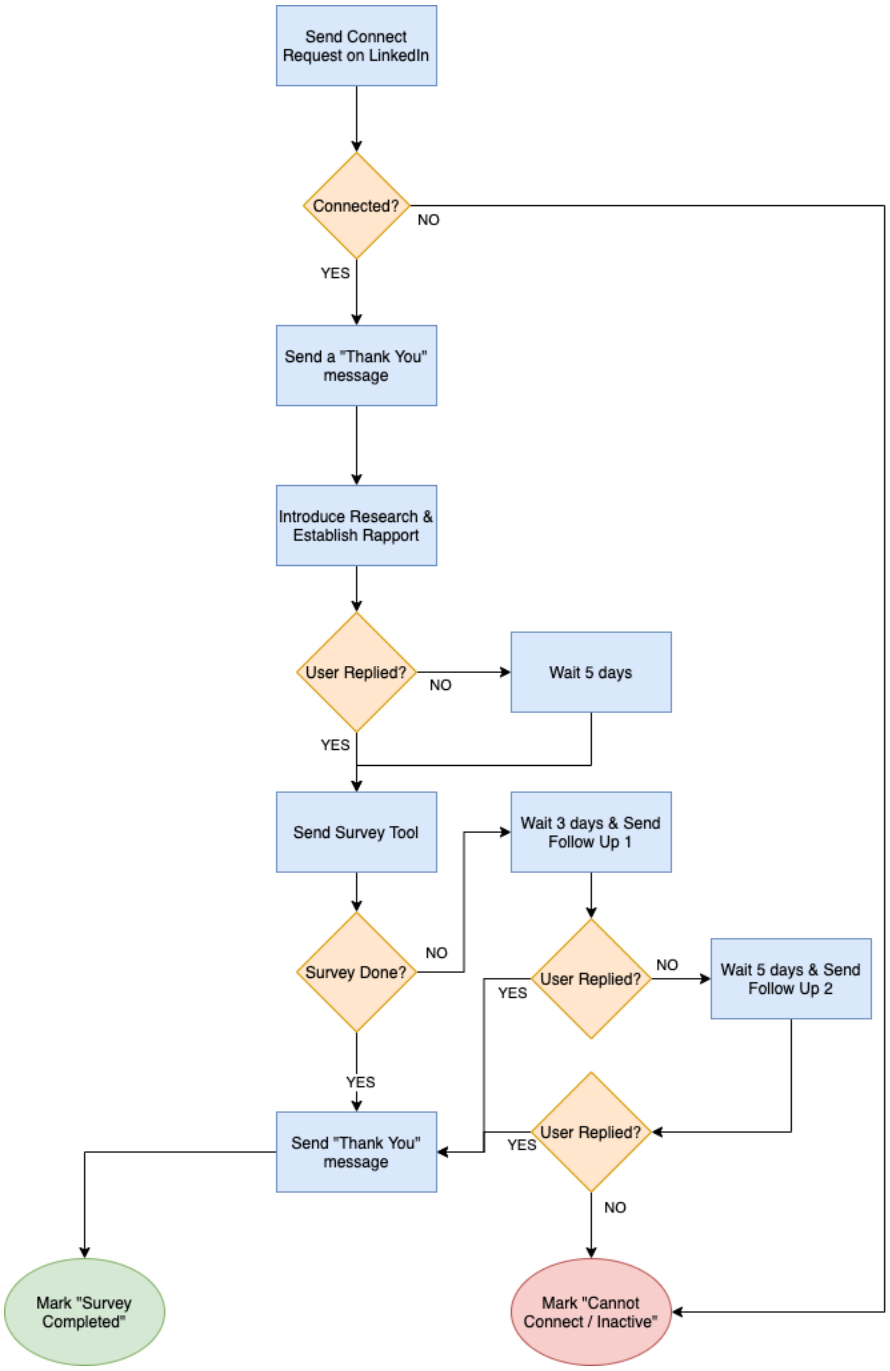
The researcher proceeded to set up the data collection process, which is illustrated in Figure 3.2 below. The tool used to interact with the respondents was LinkedIn's chat feature. LinkedIn prevents users who do not know one another from sending each other a message. Therefore, the researcher had to establish rapport with the respondents before requesting them to fill out the survey.

From the pool of 1500 respondents, the researcher sent 15 connection requests daily introducing himself and sharing his intent. If the respondent accepted the connection request, it is taken as consent for further contact. The researcher sent a "Thank you" message and continued to share details about this study being conducted. When the respondent replies, the researcher proceeds to share the survey tool with instructions and context. If the respondent did not reply, the researcher waits an appropriate number of days before attempting to contact again. As shown in Figure 3.2, if a respondent did not reply after getting connected on LinkedIn, the researcher waited five days before contacting the respondent again by introducing the survey tool. If the respondent did not reply after receiving the survey tool, the researcher waited another three days before attempting to contact the respondent again. If a reply is still not received, the researcher waited five more days

and sent the final message before the researcher ceased further attempts to contact the respondent. Once the researcher has sent three messages without getting a reply (spaced between a total of 13 days as explained above and as shown in Figure 3.2), then the respondent was moved to the “Cannot Connect / Inactive” list and no further contact was attempted. Since the survey is completely anonymous, the researcher is unable to track who has completed it, however when a respondent acknowledges by LinkedIn chat that they have completed the survey, then the researcher sends another “Thank you” message and moves them to “Survey Completed” on Monday.com.

Figure 3.2

LinkedIn Data Collection Process



Note. Process created by the author to automate and optimise the data gathering through LinkedIn cold outreach.

3.11 Data Analysis

Vogt et al. (2014) discussed that quantitative data analysis comes in three forms, specifically:

Descriptive: where the focus is given to exploration and description of the data that could be enough to answer research questions or generate hypothesis to prepare the study for further forms of data analysis.

Inferential: which uses data from known sample sizes to predict probability in bigger populations and usually comes in the form of Null Hypothesis Significance Testing (NHST) or Effect Sizes with Confidence Intervals (ESCI).

Associational: where statistical analysis in the form of regression and correlation is used to delineate complex relationships in variables.

Data analysis may follow a linear approach, which helps the researcher in the ease of application through the use of a pre-determined process that is straightforward and structured (Academy for Educational Development, 2006). However, Samuels (2020) argued that data is usually disorganised and intricate so researchers should consider more than a single way to analyse data and be ready to change plans as more is learned working through the process. Therefore, the researcher decided to use a cyclical approach with all three quantitative data analysis forms described by Vogt et al. (2014) applied in the manner of feedback loops.

Firstly, Descriptive data analysis will be employed to answer some part of the primary research question:

"*What project conditions are true for software projects that use the Scrum Framework with the accompanied presence or absence of a Project Manager?"*

The raw data was coded with nominal values and then Microsoft Excel's pivot table, chart feature, and Descriptive Statistics function were used to conduct exploratory analysis on the coded data. The hypotheses were then be generated at the same time in the Descriptive phase, which were used in testing in the next phase.

Next, Inferential data analysis will employ Null Hypothesis Significance Testing to validate the generated null hypotheses from the prior phase (Vogt, et al., 2014). In this phase, the researcher was looking to answer the primary question and then address the secondary objective:

"*Is there a significant relationship between the presence or absence of a Project Manager and the perception of project success?"*

Depending on the variables being tested, the researcher used IBM SPSS v.22's Chi-Square or Mann-Whitney U tests to find the *p* values and use it to accept or reject the null hypothesis.

The Chi-Square test can be utilized to measure the relationship among categorical variables (Ugoni & Walker, 1995). All of the research questions produced categorical responses, such as if there was a Project Manager (Yes/No), Scrum Team members location (Co-located/Distributed), Scrum Certification (Certified/Not Certified), or the project scope (New Software/Existing Product). Therefore, the Chi-Square test is appropriate for testing the hypotheses among these kinds of variables.

There is a special exemption in the Project Budget question, where respondents were asked to write down their project budget in an open text field. However, that was been pruned away in the final results due to irregularities found, which will be discussed in the next chapter.

On the other hand, Mann-Whitney U tests can be employed in the event variables are ordinal with a subjective and imprecise scale (Nachar, 2008). As mentioned, all the survey responses are categorical but some of them could be treated ordinally. For instance, when respondents were asked to report their project length and responses were a list of week ranges in increments of four weeks. The Mann-Whitney U test can be used as a secondary way to validate findings from the Chi-Square test in hypotheses with these kinds of data. The findings of this phase generated the results of the null hypotheses significance testing, which will helped the researcher answer the primary research question and secondary objective question.

3.12 Ethical Considerations

This study was conducted in accordance with the Otago Polytechnic Research and Ethics Committee's policies (Otago Polytechnic, n.d.). In concert with the research proposal submitted for review to Otago Polytechnic's Research Committee, an ethics application was also submitted to the Ethics Committee. Both were approved by the relevant bodies. The ethics confirmation number is AIC75 and this study was judged as low risk. A copy of the confirmation from the Ethics Committee can be found in Appendix 4. Finally, consultation was sought with Otago

Polytechnic Kaitohutohu Office in order to share the research being conducted at Otago Polytechnic to assess significance to Māori.

The ever-evolving innovation of the online environment and how virtual tools are changing can potentially undermine the respondent's informed consent, data security, and privacy (Nayak & Narayan, 2019). Therefore, the researcher has taken the following steps to address each of these concerns:

1. **Informed Consent:** At the start of the survey, the participant (respondent) is given the contact information of the Otago Polytechnic Research Ethics Committee Chair and access to the Participant Information Sheet (Appendix 2), which provides the context of this study, guarantee of anonymity, data protection measures, access to the Consent Form (Appendix 3), and contact details of the researcher and supervisors. Lastly, the respondent is advised that informed consent is supplied when they decide to click the "I wish to participate" button.
2. **Data Security**: The researchers selected a tool with multi-factor authentication and end-to-end encryption of data. The survey is administered through Typeform and responses are stored in their secure servers, which are hosted by Amazon Web Services and comply with industry standards for data security (Typeform, n.d.). Furthermore, respondent names and LinkedIn URLs are stored in Monday.com, which offers a similar level of security (Monday.com, 2021).
3. **Privacy**: The researcher has ensured responses cannot be linked back to the respondents. Among the data collected, only "country" and "age range" can be considered personal identifying information but those two alone will not be able to isolate a respondent among the sample pool of 1500 names.

Furthermore, respondents are given the option not to disclose any identifying information with the selection, “I’d rather not say.” as part of the response choices.

Finally, to encourage the respondent to fill out the survey, they will be offered a copy of the research findings after completion of this study. Instead of requesting contact information, an online folder was shared with the respondent, which they can access at a predetermined date, where the researcher will publish the findings after peer-review and institutional approval.

3.14 Chapter Summary

The researcher decided to take on Positivism as a paradigm, a deductive approach, to answer the research question and secondary objective raised in Chapter 1. In consideration to the primary research question seeking to establish conditions present in Scrum Teams with or without a Project Manager and the secondary objective to seek a significant relationship between the perceived success and the relative presence of the Project Manager, the researcher chose a Quantitative approach using Descriptive and Inferential data analysis methods with the aid of a survey questionnaire as the main research tool. Since the study’s regions of interest are across different countries and borders, it was decided to administer the survey online using the LinkedIn Sales Navigator tool to generate the sampling frame, Probabilistic Cluster Sampling method to generate a properly random sample between Oceania and Southeast Asia, Monday.com to manage the data collection process, LinkedIn Chat tool to reach out to the study participants/respondents, and Typeform to host the online survey and responses

securely. Data was processed with the aid of Microsoft Excel and IBM SPSS v.22 software tools and completed through descriptive and inferential statistical data analysis to answer the research questions. Finally, all of this was completed in compliance with the ethical standards set by the Otago Polytechnic Research and Ethics Committee and in consultation with the Otago Polytechnic Kaitohutohu Office.

Chapter 4

Research Findings

4.1 Introduction

Chapter 4 covers the data analysis process in detail. As discussed in the previous chapter, the researcher decided to use a cyclical approach between two of the three data analysis forms as discussed by Vogt, et al. (2014), which are Descriptive and Inferential analysis. Using the cyclical approach meant the researcher conducted some initial exploratory (Descriptive) analysis, moved on to performing some Inferential analysis, went back to carry out more Exploratory analysis with a fresh perspective, and continued back-and-forth through the two data analysis forms as more information was learned in each cycle. For the purpose of clearer reporting, the researcher has grouped all analysis by the form used (e.g. Descriptive and Inferential) instead of the actual cyclical approach. Therefore, the following subsections will cover a background of the data and relevant steps to prepare data for analysis, discusses the findings in the Descriptive analysis and concludes with the Inferential analysis.

4.2 Background

The sampling frame for this study was generated from LinkedIn's Sales Navigator tool using "Scrum" as the keyword and a combination of the following filters:

- **Geography**: All countries in Oceania and Southeast Asia
- **Language**: "English"
- **Title**: "Scrum Master", "Product Owner", "Scrum Developer"
- **Industry**: "Software Development", "Information Technology & Services", and "Telecommunications"

The search across the two regions, Oceania and Southeast Asia, yielded over 8,500 results from LinkedIn's database, which is 2.13% of the total reported tally of Scrum professionals worldwide (Scrum.org, 2020). In Oceania, only Australia (n=4000) and New Zealand (n=1000) had a significant number of results. Across Southeast Asia, Indonesia (n=567), Malaysia (n=360), Philippines (n=1000), Singapore (n=639), and Vietnam (n=599) were accepted by the researcher to be enough search results to merit inclusion into the study. Since LinkedIn does not offer the functionality to check by months of experience, the researcher further narrowed the sampling by manually disqualifying search results that showed less than four months of experience with Scrum. This step involved visiting each of the respondent's LinkedIn profiles and counting their months of experience in Scrum. If a user had four or more months experience with Scrum, their details were recorded in Microsoft Excel. This ensured that all samples in the frame had at least completed one Scrum project, considering the average Scrum project lasted three months (Scrum Alliance, 2017).

By using Probabilistic Cluster Sampling, the researcher used both regions, Oceania and Southeast Asia as clusters, then divided each cluster into countries as

smaller clusters. All profiles found in the LinkedIn search as described from the previous paragraphs, excluding those with less than four months experience with Scrum, were recorded in Microsoft Excel and sorted by country (smaller clusters). Using the RAND formula on Microsoft Excel, every name in each of the smaller clusters was assigned a value. Then, the researcher retrieved the top 375 values and their associated names from each of Australia and New Zealand, and the top 150 from each of Indonesia, Malaysia, Philippines, Singapore, and Vietnam. This generated a pool of 750 respondents for Oceania and another 750 respondents from Southeast Asia. The total sample size is 1500.

Once the sample size was determined, the researcher launched the data collection campaign as described in Chapter 3, section 3.10. After 14 weeks of individual outreach using LinkedIn's Connect and Chat feature, 562 respondents did not accept the researcher's connect request and were therefore unreachable through the chat system. No further contact was attempted with this group for the duration of the study. Of the connect requests sent, 938 respondents accepted and were given context about the study and presented with the online survey questionnaire through LinkedIn chat. Of the 938 who expressed their interest, the researcher was able to collect 584 survey responses. This translated into a response rate of 39% against the entire sample size.

In comparison with a previous study, Shastri et al. (2021) achieved a 14-19% response rate using a similar LinkedIn approach in their investigation of the Project Manager's role in software projects with an Agile approach.

After the clean-up of the data, nine entries were removed due to four entries with countries falling outside the specified regions being studied, three entries did not know if they had a Project Manager in their Scrum Team, and two entries reported a

Scrum hybrid unidentified in literature. Ultimately, 575 survey responses were accepted and taken into data analysis.

4.3 Descriptive Analysis

This section will discuss the findings uncovered during the Descriptive Analysis. Undergoing a Descriptive Analysis assisted the researcher to generate some parts of the solution sought in the primary research question and prepare the investigation for Inferential analysis, which helped provide a more robust answer to support this study.

In order to prepare for this phase, the researcher coded all raw data by designating values to all choices in each survey question. Since the responses were categorical, they were all assigned nominal values so statistical tests could be run for analysis. This was done by listing all survey choices by question and then numbering them systematically. The number “1” was assigned to the first choice, “2” to the second, and so on. For example, the question “Which country are you currently residing in?” had seven different choices for answers. In this case, “Australia” was assigned the value “1”, “New Zealand” the value “2”, “Indonesia” the value “3” and so on. Since there are at least 17 variables and 575 survey responses, the researcher used Microsoft Excel’s IF formula. For example, in coding the Location of Respondent data, the following formula was used (A2 = raw “Country” in text form column):

=IF(A2="Australia",1,IF(A2="Indonesia",3,IF(A2="Malaysia",4,IF(A2="New Zealand",2,IF(A2="Philippines",5,IF(A2="Singapore",6,IF(A2="Vietnam",7,"")))))))

Similar treatment was applied across all survey choices for each question.

Using Microsoft Excel's pivot table and chart tools, the researcher was able to organise the different variables and come up with visual guides to help formulate hypotheses for testing. This phase was used to understand the data and assess what else needed to be done in order to answer the primary research question and secondary objective.

4.3.1 Demographics

This subsection will cover the individual characteristics of the respondents. By understanding the distribution across demographics, representation between respondents' attributes, specifically their location, Scrum role, employment status, and age range, was established from the sample.

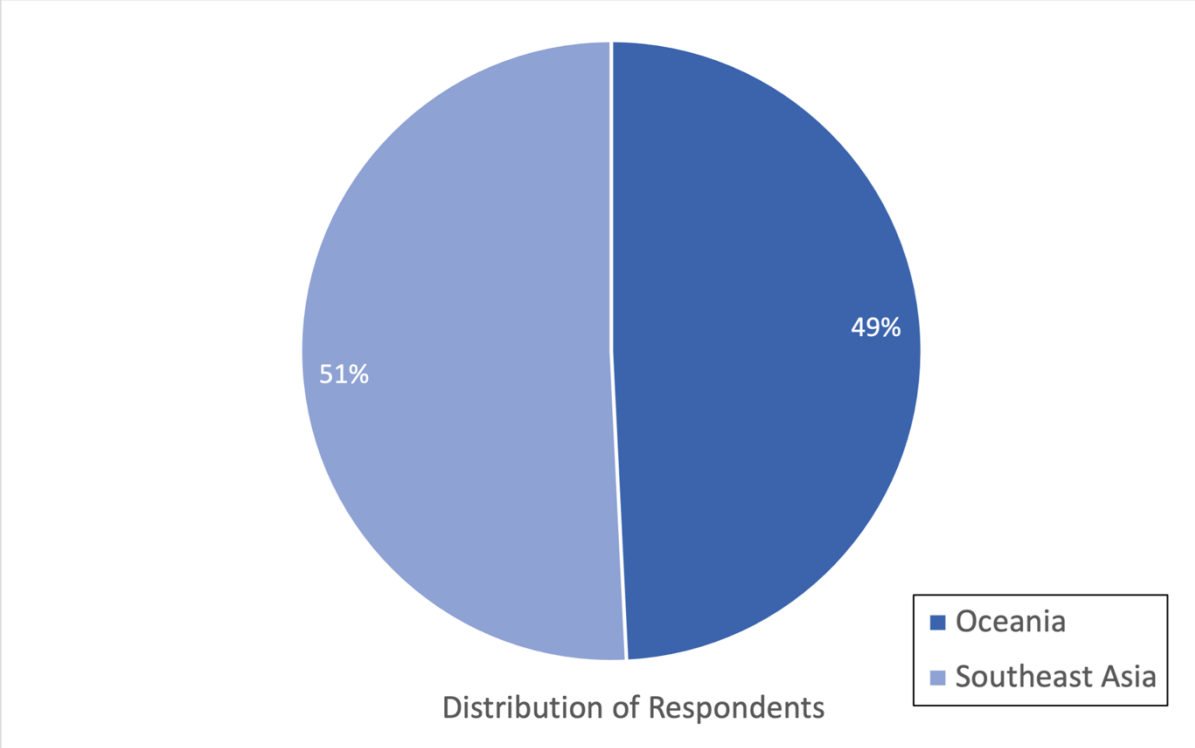
4.3.1.1 Distribution by Location

With a difference of only one percent, the geographical distribution of the 575 responses is almost perfectly split down the middle between the two regions. Oceania (n=283) contributed 49% of the responses while Southeast Asia (n=292) contributed slightly more at 51%. This can be visualised in Figure 4.1 below. The

result of distribution by region is desirable and was facilitated by the use the Cluster Sampling method.

Figure 4.1

Sample Distribution by Region

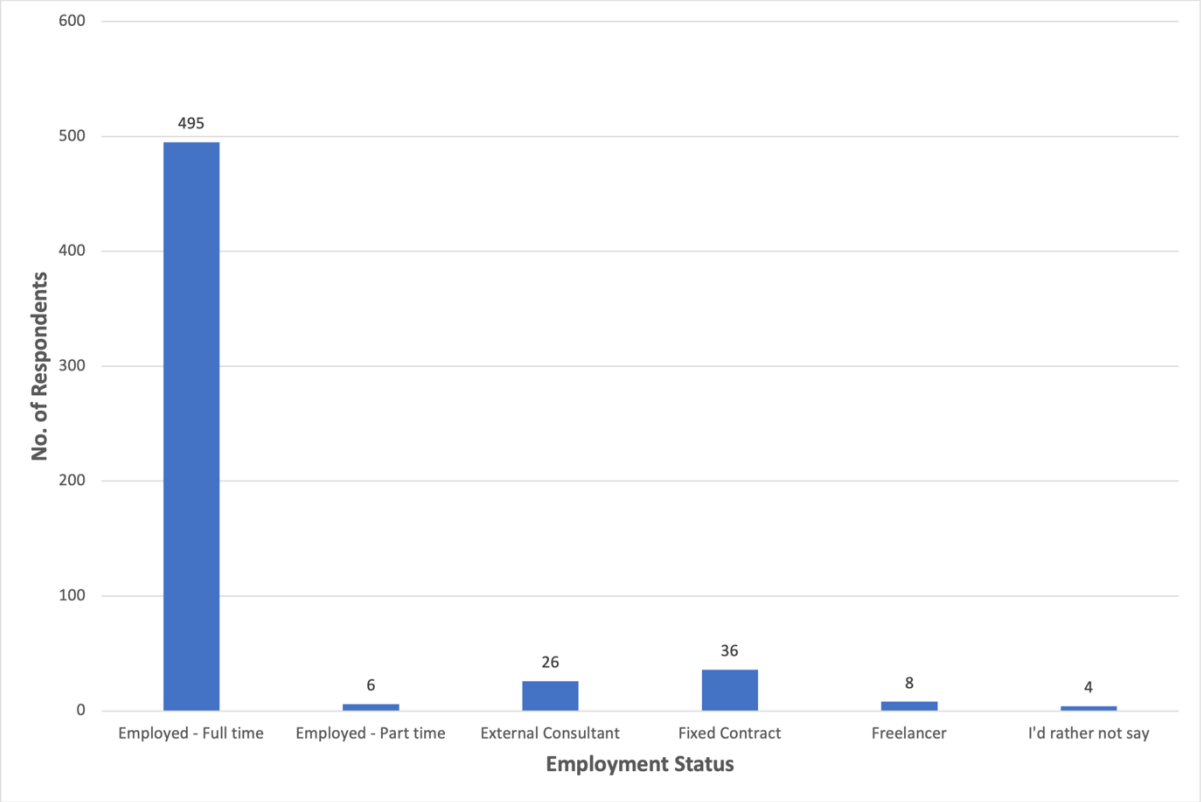


The number of respondents contacted from Australia and New Zealand (Oceania) were 350 each, while 150 respondents each were sought from Indonesia, Malaysia, Philippines, Singapore, and Vietnam (Southeast Asia). When broken down by nation, Figure 4.2 below shows Australia (n=156) and New Zealand (n=127) comprised Oceania and Southeast Asia is represented by the Philippines (n=102) at

the forefront, followed by Indonesia (n=57), Singapore (n=49), Vietnam (n=44), and Malaysia (n=40). Among all the countries surveyed, it was interesting to find that the Philippines had the highest response rate at 68% and followed by Australia at 41.6%. The lowest response rate was garnered from Malaysia at 26.67%.

Figure 4.2

Sample Distribution by Country



4.3.1.2 Distribution by Scrum Role

The survey was dominated by Scrum Masters (n=307), followed by Product Owners (n=140), with poor representation from the Development Team role (n=26). This is illustrated in Figure 4.3 below. There was a small group that reported they did

not hold any of the contemporary Scrum Roles (n=12) and further investigation revealed these respondents were Project Managers (n=6), Agile Coaches (n=4), a Release Train Engineer (n=1), and a Customer Engagement Lead (n=1). Furthermore, there were respondents who reported they held Mixed Roles (n=90). Figure 4.4 below breaks down the hybrid Scrum roles they held. Specifically, there were Product Owners who also acted as Scrum Masters (n=44), Scrum Masters who also held a Development Team role (n=34), and a Development Team member who was also the Product Owner of their project (n=12).

Figure 4.3

Distribution by Scrum Role

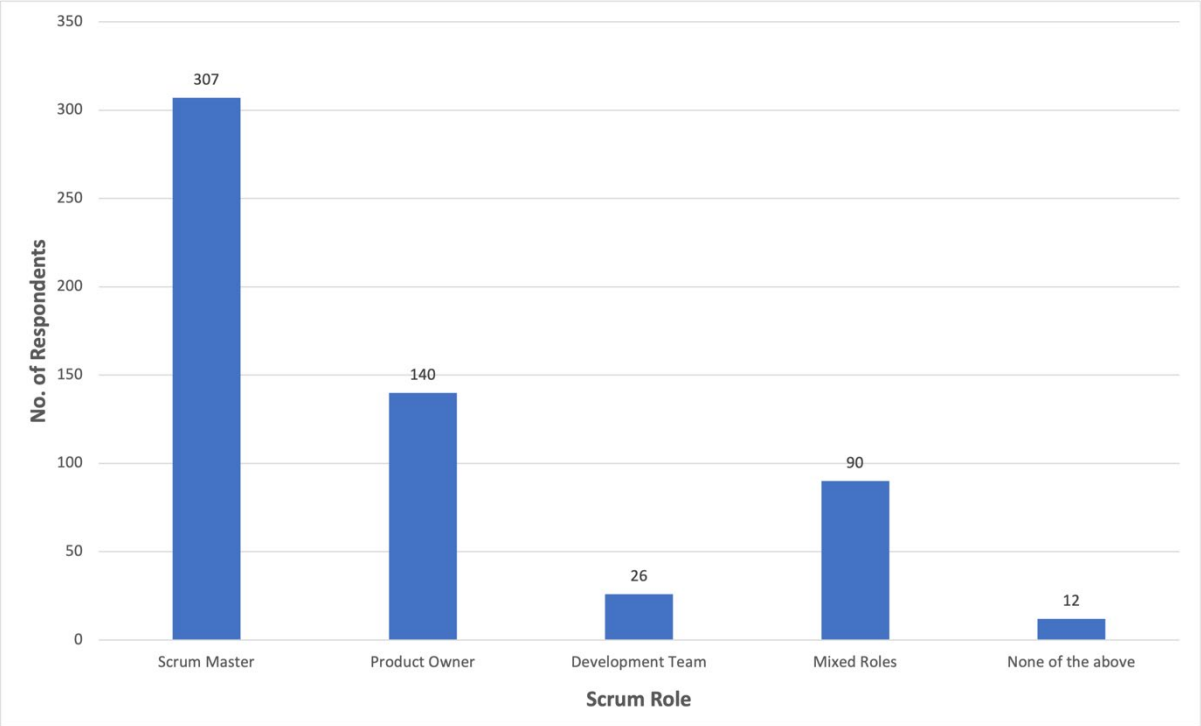
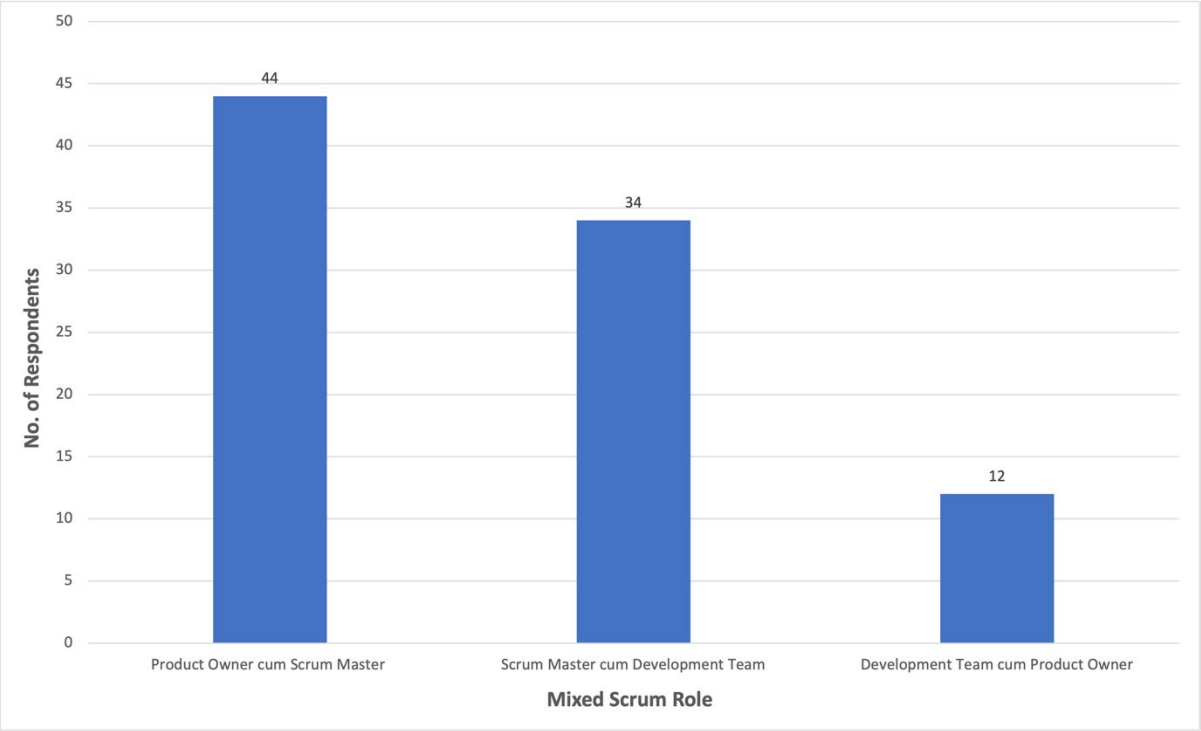


Figure 4.4

Breakdown of Mixed Roles



The poor balance in role representation, and possibly other exclusive attributes (e.g. age, experience, etc.), within the sample was expected and can be attributed to the selected sampling method (cluster), which sought to prioritise equal distribution between the different geographical interests of this study and arrive at generalisable conclusions for Oceania and Southeast Asia. Future research could

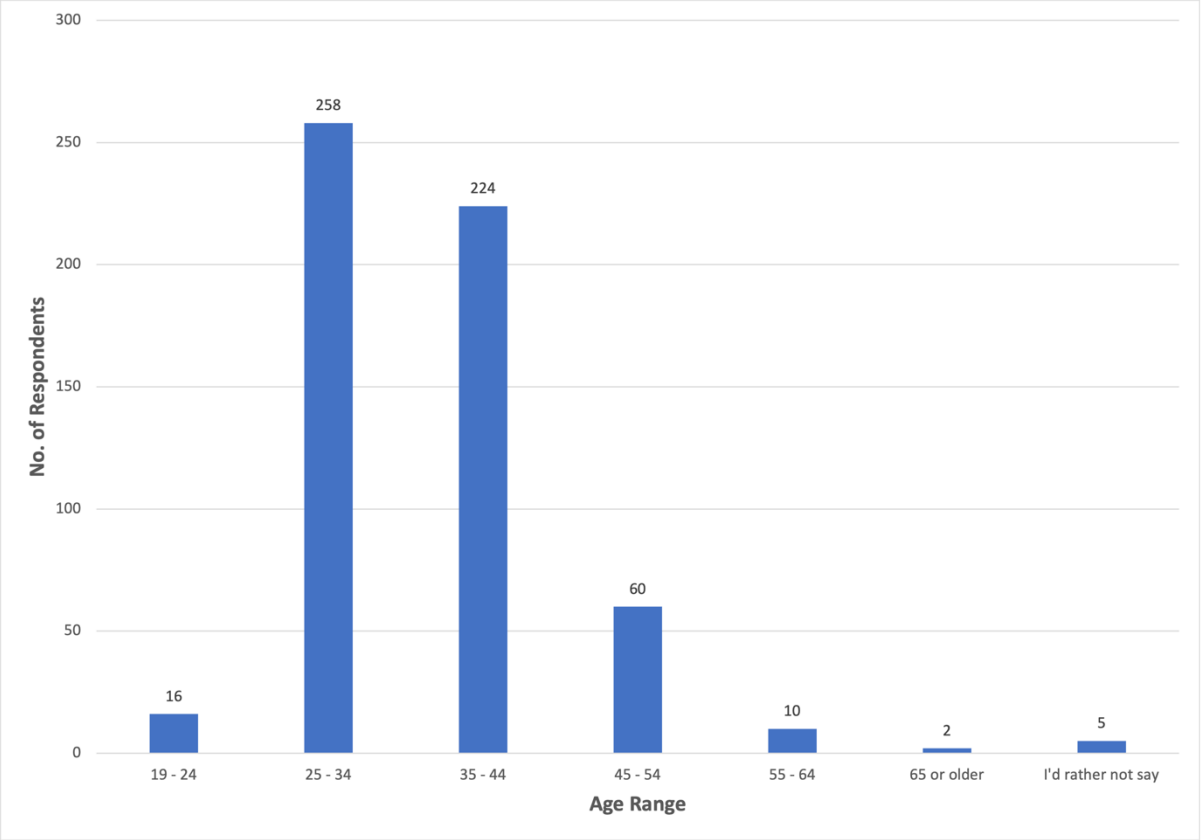
employ a different sampling method, such as stratified sampling, to focus on equal distribution of Scrum roles or other attributes, instead of their location.

4.3.1.3 Distribution by Age

Figure 4.5 outlines the respondent distribution according to their age range and reveals that Scrum professionals are commonly within their mid-twenties to mid-forties. The majority of the respondents were between 25 to 34 years old (n=258), closely followed by respondents in the 35 to 44 years old range (n=224). A minor portion of the sample was aged between 45 to 54 (n=60), with an even smaller and roughly equal representation for those aged 19 to 24 (n=16) and 55 to 64 (n=10). Respondents aged above 65 years old (n=2) were also represented in the survey, with a few respondents not wishing to indicate their age at all (n=5). This distribution by age might be influenced by the sampling frame source, which is LinkedIn's database, where active users are likely to be professionals within the 25- to 44-year-old age range. Also, there was no way to determine the age of users who have declined the invitation to participate in this study.

Figure 4.5

Distribution by Age

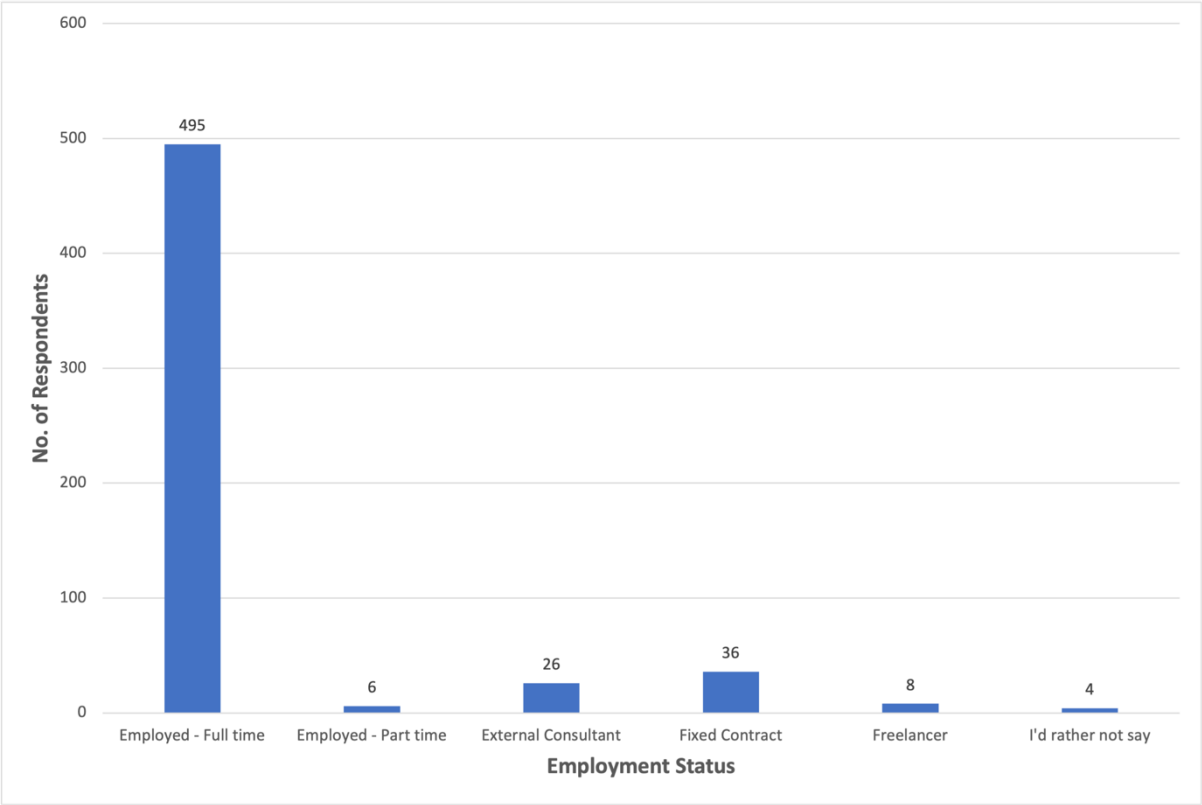


4.3.1.4 Distribution by Employment Status

The final demographical data collected by the survey was the respondent's employment status. Figure 4.6 below shows nearly 90% of the respondents are employed full-time (n=495) and part-time (n=6). This grants some insight into how Scrum is applied in the industry setting in those organisations who run projects using the framework operate them with permanently employed team members as opposed to temporary project-based team members, such as external consultants (n=26), fixed contractors (n=36), and freelancers (n=8).

Figure 4.6

Distribution by Employment Status



4.3.2 Familiarity with Scrum

This subsection will cover the respondent's skill level with Scrum. It will seek to describe the respondent's foundational instruction of the framework, their industry experience using Scrum, and their certification.

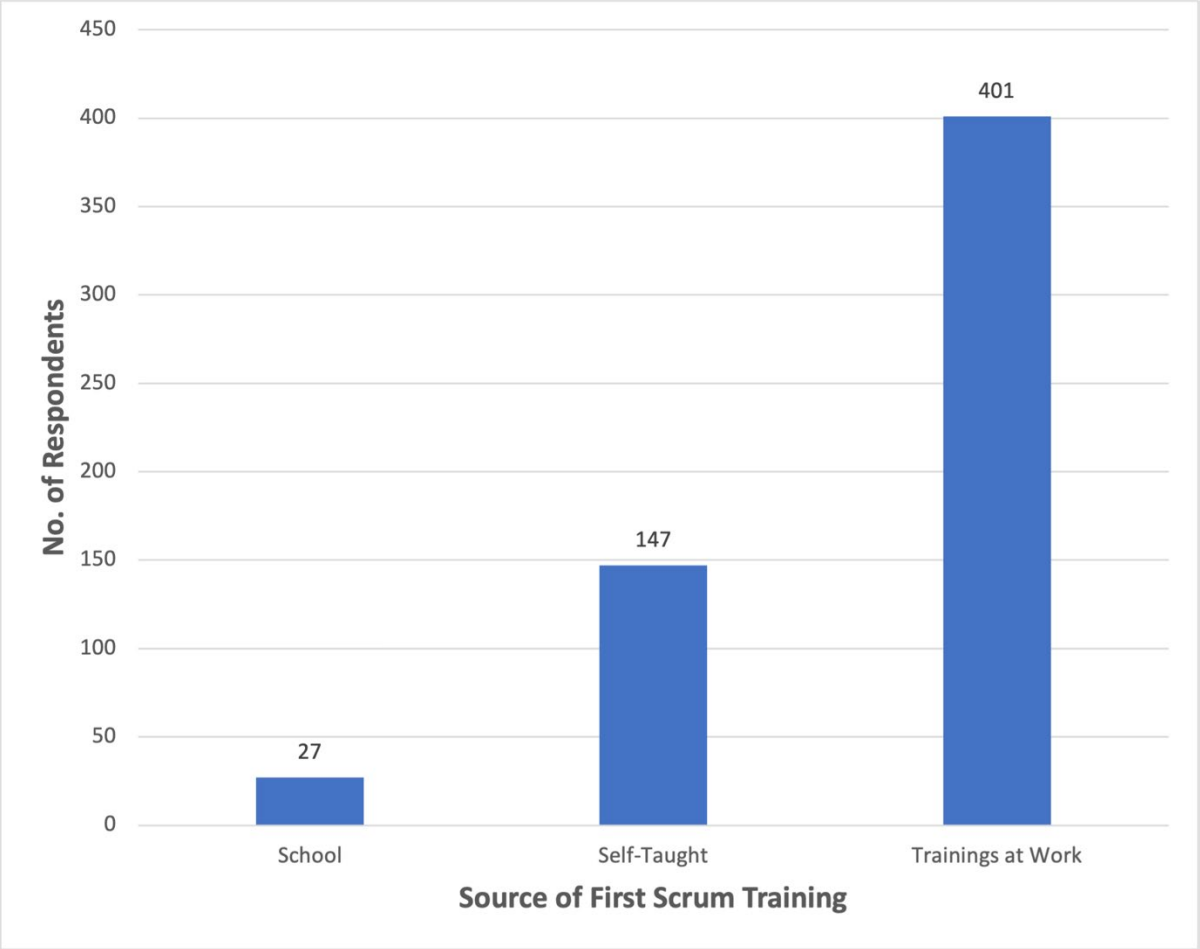
4.3.2.1 Distribution by Foundational Instruction

The survey tool asked respondents, "How did you first learn about the Scrum Framework?" From Figure 4.7 below, it is immediately clear that Scrum is mostly learned from industry practice and not from academic curriculum. Seven out of ten

respondents shared they first learned about Scrum from the industry setting (n=401) in the form of work training, while a quarter were self-taught (n=147). Only five percent learned about Scrum from an educational institution (n=27).

Figure 4.7

Distribution by Foundational Instruction of Scrum



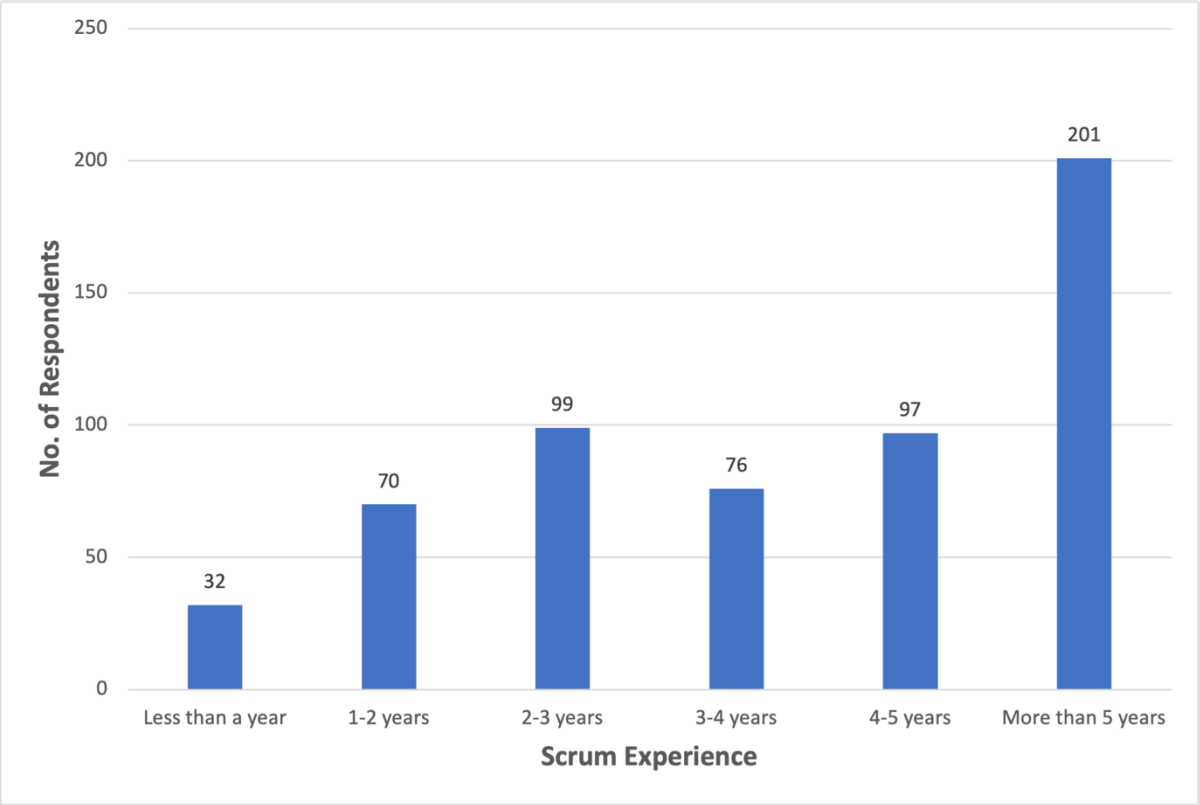
4.3.2.2 Distribution by Scrum Experience

Respondents were requested to share their accumulated years of experience working with the Scrum Framework and the overall population was revealed to be adequately experienced in Scrum as shown in Figure 4.8 below. Considering the researcher had manually filtered out respondents with less than four months of Scrum experience before sampling, it was expected that the actual sample had a low count of respondents with less than a year's experience (n=32). Participants with 1-2 years (n=70), 2-3 years (n=99), 3-4 years (n=76), and 4-5 years' experience (n=97) had roughly the same composition and safely ensured the respondents were well-

equipped with the relevant experience to answer the rest of the survey. Lastly, 34.9% of the respondents had over five years' experience (n=201), which only serves to add confidence to the quality of answers received in this study.

Figure 4.8

Distribution by Accumulated Scrum Experience



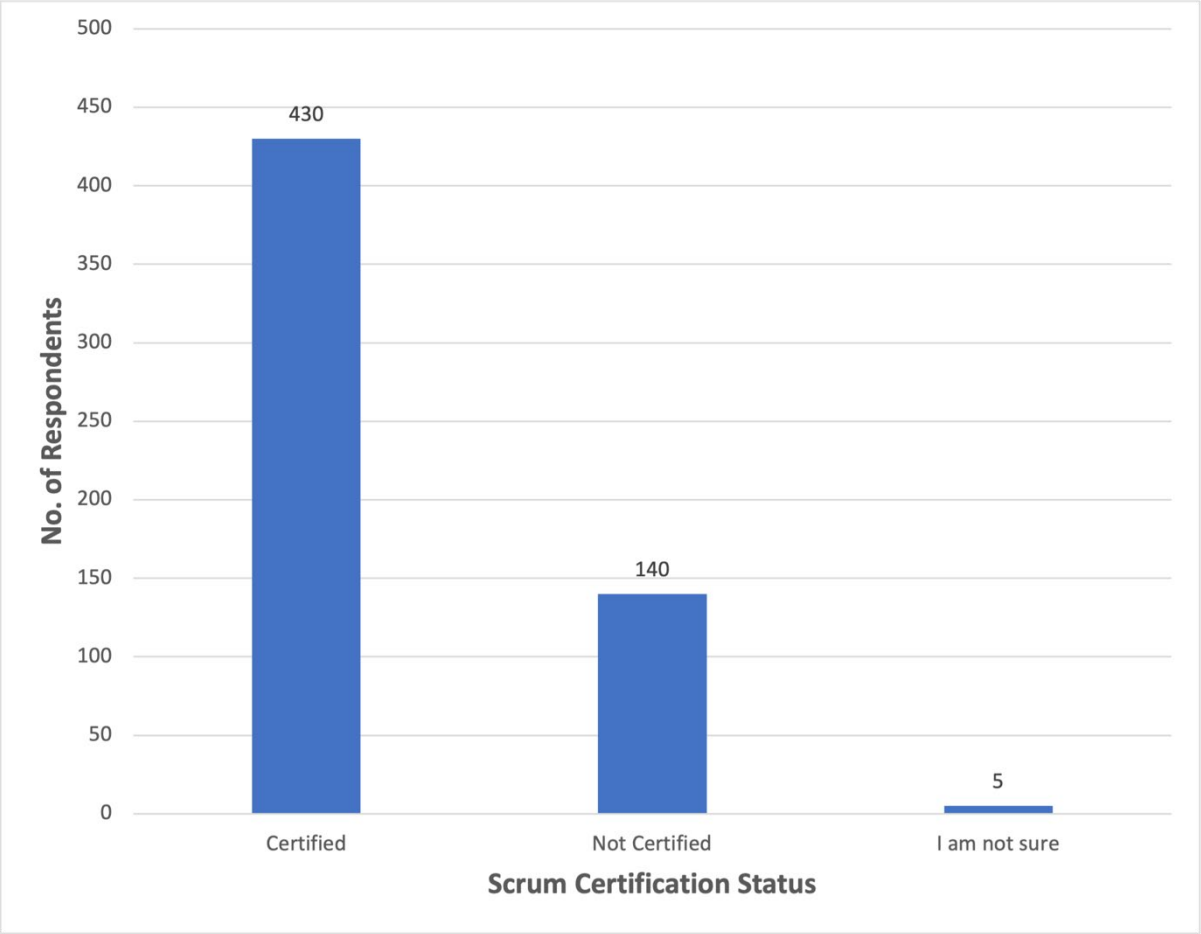
4.3.2.3 Distribution by Scrum Certification

The final data collected to assess the respondent's handle of the Scrum Framework was their certification status. Respondents were asked to share their certification status in Scrum and Figure 4.9 below reveals that an overwhelming number were certified (n=430) while roughly a quarter of the sample were not certified (n=140). Roughly having 75% of the respondents certified is logically

congruous with the respondents' reported maturity level with Scrum as discussed in the previous subsection and lends more confidence to this study in that the rest of their responses across the survey were well-informed. However, the researcher is not able to ascertain which Scrum body has granted their certifications (e.g. Scrum.org, Scrum Alliance, etc.), since each has different standards, and some respondents may hold company-issued workshop certifications or online foundational course certificate/s of completion as actual professional certifications.

Figure 4.9

Distribution by Scrum Certification



4.3.3 Project Conditions

This subsection seeks to explore the Scrum project conditions as reported by each respondent. This portion of the survey was keen to investigate the project conditions according to the contemporary “Iron Triangle”, the timeline, budget, and deliverable of a project (Bronte-Stewart, 2015). Furthermore, the researcher introduced concepts of the Scrum variant (hybrid type) used, the Scrum Team size, the number of Scrum Teams in a project, and the Scrum Team member’s geographical location in relation to one another.

To ensure the respondent’s answers were accurate and only refer to a singular Scrum-based project, as opposed to providing answers from different projects they have been a part of using Scrum, the following instruction was provided at the start of the survey:

“*For the purpose of easy recall and accuracy, please base your responses on your most recently completed software development project that used Scrum.*”

4.3.3.1 Project Timeline

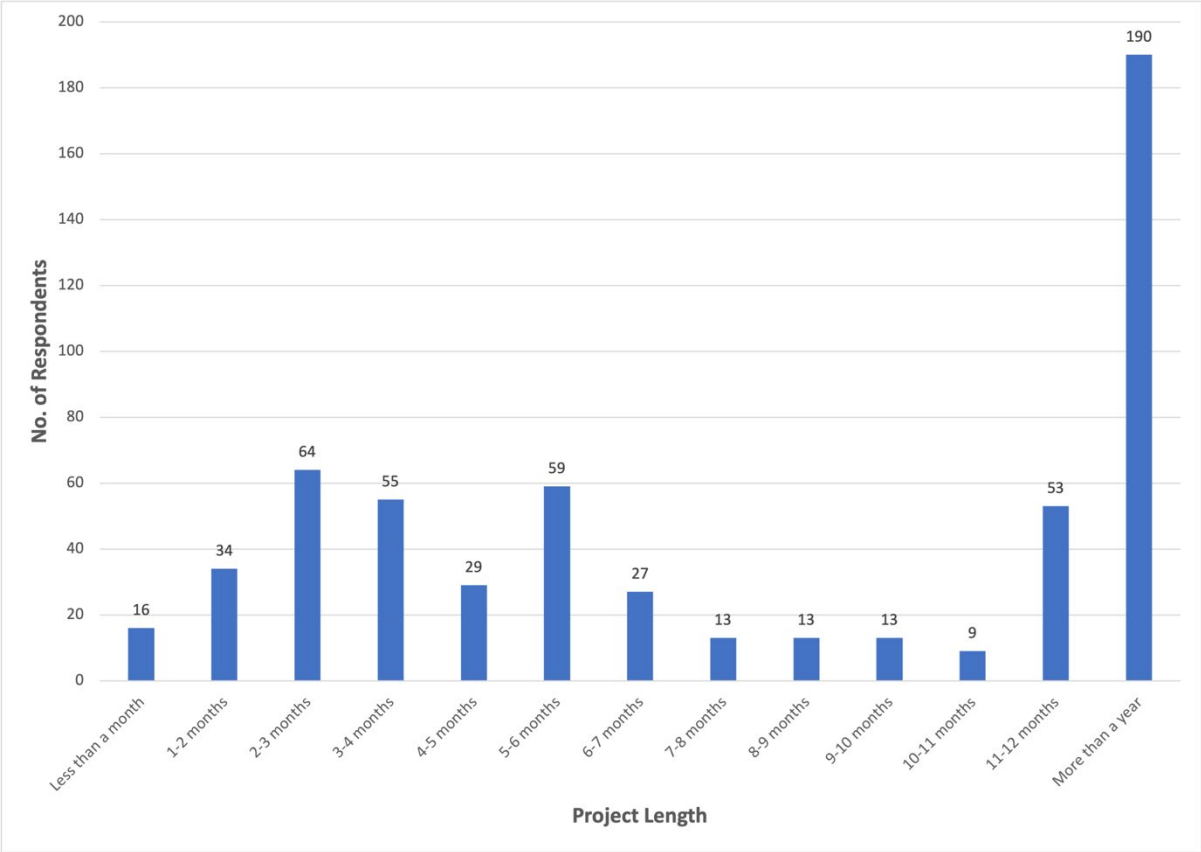
The first side of the Iron Triangle is “time”, which the researcher has represented as the Project Timeline. The respondents were asked what their project timeline was, and the response choices were broken down by a range of weeks for accuracy with a conversion to months for the respondent’s convenience.

Figure 4.10 below distinctly outlines that a large percentage of respondents reported Scrum projects were lasting more than a year (n=190). This information surprisingly challenges Scrum Alliance’s (2017) report that the average Scrum

project lasts 11.6 weeks, which translates to two to three months, and collected only 64 responses in the survey.

Figure 4.10

Project Timeline



4.3.3.2 Project Budget

The second side of the Iron Triangle is “cost”, which is translated as the Project Budget. A question in the survey sought to ask the budget for the respondent’s Scrum project. However, a challenge was posed during instrument peer review and subsequent user testing with regards to the concern that a singular currency could not be used, considering the survey would be launched across seven

different countries. The idea of using United States Dollar (USD) as a currency was also rejected, since it would add work for the respondent having to convert currencies and might risk them leaving the survey. An idea was raised to see if there could be ways to automatically convert currencies for values set as choices. However, the survey tool platform used was not able to automatically adjust currencies based on the respondent's location. Therefore, providing pre-defined answers could not be done.

As a result of the challenges shared in the peer review, an open text field was decided to be used and left for respondents to supply their answers. The question was set as skippable. This elicited a wide range of responses, where 75 submitted a number with a currency (e.g. AUD, NZD, IDR, MYR, PHP, SGD, and VND), 76 submitted a number without a currency, 8 reported the project did not have a budget, while 416 shared they had no idea about the budget or would rather not say.

The 76 participants who shared a number without a currency was attributed to a location from one of the previous survey questions. It might make sense to use their country location response to match the missing currency. However, it was very likely that a respondent answering the questionnaire from Malaysia could be working remotely with a Singaporean team and is referring to Singaporean Dollars (SGD) and not Malaysian Ringgit (MYR). Remote and distributed Scrum Teams were actual scenarios as discussed in section 4.3.3.7. Therefore, there is no way to know for sure what the currency was for the 76 respondents who shared only a number.

Among the 75 participants who answered with a currency and a number, eight of them provided a range or an incorrect number format (e.g. "NZD ~1,000,000" or "500.000 USD"). These were removed from the accepted responses. Therefore, only 67 participants submitted a clear answer to this survey question. By converting all 67

responses into USD according to current market rates, the researcher found that Scrum projects had a budget of US$ 808,5754.93 on average.

Using the accepted answers in the Project Budget question would require the researcher to cut down the dataset size from 575 to only 67. This would seem like a huge waste of the potential information one can derive from the larger data size. Therefore, to optimise the results of this study, the researcher decided to omit the Project Budget responses from the data analysis. However, a recommendation could be made to go back to and isolate the 67 respondents who filled out the Project Budget properly and run a separate and complete data analysis of just that group of respondents.

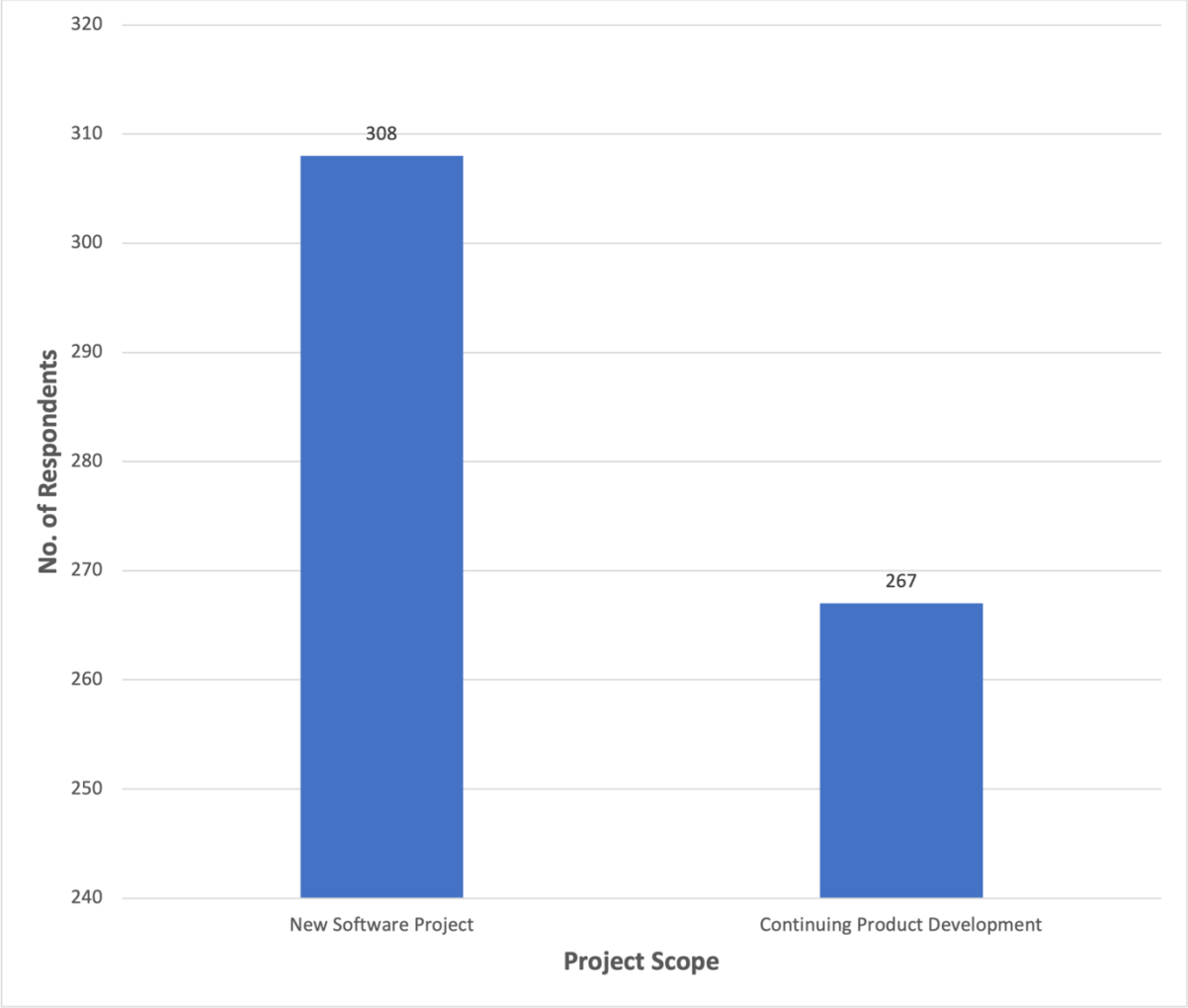
As a learning from this portion of this study, the researcher now understands it is not a good idea to leave an open text field to capture financial data.

4.3.3.3 Project Scope

The third side of the Iron Triangle is “output” and is defined by the researcher as the scope of whether it is a New Software Project or Existing Software Project, with the former broken down by software type to generate further context. Respondents were asked if they were developing a new software product for their Scrum project or were they working on improving an existing software product or feature. As shown in Figure 4.11 below, 53.50% of respondents reported they were creating new software in their Scrum Project (n=308), while the rest were working on improvements to existing software (n=267).

Figure 4.11

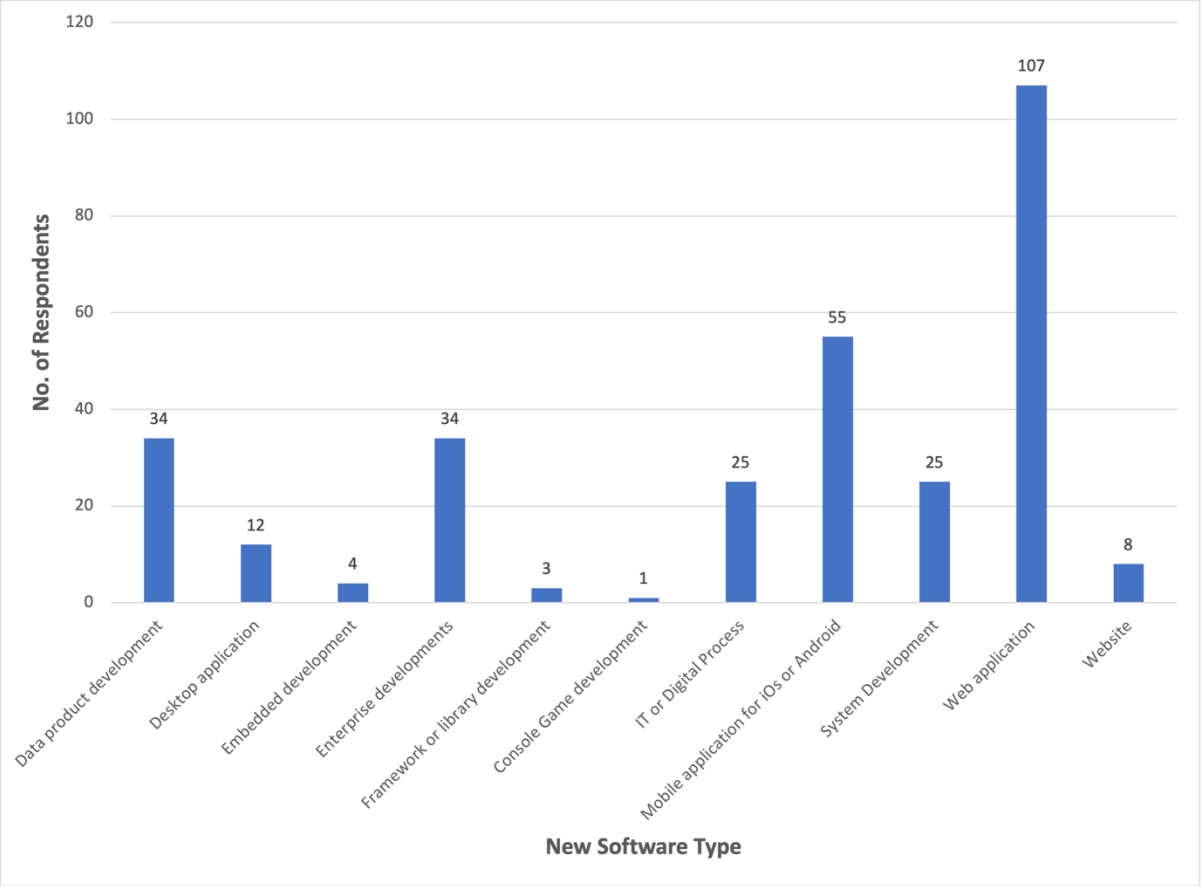
New Software Project or Existing Software Project



Participants who shared they were creating new software were presented with question unique to them where the survey sought to ask what specific ICT project they were building. A summary of the survey response is seen in Figure 4.12 below. A third of this group (n=107) shared they were creating web applications, followed by mobile applications for iOs and Android phones (n=55). It is interesting to see website development (n=8) is one of the lowest occurring projects.

Figure 4.12

Software Type for New Projects



4.3.3.4 Type of Scrum

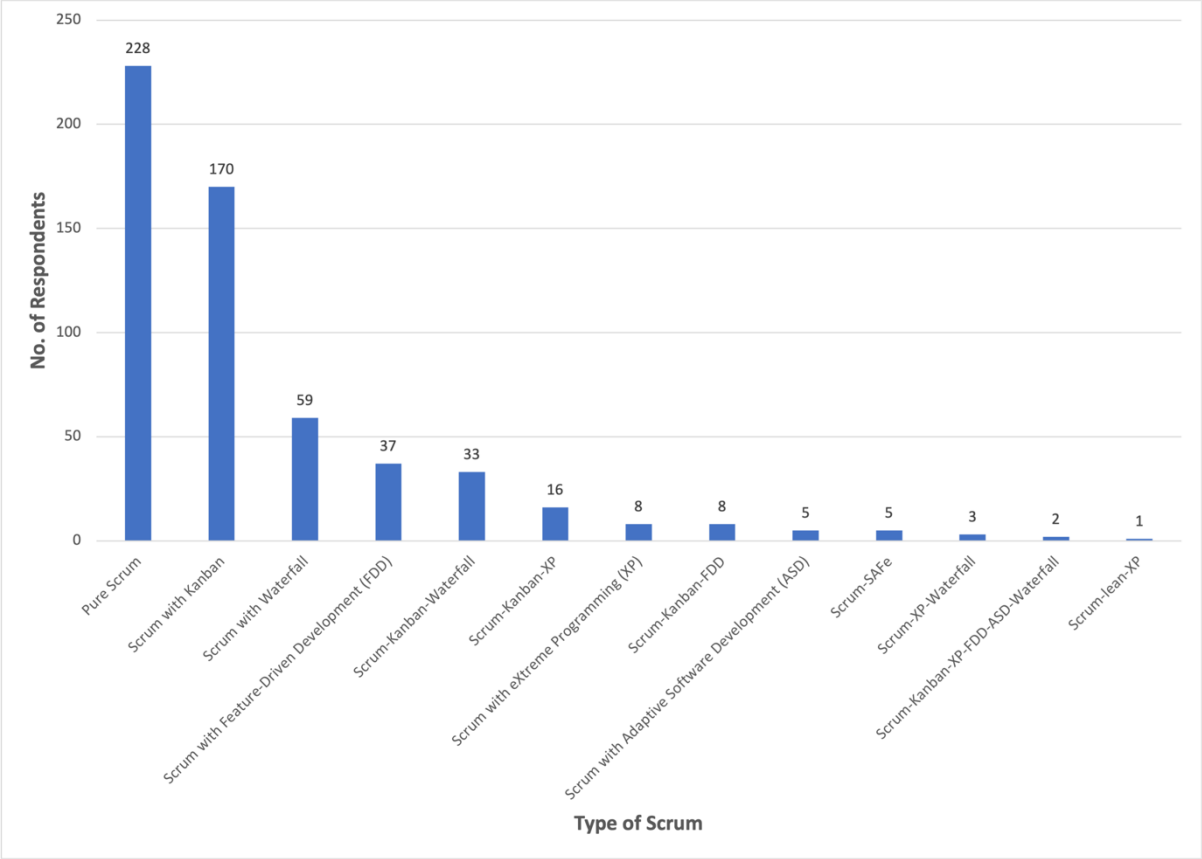
The variant of Scrum used, either it a pure form of the framework or mixed with other methodologies were used, affects how a project is run and is marked as an important condition. The survey asked the respondents what variant of Scrum they used, and a list of Scrum hybrids was shared. The list of hybrids was derived from Shastri et al.'s (2016) study on the existence of Project Managers in ASD. Furthermore, the researcher provided a "None of the Above" choice in case the respondent could not find their variant. If this choice was selected, the respondent

would get a unique follow-up question with an open-ended text field to write what variant they used. Ultimately, 12 respondents chose this option and submitted a hybrid outside of the pre-set choices. Two respondents' responses were removed from the final results since they indicated responses outside of known literature. Five respondents indicated they used Scrum with Scaled Agile Framework (SAFe) and one shared they used Scrum-Lean-XP. These were added as separate categories. Four respondents shared an answer already in the pre-set list and were manually counted towards those choices.

Overwhelmingly, the majority of respondents using Scrum did so in a completely Agile manner, by using it alone or combining it with other Agile frameworks or methodologies as seen from Figure 4.13 below. It was also reported that 40% used the Scrum Framework in its pure form (n=228), without combining it with other methodologies. It is closely followed by a large group of respondents that reported using Scrum with Kanban (n=170), which keeps the project approach purely Agile. The Sequential approach still thrives in Agile-dominated industry practice and can be seen integrated with Scrum through Scrum-Waterfall (n=59), Scrum-Kanban-Waterfall (n=33), Scrum-XP-Waterfall (n=3), and Scrum-Kanban-XP-FDD-ASD-Waterfall (n=2). Combined, projects using a degree of traditional project management comprised 17% of the total sample.

Figure 4.13

Type of Scrum Used



4.3.3.5 Scrum Team Size

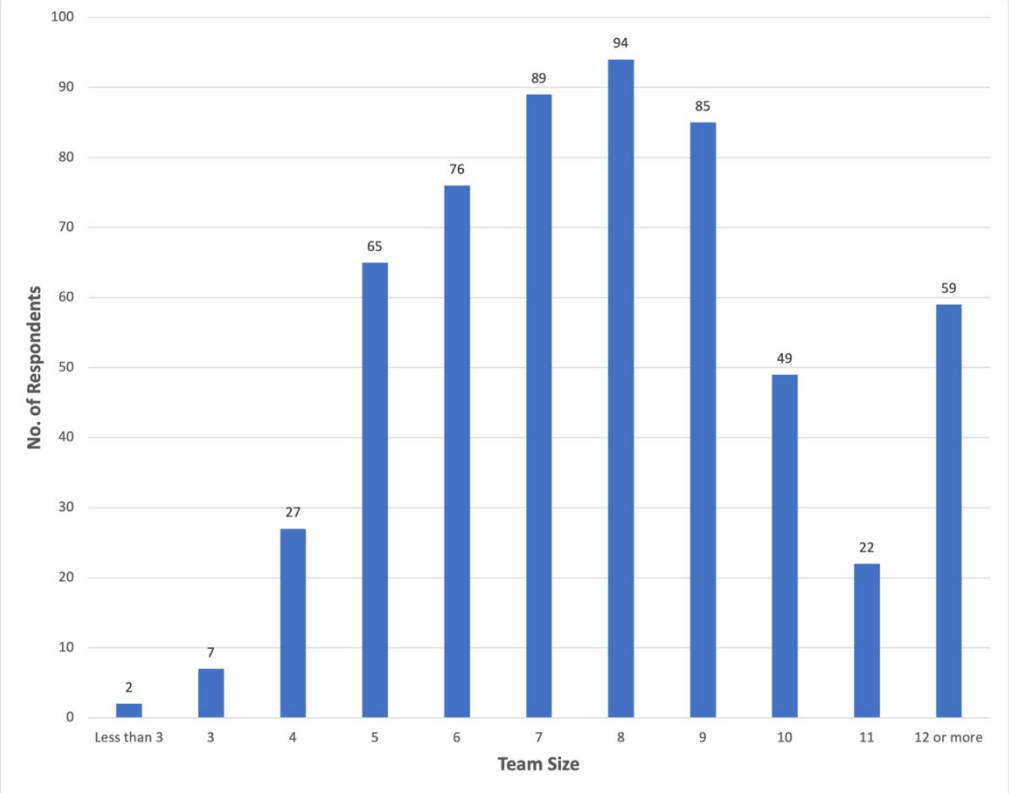
The researcher considered the Scrum Team size as a project condition that may indicate when a Project Manager was needed for the team. The survey asked the respondents how many people were in their Scrum Team and were given choices between “1-2”, “3”, “4”, ”5”, “6”, “7”, “8”, “9”, “10”, “11”, and “12 or more”.

Figure 4.14 below illustrates how respondents reported the size of their Scrum Teams. It is interesting to see that there is a significant number of respondents reporting outside the prescribed team size of 5 to 11, which is a Product Owner, a Scrum Master, and 3 to 9 Development Team members (Schwaber and Sutherland,

2017). However, the case would be different if both the Product Owner and Scrum Master were a shared role or if each also held a Development Team role, which is highly plausible as demonstrated in the Demographics subsection 4.3.1.2 “Distribution by Scrum Role”, bringing the range down to 3 to 9. In this scenario, the researcher accepts an ideal team size minimum of 3, where the Product Owner and Scrum Master also act as a developer together with a person to make a Development Team, and a maximum of 11, where the Product Owner and Scrum Master are separate from nine other people in the Development Team. In this case, 514 respondents fell within this range and only two groups of respondents reported a Scrum Team size outside the ideal size, which is “less than 3” (n=2) and “12 or more” (n=59).

Figure 4.14

Scrum Project Team Sizes



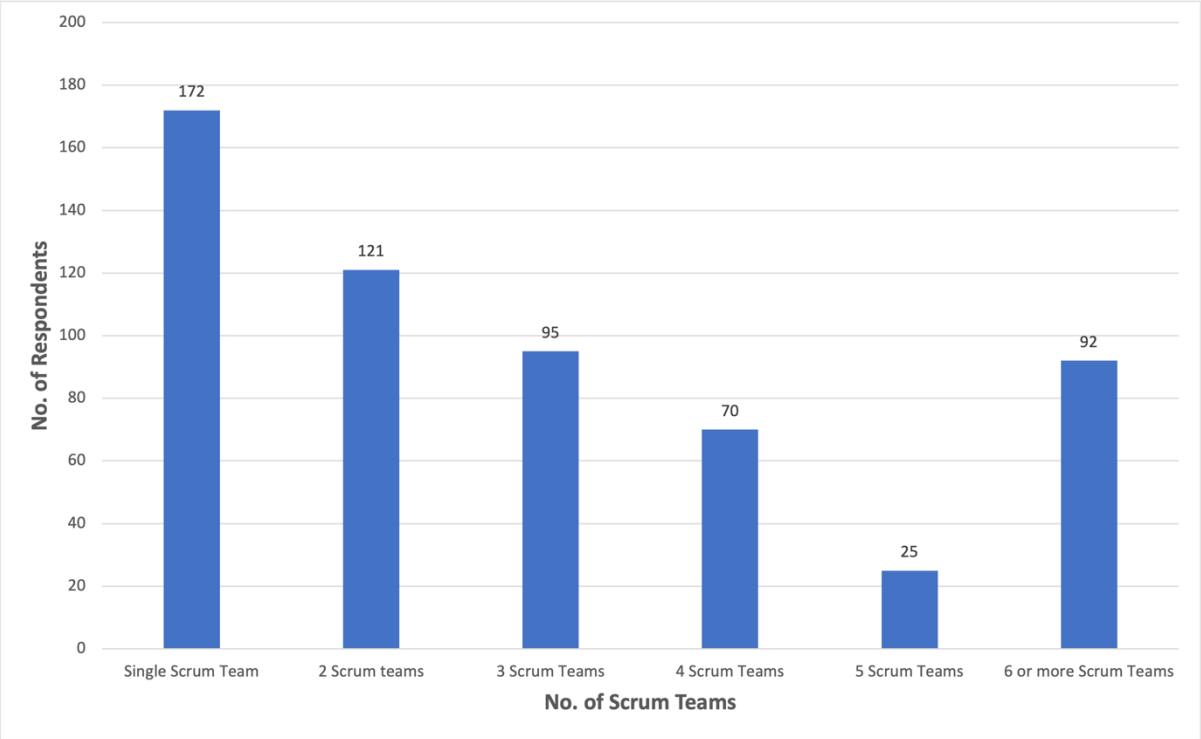
4.3.3.6 Scrum Team Collaboration

This portion of the survey asked respondents to share how many other Scrum Teams worked with their team on the project. The question was, "*Was your team alone in developing the software product or did you collaborate with several Scrum Teams*?" The respondents were given pre-defined choices. The results are summarised in Figure 4.15 below.

Among the 575 respondents, 70% (n=403) shared they worked with another Scrum Team and roughly a third reported they worked alone on the project (n=172). Working with one other Scrum Team, totaling two teams, was common for those who didn't work alone (n=121), and collaborating with four other Scrum Teams, totaling five teams, was the least common (n=25). However, 92 respondents shared that they were part of a larger collaboration of Scrum Teams, stating their team worked with five or more other Scrum Teams.

Figure 4.15

Number of Scrum Teams in a Single Project



4.3.3.7 Scrum Team Distribution

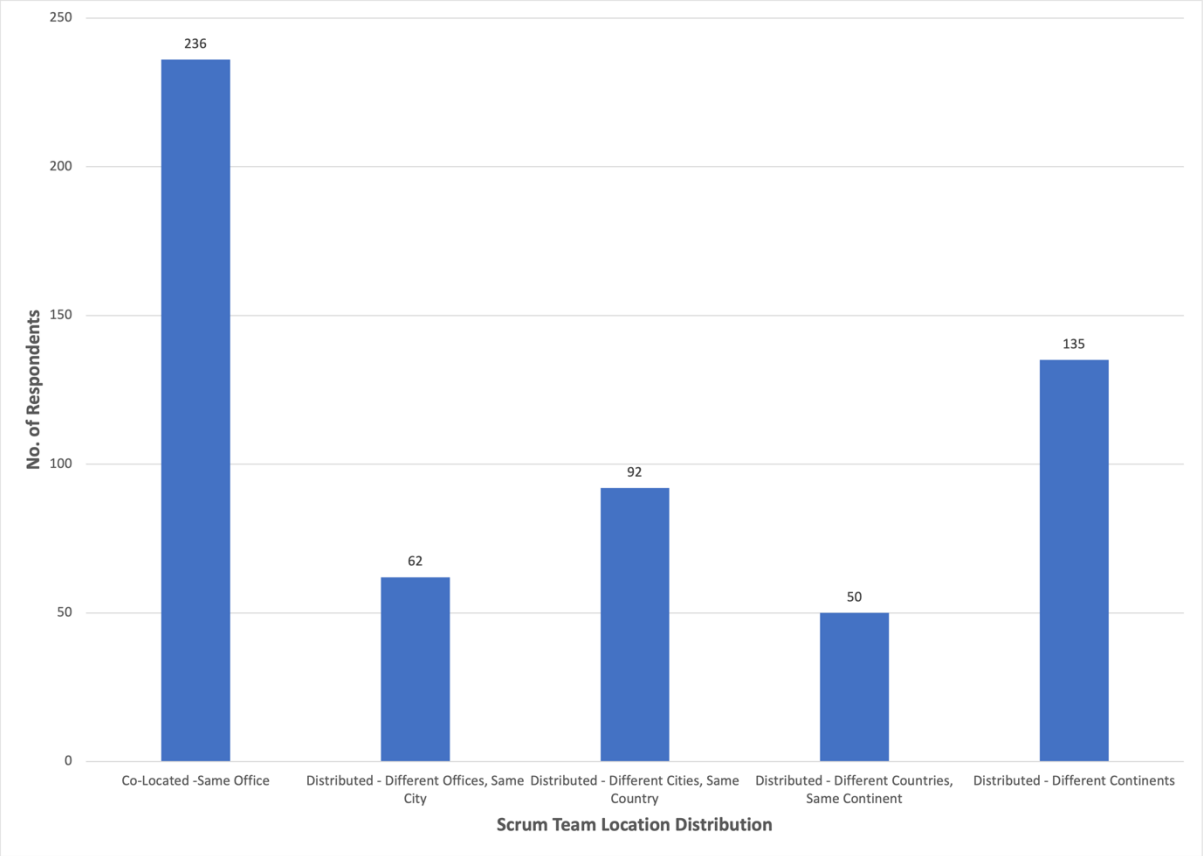
The final project condition question asked in the survey was the Scrum Team member's geographical distribution in relation to one another. Specifically, it sought to understand if the respondent's Scrum Team were all located in a single location (co-located) or if their team was distributed across multiple locations (distributed). If the Scrum Teams were distributed, the survey probed to break it down further and checked if they were merely in separate offices in one city, separate cities in one country, separate countries in one continent, or different continents across the world altogether.

As summarised in Figure 4.16 below, the survey revealed Scrum Teams were more frequently dispersed across different locations (n=339) than they were at the

same office (n=236). Among the respondents who shared their teams were distributed in different locations, intercontinental/global team distribution was more common (n=135), followed by teams dispersed across one country but in different cities (n=92).

Figure 4.16

Scrum Team Member Geographical Distribution



4.3.4 Project Managers in the Scrum Team

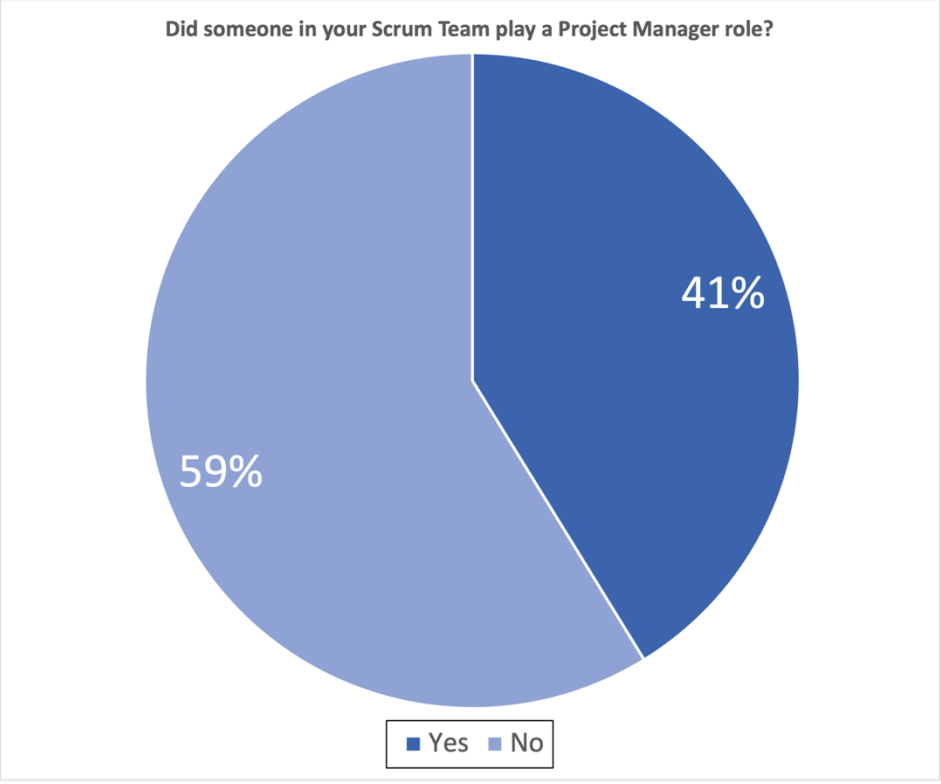
One of the vital questions in the survey was to ask the respondents if their Scrum Team had a Project Manager. Specifically, the survey asked, “Was someone in the Scrum Team playing a Project Manager role?” Choices were pre-defined with

a “Yes”, “No”, or “I don’t know” response. Three responded with “I don’t know” and were removed from the final sample of 575 responses.

Figure 4.17 below illustrates the distribution of Yes or No answers from the research respondents. Close to six out of every ten (58.78%) respondents reported their Scrum Team did not have a Project Manager (n=338). This means that there is a significant number of respondents who reported their Scrum Teams did have a Project Manager (n=237). These findings are desirable in the sense that this clear line of distinction between the entire survey sample helped the researcher outline what project conditions, and possibly demographics, are generally true for both groups and helped answer the primary research question.

Figure 4.17

Project Manager Presence in Scrum Teams



4.3.4.1 Comparison by Demographics

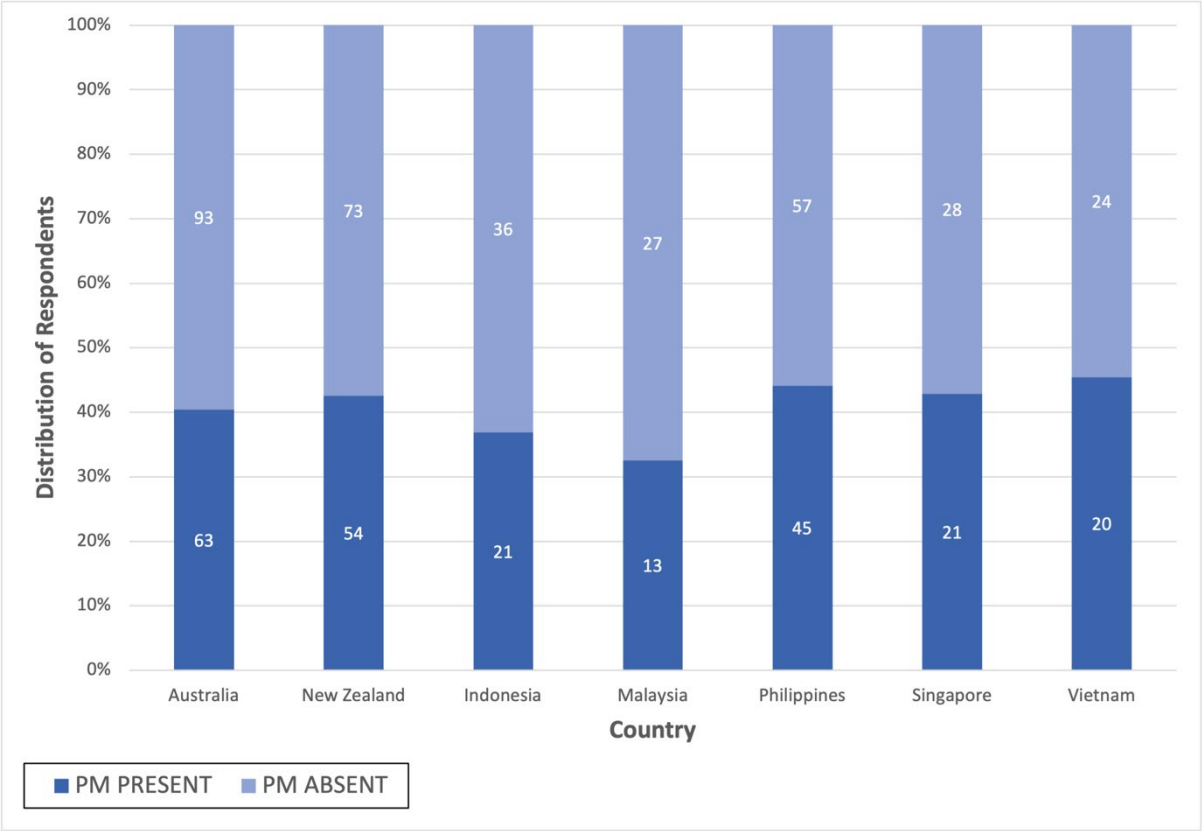
Since demographics were collected to determine the representation of certain respondent attributes in the sampling pool, it has no further contribution towards attempting to answer the primary research question and secondary objective. However, the location of the respondents, and thus the project, could be argued as a project condition and not merely as a respondent demographic. Therefore, for comparison by demographics, the researcher will look at only the location.

Figure 4.18 below illustrates that the respondents of all the seven countries across the two regions surveyed report the majority of their Scrum Teams operate without a Project Manager (PM). By looking at Figure 4.18, it is clear each country's Scrum project operates with a Project Manager only 35% to 45% of the time, which is in line with the Agile approach and Scrum Framework literature indicating the lack of a need for Project Managers. Therefore, the first null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.1) phase were generated:

> *(Null) $H1_0$: The location of the Scrum project does not affect the decision to include or not include a Project Manager in the team.*
> *(Alternative) $H1_1$: The location of the Scrum project affects the decision to include or not include a Project Manager in the team.*

Figure 4.18

Project Manager Presence in Scrum Teams by Country



Note. The numbers within each bar indicate the actual number of respondents. For example, 63 respondents in Australia indicated they had a Project Manager (PM) while 93 respondents indicated they did not have a Project Manager.

4.3.4.2 Comparison by Scrum Familiarity

Unlike demographics, which mainly sought to establish the distribution of respondents in the sampling pool by individual attributes (apart from the location as argued above), the respondent's familiarity with the Scrum Framework might contribute to the presence or absence of a Project Manager. The researcher was

interested to investigate this by conducting visual comparisons and generating further hypotheses for testing in the next phase.

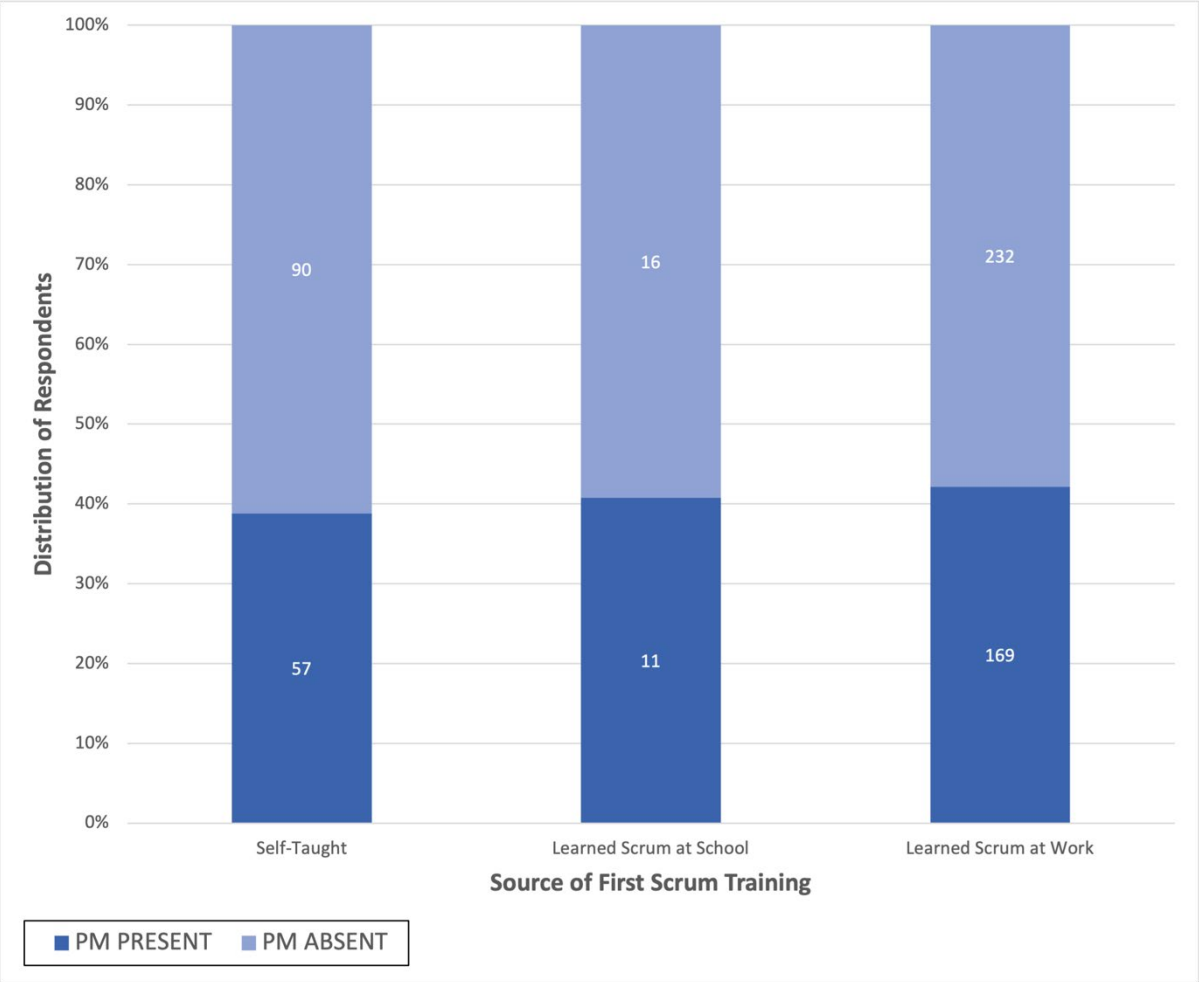
by Foundational Instruction

In the survey, the researcher was able to determine how the respondents first learned about the Scrum Framework, either from an academic institution, from occupational training, or if they were self-taught. It would be interesting to investigate if the respondent's source of instruction would somehow affect the presence of a Project Manager in the Scrum Team. Figure 4.19 below illustrates the majority of the respondents shared they did not have a Project Manager in their Scrum Team regardless of their source of education about Scrum. In consideration of the literature as discussed in Chapter 2 section 2.4, it is expected that Project Managers are not needed in Scrum Teams regardless of where the team members learned Scrum. Therefore, the second null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.2) phase were generated:

> *$H2_0$: The foundational instruction of Scrum, whether it is learned from school, from work, or self-taught, does not affect the presence or absence of a Project Manager in the team.*
>
> *$H2_1$: The foundational instruction of Scrum, whether it is learned from school, from work, or self-studied, affects the presence or absence of a Project Manager in the team.*

Figure 4.19

Project Manager Presence in Scrum Teams as Reported by Respondents According to their Foundational Instruction



Note. The numbers within each bar indicate the actual number of respondents. For example, 57 respondents, who learned Scrum by themselves (Self-Taught), indicated they had a Project Manager (PM) while 90 respondents indicated they did not have a Project Manager.

by Scrum Experience

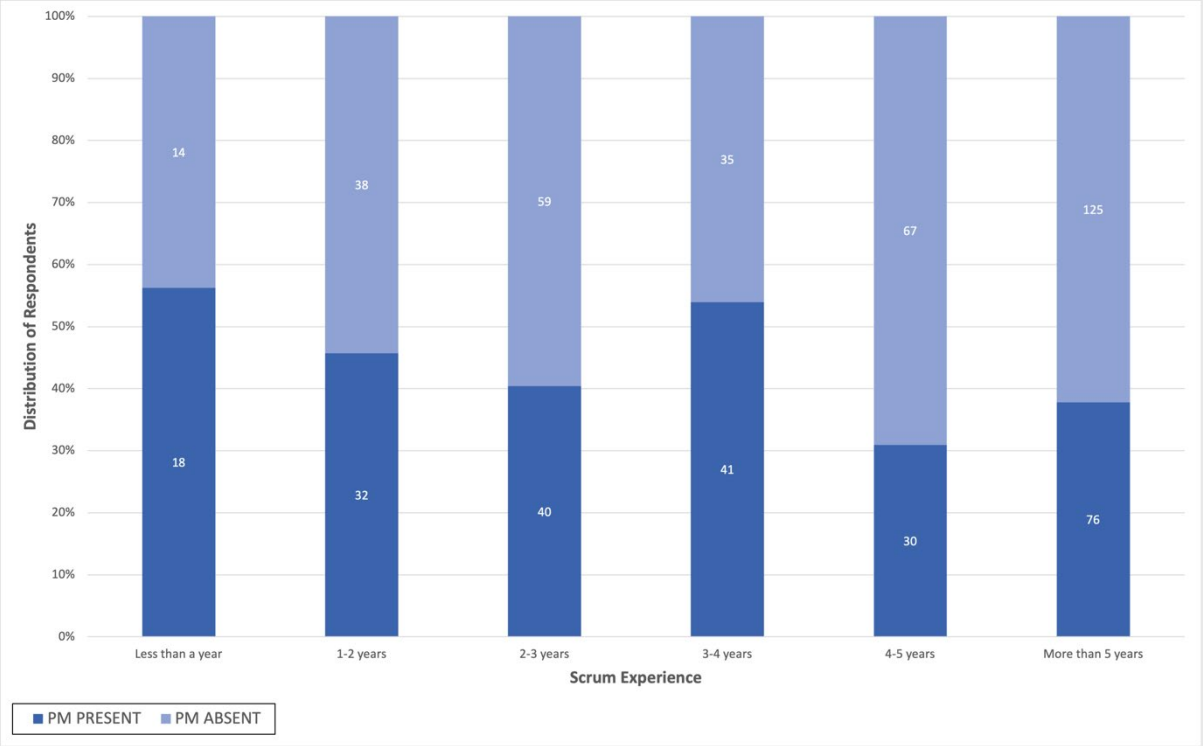
The survey was able to get an indication of a respondent's years of experience working with the Scrum Framework. It would be interesting to see if

certain groups with a level of experience had more or fewer reports of a Project Manager in their Scrum Teams. Figure 4.20 below illustrates that almost 60% of respondents with less than a year's experience with Scrum reported they had a Project Manager, while under 40% of respondents with four or more years' experience had a Project Manager. This would seem logical considering the more experience you had with Scrum, then the more you should abide by its theoretical framework. If that is the case, then it becomes curious why over 50% of respondents with three to four years' experience with Scrum have reported they had a Project Manager. Also, it is important to note the group of respondents with less than a year's experience number only 32 of the 575 participants. Project Manager presence should not be influenced by the length of experience with Scrum, since literature (Schwaber & Sutherland, 2017) does not indicate the need for them if Scrum Team members are inexperienced. Therefore, the third null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.3) phase were generated:

> *$H3_0$: Experience in Scrum does not influence the presence or absence of a Project Manager in a Scrum Team.*
>
> *$H3_1$: More than four years' experience with Scrum diminishes the presence of a Project Manager in Scrum Teams.*

Figure 4.20

Project Manager Presence in Scrum Teams as Reported by Respondents According to their Scrum Experience



Note. The numbers within each bar indicate the actual number of respondents. For example, 18 respondents, who have practiced Scrum for less than a year, indicated they had a Project Manager (PM) while 14 respondents indicated they did not have a Project Manager.

by Scrum Certification

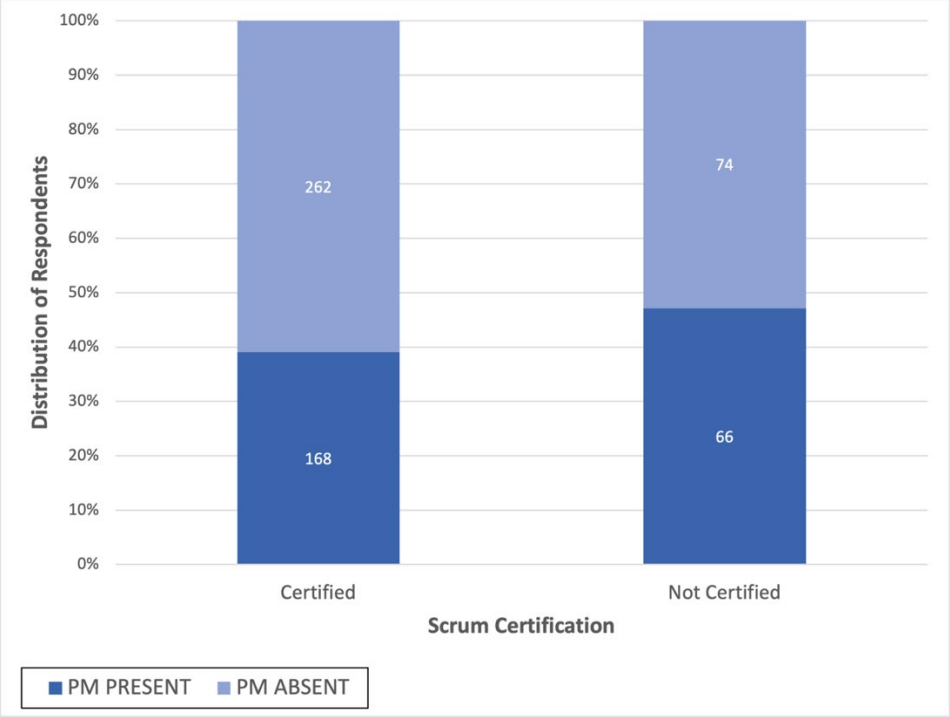
The final determinant for Scrum familiarity checked in the survey was the respondent's Scrum certification status. The respondents who did not know if they were certified or not (n=5) were not included in this review. The groups, Certified and Not Certified, were compared in Figure 4.21 below and revealed that Project Manager presence was slightly lower in Scrum Teams with certified members. The six percent variance might not seem to indicate much but was investigated further.

Ideally, one's certification status in Scrum should not affect the decision to hire a Project Manager in the team, since nowhere in Scrum's literature (Schwaber & Sutherland, 2017) does it prescribe that one is needed if the Scrum Team members are not certified. Therefore, the fourth null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.4) phase were generated:

> *$H4_0$: Scrum certification status has no impact on the presence or absence of a Project Manager in a Scrum Team.*
>
> *$H4_1$: Scrum certification status has an impact on the presence or absence of a Project Manager in a Scrum Team.*

Figure 4.21

Project Manager Presence in Scrum Teams as Reported by Respondents According to their Scrum Certification Status



Note. The numbers within each bar indicate the actual number of respondents. For example, 168 respondents, who were Certified, indicated they had a Project Manager (PM) while 262 respondents indicated they did not have a Project Manager.

4.3.4.3 Comparison by Project Conditions

Comparing the two groups of respondents, those who reported they had a Project Manager and did not have a Project Manager in their Scrum Teams, by project condition was the highlight of this study. By being able to do a Descriptive analysis, the researcher was able to pick out details of interest and form a plan for the succeeding Inferential analysis. Visual comparisons and exploratory reviews were undertaken to generate hypotheses. The following sections will cover different project conditions captured in the survey and the relative presence of a Project Manager.

by Project Timeline

It was important to explore if a project's timeline can somehow affect the presence or absence of a Project Manager in a Scrum Team. A logical assumption would be that a Project Manager is helpful in Scrum projects with short timelines to drive the Scrum Team and deliver within the deadline. Another assumption would be that the Project Manager could be useful in long-running projects, where resource management and stakeholder engagement are extended. Figure 4.22 below illustrates it is not the case in either group.

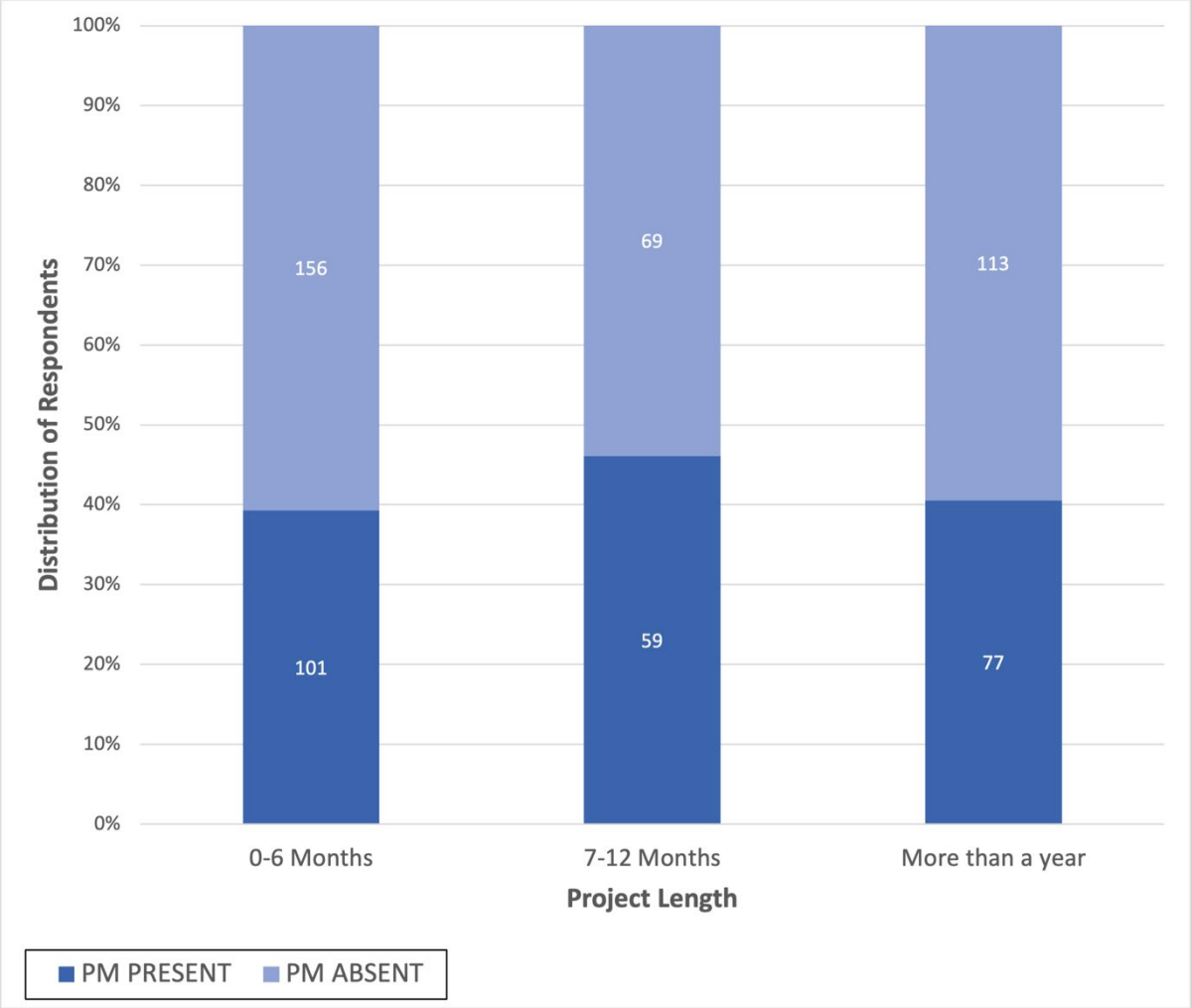
Instead of dividing the project timeline by months, as in subsection 4.3.3.1, the researcher consolidated all responses into zero to six months, seven to twelve

months, and any project that ran for more than a year. The Project Manager role was predominantly absent in all three project timeline groups. Figure 4.22 below shows 61% of respondents who ran projects in 0-6 months (n=156) reported they did not have a Project Manager, no Project Manager in 54% of respondents who had run a project for 7-12 months (n=69), and no Project Manager in 60% of those who ran it for more than a year (n=113). This conforms with literature (Schwaber & Sutherland, 2017) considering the Scrum Framework does not suggest having a Project Manager regardless of the project length. Therefore, the fifth null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.5) phase were generated:

> *$H5_0$: The length of a Scrum software project has no effect on the presence or absence of a Project Manager in a Scrum Team.*
>
> *$H5_1$: The length of a Scrum software project has an effect on the presence or absence of a Project Manager in a Scrum Team.*

Figure 4.22

Project Manager Presence in Scrum Teams According to Project Length



Note. The numbers within each bar indicate the actual number of respondents. For example, 101 respondents, who were running a Scrum project between zero to six months, indicated they had a Project Manager (PM) while 156 respondents indicated they did not have a Project Manager.

by Project Scope

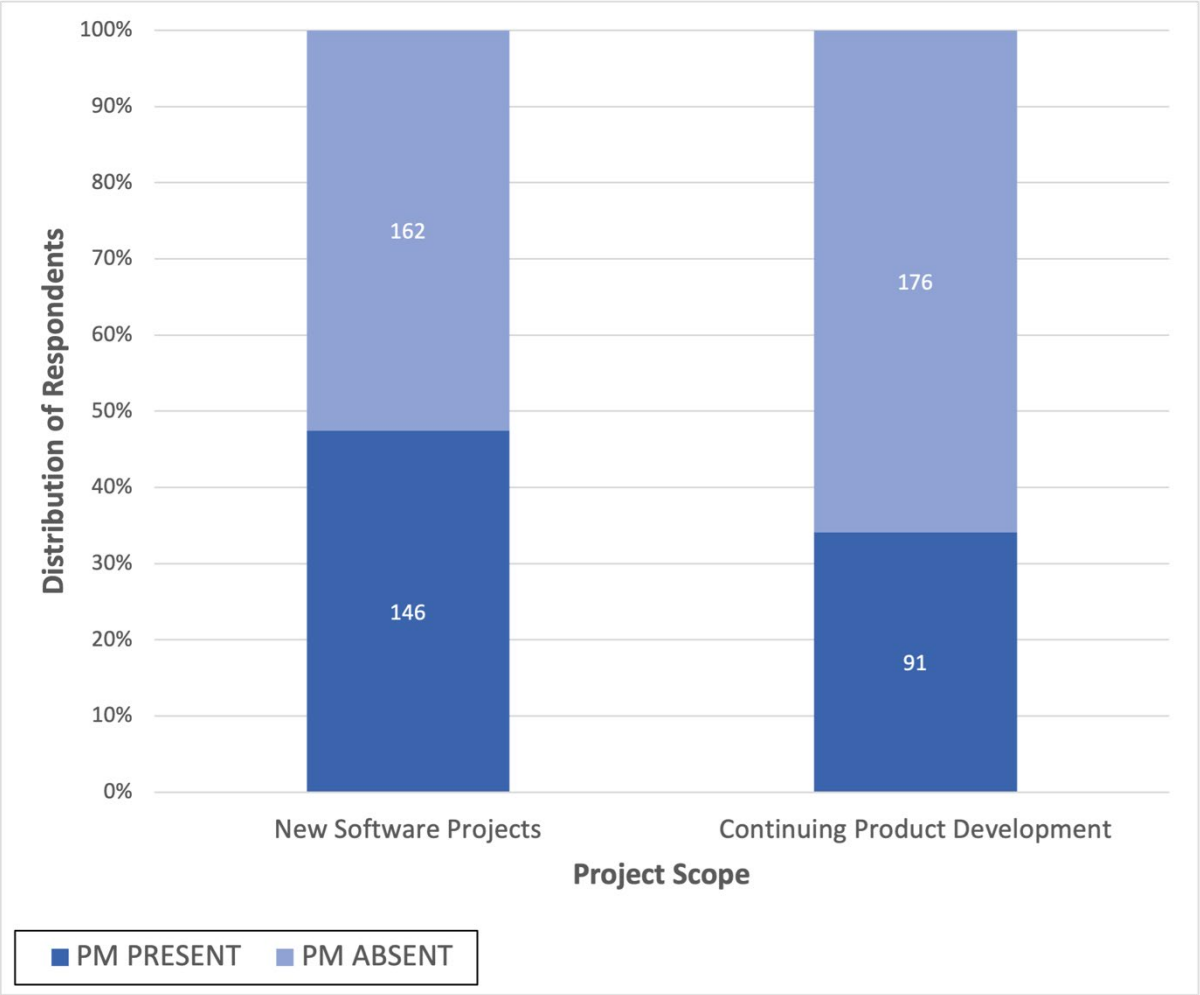
Through investigation of the presence or absence of Project Managers according to the project's scope, whether it is a new software project or an existing product development/improvement, the researcher was able to distinguish how this

project condition helped answer the primary research question. Figure 4.23 below illustrates that regardless of whether the respondent is working on a new project or an existing product, the Project Manager's absence still consisted in the majority of cases. However, there is a marked ten percent difference between the Project Manager being present in New Software Projects (n=141) as opposed to their presence in Continuing Product Development (n=91). Traditionally, working on new or existing software should not matter in Scrum and a Project Manager is discouraged in either scenario as discussed in Chapter 2, section 2.4. Therefore, the sixth null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.6) phase were generated:

> *$H6_0$: The scope of the project, whether it is to work on a new software product or continue work on an existing product, has no effect on the presence or absence of a Project Manager in a Scrum Team.*
>
> *$H6_1$: The scope of the project, whether it is to work on a new software product or continue work on an existing product, has an effect on the presence or absence of a Project Manager in a Scrum Team.*

Figure 4.23

Project Manager Presence in Scrum Teams According to Project Scope



Note. The numbers within each bar indicate the actual number of respondents. For example, 146 respondents, who were working on new software projects, indicated they had a Project Manager (PM) while 162 respondents indicated they did not have a Project Manager.

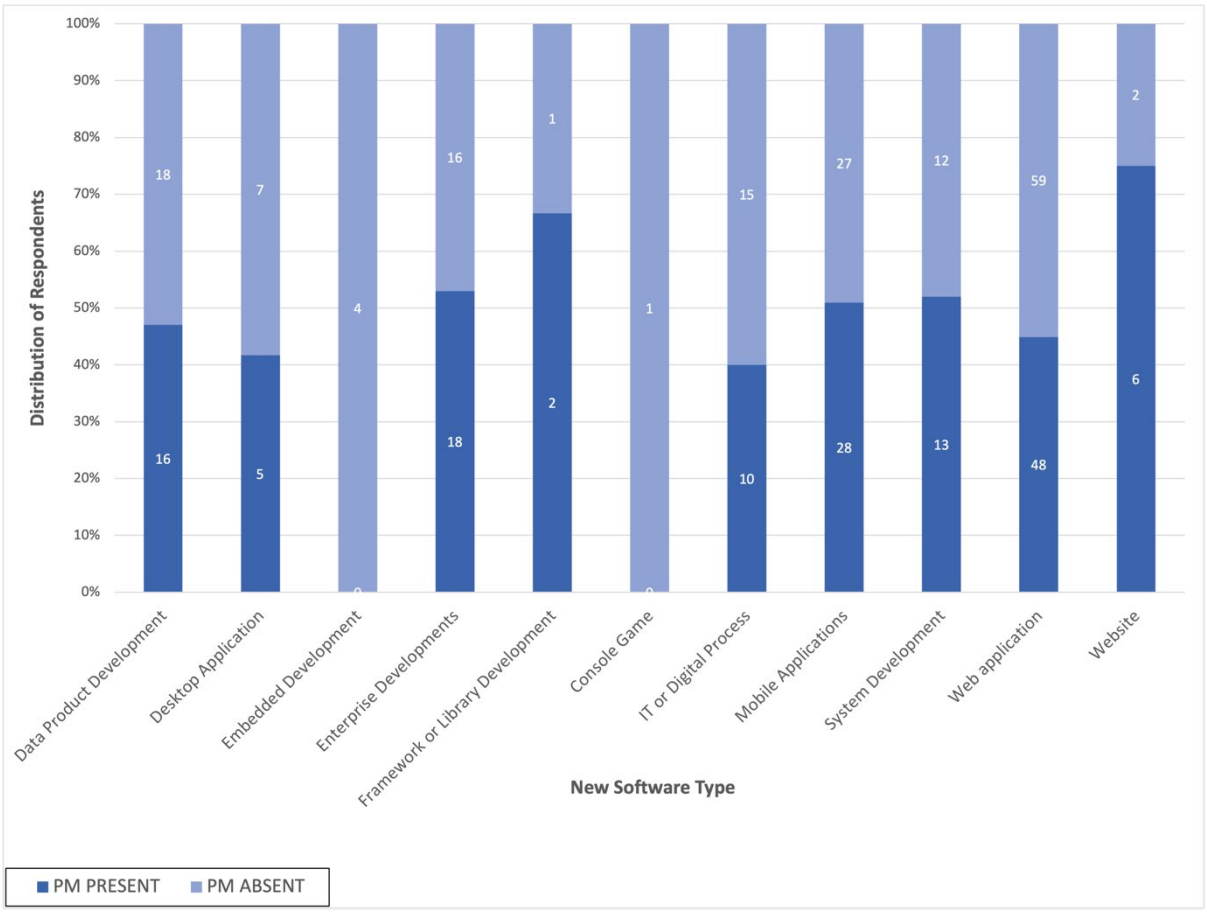
For respondents who answered they worked on New Software Projects (n=308), they were asked to share what kind of software they were building. It might be interesting to investigate further if the type of new software project would affect how a Project Manager might be present or absent in a Scrum Team, which was done and described below. Figure 4.24 below illustrates that more than 50% of

respondents were developing Enterprise (n=18), Framework or Library (n=2), Mobile Applications (n=28), System Development (n=13), and Website (n=6) software projects shared they had a Project Manager in their Scrum Team. However, the numbers behind these percentages are not conclusive. Therefore, the seventh null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.7) phase were generated:

> *$H7_0$: The kind of new software project developed does not determine the presence or absence of a Project Manager in a Scrum Team.*
> *$H7_1$: The kind of new software project developed does determine the presence or absence of a Project Manager in a Scrum Team.*

Figure 4.24

Project Manager Presence in Scrum Teams According to New Software Project Type



Note. The numbers within each bar indicate the actual number of respondents. For example, 16 respondents, who were working on Data Product Development, indicated they had a Project Manager (PM) while 18 respondents indicated they did not have a Project Manager.

by Scrum Type

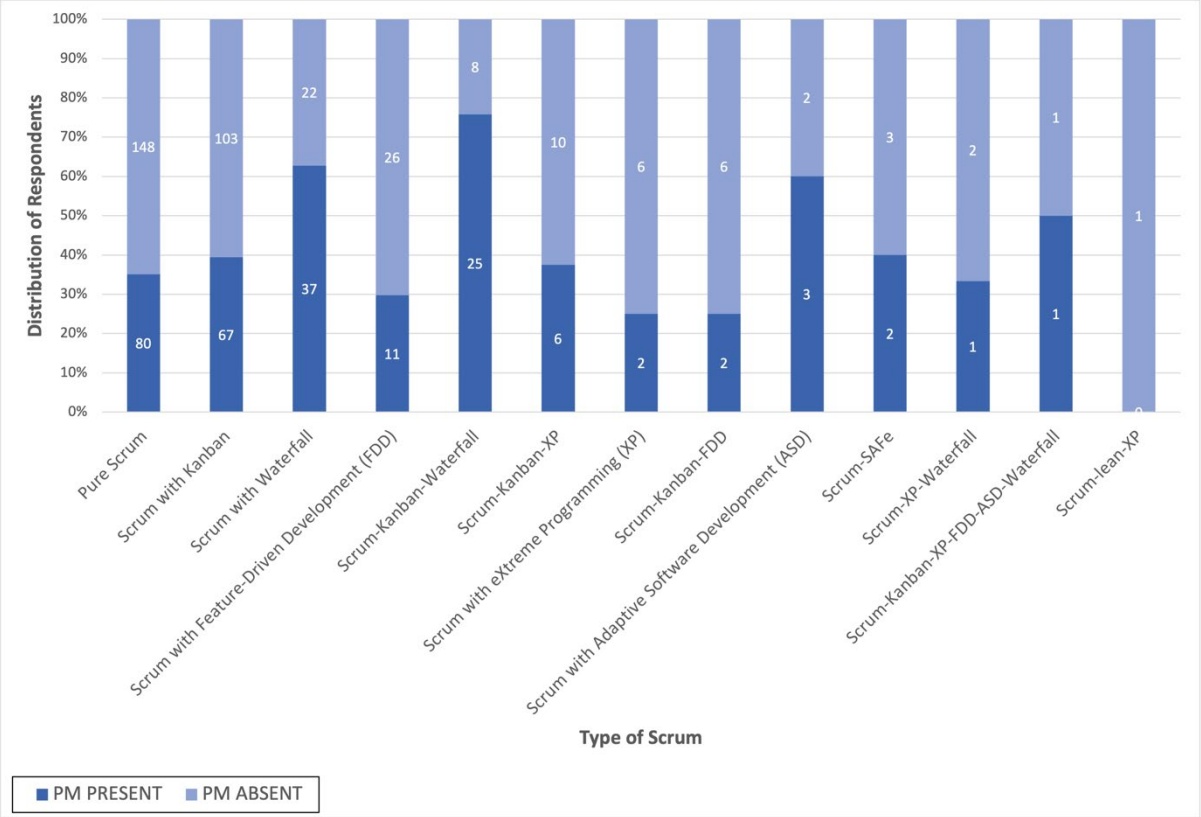
The form of Scrum used, whether it is Pure Scrum or a Scrum hybrid, should give some indication whether a Project Manager is part of the Scrum project or not. For example, if one would say they are practicing pure Scrum, then there should not be a Project Manager considering the role is not part of its framework. However,

Figure 4.25 below illustrates that over 30% of respondents who shared they were practicing Pure Scrum also reported they had a Project Manager in their Scrum Team (n=80).

On the other hand, Scrum that has an element of Traditional Sequential approaches (Scrum-Waterfall, Scrum-Kanban-Waterfall, Scrum-XP-Waterfall, Scrum-Kanban-XP-FDD-ASD-Waterfall) should show more instances of Project Manager presence. This assumption is represented somewhat well in Figure 4.25 below and illustrates more than 50% Project Manager presence in each one except Scrum-XP-Waterfall. However, the total number of respondents who reported using Scrum-XP-Waterfall is only three, with one saying they had a Project Manager and the other two saying they had none. A breakdown of the numbers can be reviewed in subsection 4.3.3.4.

Figure 4.25

Project Manager Presence in Scrum Teams According to Scrum Type



Note. The numbers within each bar indicate the actual number of respondents. For example, 80 respondents, who used Pure Scrum, indicated they had a Project Manager (PM) while 148 respondents indicated they did not have a Project Manager.

To clarify further, Figure 4.26 below groups the different forms into Pure Scrum, Pure Agile Scrum (Scrum mixed with other Agile approaches such as Kanban, XP, etc), and Traditional + Agile Scrum (Scrum, other Agile, and Traditional approaches such as Waterfall). The new grouping illustrates Pure Scrum and Pure Agile Scrum had a lower presence of Project Managers while almost 70% of respondents who stated they used Traditional + Agile Scrum reported having Project Managers.

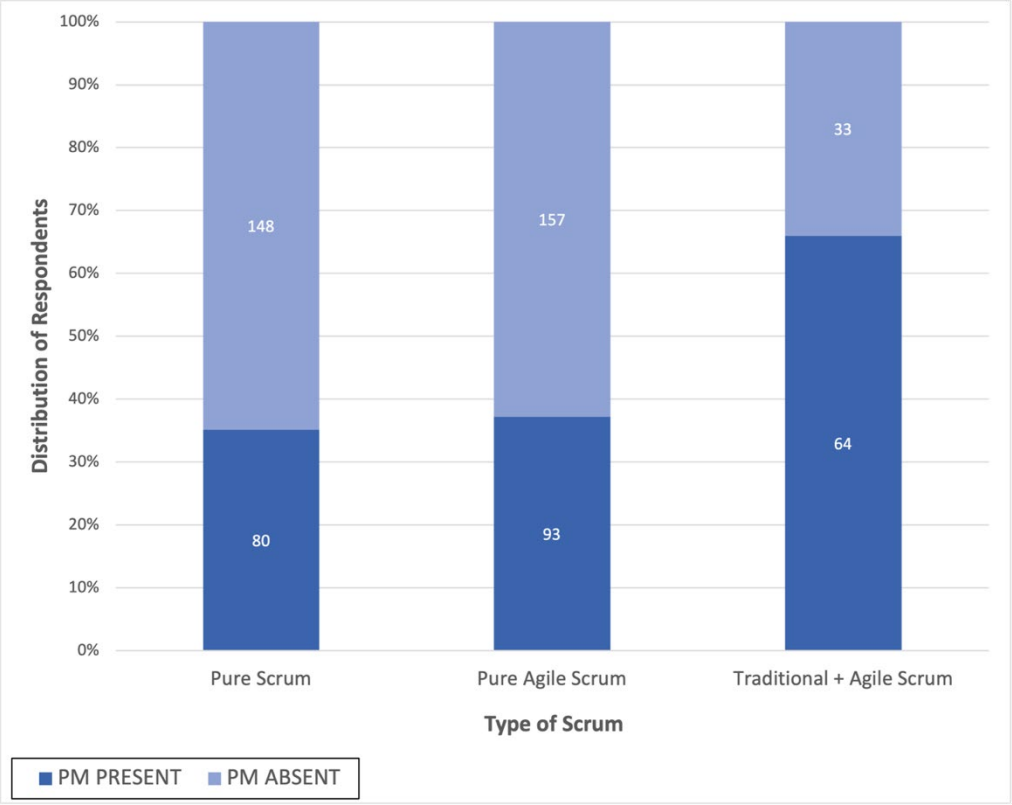
Although the exploratory data shows that there are more Project Managers in Traditional + Agile Scrum hybrids, contemporary literature (Schwaber & Sutherland, 2017) would suggest that regardless of the Scrum hybrid, it should not influence the presence of a Project Manager. Therefore, the eighth null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.8) phase were generated:

$H8_0$: The type of Scrum used, whether it is pure or mixed with another software development methodology, does not affect the presence or absence of a Project Manager in a Scrum Team.

$H8_1$: Scrum mixed with a traditional approach, such as the Waterfall Methodology, increases the presence Project Managers in a Scrum Teams.

Figure 4.26

Project Manager Presence in Scrum Teams According to Scrum with Pure Agile or Agile and Traditional Approach



Note. The numbers within each bar indicate the actual number of respondents. For example, 80 respondents, who used Pure Scrum, indicated they had a Project Manager (PM) while 148 respondents indicated they did not have a Project Manager.

by Scrum Team Size

Another project condition and a possible indicator that could influence the presence or absence of a Project Manager in a Scrum Team is the team's size. The researcher consolidated the survey responses and instead of detailing it by number of members, three groups were made. The main group is Ideal Team Size, which is between three to eleven members as determined in Chapter 2, section 2.4.2. The

other two groups are Less than Ideal Team Size (1-2 members) and More than Ideal Team Size (12 or more).

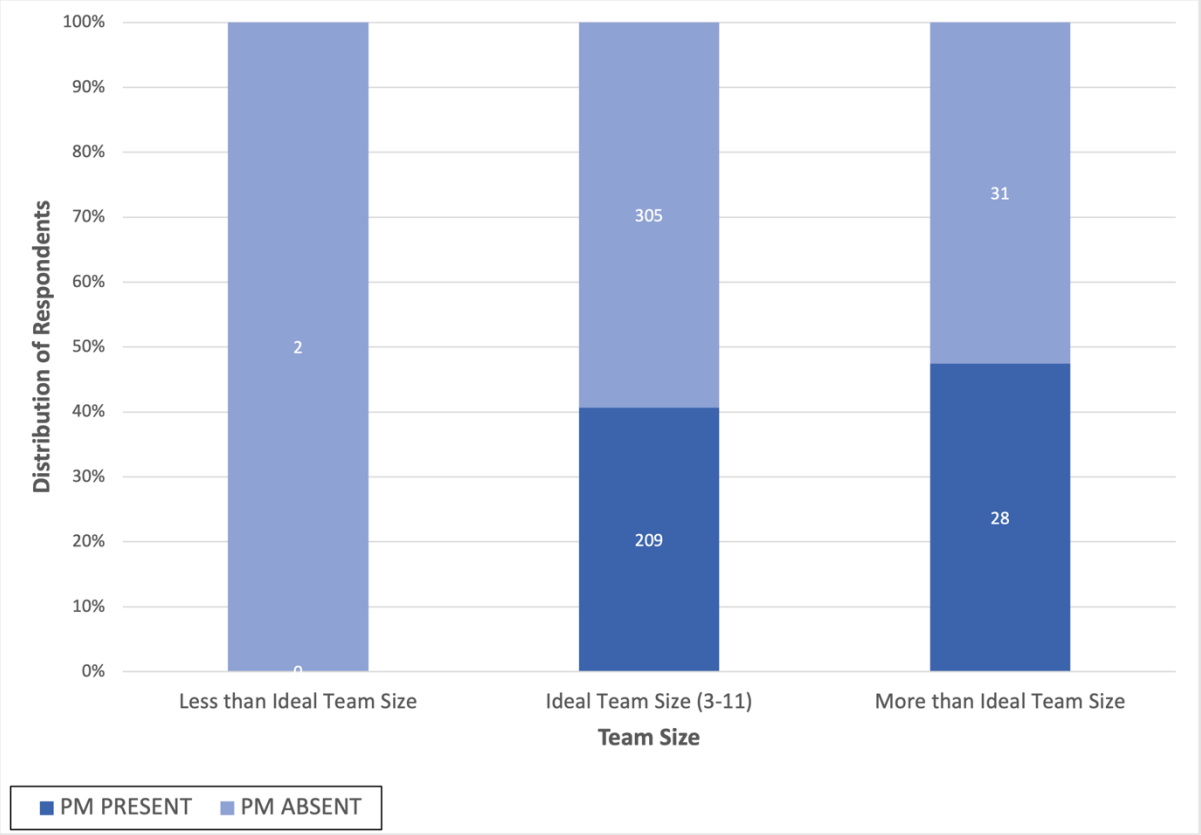
The Exploratory analysis is illustrated in Figure 4.27 below and shows that there is only a seven percent difference of Project Manager presence/absence between the Ideal Team Size and More than Ideal Team Size. This result conforms with the literature (Schwaber & Sutherland, 2017), since the Scrum Framework does not recommend having a Project Manager even if the Scrum Team size is too large. Therefore, the ninth null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.9) phase were generated:

$H9_0$: The Scrum Team size, whether it is within or outside the ideal size, has no impact on the presence or absence of a Project Manager in a Scrum Team.

$H9_1$: Large Scrum Teams outside the ideal size increases the Project Manager presence.

Figure 4.27

Project Manager Presence in Scrum Teams According to Scrum Team Size



Note. The numbers within each bar indicate the actual number of respondents. For example, 209 respondents, who worked within the ideal team size of three to 11 members, indicated they had a Project Manager (PM) while 305 respondents indicated they did not have a Project Manager.

by Number of Scrum Teams

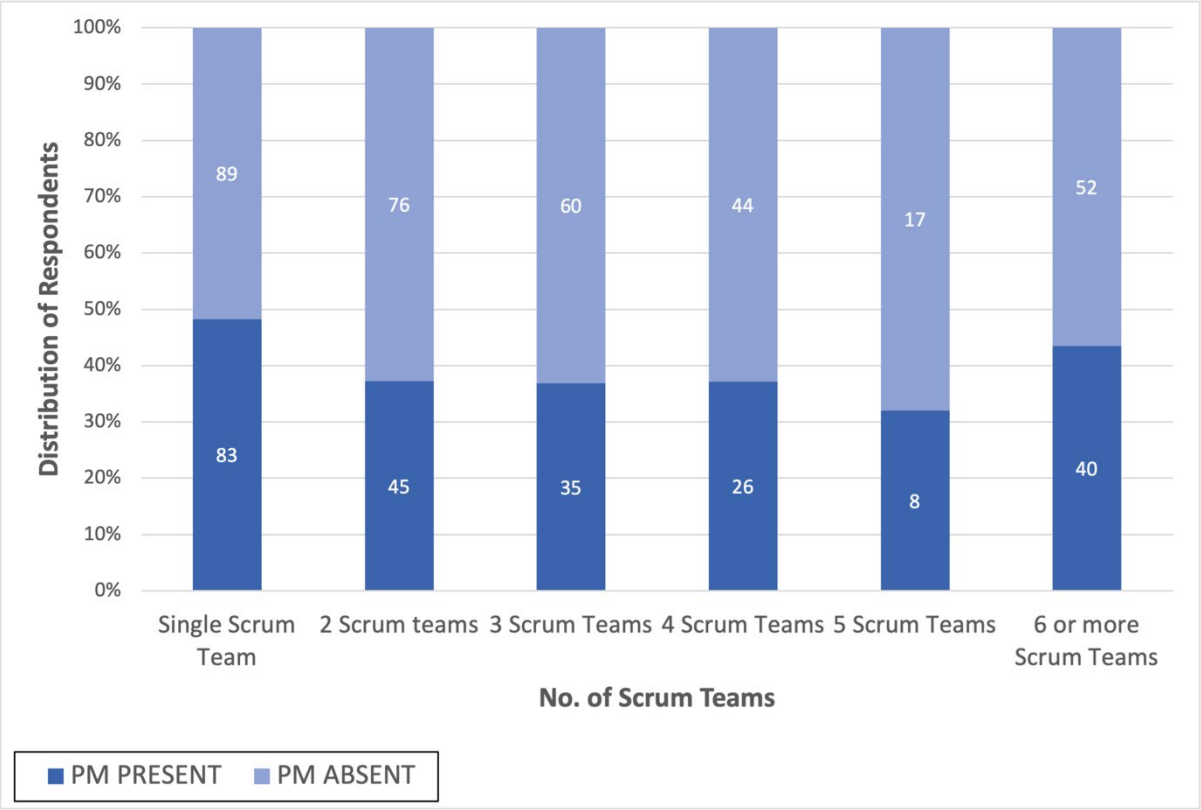
Having more than one Scrum Team working on a project presumably increases coordination work and overall complexity, which might indicate a role like a Project Manager would be best suited to assist in these challenges. However, the Descriptive analysis revealed this is not the obvious pattern. Figure 4.28 below illustrates that the Project Manager presence stayed below 50% regardless of the number of Scrum Teams collaborating, which corroborates Scrum literature

(Schwaber & Sutherland, 2017). Furthermore, the complete opposite of the assumption occurred, and analysis unveiled the highest instance of Project Manager presence happened in the Single Scrum Team group (n=83), compared to Project Managers present in two Scrum Teams (n=45), three Scrum Teams (n=35), four Scrum Teams (n=26), five Scrum Teams (n=8), and six or more Scrum Teams (n=40). There was no clear trend, however, the variation is obvious between the different groups. Therefore, the tenth null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.10) phase were generated:

> *$H10_0$: The number of Scrum Teams collaborating on a single project does not influence the presence or absence of a Project Manager in a Scrum Team.*
> *$H10_1$: The number of Scrum Teams collaborating on a project influences the presence of Project Managers in Scrum Teams.*

Figure 4.28

Project Manager Presence in Scrum Teams According to Number of Scrum Teams Collaborating



Note. The numbers within each bar indicate the actual number of respondents. For example, 83 respondents, who worked within only one Scrum Team, indicated they had a Project Manager (PM) while 89 respondents indicated they did not have a Project Manager.

by Scrum Team Member Distribution

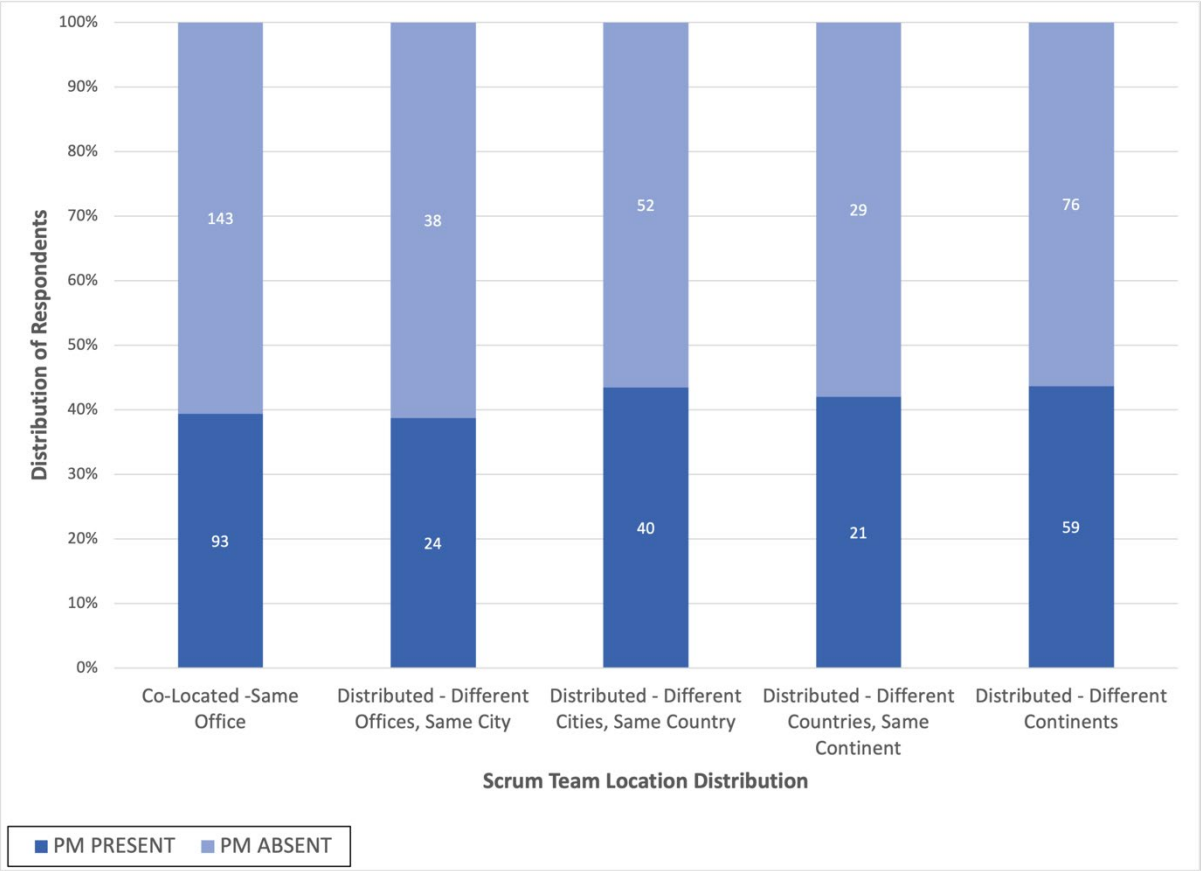
An assumption can be made that a Project Manager would be ideal in scenarios where the project team is located in different places in a country or the world. The task to collaborate and plan work around this setup falls within the Project Manager role's realm. Alternatively, it can be assumed that a Project Manager would

be less ideal if the entire Scrum Team is in one physical office. However, as covered in Chapter 2, section 2.4, Scrum literature does not indicate that a Project Manager is needed if the Scrum Team is globally distributed. Initial Exploratory analysis confirms what literature suggests (Schwaber & Sutherland, 2017) and shows that Project Managers are not markedly increased in distributed teams. Figure 4.29 below illustrates that regardless of the Scrum Team members' geographical distribution, the respondents all report around the same presence/absence of Project Managers in their Scrum Teams. Therefore, the eleventh null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.11) phase were generated:

> *$H11_0$: The geographical distribution of Scrum Team members, whether they all work in the same office or different countries, does not affect the presence or absence of a Project Manager in a Scrum Team.*
>
> *$H11_1$: The geographical distribution of Scrum Team members, whether they all work in the same office or different countries, affects the presence or absence of a Project Manager in a Scrum Team.*

Figure 4.29

Project Manager Presence in Scrum Teams According to Scrum Team Members' Geographical Distribution



Note. The numbers within each bar indicate the actual number of respondents. For example, 93 respondents, who were co-located and worked in the same office, indicated they had a Project Manager (PM) while 143 respondents indicated they did not have a Project Manager.

4.3.5 Perceived Project Outcome

The final survey question not yet discussed in this phase is Perceived Project Outcome. Specifically, the participants were asked, "From your personal perspective, what was that project's outcome?" The question was raised in an attempt to answer the secondary research question, "*Is there a significant relationship between the*

presence or absence of a Project Manager and the perception of project success?" As a reminder, the question seeks to cover the "perceived" success or failure, since real metrics for success/failure are arbitrary and can vary depending on the person asked.

After they were asked the question, the participants were given the options of "It was a success", "It was a failure", "It was partly successful and partly a failure", and "I don't know what the outcome was."

Figure 4.30 below describes the distribution of responses and outlines 70% of respondents perceive their project was a success (n=405). Only 1% marked their Scrum project as a perceived failure (n=8), 27% reported they perceived it was a mix of both success and failure (n=154), and another 1% did not know the outcome (n=8).

Figure 4.30

Respondent's Perceived Project Outcome Distribution

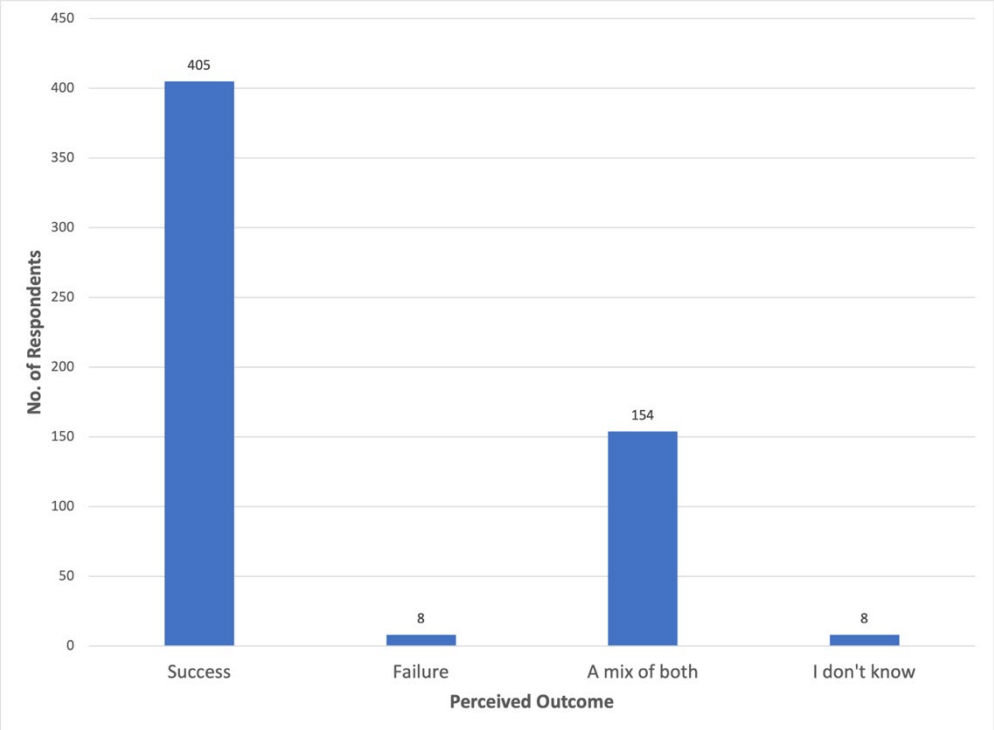
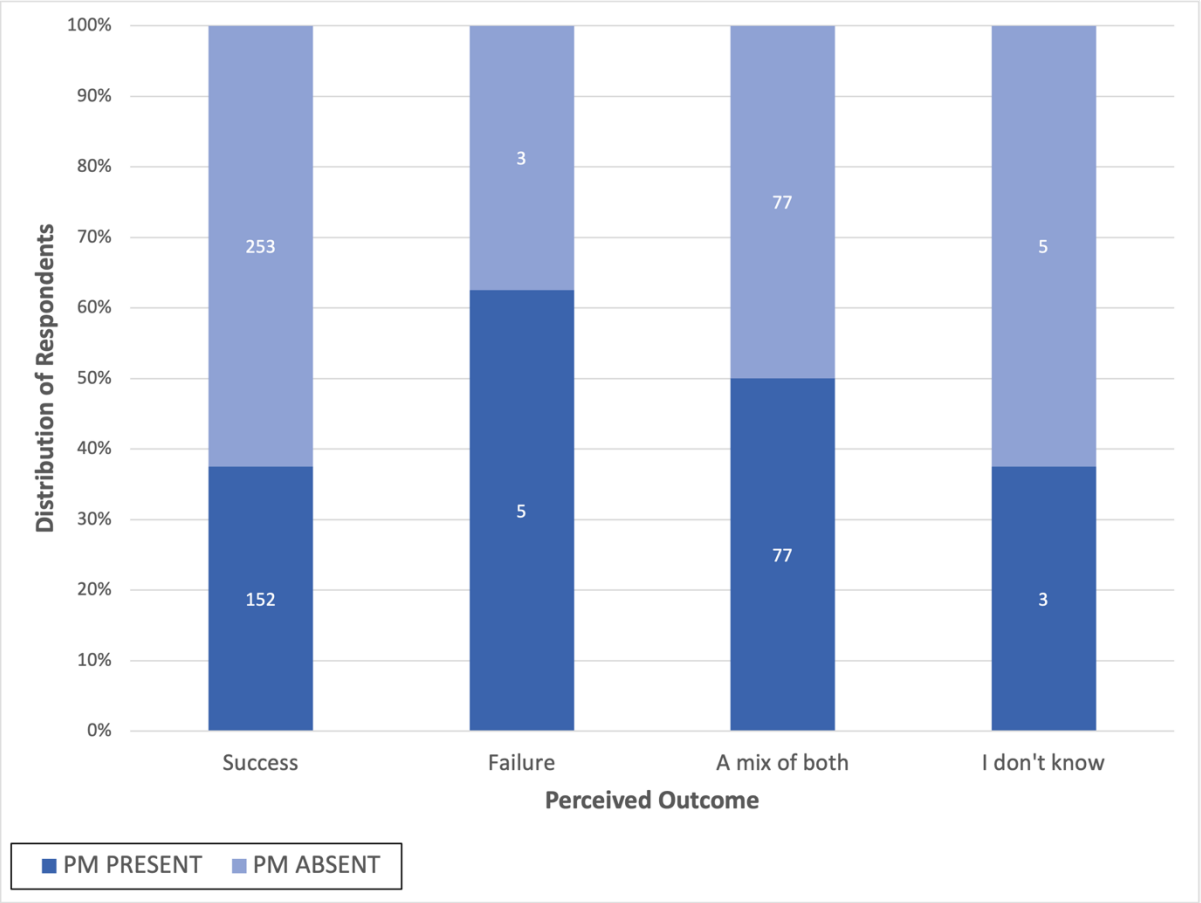


Figure 4.31 below breaks down the distribution of the participants' perceived project outcome by presence or absence of the Project Manager. There is a visual opposite relationship of lower Project Manager presence in respondents who reported they perceived success in their project (37.5%) and higher Project Manager presence in those who reported a perceived failure (62.5%). However, this is inconclusive because the 62.5% translates to only five respondents out of eight total who reported a perceived failure in the survey.

Figure 4.31

Distribution of Project Manager Presence in Scrum Teams Based on Respondent's Perceived Project Outcome



Note. The numbers within each bar indicate the actual number of respondents. For example, 152 respondents, who perceived success as the outcome, indicated they had a Project Manager (PM) while 253 respondents indicated they did not have a Project Manager.

From this initial result, the survey failed to collect enough "failure" responses to attempt and create a clear delineation in exploratory analysis. Considering there is not enough literature and industry data to support how Project Managers affect the perception of project success, it is assumed the role does not affect the outcome perception. Therefore, further analysis and consideration will be done on this pair of variables with the understanding that finding the significance or insignificance of their relationship will answer the secondary objective. Therefore, the twelfth null and alternative hypotheses for testing at the Inferential Analysis (section 4.4.12) phase were generated:

> *$H12_0$: The presence or absence of a Project Manager does not influence the perception of project success.*
>
> *$H12_1$: The presence or absence of a Project Manager influences the perception of project success.*

4.4 Inferential Analysis

This subsection aims to test all the hypotheses generated from the Descriptive Analysis phase in section 4.3. By being able to determine whether each hypothesis can be accepted or rejected, the researcher was able to generate a more robust answer to the primary research question

"*What project conditions are true for software projects that use the Scrum Framework with the accompanied presence or absence of a Project Manager?"*

As discussed in Chapter 3 (section 3.11), the researcher will use either the Chi-Square test or the Mann-Whitney U test to determine the p-value of the variables in the hypothesis validated. The Chi-Square Test was the preferred choice to test all the hypotheses formulated in the previous section. In some instances, the Mann-Whitney U Test was utilised as a secondary way to validate hypothesis with categorical data that could be treated ordinally (e.g. "1-2 months", "2-3 months", and so on). The confidence level is assumed to be 95%, which means the significance level is five percent. Therefore, by using these tests and uncovering the *p* values, the researcher was able to reject the null hypotheses in favor of the alternative hypotheses if *p* is lesser than .05 or fail to reject the null hypotheses if *p* is greater than .05 (Nachar, 2008; Ugoni & Walker, 1995).

To prepare for this phase, the researcher created a cross-tabulation of the variables being tested in each hypothesis, which are presented below. Some information was gleaned from the descriptive data and was used to support the result of the hypothesis test findings.

The cyclical approach to the data analysis ultimately yielded 12 null and alternative hypotheses that the researcher considered of relevant importance and subsequently tested to support in answering the primary research question. The following subsections are divided by each of the null and alternative hypotheses generated and will be presented by reviewing the null and alternative hypotheses, then the findings, and the cross-tabulation used in testing.

4.4.1 Hypotheses 1

Null Hypothesis 1: The location of the Scrum project does not affect the decision to include or not include a Project Manager in the team.

Alternative Hypothesis 1: The location of the Scrum project affects the decision to include or not include a Project Manager in the team.

Findings: Table 4.1 below illustrates the result of the cross-tabulation analysis between the project location and the presence or absence of a Project Manager. Testing the hypothesis revealed $p = .86$, which indicates $p > .05$ and is not significant. Therefore, the project location does not affect the presence or absence of a Project Manager.

Conclusion: Null Hypothesis 1 cannot be rejected.

Table 4.1

Cross-Tabulation of Scrum Project Location and Project Manager Presence

			PM		Total by Country
			Absent	Present	
COUNTRY	Australia	Count	93	63	156
		% of Total	16.2%	11.0%	27.1%
	New Zealand	Count	73	54	127
		% of Total	12.7%	9.4%	22.1%
	Indonesia	Count	36	21	57
		% of Total	6.3%	3.7%	9.9%
	Malaysia	Count	27	13	40
		% of Total	4.7%	2.3%	7.0%
	Philippines	Count	57	45	102
		% of Total	9.9%	7.8%	17.7%
	Singapore	Count	28	21	49
		% of Total	4.9%	3.7%	8.5%
	Vietnam	Count	24	20	44
		% of Total	4.2%	3.5%	7.7%
	Total by PM Presence	Count	338	237	575
		% of Total	58.8%	41.2%	100.0%
					Chi-Square *p* value = .86

4.4.2 Hypotheses 2

Null Hypothesis 2: The foundational instruction of Scrum, whether it is learned from school, from work, or self-taught, does not affect the presence or absence of a Project Manager in the team.

Alternative Hypothesis 2: The foundational instruction of Scrum, whether it is learned from school, from work, or self-studied, affects the presence or absence of a Project Manager in the team.

Findings: Table 4.2 below illustrates the result of the cross-tabulation analysis between the source of the respondent's Scrum training and the presence or absence of a Project Manager. Testing the hypothesis revealed $p = .78$, which indicates $p > .05$ and is not significant. Therefore, the foundational instruction of Scrum should not affect the presence or absence of a Project Manager.

Conclusion: Null Hypothesis 2 cannot be rejected.

Table 4.2

Cross-Tabulation of Scrum Training and Project Manager Presence

			PM		Total by Training
			Absent	Present	
TRAINING	Learned Scrum at School	Count	16	11	27
		% of Total	2.8%	1.9%	4.7%
	Self-Taught	Count	90	57	147
		% of Total	15.7%	9.9%	25.6%
	Learned Scrum at Work	Count	232	169	401
		% of Total	40.3%	29.4%	69.7%
	Total by PM Presence	Count	338	237	575
		% of Total	58.8%	41.2%	100.0%
					Chi-Square *p* value = .78

4.4.3 Hypotheses 3

Null Hypothesis 3: Experience in Scrum does not influence the presence or absence of a Project Manager in a Scrum Team.

Alternative Hypothesis 3: More than four years' experience with Scrum diminishes the presence of a Project Manager in Scrum Teams.

Findings: Table 4.3 below illustrates the result of the cross-tabulation analysis between the respondent's overall experience with Scrum and the presence or absence of a Project Manager. Testing the hypothesis revealed $p = .02$, which indicates $p < .05$ and is significant. By looking at the descriptive statistics in Table 4.3, it is clear that respondents with zero to four years' experience have roughly an equal distribution between having and not having a Project Manager. On the other hand, Scrum professionals with more than four years' experience are more inclined to be involved in software projects without a Project Manager.

As a further way to validate the finding, the responses for the Scrum Experience survey questions could be considered ordinal data (e.g. "1-2 years", "2-3 years", and so on). A Mann-Whitney U test was performed and it reported $p = .04$, which is still significant and serves to reject the null hypothesis.

Therefore, the overall experience with Scrum can influence the presence or absence of a Project Manager. According to the survey data, respondents with more than four years' experience in Scrum are less predisposed to having a Project Manager in their Scrum Team.

Conclusion: Null Hypothesis 3 is rejected in favour of Alternative Hypothesis 3.

Table 4.3

Cross-Tabulation of Scrum Experience and Project Manager Presence

			PM		Total by Experience
			Absent	Present	
EXPERIENCE	Less than a year	Count	14	18	32
		% of Total	2.4%	3.1%	5.6%
	1-2 years	Count	38	32	70
		% of Total	6.6%	5.6%	12.2%
	2-3 years	Count	59	40	99
		% of Total	10.3%	7.0%	17.2%
	3-4 years	Count	35	41	76
		% of Total	6.1%	7.1%	13.2%
	4-5 years	Count	67	30	97
		% of Total	11.7%	5.2%	16.9%
	More than 5 years	Count	125	76	201
		% of Total	21.7%	13.2%	35.0%
	Total by PM Presence	Count	338	237	575
		% of Total	58.8%	41.2%	100.0%
			Chi-Square *p* value = .02	Mann-Whitney U *p* value = .04	

4.4.4 Hypotheses 4

Null Hypothesis 4: Scrum certification status has no impact on the presence or absence of a Project Manager in a Scrum Team.

Alternative Hypothesis 4: Scrum certification status has an impact on the presence or absence of a Project Manager in a Scrum Team.

Findings: Table 4.4 below illustrates the result of the cross-tabulation analysis between the source of the respondent's Scrum certification and the presence or absence of a Project Manager. For this test, five respondents in the sample were removed because they did not know if they had a Scrum certification or

not. Testing the hypothesis revealed $p = .11$, which indicates $p > .05$ and is not significant. Therefore, the status of Scrum certification has no impact on the presence or absence of a Project Manager.

Conclusion: Null Hypothesis 4 cannot be rejected.

Table 4.4

Cross-Tabulation of Scrum Certification and Project Manager Presence

			PM		Total by Certification
			Absent	Present	
CERTIFICATION	Certified	Count	262	168	430
		% of Total	46.0%	29.5%	75.4%
	Not Certified	Count	74	66	140
		% of Total	13.0%	11.6%	24.6%
	Total by PM Presence	Count	336	234	570
		% of Total	58.9%	41.1%	100.0%
					Chi-Square p value = .11

4.4.5 Hypotheses 5

Null Hypothesis 5: The length of a Scrum software project has no effect on the presence or absence of a Project Manager in a Scrum Team.

Alternative Hypothesis 5: The length of a Scrum software project has an effect on the presence or absence of a Project Manager in a Scrum Team.

Findings: Table 4.5 below illustrates the result of the cross-tabulation analysis between the Scrum project length and the presence or absence of a Project

Manager. Testing the hypothesis revealed $p = .43$, which indicates $p > .05$ and is not significant. As a second measure to validate the finding, the responses for the Project Timeline survey questions could be considered ordinal data (e.g. “1-2 months”, “2-3 months”, and so on). A Mann-Whitney U test was done and it unveiled $p = .69$, which is still not significant and serves to accept the null hypothesis.

Therefore, the length of the Scrum project has no effect on the presence or absence of a Project Manager.

Conclusion: Null Hypothesis 5 cannot be rejected.

Table 4.5

Cross-Tabulation of Project Length and Project Manager Presence

			PM		Total by Project Length
			Absent	Present	
PROJECT LENGTH	0-6 Months	Count	156	101	257
		% of Total	27.1%	17.6%	44.7%
	7-12 Months	Count	69	59	128
		% of Total	12.0%	10.3%	22.3%
	More than a year	Count	113	77	190
		% of Total	19.7%	13.4%	33.0%
Total by PM Presence		Count	338	237	575
		% of Total	58.8%	41.2%	100.0%
			Chi-Square p value = .43	Mann-Whitney U p value = .69	

4.4.6 Hypotheses 6

Null Hypothesis 6: The scope of the project, whether it is to work on a new software product or continue work on an existing product, has no effect on the presence or absence of a Project Manager in a Scrum Team.

Alternative Hypothesis 6: The scope of the project, whether it is to work on a new software product or continue work on an existing product, has an effect on the presence or absence of a Project Manager in a Scrum Team.

Findings: Table 4.6 below illustrates the result of the cross-tabulation analysis between the scope of the project, whether it is considered a new software project or an existing product, and the presence or absence of a Project Manager. Testing the hypothesis reported $p = .002$, which indicates $p < .05$ and is significant. By looking at the descriptive statistics in Table 4.6, it is immediately apparent that new software projects have a roughly equal distribution between those that have and do not have a Project Manager. However, projects continuing product development have a higher absence of Project Managers (66%) compared to those that do have a Project Manager present (44%).

Therefore, the project type, whether if it's a new software project or existing product development, has an effect on the presence or absence of a Project Manager. Based on the data presented, Scrum Teams working on existing products are less inclined to have a Project Manager.

Conclusion: Null Hypothesis 6 is rejected in favour of Alternative Hypothesis 6.

Table 4.6

Cross-Tabulation of Project Scope and Project Manager Presence

			PM		Total by Project Type
			Absent	Present	
NEW OR EXISTING	New Software Projects	Count	162	146	308
		% of Total	28.2%	25.4%	53.6%
	Continuing Product Development	Count	176	91	267
		% of Total	30.6%	15.8%	46.4%
	Total by PM Presence	Count	338	237	575
		% of Total	58.8%	41.2%	100.0%
					Chi-Square *p* value = .002

4.4.7 Hypotheses 7

Null Hypothesis 7: The kind of new software project developed does not determine the presence or absence of a Project Manager in a Scrum Team.

Alternative Hypothesis 7: The kind of new software project developed does determine the presence or absence of a Project Manager in a Scrum Team.

Findings: Table 4.7 below illustrates the result of the cross-tabulation analysis between the new software project type and the presence or absence of a Project Manager. Testing the hypothesis unveiled $p = .24$, which indicates $p > .05$ and is not significant. Therefore, the kind of new software project being developed does not determine the presence or absence of a Project Manager.

Conclusion: Null Hypothesis 7 cannot be rejected.

Table 4.7

Cross-Tabulation of New Software Project Type and Project Manager Presence

			PM		Total by New Project Type
			Absent	Present	
NEW PROJECT TYPE	Data Product Development	Count	19	15	34
		% of Total	7.0%	5.5%	12.5%
	Desktop Application	Count	7	5	12
		% of Total	2.6%	1.8%	4.4%
	Embedded Development	Count	1	3	4
		% of Total	.4%	1.1%	1.5%
	Framework or Library Development	Count	2	1	3
		% of Total	.7%	.4%	1.1%
	IT or Digital Process	Count	15	10	25
		% of Total	5.5%	3.7%	9.2%
	Mobile Applications	Count	36	19	55
		% of Total	13.2%	7.0%	20.1%
	System Development	Count	15	10	25
		% of Total	5.5%	3.7%	9.2%
	Web application	Count	75	32	107
		% of Total	27.5%	11.7%	39.2%
	Website	Count	8	0	8
		% of Total	2.9%	0.0%	2.9%
	Total by PM Presence	Count	178	95	273
		% of Total	65.2%	34.8%	100.0%
					Chi-Square *p* value = .24

4.4.8 Hypotheses 8

Null Hypothesis 8: The type of Scrum used, whether it is pure or mixed with another software development methodology, does not affect the presence or absence of a Project Manager in a Scrum Team.

Alternative Hypothesis 8: Scrum mixed with a traditional approach, such as the Waterfall Methodology, increases the presence Project Managers in a Scrum Teams.

Findings: Table 4.8 below illustrates the result of the cross-tabulation analysis between the type of Scrum used and the presence or absence of a Project Manager. From the original distribution in subsection 4.3.3.4, the researcher consolidated all Scrum mixed with Agile approaches to “Pure Agile Scrum”, all Scrum mixed with Waterfall and Agile approaches to “Traditional + Agile Scrum”, and retained the “Pure Scrum” group.

Testing the hypothesis revealed $p = .001$, which indicates $p < .05$ and is significant. By reviewing the descriptive statistics in Table 4.8, Pure Scrum and Pure Agile Scrum represent an inverse relationship with Traditional + Agile Scrum. It can be distinguished that there are lower instances of Project Manager presence in Pure Scrum and Pure Agile Scrum, and a higher instance of Project Manager presence in Tradition + Agile Scrum.

Therefore, the Scrum type used, whether if it’s Pure Scrum, Pure Agile Scrum, or Traditional + Agile Scrum, affects the presence of a Project Manager. Based on the data presented, Scrum Teams mixed with traditional methodologies have a higher presence of Project Managers and those that remain pure Scrum or purely Agile with Scrum have a lower presence of Project Managers.

Conclusion: Null Hypothesis 8 is rejected in favour of Alternative Hypothesis 8.

Table 4.8

Cross Tabulation of Type of Scrum and Project Manager Presence

			PM		Total by Scrum Form
			Absent	Present	
SCRUM TYPE	Pure Scrum	Count	148	80	228
		% of Total	25.7%	13.9%	39.7%
	Pure Agile Scrum	Count	157	93	250
		% of Total	27.3%	16.2%	43.5%
	Traditional + Agile Scrum	Count	33	64	97
		% of Total	5.7%	11.1%	16.9%
	Total by PM Presence	Count	338	237	575
		% of Total	58.8%	41.2%	100.0%
					Chi-Square *p* value = .001

4.4.9 Hypotheses 9

Null Hypothesis 9: The Scrum Team size, whether it is within or outside the ideal size, has no impact on the presence or absence of a Project Manager in a Scrum Team.

Alternative Hypothesis 9: Large Scrum Teams outside the ideal size increases the Project Manager presence.

Findings: Table 4.9 below illustrates the result of the cross-tabulation analysis between Scrum Team size, whether it is within the idea 3-11 members or outside of that range, and the presence or absence of a Project Manager. Testing the hypothesis reported $p = .52$, which indicates $p > .05$ and is not significant. Therefore, the Scrum Team size has no impact on the presence or absence of a Project Manager.

Conclusion: Null Hypothesis 9 cannot be rejected.

Table 4.9

Cross-Tabulation of Scrum Team Size and Project Manager Presence

			PM		Total by Team Size
			Absent	Present	
TEAM SIZE	Ideal Team Size (3-11)	Count	305	209	514
		% of Total	53.0%	36.3%	89.4%
	NOT Ideal Team Size	Count	33	28	61
		% of Total	5.7%	4.9%	10.6%
	Total by PM Presence	Count	338	237	575
		% of Total	58.8%	41.2%	100.0%
					Chi-Square *p* value = .52

4.4.10 Hypotheses 10

Null Hypothesis 10: The number of Scrum Teams collaborating on a single project does not influence the presence or absence of a Project Manager in a Scrum Team.

Alternative Hypothesis 10: The number of Scrum Teams collaborating on a project influences the presence of Project Managers in Scrum Teams.

Findings: Table 4.10 below illustrates the result of the cross-tabulation analysis between number of Scrum Teams collaborating in a single software project and the presence or absence of a Project Manager. Testing the hypothesis revealed $p = .25$, which indicates $p > .05$ and is not significant. As a second measure to confirm the finding, the responses for the Team Collaboration survey questions could be considered ordinal data (e.g. “1 team”, “2 teams”, “3 teams” and so on). A Mann-Whitney U test was performed and it reported $p = .16$, which is still not significant and affirms that the null hypothesis should be accepted.

Therefore, having a single or multiple Scrum Teams collaborating on a project does not influence the presence or absence of a Project Manager.

Conclusion: Null Hypothesis 10 cannot be rejected.

Table 4.10

Cross-Tabulation of Team Collaboration and Project Manager Presence

			PM		Total by Team Collaboration
			Absent	Present	
TEAM COLLABORATION	Single Scrum Team	Count	89	83	172
		% of Total	15.5%	14.4%	29.9%
	2 Scrum Teams	Count	76	45	121
		% of Total	13.2%	7.8%	21.0%
	3 Scrum Teams	Count	60	35	95
		% of Total	10.4%	6.1%	16.5%
	4 Scrum Teams	Count	44	26	70
		% of Total	7.7%	4.5%	12.2%
	5 Scrum Teams	Count	17	8	25
		% of Total	3.0%	1.4%	4.3%
	6 or more Scrum Teams	Count	52	40	92
		% of Total	9.0%	7.0%	16.0%
	Total by PM Presence	Count	338	237	575
		% of Total	58.8%	41.2%	100.0%
			Chi-Square *p* value = .25	Mann-Whitney U *p* value = .16	

4.4.11 Hypotheses 11

Null Hypothesis 11: The geographical distribution of Scrum Team members, whether they all work in the same office or different countries, does not affect the presence or absence of a Project Manager in a Scrum Team.

Alternative Hypothesis 11: The geographical distribution of Scrum Team members, whether they all work in the same office or different countries, affects the presence or absence of a Project Manager in a Scrum Team.

Findings: Table 4.11 below illustrates the result of the cross-tabulation analysis between the Scrum Team members' geographical distribution and the presence or absence of a Project Manager. Testing the hypothesis unveils p =.91, which indicates $p > .05$ and is not significant. As a separate way to corroborate this finding, the responses for the Team Distribution survey questions could be considered ordinal data (e.g. "same city", "same country", and so on). A Mann-Whitney U test was performed and it reported $p = .38$, which is still not significant and serves to validate the null hypothesis. Lastly, the researcher consolidated all distributed cases into one and tested it again as illustrated in Table 4.12 below. The third test still showed a statistically insignificant result of $p = .46$.

Therefore, the team members' work locations relative to one another does not affect the presence or absence of a Project Manager.

Conclusion: Null Hypothesis 11 cannot be rejected.

Table 4.11

Cross-Tabulation between Co-Located or Distributed and Project Manager Presence (Distributed Teams Broken Down)

			PM		Total by Team Distribution
			Absent	Present	
TEAM DISTRIBUTION	Co-Located -Same Office	Count	143	93	236
		% of Total	24.9%	16.2%	41.0%
	Distributed - Different Offices, Same City	Count	38	24	62
		% of Total	6.6%	4.2%	10.8%
	Distributed - Different Cities, Same Country	Count	52	40	92
		% of Total	9.0%	7.0%	16.0%
	Distributed - Different Countries, Same Continent	Count	29	21	50
		% of Total	5.0%	3.7%	8.7%
	Distributed - Different Continents	Count	76	59	135
		% of Total	13.2%	10.3%	23.5%
	Total by PM Presence	Count	338	237	575
		% of Total	58.8%	41.2%	100.0%
			Chi-Square *p* value = .91	Mann-Whitney U *p* value = .38	

Table 4.12

Cross-Tabulation between Co-Located or Distributed and Project Manager Presence (Consolidated Distributed Teams)

		PM		Total by Location
		Absent	Present	
TEAM DISTRIBUTION	Co-Located	143	93	236
	Distributed	195	144	339
	Total by PM Presence	338	237	575
			Chi-Square *p* value = .46	

4.4.12 Hypotheses 12

Null Hypothesis 12: The presence or absence of a Project Manager does not influence the perception of project success.

Alternative Hypothesis 12: The presence or absence of a Project Manager influences the perception of project success.

Findings: Ultimately, the results of testing null hypothesis 12 answered the secondary objective that sought to establish a significant relationship between Project Manager presence or absence and perception of project success. Will having a Project Manager affect project success in the eyes of the participant?

Table 4.13 below illustrates the result of the cross-tabulation analysis between the presence or absence of a Project Manager and perceived project outcome, whether it was a success, a failure, partially successful and partially a failure (mix of both), or if the respondent doesn't know. By using the Chi-Square test to appraise the hypothesis, it revealed $p = .03$, which indicates $p < .05$ and that it is significant. An inverse relationship was observed with the Project Manager's presence and perceived project outcome. Of the respondents who declared project success, 62.4% of them reported a Project Manager was absent while 62.5% of the respondents who declared they failed reported a Project Manager present. However, this becomes questionable since the latter is only represented by five out of eight respondents who declared project failure in the entire survey. Therefore, the researcher decided to amend the definition of perceived project success or failure and repeat the hypothesis testing using the change in approach.

Table 4.13

Cross-Tabulation of Project Manager Presence and Perceived Project Outcome (Partial Success/Failure and Failure Not Combined)

			PM		Total by Project Outcome
			Absent	Present	
OUTCOME	I don't Know	Count	5	3	8
		% of Total	. 9%	.5%	1.4%
	Success	Count	253	152	405
		% of Total	44.0%	26.4%	70.4%
	Failure	Count	3	5	8
		% of Total	.5%	.9%	1.4%
	Mix of both	Count	77	77	154
		% of Total	13.4%	13.4%	26.8%
	Total by PM Presence	Count	338	237	575
		% of Total	58.8%	41.2%	100.0%
					Chi-Square *p* value = .03

According to Sudhakar (2016), a project can be considered successful or a failure based on a host of different perspectives and opinions. Sudhakar (2016) believes that success to the project team members may not be success to the stakeholders. Therefore, the researcher argues in order to help quantify this problem better, the perception of success or failure should be more absolute: a perceived outcome is either only a success or not a success. In order for a project to be considered a success, then it should not contain an element of failure. In the case of the survey, an option was provided for participants to declare the perceived outcome was “partly successful and partly a failure.” Although the nature of the quantitative survey is not able to reveal why the respondent chose “partly successful and partly a

failure", the researcher believes that this may be related to Sudhakar's argument on difference of opinions with outcomes. Following a more absolute viewpoint to perceived outcome, respondents who chose the "It was a success" option in the survey will be grouped to "Success" and respondents who chose "It was a failure" and "It was partly successful and partly a failure" will be grouped in "Not a success", while respondents who chose "I don't know what the outcome was" shall be omitted. Table 4.14 below shows a cross-tabulation analysis of the new grouping. A new Chi-Square test based on Table 4.14 below reveals $p = .006$, which indicates $p < .05$ and that it is still significant.

Therefore, the secondary objective "*Is there a significant relationship between the presence or absence of a Project Manager and the perception of project success?"* has been answered. The null hypothesis is rejected in favour of the alternative hypothesis and this study finds that the presence of a Project Manager influences the perception of project success. Furthermore, Descriptive Analysis shows that Scrum Teams with no Project Managers had a 12% higher perception of success.

Conclusion: Null Hypothesis 12 is rejected in favour of Alternative Hypothesis 12.

Table 4.14

Cross-Tabulation of Project Manager Presence and Perceived Project Outcome (Regrouped to "Success" and "Not a Success")

			PM		Total by Project Outcome
			Absent	Present	
OUTCOME	Success	Count	253	152	405
		% of Total	44.6%	26.8%	71.4%
	Not a success	Count	80	82	162
		% of Total	14.1%	14.5%	28.6%
	Total by PM Presence	Count	333	234	567
		% of Total	58.7%	41.3%	100.0%
					Chi-Square *p* value = .006

Differing opinions and perspectives about project success and failure may allow for alternative treatment of data. Analysing the data differently may yield different results. For instance, some may argue that only responses of Success and only responses of Failure should be used in the analysis, omitting the other two options, and doing so will result in different values. The line of thinking and argument presented in subsection 4.4.12 reflect the researcher's point of view and best judgment from the data available.

4.5 Chapter Summary

The cyclical approach employed by the researcher led to a robust understanding of the data by iterating through Descriptive and Inferential data analysis. The back-and-forth between Exploratory Analysis and the Null Hypothesis Significance Testing generated 12 hypotheses and their respective statistical

significance or lack of statistical significance. This set the foundational groundwork for further discussion as set out in the next chapter and helped formulate a full-bodied answer to the primary research question seeking to understand the conditions true in Scrum projects that had or did not have a Project Manager present. Lastly, the secondary objective seeking to find if there was a significant relationship between the presence or absence of a Project Manager and the perception of project success was answered in this phase. It was found that the presence of a Project Manager in a Scrum Team affects the team member's perception of the project outcome. The descriptive data reveals the perception of success is lower with the presence of a Project Manager in the Scrum Team.

Chapter 5

Discussion and Conclusion

5.1 Introduction

Chapter 5 discusses the findings presented in Chapter 4 by first reviewing the information uncovered by this study, then comparing to the theoretical framework as discussed in Chapter 2. This will be followed by the data and findings presented being compared to other research and industry reports. The contribution of the study findings is then discussed, followed by the implications of the research discoveries and a conclusion. Finally, the chapter concludes by identifying the limitations of this study and recommendations based on the research restrictions and findings.

5.2 Overview of Findings

In the previous chapter, it was revealed that 41% of the survey respondents in Oceania and Southeast Asia reported there was a Project Manager present in their Scrum Team (n=237). This is highly significant as it validates the need for the study's primary research question. A dilemma was brought about by the argument that the conceptual Scrum Framework should not have a Project Manager, but industry practice highlights the need and, in some cases, the actual presence of the role as discussed in Chapter 2. With almost half of the 575 respondents revealing they still have Project Managers in their Scrum Team, more weight was given to the

importance of having this study's primary research question answered. The primary research question was stated as:

> *What project conditions are true for software projects that use the Scrum Framework with the accompanied presence or absence of a Project Manager?*

By exploring the data generated in the survey, the researcher was able to formulate 12 hypotheses that, after testing and validation, answered the primary research question. Among the 12 null hypotheses that underwent statistical testing in Chapter 3, eight of them could not be rejected. Specifically, they were:

> *$H1_0$: The location of the Scrum project does not affect the decision to include or not include a Project Manager in the team.*
> *$H2_0$: The foundational instruction of Scrum, whether it is learned from school, from work, or self-taught, does not affect the presence or absence of a Project Manager in the team.*
> *$H4_0$: Scrum certification status has no impact on the presence or absence of a Project Manager in a Scrum Team.*
> *$H5_0$: The length of a Scrum software project has no effect on the presence or absence of a Project Manager in a Scrum Team.*
> *$H7_0$: The kind of new software project developed does not determine the presence or absence of a Project Manager in a Scrum Team.*

$H9_0$: The Scrum Team size, whether it is within or outside the ideal size, has no impact on the presence or absence of a Project Manager in a Scrum Team.

$H10_0$: The number of Scrum Teams collaborating on a single project does not influence the presence or absence of a Project Manager in a Scrum Team.

$H11_0$: The geographical distribution of Scrum Team members, whether they all work in the same office or different countries, does not affect the presence or absence of a Project Manager in a Scrum Team.

This implies that project location, source of Scrum training, Scrum certification, project length, new software project type, team size, team collaboration, and geographical distribution of the Scrum Team members did not have any effect to the relative presence of a Project Manager in a software Scrum Team in Oceania and Southeast Asia. Being unable to reject these null hypotheses indicates that Scrum practice in these regions related to the variables in the eight hypotheses listed above conforms more towards the traditional Scrum Framework in literature. This formed the first part of the answer to the primary research question.

However, four of the null hypotheses were revealed to have significant *p* values and were rejected, specifically:

$H3_0$: Experience in Scrum does not influence the presence or absence of a Project Manager in a Scrum Team.

$H6_0$: The scope of the project, whether it is to work on a new software product or continue work on an existing product, has no effect on the presence or absence of a Project Manager in a Scrum Team.

$H8_0$: The type of Scrum used, whether it is pure or mixed with another software development methodology, does not affect the presence or absence of a Project Manager in a Scrum Team.

$H12_0$: The presence or absence of a Project Manager does not influence the perception of project success.

Therefore, these null hypotheses were rejected in favour of the following alternative hypotheses:

$H3_1$: More than four years' experience with Scrum diminishes the presence of a Project Manager in Scrum Teams.

$H6_1$: The scope of the project, whether it is to work on a new software product or continue work on an existing product, has an effect on the presence or absence of a Project Manager in a Scrum Team.

$H8_1$: Scrum mixed with a traditional approach, such as the Waterfall Methodology, increases the presence Project Managers in a Scrum Teams.

$H12_1$: The presence or absence of a Project Manager influences the perception of project success.

These statistically significant findings imply that there are noteworthy relationships between these variables and form the second part of the answer to the primary research question.

Firstly, the experience of practicing Scrum has an impact on the relative presence of a Project Manager. The data reveal that respondents who reported between zero- and four-years' experience with Scrum had roughly an equal

presence and absence of Project Managers in their teams. However, respondents with over four years' experience with the framework showed lesser Project Managers in their Scrum group.

Secondly, the scope of the project, whether it is to develop new software or work on an existing product, affects the presence or absence of a Project Manager. The data reports that there is a lesser need for Project Managers when the project is working on existing software products.

Third, the type of Scrum used, be it purely Scrum, Scrum mixed with other Agile methodologies, or Scrum mixed with Traditional and Agile both, can influence the presence or absence of Project Managers. The data unveils that Project Managers are found more when Scrum Teams are used together with traditional approaches, such as the Waterfall Methodology.

Finally, the respondent's perception of project success is affected by the relative presence or absence of a Project Manager. The study found that more respondents reported perception of success in their project when the Project Manager was absent from the Scrum Team. Moreover, the survey also revealed that more respondents perceived their project was not a success when the Project Manager was present in the Scrum Team. This finding answered the secondary objective:

"*Is there a significant relationship between the presence or absence of a Project Manager and the perception of project success?*"

5.4 Comparison of Research Findings and Theoretical Framework

This section discusses the survey findings that conform with or challenge the conceptual framework of Scrum. Among the survey variables, “Scrum Team Size” and the “Project Manager Presence” produce results that can be compared with the theoretical framework (covered in Chapter 2) and will be discussed below.

5.4.1 Scrum Team size

According to the Scrum framework, the ideal team size of Scrum is one Product Owner, one Scrum Master, and three to nine members of the Development Team (Schwaber & Sutherland, 2017). Schwaber & Sutherland (2017) argue this range is small enough to preserve meaningful interactions that are essential in Scrum and large enough to still be manageable. There are some cases, as demonstrated in the survey, where the Product Owner also plays as a Scrum Master or a part of the Development Team and vice versa as discussed in Chapter 4, section 4.3.1.2. This would mean the ideal team size for Scrum is between three and 11 members.

The survey revealed that almost 90% (89.39%) of respondents (n=514) shared their Scrum Team was between three to 11 members, which validates that this recommendation by the framework works very well in actual industry practice. However, there were 10% (n=59) of respondents who reported they had 12 or more members. Of these 59 respondents, 40 of them are certified Scrum professionals with at least 12 months of experience. Although they only represent seven percent of the total survey population, industry-certified Scrum practitioners with adequate

experience should be expected to hold to guidelines of team sizes, which the authors (Schwaber & Sutherland, 2017) have argued as a contributor to success. However, 26 of the 40 respondents shared they collaborated with at least one other Scrum Team and it is possible that this small group counted members of the other Scrum Teams. Unfortunately, this context could not be captured clearly in the survey. Further research could be undertaken to explore this possibility to further clarify how ideal team size is practiced in the industry to reinforce its effectiveness.

5.4.2 Presence of Project Managers in “Pure Scrum” teams

In the survey conducted, 40% of the respondents (n=228) reported they used Pure Scrum. This would indicate they did not mix the framework with other software development practices or methodologies. Furthermore, stating that they used Pure Scrum implies their application was by the book. However, 80 of the 228 respondents reportedly using Pure Scrum have shared there was a Project Manager role present in their Scrum Team. This is contradictory to the 2020 version of the Scrum Guide, which indicates that there is no such role in the Scrum framework (Schwaber & Sutherland, 2020).

An assumption for this behavior could be made in thinking that these 80 respondents do not completely understand what Scrum is and therefore cannot be relied on to judge what “Pure Scrum” is and what it is not. However, 58 of these 80 respondents have Scrum certifications, which would mean they have complied with industry standards and have a sound theoretical foundation of the framework to merit professional certificates. Therefore, 10% of the entire survey population are known to be competent in their understanding of the theoretical framework and believe they

are practicing Scrum by the book, but also say their team holds a role outside of the actual framework. These two circumstances are contradictory.

This phenomenon raises a few questions. Is there a need to review the certification standards of Scrum organisations across the world? Could the understanding of Scrum be changing outside of the official Scrum Guide as written by its original authors (Schwaber & Sutherland, 2020)? Lastly, since the survey was limited to pre-defined choices, further investigation could be undertaken to explore how Scrum Team members consider their Scrum pure but host a role outside traditional literature.

5.5 Comparison of Research Findings and Industry Data

This section covers study findings that confirm or challenge the observations of previous studies and industry reports.

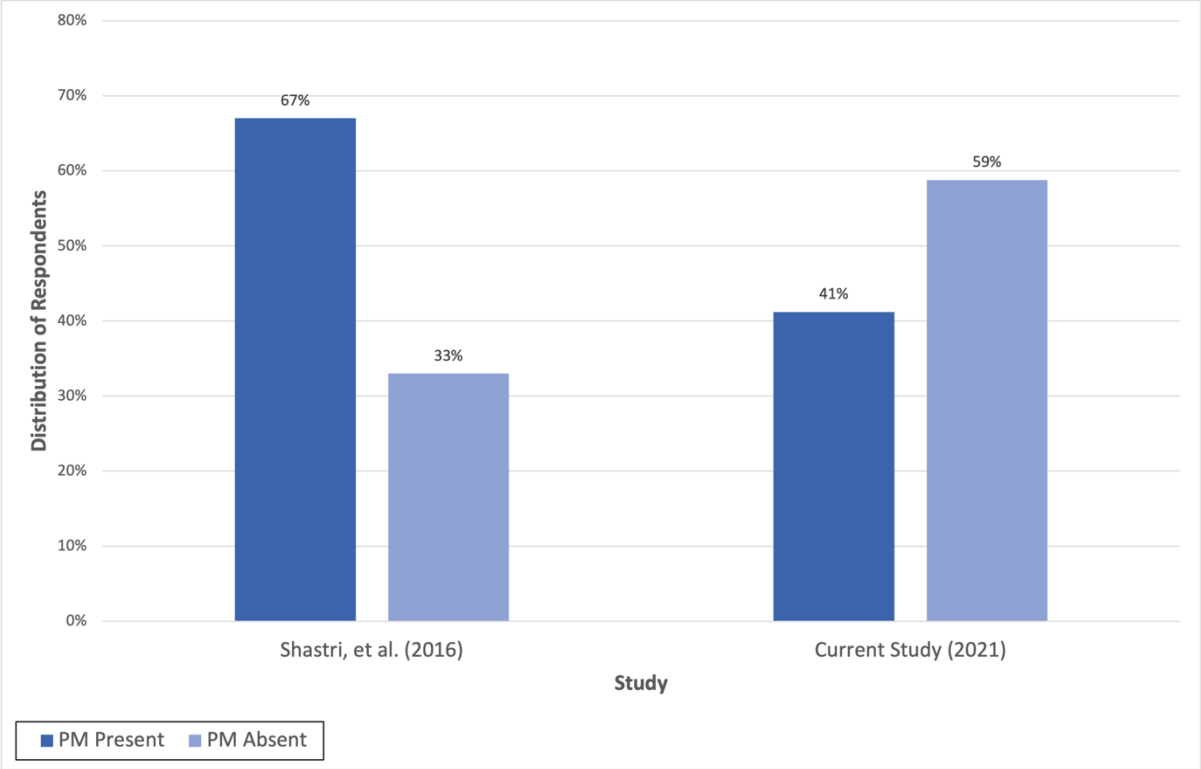
5.5.1 Project Manager Presence

When Shastri, et al. (2016) conducted a similar study, they sought to determine if Project Managers still existed in ASD projects and their study was also conducted virtually through LinkedIn. Their scope differs slightly from this study in that they covered all Agile approaches while the current study only focused on Scrum and its variants. Furthermore, the previous study was global while the current study only focused on two world regions, Oceania and Southeast Asia. Figure 5.1 below illustrates the difference between the 2016 study and this study. There is a clear delineation with regards to the presence or absence of Project Managers in

project teams. The previous 2016 study reported 67% (n=65) of project teams shared they had a Project Manager however this study indicated a decline to 41% (n=237). Alternatively, teams that reported they did not have a Project Manager increased from 33% (n=32) in the 2016 study to 59% (n=338) in this study.

Figure 5.1

Comparison of Project Manager Presence in Project Teams



The declining shift in the Project Manager presence across project teams over the past five years can give an indication of how the role's industry application might be eroding in an Agile environment in the software development industry. This conforms to contemporary literature as well as this study's findings in that Scrum Teams have a lower perception of success when a Project Manager role is present in their project.

5.5.2 Scrum Project Length

The industry report from the Scrum Alliance (2017) indicated that Scrum projects lasted an average of 11.6 weeks, which translates to roughly under three months. However, this study has found only 11% of the respondents reported their Scrum project lasted between two to three months. The other respondents reported 32% had a project timeline of between five to 12 months and a further 33% indicated their project ran for more than a year. A summary can be found in Figure 4.10 in Chapter 4, section 4.3.3.1.

The increase from the average project timeline captured in this study indicates that Scrum has started to move on to bigger software projects. This finding challenges Ozkan and Kucuk's (2016) critique that Scrum is meant for small-scale projects and will struggle with larger ones. The significant portion of respondents who indicated their Scrum projects lasted more than a year might refer to continuing product development and suggest Scrum's industry application is moving away from limited cost projects into persisting product work. This variation between the industry findings warrants further investigation since the implications of Scrum moving away from project work might herald a transformation in the theoretical framework.

5.5.3 Pure Scrum and Scrum Hybrids

Previous studies and industry reports (Shastri, et al., 2016; Scrum Alliance, 2017; CollabNet VersionOne, 2019; Digital.ai, 2020) reveal how Scrum is used in the real-world setting. Table 5.1 below illustrates the use of Pure Scrum, its hybrids, and non-Scrum frameworks used in industry as reported by different studies, reports, and this study.

Table 5.1

Comparison Scrum, Hybrids, and Other Frameworks Used in Industry

Framework Used	Shastri, et al. (2016)	Scrum Alliance (2017)	CollabNet VersionOne (2019)	Digital.ai (2020)	Current Study (2021)**
Pure Scrum	49%	16%	54%	58%	39.7%
Scrum with Kanban	8%	78%*	8%	10%	29.6%
Scrum with Waterfall	3%		ND	ND	10.3%
Scrum with Feature-Driven Development (FDD)	5%		ND	ND	6.4%
Scrum-Kanban-Waterfall	4%		ND	ND	5.7%
Scrum-Kanban-XP	4%		ND	ND	2.8%
Scrum with eXtreme Programming (XP)	1%		10%	8%	1.4%
Scrum-Kanban-FDD	1%		ND	ND	1.4%
Scrum with Adaptive Software Development (ASD)	1%		ND	ND	0.9%
Scrum-SAFe	0%		ND	ND	0.9%
Scrum-XP-Waterfall	2%		ND	ND	0.5%
Scrum-Kanban-XP-FDD-ASD-Waterfall	2%		ND	ND	0.3%
Scrum-lean-XP	0%		ND	ND	0.2%
Other Scrum Hybrids	10%		ND	ND	0.0%
Non-Scrum Frameworks	10%	6%	28%	24%	0.0%

Note. ND = No data

* Scrum Alliance's report consolidated all Scrum hybrids and did not provide a breakdown.

**Better accuracy to figures provided due to access to raw data.

Summary adapted from "Does the "project manager" still exist in agile software development projects?", Y. Shastri, R. Hoda, and R. Amor, 2016, *Proceedings - Asia-Pacific Software Engineering Conference, APSEC, 0*(October 2017), p.57–64. Copyright 2021 by IEEE Explore. Summary adapted from https://www.scrumalliance.org/ScrumRedesignDEVSite/media/ScrumAllianceMedia/Files and PDFs/State of Scrum/2017-SoSR-Final-Version-(Pages).pdf. Copyright 2021 by Scrum Alliance Inc. Summary adapted from https://stateofagile.com/?_ga=2.186885928.1823171340.1616792226- 11212933.1616792226#ufh-i-613553418-13th-annual-state-of-agile-report/7027494. Copyright 2021 by Digital.ai. Summary adapted from https://stateofagile.com/?_ga=2.186885928.1823171340.1616792226-11212933.1616792226#ufh-i-615706098-14th-annual-state-of-agilereport/7027494. Copyright 2021 by Digital.ai.

Before analysing the differences in the various studies and reports over the years, context needs to be established regarding these surveys' sample composition. Shastri et al.'s (2016) study was a global survey of software practitioners and collected 97 responses, coming mostly from North America, Asia (only India), Europe, and a small percentage from Oceania (roughly 2-8%). The Scrum Alliance (2017) industry report had the biggest survey size and was a collection of over 2,000 ICT professionals coming mostly from North and South America, Europe, Asia, with small percentage shared between Africa and Oceania (4%). CollabNet VersionOne (2019) conducted a worldwide survey of roughly 1,300 respondents, which focused on North America, Europe, Asia, with a small representation of Oceania (3%). Digital.ai (2020) was a report from approximately 1,100 respondents with the same geographical concentration as CollabNet VersionOne also reporting a small representation of Oceania (2%). Lastly, this study collected 575 responses localised only within Oceania and Southeast Asia. In comparison to previous reports and as far as the researcher is aware at the time of

writing, this is the first major study of an ICT software development approach with a high representation of Oceania (49% of the respondents).

It is also important to highlight that the previous industry reports in Table 5.1 conducted their study on professionals in the ICT industry regardless of what software development framework they used whereas the current study only focused on ICT professionals that use the Scrum Framework or its hybrids.

Table 5.1 above shows us that all five studies report that Scrum, which includes Pure Scrum and Scrum hybrids, is the most popular framework and dominates the approach to software development models. The fact that the studies were all conducted across different years and were done inter-continentally lends weight and credibility that Scrum is the most dominantly used software development framework to penetrate the industry. Table 5.1 also illustrates that four of the reports indicate using Pure Scrum is the most popular choice among the industry and Scrum with Kanban is consistently the second choice if a hybrid approach was needed.

These findings in industry and supplemented by this study adds more weight to the importance of understanding the project conditions that affect the Project Manager's presence in Scrum Teams.

5.5.4 Scrum Team Member Location Distribution (Co-Located or Distributed)

Shastri, et al. (2016) found that 54% of Agile teams work in different locations. Digital.ai (2020) reported 81% of their respondents were distributed teams (i.e. they did not work in the same office). This study found 59% of the Scrum Teams in Oceania and Southeast Asia worked in separate locations.

Further comparison can be done with Shastri, et al.’s (2016) study as they were able to delineate Project Manager presence between the Co-Located and

Distributed teams. Table 5.2 below illustrates the findings from Shastri, et al. (2016) and this study.

Table 5.2

Comparison of Project Manager Presence Between Co-Located and Distributed Teams

Team Distribution	Shastri, et al. (2016)		Current Study (2021)	
	PM Present	PM Absent	PM Present	PM Absent
Co-Located	26 (40%)	18 (56.25%)	93 (39%)	143 (42%)
Distributed	39 (60%)	14 (43.75%)	144 (61%)	195 (58%)
Total	65 (100%)	32 (100%)	237 (100%)	338 (100%)

This study validates the findings from the previous Shastri, et al., 2016 study. Project Manager presence is almost similar across Scrum Teams that are Co-located and Distributed between the 2016 and present research.

From their data presented, Shastri, et al. (2016) shared a suspicion that an inverse relationship may exist between Project Manager presence and team distribution. They discussed that a Co-located team might have a higher Project Manager absence and Distributed teams might have a higher Project Manager presence. However, this speculation from Shastri, et al. (2016) is put to the test in this study. Using the recent data found, the researcher hypothesised that the geographical distribution of the Scrum Team, whether they work in the same office (Co-located) or different offices (Distributed), does not influence the presence of a Project Manager since there is no indication in literature that a Project Manager

should be present in either scenario (Schwaber & Sutherland, 2017). The researcher did three iterations of *p* value testing and found that there is no Scrum Team location distribution has no impact on the Project Manager presence. The steps taken are defined in detail in Chapter 4, section 4.4.11. Therefore, teams working in the same office or different locations does not influence the decision to include or not include a Project Manager in the Agile or Scrum Team.

5.5.5 Project Outcome

Project success using Scrum is a very important metric in the industry. If the previous subsection has described the prolific use of the framework globally, then it follows that much success is a consequence of using Scrum. As discussed in Chapter 1, success is very arbitrary. Scrum Alliance (2017) reported 63% of their 2000+ respondents indicated their Scrum projects were successful. CollabNet VersionOne (2019) found 95% of their 1,300 respondents shared “some” measure of success with their Agile projects and 48% reported “most” of their Agile projects was a success. Lastly, this study measured success from the personal subjective perception of the respondent. This study found 70% of the 575 respondents shared their Scrum project was a success and 27% reported it was partially successful. Table 5.3 below illustrates comparison of all three reports.

Table 5.3

Comparison of Project Success

Scrum Alliance (2017)	VersionOne (2019)	This Study (2021)
63%	48%*	70%

Note. *Measured all types of Agile projects instead of only Scrum. Only counted responses of projects which were “mostly” successful.

The three studies, completed between 2017 and 2021, show the sustainability of success through the use of Scrum and Agile practice. The Scrum Alliance 2017 report and this study, which were spaced four years apart, both focused on project outcomes exclusively from Scrum Teams and found well over half of the respondents report success.

5.6 Contribution

The findings of this study contribute a lot to different groups of individuals. Now that there is an understanding that project conditions are tied to the presence or absence of Project Managers, professionals involved in Software Project Management can use this information to improve their skills in the related conditions, refine their skillset, and stay relevant according to the demands of the industry. For instance, since this study has found Project Managers were needed more in projects developing new software than they were for existing software projects, then they might consider upskilling in user experience trends, best practices in design, or any

related focus that can be used by software managers to stay competent at working with teams developing something new.

Another group of individuals who could benefit from this study is those in higher-level management, such as business owners, management executives, or project stakeholders. By using this study's findings as to what influences the presence or absence of Project Managers, they can make better planning or cost projections when preparing to run a project. For example, this study found the geographical location of Scrum Team members, whether they work in the same office or are distributed around the world, does not necessarily determine the need for a Project Manager. When businesses need to run a Scrum project with team members in different countries, then they should now know a Project Manager is not required to ensure success.

Lastly, future researchers will be able to use the findings of this study to help bridge the gap caused by the established theoretical framework and actual industry practice. As discussed in the earlier chapters, there is a disconnect between ideal practice defined in the literature and real-world data found in previous studies and industry reports. The findings of this study will hopefully help clarify some of these inconsistencies and pave the way for future researchers to build on this knowledge base through further study.

5.7 Implications and Conclusion

Based on the findings of this study, it has significant implications for the use of Scrum in the industry setting and the Project Manager role. Regardless if the findings were in the form of mere descriptive analysis, significant relationships established in

statistical testing, or even failing to reject the null hypothesis in testing, implications can be derived for practical application.

This study has been able to confirm that almost half of the respondents in Oceania and Southeast Asia still report they have a Project Manager in their Scrum Teams. Although this number is now lower than the findings from a similar study done by Shastri, et al. (2016), the figure is still high enough to be relevant. The implication of this is that the Project Manager role is not completely obsolete even in Scrum-based projects and is a profession that continues to give value proven by the fact of their presence across hundreds of Scrum Teams.

This study also found 70% of respondents first learned about Scrum from work-sponsored training. This implies educational bodies are not offering Scrum as part of the curriculum for undergraduates as they are earning their diplomas or degrees. Considering the widespread dominance of Scrum in software development models in at least the past five years and the fact that the framework was introduced almost 30 years ago, there is strong reason to believe this is not merely a “trend” or “fad”. Academic institutions need to integrate instruction of the framework into their curriculum of ICT-related courses to make certain learning is standardised. This ensures that undergraduates are competent in the industry and improve the quality of young professionals entering the workforce.

This study uncovered at least a third of the respondents reported their Scrum projects lasted more than a year. This goes well beyond the reported 3-month average from a study done four years ago (Scrum Alliance, 2017). This implies that a significant number of teams are either using Scrum for bigger software projects or starting to use Scrum at a sustained development approach or ICT operations, as opposed to fixed-cost and fixed-time projects. This finding challenges Ozkan and

Kucuk's (2016) criticism of Scrum when they argued that the framework is only meant for small-scale projects. The significance of this shift leaves opportunities for further study as it could lead to adjustments in the framework to accommodate longer engagements or as a way to test its current structure's flexibility with new applications.

Another point is the finding that six in every ten of the respondents shared their Scrum Team were working from different offices. This indicates the framework's flexibility for either in-house workgroups or globally distributed teams. Furthermore, there was no significant relationship found between the Project Manager's presence and the location distribution of the Scrum Team members. This study's data implies that having your Scrum Team all sharing a physical workspace, all working from home, or even working from different offices across the globe does not indicate the team should need a Project Manager. This is good news considering how the global pandemic has accelerated digital transformation leaning towards remote teams working from home.

Data from this study also found that the number of people in a single team and situations where multiple Scrum Teams, which expands the headcount, are collaborating in one project also does not influence the decision to include a Project Manager in the Scrum Team to aid in coordination. This challenges the argument made by Noll, et al. (2017) when they highlighted Project Managers are needed in Scrum to handle cross-team management. This finding signifies that the Scrum Framework can scale organisational handling of teams regardless of size without the presence of Project Managers, who traditionally excel at coordination and collaboration.

A discovery from this study was that respondents with longer Scrum experience had an inverse effect on the Project Manager presence, with a statistically significant relationship established. As revealed by the data, this finding should be able to guide managers and executives to avoid introducing a Project Manager role if the Scrum Team has members with over four years' experience. Alternatively, a Project Manager should be considered if team members have less than four years of practice with Scrum.

Furthermore, the presence of Project Managers was affected when Scrum Teams were building completely new software or working on existing ones. Project Managers were found to be more absent in Scrum work dealing with existing product software projects. Implications of this finding would be vital in industry application where business decision-makers can now make the strategic choice to eschew a Project Manager when their Scrum Team is required to work on a sustained basis with existing product improvements. Alternatively, the presence of a Project Manager can be considered when the Scrum project deals with completely new software.

A traditional approach to software development mixed with Scrum was also found to influence a higher presence of Project Managers. Therefore, teams who need to use traditional project management with Scrum must consider the presence of a Project Manager in the team. It goes without saying that if no element of traditional sequential models is used with Scrum, then the team may forgo a Project Manager.

Finally, this study discovered that Scrum Team members' perception of success or failure is affected by the presence or absence of a Project Manager. The data revealed there is higher perceived success for teams who operate without a Project Manager and there is a higher perceived failure in teams with a Project

Manager. Further research needs to be undertaken to understand the context behind this perception, but this finding is a validation of theoretical claims and justifies Scrum's prescriptive conceptual framework, specifically highlighting the need for self-managing teams and moving away from intensive upfront planning.

The data implies the presence of a Project Manager in a Scrum Team has a negative effect on the team's perception. Therefore, business decision-makers should avoid this unless necessary such as if the project deals with new software, if there is no one in the Scrum Team with more than four years of experience, or if the project is going to use elements of the Waterfall Model, which are Scrum project conditions found in the study that might need a Project Manager. More strategic approaches can be undertaken if management skills need to be injected into a Scrum Team such as assigning a Technical Lead as part of the Development Team instead of a Project Manager.

Rather than resisting change and looking for a workaround to fit into Scrum Teams as a traditional Project Manager, this finding will make it easier for them to make strategic career decisions instead. For instance, they can look to the other statistically significant findings of this study and apply themselves in Scrum Teams that delve into new software development, inexperienced Scrum Teams, or those teams that need to use Traditional Sequential approaches with Scrum. Furthermore, Project Managers could learn new skills so they can contribute to existing Scrum structures in order to stay competitive and relevant in an evolving industry. This is also supported by other research that traditional Project Managers make good Product Owners (Noll, et al., 2017). Alternatively, Project Managers may shift their focus from Scrum projects into other Agile approaches or plan-driven software work.

In conclusion, this study was able to derive conditions that highlight the need for Project Managers in Scrum software development projects. Although it was found the Scrum Team members' perception of success was negatively affected by the presence of a Project Manager, the investigation also uncovered conditions where they are still needed in Scrum.

5.8 Limitations

This study has several limitations brought about by the approach and application of the research. Due to the global pandemic at the time of this study, which has limited the ability to travel, and the scope to cover Oceania and Southeast Asia, the researcher decided to conduct data gathering through online means. The restricted yet practical decisions made to keep this study viable caused several limitations to the study as defined below.

The first limitation was caused by the database choice. LinkedIn is one of the biggest professional networking platforms worldwide (Leighton, 2021) and was the natural choice for this study to tap into for a sampling frame. However, not all Scrum professionals are registered on the platform, but this would be true regardless of which platform was chosen. To compensate for this, the researcher ensured that each individual identified in the LinkedIn database search results (over 8,500) with four or months experience with Scrum was listed in the Microsoft Excel randomisation sheet to ensure a true random sample could be generated. Among the 1500 randomised samples, the researcher was able to collect 575 responses, which makes this study highly credible despite this limitation.

Secondly, the LinkedIn platform required the researcher to get chat permission by establishing a connection with the respondent before inviting them to

participate. This meant that this study was limited only to respondents who could read and write in English, since the researcher can only communicate through that language. On top of this, the survey tool was only available in English.

The third limitation was this study's focus on Oceania and Southeast Asia. This limited the researcher to only generate a sampling frame from these regions and results can only be generalised in confidence to the Scrum projects operating in the related countries. However, the researcher has established extensive research has been done on the topic globally for at least the past five years but with very poor representation of Oceania. As discussed in subsection 5.5 of this chapter, the exploratory findings of the global reports were similar to what the researcher found in Oceania and Southeast Asia.

Lastly, the research was conducted using a quantitative approach. This limited the researcher from capturing the context behind answers and insight beyond the selections the research respondents chose in the survey.

Although the listed limitations are valid, they did not hinder the completion of this study. While the issues discussed limited this study, they were inevitable and natural consequences that followed strategic decision-making to ensure this study was successful considering travel constraints, resources on hand, and time available. However, these limitations open up opportunities for future researchers, which will be discussed in the next subsection.

5.9 Recommendations

Regardless of this study's success at answering its primary research question and secondary objective, there appear to be many opportunities that have been

opened up for further research. The following is a list of potential recommendations for additional study:

- The most obvious recommendation would be to replicate this study to address the limitations cited in the previous subsection. For instance, a multi-lingual approach using another dominant professional networking platform (or all of them) could be undertaken to validate this study's findings. A mixed methodology or purely qualitative approach can also be applied to gather insights.
- Further research is required to explore why Scrum Teams are reporting members beyond the ideal team size of 11 people. This contradicts theoretical reasoning and standard practice from the rest of the industry. It would be interesting to find out the context behind this decision; What project conditions caused this? What advantages or disadvantages does it pose? What are the perceived project outcomes?
- A recommendation can be made on investigating the current trend of Scrum as a project framework or continuous product development model. This study found a significant number of respondents reported their Scrum projects were lasting more than a year. Furthermore, almost half of the respondents shared they were working on existing software. This might indicate a significant portion of the Scrum respondents are now using the framework in sustained product development instead of time-bound projects. Exploring this could help predict where Scrum as a framework might be headed in industry applications.
- Further investigation is also recommended to understand why a significant portion of the respondents reported they were using "Pure Scrum" but also

shared the presence of a Project Manager in their Scrum Team. Theoretically, one cannot say they are practicing “Pure” Scrum if an undefined role sits within the team. Furthermore, a substantial portion of this group of respondents reported they were industry certified. Generating context to explain this phenomenon would appear to require further exploration.

- Finally, this study was able to establish that perceived project success is higher in Scrum Teams with the absence of Project Managers. Further study is required to understand the context behind this categorical finding, such as moving beyond subjective “perception” and objectively outlining what success and failure metrics do Project Manager affect in a Scrum Team. A qualitative study may also add more insight to this finding so there is a better understanding of the relationship and adjustments that can be proposed to benefit both Scrum Teams and practitioners of the Project Management profession.

References:

Aaltola, K. (2017). *Project Management Handbook*. Laurea Publication, Laurea University of Applied Sciences. doi: https://doi.org/10.1002/9780470172353

Academy for Educational Development. (2006). *Introduction to Data Analysis Handbook*. AED/TAC-12.

Adi, P. (2015). Scrum Method Implementation in a Software Development Project Management. *International Journal of Advanced Computer Science and Applications, 6(1)*. doi: 10.14569/IJACSA.2015.060927

APM BOK. (2012). *The APM Body of Knowledge (6th edition)*. The Association of Project Managers.

Apuke, O. (2017). Quantitative Research Methods : A Synopsis Approach. *Arabian Journal of Business and Management Review (kuwait Chapter), 6(1),* 40-47. doi: 10.12816/0040336.

Australian Bureau of Statistics. (2021, March 3). *Australian National Accounts: National Income, Expenditure and Product*. https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-national-income-expenditure-and-product/latest-release

Australian Trade and Investment Commission. (n.d.). *Australian industry capabilities*. Retrieved from March 20, 2021, https://www.austrade.gov.au/international/buy/australian-industry-capabilities/ict.

Barker, I. (2019). *97 percent of companies now use agile development methods.* Beta News. Retrieved from https://betanews.com/2019/05/07/state-of-agile-report/#:~:text=Agile%20is%20clearly%20becoming%20the,agile%20landscape%20for%2013%20years.

Bassil, Y. (2012). *A Simulation Model for the Waterfall Software Development Life Cycle.* doi: abs/1205.6904.

Beck, K., & Andres, C. (2005). *Extreme Programming Explained: Embrace Change*. Addison-Wesley.

Beltekian, D. (2015). *World map region definitions*. Our World in Data. Retrieved from https://ourworldindata.org/world-region-map-definitions

Beynon-Davies, P., Carne, C., Mackay, H., & Tudhope, D. (1999). Rapid application development (RAD): An empirical review. *European Journal of Information Systems, 8*. doi: 10.1057/palgrave.ejis.3000325.

Boehm, B. (1995). A Spiral Model of Software Development and Enhancement. *Readings in Human–Computer Interaction, 2(1*), 281-292. doi: https://doi.org/10.1016/B978-0-08-051574-8.50031-5

Bolloju, N., Chawla, R., & Ranjan, R. (2018). Pros and cons of rotating scrum master role - A qualitative study. *ACM International Conference Proceeding Series*. https://doi.org/10.1145/3172871.3172883

Bridges, S. (2017, July 28). *New Zealand's ICT sector stronger than ever*. Beehive.govt.nz. Retrieved from https://www.beehive.govt.nz/release/new-zealand's-ict-sector-stronger-ever

Bronte-Stewart, M. (2015). Beyond the iron triangle: evaluating aspects of success and failure using a project status model. *Computing and Information Systems, 19(2),* 19+. Retrieved from https://link-gale-com.op.idm.oclc.org/apps/doc/A471554577/AONE?u=per_dcop&sid=AONE&xid=08f0ec66

Brooks, Jr, Frederick. (1995). *The Mythical Man-Month: Essays on Software Engineering.* Retrieved from https://www.researchgate.net/publication/220689892_The_Mythical_Man-Month_Essays_on_Software_Engineering

Cervone, H. F. (2011). Understanding agile project management methods using scrum. *OCLC Systems & Services, 27(1),* 18-22. doi:http://dx.doi.org.op.idm.oclc.org/10.1108/10650751111106528

CollabNet VersionOne. (2019). *The 13th Annual State of Agile Report*. Retrieved from https://stateofagile.com/?_ga=2.186885928.1823171340.1616792226-11212933.1616792226#ufh-i-613553418-13th-annual-state-of-agile-report/7027494

Cox, N. (2020, March 5). *Digital overtakes wine exports*. Retrieved from https://www.stats.govt.nz/news/digital-overtakes-wine-exports

Cresswell, J., & Cresswell, J. (2018). *Research Design : Qualitative, Quantitative, and Mixed Methods Approaches.* SAGE Publications Inc.

Daniel, E. (2016). The Usefulness of Qualitative and Quantitative Approaches and Methods in Researching Problem-Solving Ability in Science Education Curriculum. *Journal of Education and Practice, 7(15),* 91-100. Retrieved from https://files.eric.ed.gov/fulltext/EJ1103224.pdf

Datta, S. (2018). *Concept of sampling methods and different types of sampling*. doi: 10.13140/RG.2.2.22856.57605

Deloitte. (2020). *Australia's Digital Pulse*. https://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloite-au-economics-australias-digital-pulse-2020-230920.pdf

Dhanotia, S., & Goyal, R. (2012). Rapid Application Development (Rad) Approach with Halt Points. *IJESRT, 1(3),* 109-114. Retrieved from https://www.academia.edu/5753212/Rapid_Application_Development_Rad_Approach_with_Halt_Points

Digital.ai. (2020). *14th Annual State of Agile Report*. Retrieved from https://stateofagile.com/?_ga=2.186885928.1823171340.1616792226-11212933.1616792226#ufh-i-615706098-14th-annual-state-of-agilereport/7027494

Dixon, Nancy. (2000). *Common Knowledge : How Companies Thrive By Sharing What They Know*. Harvard Business School Press

Ereiz, Z., & Music, D. (2019). Scrum Without a Scrum Master. 2019 *IEEE International Conference on Computer Science and Educational Informatization*, CSEI 2019, 325–328. https://doi.org/10.1109/CSEI47661.2019.8938877

Fair, J. (2012). *Agile versus Waterfall: approach is right for my ERP project?* Paper presented at PMI® Global Congress 2012—EMEA, Marsailles, France. Newtown Square, PA: Project Management Institute.

Fernando, J. (2020, November 13). *Gross Domestic Product (GDP).* Investopedia. https://www.investopedia.com/terms/g/gdp.asp

Figure NZ. (2019, March). *GDP breakdown by industry in New Zealand*. Retrieved from https://figure.nz/chart/WRpSmBftC60lEu2q

Fowler, M., & Highsmith, J. (2001). The Agile Manifesto. *SpringerBriefs in Computer Science, 1(1)*. Retrieved from https://www.agilealliance.org/manifesto-download/

Gandomani, T. J., Tavakoli, Z., Zulzalil, H., & Farsani, H. K. (2020). The Role of Project Manager in Agile Software Teams: A Systematic Literature Review. *IEEE Access*, *8*(1), 117109–117121. doi: https://doi.org/10.1109/access.2020.3004450

Gray, A., Richardson, K., Rooke, K., & Thornburn, T. (2016). Guide to Life Cycles and Life Cycle Models. *Sytems Engineering and Project Management JWG, 1(1)*, 1-41. Retrieved from https://www.apm.org.uk/media/13835/guide-to-lifecycle models.pdf

Gupta, R., & Reddy,P. (2016). Adapting Agile in a Globally Distributed Software Development, *49th Hawaii International Conference on System Sciences (HICSS), 1(1)*, 5360-5367. doi: 10.1109/HICSS.2016.663

Goundar, Sam. (2012). Chapter 3 - Research Methodology and Research Method. Retrieved from https://www.researchgate.net/publication/333015026_Chapter_3_-_Research_Methodology_and_Research_Method

Harrin, E. (2012, April 12). *What is Project Management?* Project Manager. Retrieved from https://www.projectmanager.com/blog/what-is-project-management

Hastie, S. (2019, May 7). *13th State of Agile Report Released.* InfoQ. Retrieved from https://www.infoq.com/news/2019/05/13th-state-agile-report/

Hirschmann, R. (2021, Mar 2). *Gross domestic product (GDP) of the information and communication industry of Singapore from 2011 to 2020*. Statista. Retrieved from https://www.statista.com/statistics/625739/gdp-of-the-information-and communication-industry-in-singapore/

Hodgson, D. & Paton, S. (2016). Understanding the professional project manager: Cosmopolitans, locals and identity work. *International Journal of Project Management, 39(1).* doi: 10.1016/j.ijproman.2015.03.003.

Holtzhausen, N., & de Klerk, J. J. (2018). Servant leadership and the Scrum Team's effectiveness. *Leadership and Organization Development Journal*, *39*(7), 873 882. https://doi.org/10.1108/LODJ-05-2018-0193

Hon, L. & Kent, K. (2008). *GUIDELINES FOR WRITING A THESIS OR DISSERTATION*. University of Florida. Retrieved from https://www.jou.ufl.edu/grad/forms/Guidelines-for-writing-thesis-or-dissertation.pdf

IndexMundi. (2019, December 18). *Philippines - ICT service exports*. Retrieved March 14, 2021, from https://www.indexmundi.com/facts/philippines/ict-service-exports

International Trade Administration. (2020, July 20). *Philippines - Country Commercial Guide.* Retrieved from https://www.trade.gov/knowledge-product/philippines-information-and-communications-technology

International Trade Administration. (2020, September 16). *Singapore - Country Commercial Guide Information and Telecommunications Technology*. Retrieved from https://www.trade.gov/country-commercial-guides/singapore-information-and-telecommunications-technology

Kamran, M., & Waheed, U. (2012). Project Manager VS. ScrumMaster. *Journal of Independent Studies and Research*, *10*(1).

Kenton, W. (2021, February 25). *Gross Value Added (GVA).* Investopedia. Retrieved March 28, 2021, from https://www.investopedia.com/terms/g/gross-value-added.asp

Kivunja, C., & Kuyini, A. (2017). Understanding and Applying Research Paradigms in Educational Contexts. *International Journal of Higher Education, 6(5),* 26-41. doi: https://doi.org/10.5430/ijhe.v6n5p26

Korsaa, M., Olesen, R., & Vinter, O. (2002). *Iterative Software Development - A Practical View Abridged Version*. Datateknisk Forum. Retrieved from http://www.ottovinter.dk/df-16a.pdf

Kruchten, P. (2001). From Waterfall to Iterative Development -- A Challenging Transition for Project Managers The Good : Benefits of Iterative Development. Retrieved from https://www.researchgate.net/publication/237518074_From_Waterfall_to_Iterative_Development_--_A_Challenging_Transition_for_Project_Managers

Leighton, N. (2021, March 9). *Top Five Social Media Platforms For Business Leaders.* Forbes. Retrieved from https://www.forbes.com/sites/forbescoachescouncil/2021/03/09/top-five-social-media-platforms-for-business-leaders/?sh=da9fdb27e07e

Loufrani-Fedida, S. & Missonier, S. (2015). The project manager cannot be a hero anymore! Understanding critical competencies in project-based organizations from a multilevel approach. *International Journal of Project Management, 3(1),* 1220-1235. doi: 10.1016/j.ijproman.2015.02.010.

MacDonald, S., & Headlam, N. (2011). *Research Methods Handbook Introductory guide to research methods for social research (1st ed).* Center for Local Economic Strategies.

Machado, F. & Martens, C. (2015). Project Management Success: A Bibliometric Analisys. Revista de Gestão e Projetos, 6(1), 28-44. doi: 10.5585/gep.v6i1.310.

Manhit, V. (2019, October 1). *Philippine ICT development, transforming barriers.* Business World. Retrieved from https://www.bworldonline.com/philippine-ict-development-transforming-barriers/

Marinho, M., Noll, J., Richardson, I. & Beecham, S. (2019). *Plan-Driven Approaches Are Alive and Kicking in Agile Global Software Development, 1(1),* 1-11. doi: 10.1109/ESEM.2019.8870168.

Matkovic, P. & Tumbas, P. (2010). *A Comparative Overview of the Evolution of Software Development Models*. Journal of Industrial Engineering and Management, 1(4), 163-172. Retrieved from https://www.researchgate.net/publication/267711880_A_Comparative_Overview_of_the_Evolution_of_Software_Development_Models

McAvoy, J., & Butler, T. (2009). The role of project management in ineffective decision making within agile software development projects. *European Journal of Information Systems*, *18*(4), 372–383. https://doi.org/10.1057/ejis.2009.22

McConnell, S. (1995), *Rapid Developmen*t, Microsoft Press, Redmond, Washington, USA.

McManus, J. J. (1997). If you want to succeed in software development try rapid applications development (RAD). *Management Services, 41(3),* 27. Retrieved from https://search-proquest-com.op.idm.oclc.org/docview/233541354?accountid=39660

McQuaid, P. (2001). Rapid Application Development: Project Management Issues to Consider. *SQP 3(3),* 19-25. Retrieved from http://rube.asq.org/pub/sqp/past/vol3_issue3/mcquaid.html

Ministry of Business, Innovation, & Employment. (2017). *NEW ZEALAND SECTORS REPORT SERIES Information and Communications Technology Focusing on New Zealand's IT product and service sector*. Retrieved from https://www.mbie.govt.nz/dmsdocument/3879-information-and-communications technology-report-2017+&cd=1&hl=nl&ct=clnk&gl=nl

Monday.com. (2021). *Work OS: the visual platform that manages everything*. Retrieved April 5, 2021, from https://monday.com/product/

Mundra, A., Misra, S., & Dhawale, C. (2013). *Practical scrum-Scrum Team: Way to produce successful and quality software*. Proceedings of the 2013 13th International Conference on Computational Science and Its Applications, ICCSA 2013, June, 119–123. https://doi.org/10.1109/ICCSA.2013.25

Nachar, N. (2008). The Mann-Whitney U: A Test for Assessing Whether Two Independent Samples Come from the Same Distribution. *Tutorials in Quantitative Methods for Psychology, 4(1)*, 13-20. doi: 10.20982/tqmp.04.1.p013.

Nations Online. (n.d.). *Map of Southeast Asia.* Retrieved March 24, 2021, from https://www.nationsonline.org/oneworld/map_of_southeast_asia.htm.

Nayak, M., & Narayan, K. (2019). Strengths and Weakness of Online Surveys. *IOSR Journal Of Humanities And Social Science, 24(5),* 31-38. doi:10.9790/08372405053138.

Naybour, P. (2014, May 14). *Project management - an introduction*. Association for Project Management. Retrieved from https://www.apm.org.uk/blog/projectmanagement-an-introduction/

New Zealand Technology Industry Association. (2016). *DIGITAL NATION NEW ZEALAND: From Tech Sector to Digital Nation*. NZ Tech. Retrieved from https://nztech.org.nz/wp-content/uploads/sites/8/2019/02/from-tech-sector-to digital-nation-2nd-edition-ebook.compressed.pdf

Nilsson, A., & Wilson, T. (2012). Reflections on Barry W. Boehm's “A spiral model of software development and enhancement”. *International Journal of Managing Projects in Business, 5(1)*. 737-756. doi: 10.1108/17538371211269031

Noll, J., Razzak, M. A., Bass, J., & Beecham, S. (2017). *A Study of the Scrum Master’s Role*. In International Conference on Product-Focused Software Process Improvement (Pp. 617-620). Springer, Cham., 2(October), 482–496. https://doi.org/10.1007/978-3-319-69926-4_22

Otago Polytechnic. (n.d.). Our research values. Retrieved May 22, 2021, from https://www.op.ac.nz/industry-and-research/research/research-values/.

Oriogun, P. K. (1999). A survey of boehm's work on the spiral models and COCOMO II--towards software development process quality improvement. *Software*

Quality Journal, 8(1), 53-62. doi: http://dx.doi.org.op.idm.oclc.org/10.1023/A:1008926902882

Ozkan, N., & Kucuk, C. (2016). A Systematic Approach to Project Related Concepts of Scrum. *Revista de Management Comparat Internațional*, *17*(4), 320–334. https://search-proquest-com.op.idm.oclc.org/docview/1873604343?accountid=39660

Pal, S. (2021, Feb 26). *Software Engineering | Spiral Model*. Geeks for Geeks. Retrieved from https://www.geeksforgeeks.org/software-engineering-spiral-model/

Parliament of Australia. (2020, October 20). *COVID-19: a chronology of state and territory government announcements (up until 30 June 2020).* https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp2021/Chronologies/COVID-19StateTerritoryGovernmentAnnouncements

Petersen, K., Wohlin, C., & Baca, D. (2009). The Waterfall Model in Large-Scale Development. *PROFES 2009 Lecture Notes in Business Information Processing, 32,* 386-400. doi: https://doi.org/10.1007/978-3-642-02152-7_29

Peterson, M. (2005). Quality and quickness. *PM Network, 19(4),* 60–64. Retrievedfrom https://www.pmi.org/learning/library/quality-quickness-fast-track-projects-4675

Philippine Statistics Authority. (2020). *2017 Survey on Information and Communication Technology (SICT) - For Information Economy (Core ICT Industries): Preliminary Results*. Retrieved from

https://psa.gov.ph/content/2017-survey-information-and-communication-technology-sict-information-economy-core-ict

PMI PMBOK. (2013). *A Guide to the Project Management Book of Knowledge* (5th edition). Project Management Institute.

PRINCE2. (2009). *Managing Successful Projects with PRINCE2*, OGC, TSO London.

Professionals Australia. (2017). *Information and Communications Technology Informer.* http://www.professionalsaustralia.org.au/engineersdirect/wp-content/uploads/sites/68/2017/03/ICT-Informer-march-2017.pdf

Rehman, A., & Alharthi, K. (2016). *An introduction to research paradigms*. Retrieved from https://www.researchgate.net/publication/325022648_An_introduction_to_research_paradigms

Rice, S., Winter, S., Doherty, S., & Milner, M. (2017). Advantages and Disadvantages of Using Internet-Based Survey Methods in Aviation-Related Research. *Journal of Aviation Technology and Engineering, 7(1),* 58–65. doi: http://dx.doi.org/10.7771/2159-6670.1160

Royce, W. (1987). *Managing the development of large software systems: concepts and techniques*. In Proceedings of the 9th international conference on Software Engineering (ICSE ’87). IEEE Computer Society Press, Washington, DC, USA.

Rodov, A. & Teixidó, J. (2016). *Blending Agile and Waterfall: The Keys to a Successful Implementation*. Paper presented at PMI® Global Congress

2016—EMEA, Barcelona, Spain. Newtown Square, PA: Project Management Institute.

Rubin, K. (2018). *What Happens to the Project Manager When Doing Agile Development with Scrum?* Innolution. Retrieved from https://innolution.com/blog/what-happens-to-the-project-manager-when-doing-agile-development-with-scrum

Samuels, P. (2020). *A Really Simple Guide to Quantitative Data Analysis*. doi: 10.13140/RG.2.2.25915.36645

Schwaber, K., & Beedle, M. (2002). *Agile Software Development with Scrum*. Upper Saddle River, NJ: Prentice-Hall.

Schwaber, K. (2004). *Agile Project Management with Scrum by Ken Schwaber.* Microsoft Press © 2004. In Livro (Issue Cmm)

Schwaber, K., & Sutherland, J. (2017). *The Scrum Guide™ The Definitive Guide to Scrum: The Rules of the Game*. Scrum.org.

Schwaber, K., & Sutherland, J. (2020). *The Scrum Guide™ The Definitive Guide to Scrum: The Rules of the Game.* Scrum.org. Retrieved from https://scrumguides.org/docs/scrumguide/v2020/2020-Scrum-Guide-US.pdf#zoom=100

Scrum Alliance. (2017). *State of Scrum 2017-2018*. 35. Retrieved from https://www.scrumalliance.org/ScrumRedesignDEVSite/media/ScrumAllianceMedia/Files and PDFs/State of Scrum/2017-SoSR-Final-Version-(Pages).pdf

Scrum.org. (2020). *What is Scrum?* Retrieved March 7, 2021, from https://www.scrum.org/resources/what-is-scrum

Sharma, G. (2017). Pros and cons of different sampling techniques. *International Journal of Applied Research, 3(7),* 749-752. Retrieved from http://www.allresearchjournal.com/archives/2017/vol3issue7/PartK/3-7-69-542.pdf

Sharma, S. (2018). *Various Research Methods Analysis (Doctoral dissertation, Horizons University, Paris).* Retrieved from https://www.researchgate.net/publication/333220560_Introduction_to_Research_Methods

Shastri, Y., Hoda, R., & Amor, R. (2016). Does the “project manager” still exist in agile software development projects? *Proceedings - Asia-Pacific Software Engineering Conference, APSEC*, *0*(October 2017), 57–64. https://doi.org/10.1109/APSEC.2016.019

Shastri, Y. & Hoda, R. & Amor, R. (2017). *Understanding the Roles of the Manager in Agile Project Management.* doi: 10.1145/3021460.3021465

Shastri, Y. & Hoda, R. & Amor, R.(2021). The role of the project manager in agile software development projects. *Journal of Systems and Software, 173*(1). doi: 10.1016/j.jss.2020.110871

Showkat, N., & Parveen, H. (2017). *Non-Probability and Probability Sampling*. Retrieved from https://www.researchgate.net/publication/319066480_Non-Probability_and_Probability_Sampling

Statista. (2020, May). *Share of nominal gross domestic product (GDP) in Singapore in 2019, by sector*. Retrieved from https://www.statista.com/statistics/1122999/singapore-nominal-gdp-breakdown-by-sector/

Stats NZ (2019). *A guide to good survey design: Fifth edition*. Retrieved from www.stats.govt.nz

Stats NZ. (2020, March 5). *Information and communication technology supply survey: 2019*. Retrieved from https://www.stats.govt.nz/information-releases/information-and-communication-technology-supply-survey-2019

Sudhakar, G. (2016). Understanding the Meaning of Project Success. *Binus Business Review, 7(1),* 163-169.

Sutherland, J. (2010). *Jeff Sutherland's Scrum Handbook*. Scrum Training Institute. Retrieved from http://www.scrummaster.dk/lib/AgileLeanLibrary/People/JeffSutherland/scrum handbook.pdf

Symeou, L., & Lamprianou, I. (2008). *Children as social researchers: A resource book for teachers and other educators (1st ed.).* Center for the Study of Childhood and Adolescence.

Tanner, M., & Mackinnon, A. (2015). Sources of interruptions experienced during a scrum sprint. *Electronic Journal of Information Systems Evaluation, 18(1),* 3-18. Retrieved from https://search-proquest-com.op.idm.oclc.org/docview/1697718518?accountid=39660

Taherdoost, H. (2016a). How to Design and Create an Effective Survey/Questionnaire; A Step by Step Guide. *International Journal of Academic Research in Management, 5(4),* 37-41. https://www.researchgate.net/publication/319998002_How_to_Design_and_Create_an_Effective_SurveyQuestionnaire_A_Step_by_Step_Guide

Taherdoost, H. (2016b). Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. *International Journal of Academic Research in Management, 5(2),* 18-27. doi: 10.2139/ssrn.3205035

Taylor, K. J. (2016). Adopting Agile software development: the project manager experience. *Information Technology and People*, *29*(4), 670–687. https://doi.org/10.1108/ITP-02-2014-0031

Tripathi, V., & Goyal, A. (2014). Changing Roles and Responsibilities from Traditional project management to Agile project management. *International Journal on Recent and Innovation Trends in Computing and Communication*, 5(2), 1005-1009.

Typeform. (n.d.). Security at Typeform. Retrieved April 3, 2021, from https://help.typeform.com/hc/en-us/articles/360029259552-Security-at-Typeform.

Ugoni, A., & Walker, B. (1995). The Chi square test: an introduction. *COMSIG review, 4(3),* 64-64. Retrieved from https://www.researchgate.net/publication/5856449_The_Chi_square_test_an_introduction

Vogt, W., Vogt, E., Gardner, D., & Haeffele, L. (2014). *Selecting the Right Analyses for Your Data : Quantitative, Qualitative, and Mixed Methods.* Guilford Publications.

Vu, K. (2013). Information and Communication Technology (ICT) and Singapore's Economic Growth. *Information Economics and Policy, 25*(1), 284–300. doi: 10.1016/j.infoecopol.2013.08.002.

Webster, F. M. (1993). PM101: project management. *PM Network*, 7(9), 20–25.

Westland, J. (2018, April 4). *Project Management 101 – A Quick Reference Guide*. Project Manager. Retrieved from https://www.projectmanager.com/blog/project-management-101-quick-reference-guide

Wong, K. (2014). Research 101: Paradigms and Methodologies. *Vue: the magazine of the Marketing Research and Intelligence Association, 1(1)*, 16-17. Retrieved from https://www.researchgate.net/publication/268449309_Research_101_Paradigms_and_Methodologies

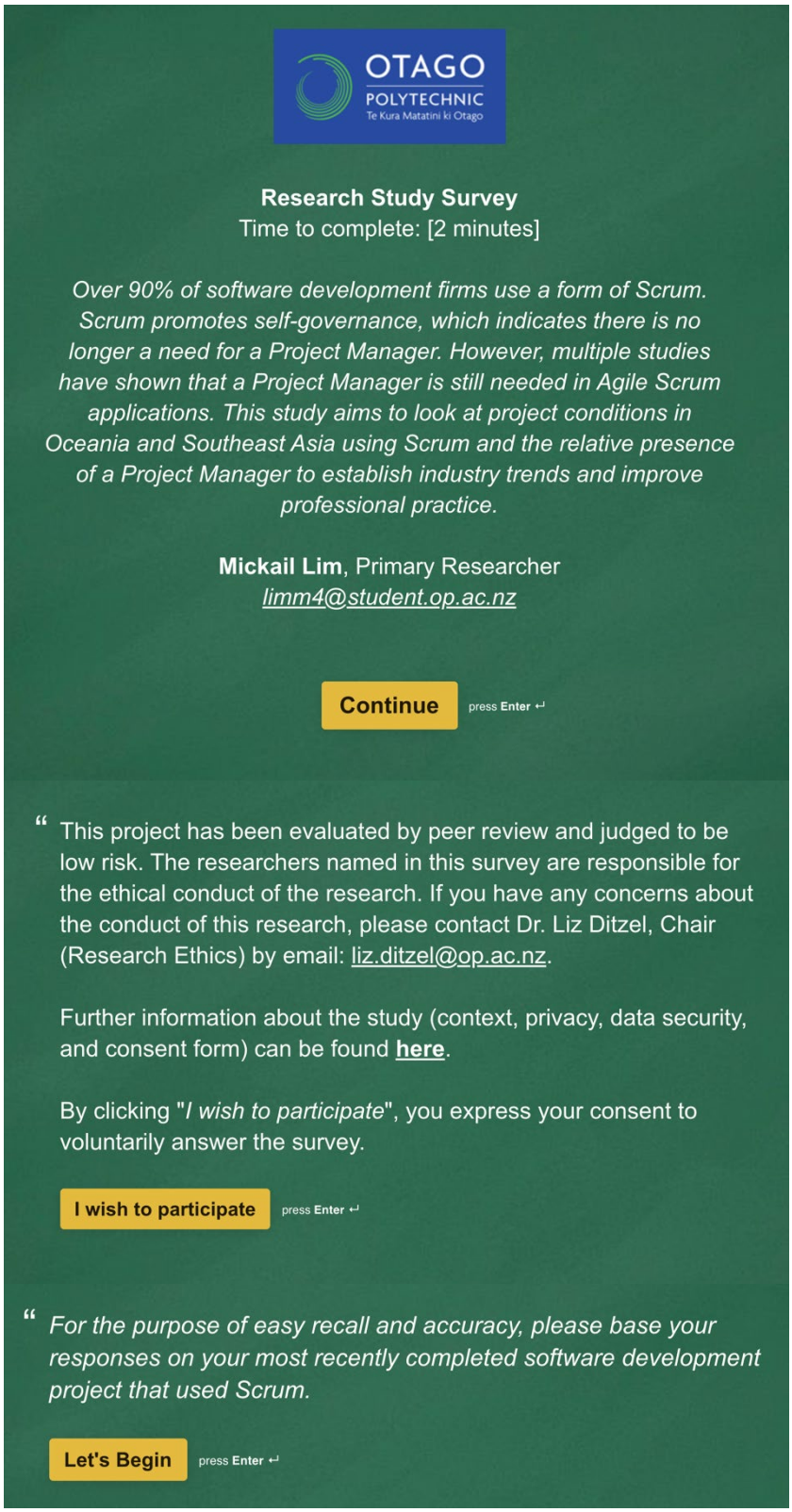
World Health Organization. (2020, June 29). *Listings of WHO's response to COVID-19.* https://www.who.int/news/item/29-06-2020-covidtimeline

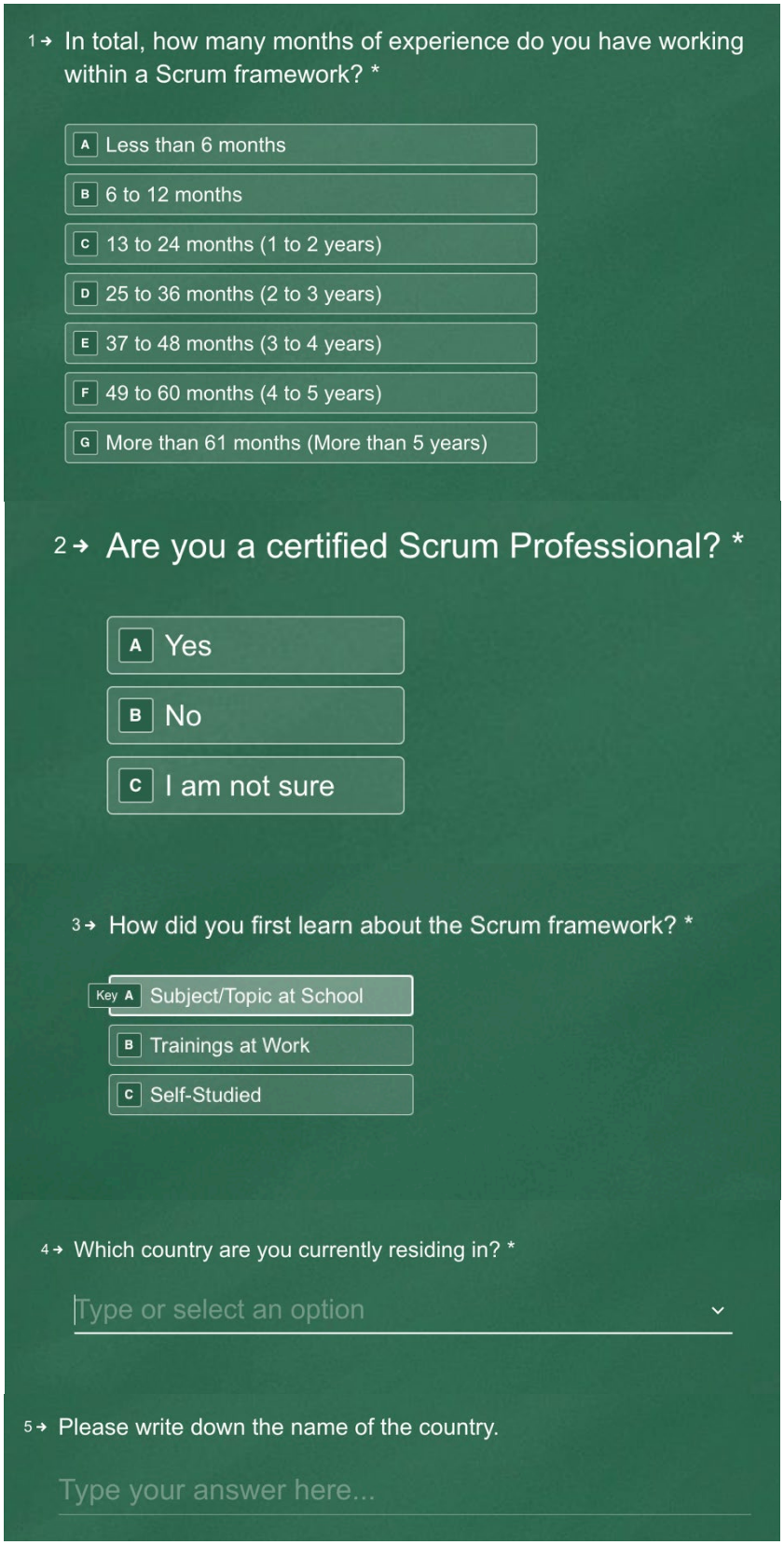
World Integrated Trade Solution. (2017). *ICT service exports By Country, in BoP, current US$ 2000-2017.* Retrieved from https://wits.worldbank.org/CountryProfile/en/Country/BY-COUNTRY/StartYear/2000/EndYear/2017/Indicator/BX-GSR-CCIS-CD#

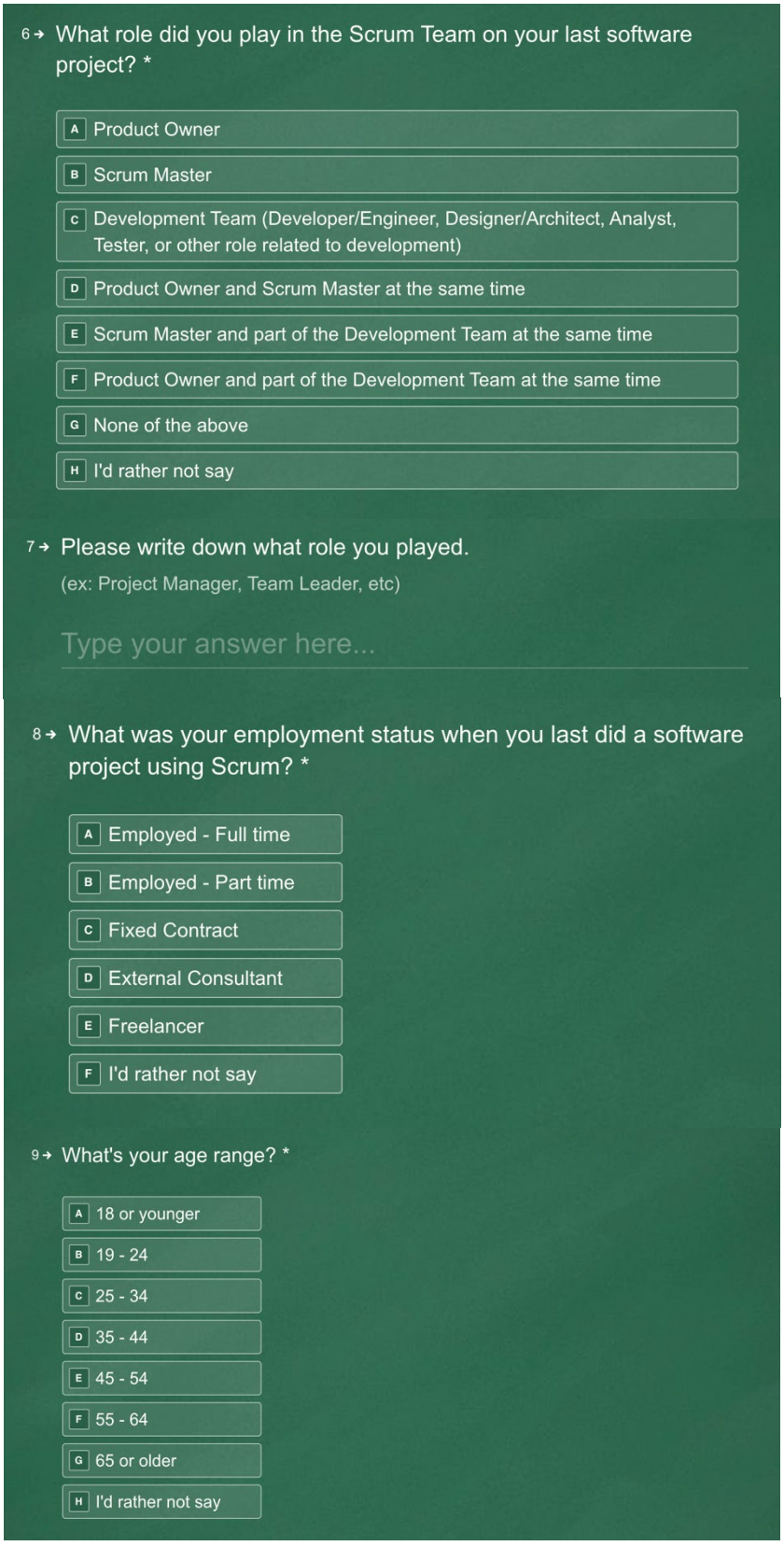
Yi, L. (2011). Manager as scrum master. *Proceedings - 2011 Agile Conference, Agile 2011*, 151–153. https://doi.org/10.1109/AGILE.2011.8

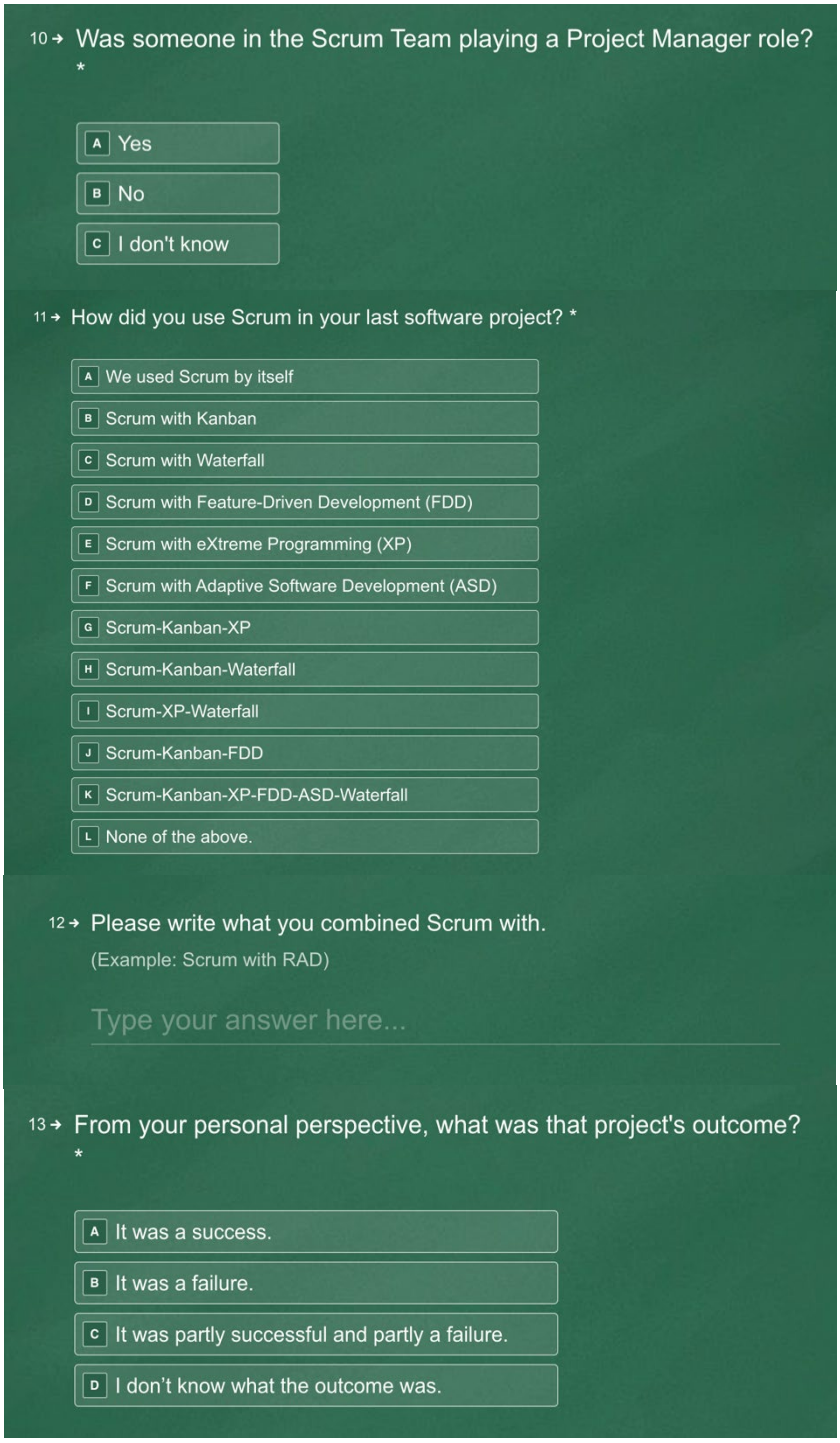
Yu, X., & Petter, S. (2014). “Understanding agile software development practices using shared mental models theory”, *Information and Software Technology, 56(1)*, 911-921. doi: https://doi.org/10.1016/j.infsof.2014.02.010

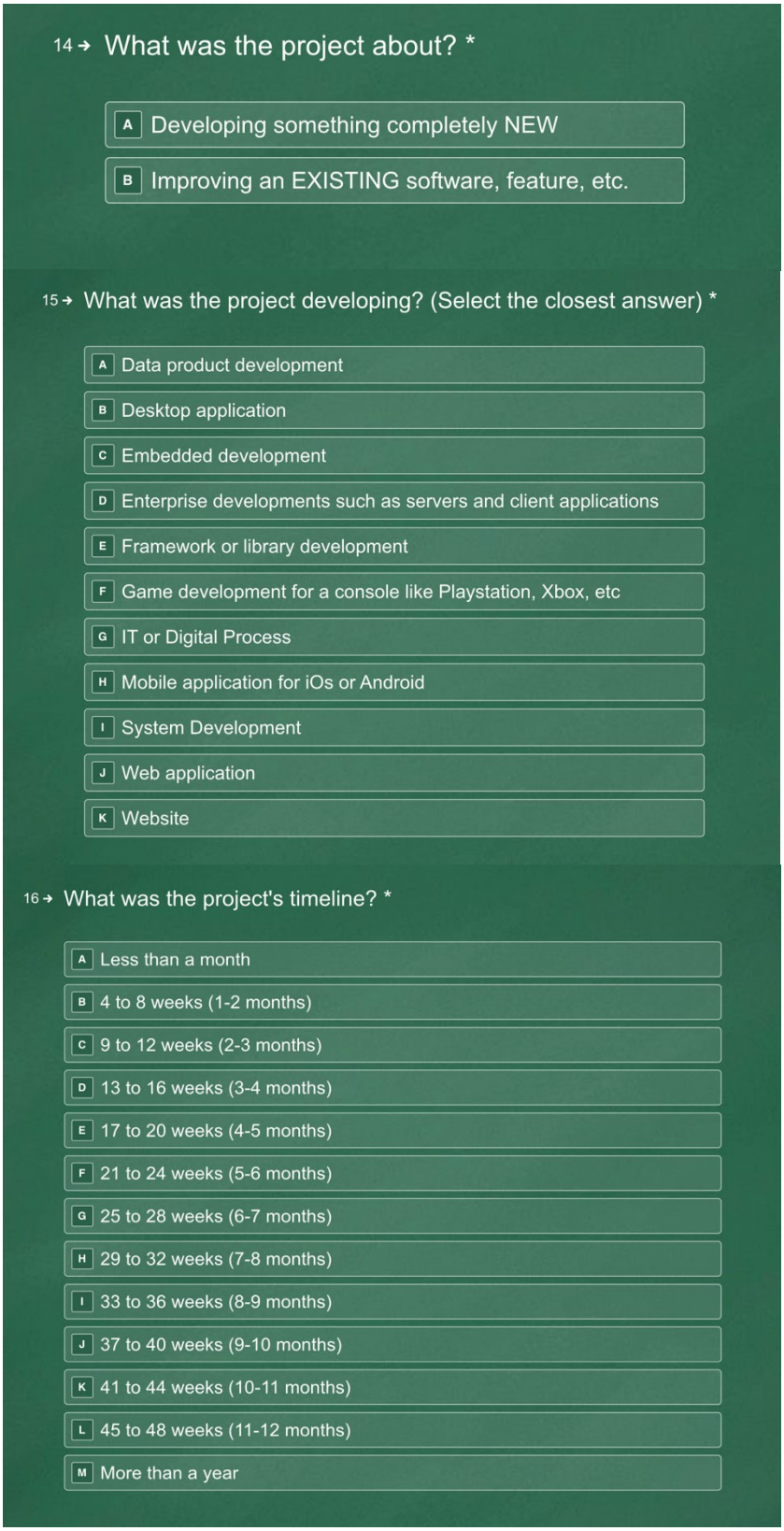
Appendix 1: Questionnaire

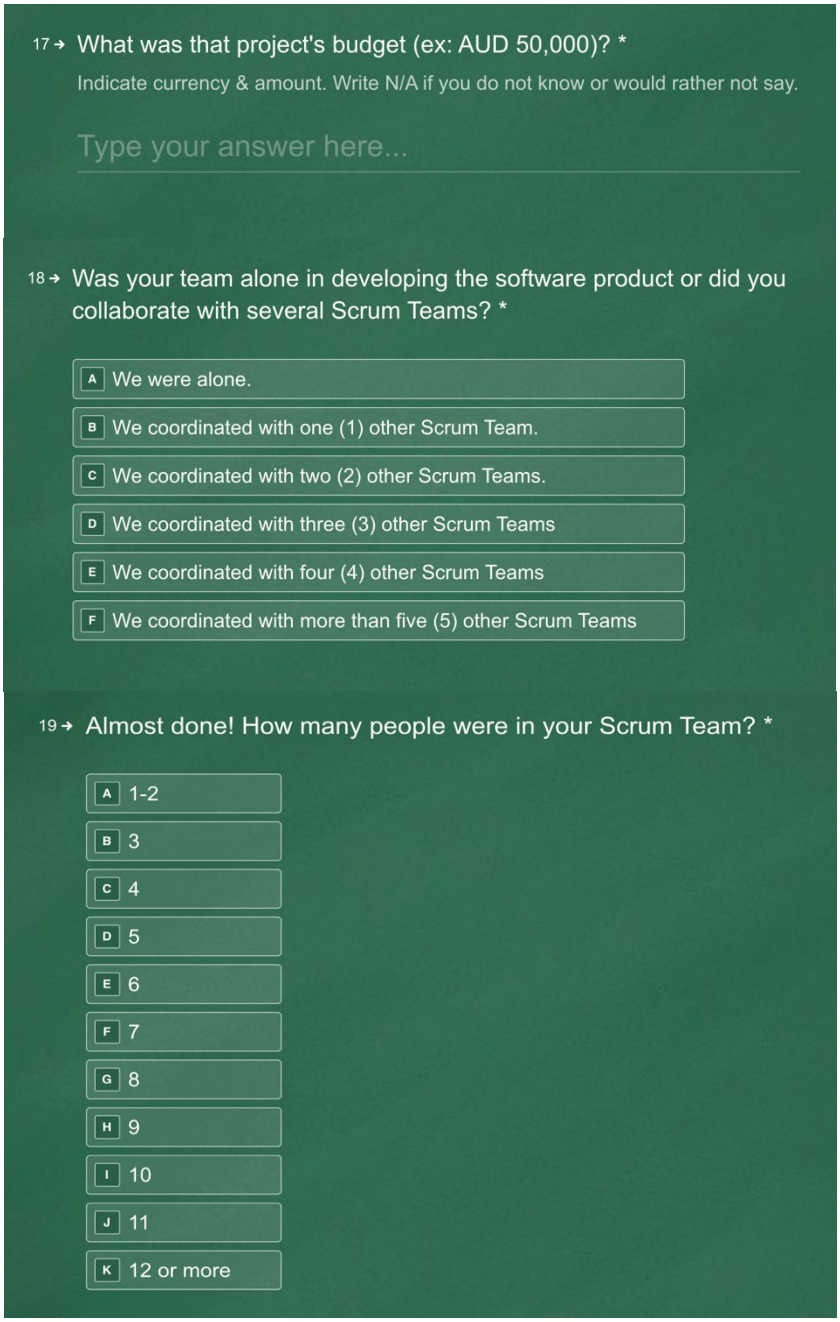


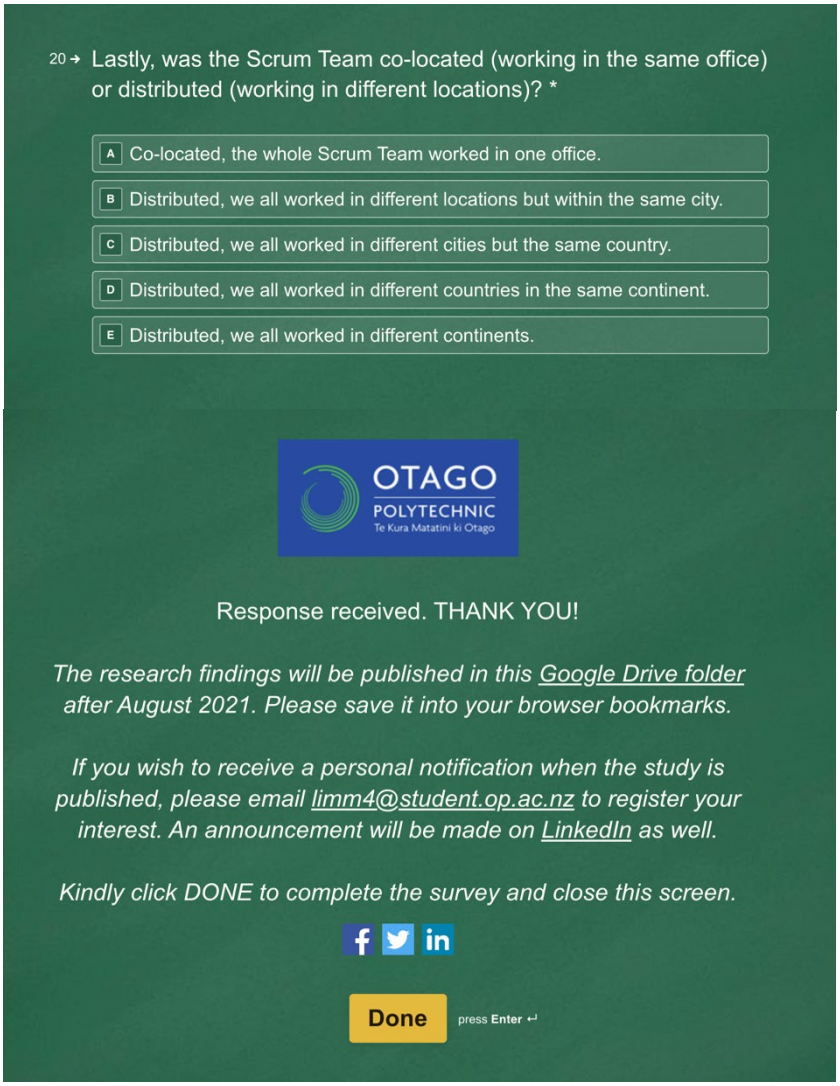

1 → In total, how many months of experience do you have working within a Scrum framework? *
A Less than 6 months
B 6 to 12 months
C 13 to 24 months (1 to 2 years)
D 25 to 36 months (2 to 3 years)
E 37 to 48 months (3 to 4 years)
F 49 to 60 months (4 to 5 years)
G More than 61 months (More than 5 years)
2 → Are you a certified Scrum Professional? *
A Yes
B No
C I am not sure
3 → How did you first learn about the Scrum framework? *
Key A Subject/Topic at School
B Trainings at Work
C Self-Studied
4 → Which country are you currently residing in? *
Type or select an option
5 → Please write down the name of the country.
Type your answer here...


6 → What role did you play in the Scrum Team on your last software project? *
A Product Owner
B Scrum Master
C Development Team (Developer/Engineer, Designer/Architect, Analyst, Tester, or other role related to development)
D Product Owner and Scrum Master at the same time
E Scrum Master and part of the Development Team at the same time
F Product Owner and part of the Development Team at the same time
G None of the above
H I'd rather not say
7 → Please write down what role you played.
(ex: Project Manager, Team Leader, etc)
Type your answer here...
8 → What was your employment status when you last did a software project using Scrum? *
A Employed - Full time
B Employed - Part time
C Fixed Contract
D External Consultant
E Freelancer
F I'd rather not say
9 → What's your age range? *
A 18 or younger
B 19 - 24
C 25 - 34
D 35 - 44
E 45 - 54
F 55 - 64
G 65 or older
H I'd rather not say


10 → Was someone in the Scrum Team playing a Project Manager role? *
A Yes
B No
C I don't know
11 → How did you use Scrum in your last software project? *
A We used Scrum by itself
B Scrum with Kanban
C Scrum with Waterfall
D Scrum with Feature-Driven Development (FDD)
E Scrum with eXtreme Programming (XP)
F Scrum with Adaptive Software Development (ASD)
G Scrum-Kanban-XP
H Scrum-Kanban-Waterfall
I Scrum-XP-Waterfall
J Scrum-Kanban-FDD
K Scrum-Kanban-XP-FDD-ASD-Waterfall
L None of the above.
12 → Please write what you combined Scrum with.
(Example: Scrum with RAD)
Type your answer here...
13 → From your personal perspective, what was that project's outcome? *
A It was a success.
B It was a failure.
C It was partly successful and partly a failure.
D I don't know what the outcome was.


14 → What was the project about? *
A Developing something completely NEW
B Improving an EXISTING software, feature, etc.
15 → What was the project developing? (Select the closest answer) *
A Data product development
B Desktop application
C Embedded development
D Enterprise developments such as servers and client applications
E Framework or library development
F Game development for a console like Playstation, Xbox, etc
G IT or Digital Process
H Mobile application for iOs or Android
I System Development
J Web application
K Website
16 → What was the project's timeline? *
A Less than a month
B 4 to 8 weeks (1-2 months)
C 9 to 12 weeks (2-3 months)
D 13 to 16 weeks (3-4 months)
E 17 to 20 weeks (4-5 months)
F 21 to 24 weeks (5-6 months)
G 25 to 28 weeks (6-7 months)
H 29 to 32 weeks (7-8 months)
I 33 to 36 weeks (8-9 months)
J 37 to 40 weeks (9-10 months)
K 41 to 44 weeks (10-11 months)
L 45 to 48 weeks (11-12 months)
M More than a year


17 → What was that project's budget (ex: AUD 50,000)? *
Indicate currency & amount. Write N/A if you do not know or would rather not say.
Type your answer here...
18 → Was your team alone in developing the software product or did you collaborate with several Scrum Teams? *
A We were alone.
B We coordinated with one (1) other Scrum Team.
C We coordinated with two (2) other Scrum Teams.
D We coordinated with three (3) other Scrum Teams
E We coordinated with four (4) other Scrum Teams
F We coordinated with more than five (5) other Scrum Teams
19 → Almost done! How many people were in your Scrum Team? *
A 1-2
B 3
C 4
D 5
E 6
F 7
G 8
H 9
I 10
J 11
K 12 or more


20 → Lastly, was the Scrum Team co-located (working in the same office) or distributed (working in different locations)? *
A Co-located, the whole Scrum Team worked in one office.
B Distributed, we all worked in different locations but within the same city.
C Distributed, we all worked in different cities but the same country.
D Distributed, we all worked in different countries in the same continent.
E Distributed, we all worked in different continents.
OTAGO POLYTECHNIC
Te Kura Matatini ki Otago
Response received. THANK YOU!
The research findings will be published in this Google Drive folder after August 2021. Please save it into your browser bookmarks.
If you wish to receive a personal notification when the study is published, please email limm4@student.op.ac.nz to register your interest. An announcement will be made on LinkedIn as well.
Kindly click DONE to complete the survey and close this screen.
Done
press Enter ↵

Appendix 2: Participant Information Sheet

Participant Information Sheet

Project title

Project Managers in Scrum Teams: A Quantitative Report of Software Development Conditions that Influence the Relative Presence of a Project Manager Role within Agile Scrum Teams in Oceania and Southeast Asia

General Introduction

Based on the Scrum Guide and related literature, a Project Manager role should not exist in in Scrum, however industry practice has allowed the role to persist within the framework. Furthermore, many studies argue that a Project Manager role is still necessary in Scrum. It is in the interest of this study to conduct a survey of Scrum professionals within Oceania and Southeast Asia to establish software project conditions that were true when they used Scrum and decided to include or not include a Project Manager role. By doing so, we will be able to establish a set of guidelines for Scrum practitioners to help in data-driven decision-making when and when not to include a Project Manager role based on their own project conditions by cross-referencing it to the results of this study.

What is the aim of the project?

The project aims to generate a set of guidelines/recommendations for practitioners of Scrum to improve decision-making when it comes to including or not including a Project Manager role in their Scrum Team based on their own software project conditions and how the rest of the project management industry does so.

What types of participants are being sought?

The study will require participants who are Scrum professionals (i.e. Product Owners, Scrum Masters, or Scrum Developers) within Oceania and Southeast Asia with at least 4 months experience in Scrum. Since the study is based in English, participants will need to be English speakers and writers as well.

How will potential participants be identified and accessed?

The participants will be based on profile results pulled from LinkedIn. Using LinkedIn's Sales Navigator tool, the researcher is able to find participants who fit the criteria from the search tool. Once found, the researcher will reach out to the potential participant to see if they are interested to take part in the study.

What will my participation involve?

Should you agree to take part in this project, you will be asked to fill out a survey.

How will confidentiality and/or anonymity be protected?

The survey is anonymous. Participants will not be asked to provide personal information, except your country and age range, which is essential data to contribute towards the study. There will be no way for the researchers to trace the identity of the person who filled out the survey.

What data or information will be collected and how will it be used?

Results of this project may be published but any data included will in no way be linked to any specific participant without prior consent.

Data Storage

The data collected will be securely stored so that only named researchers will have access to it. Access will be protected by multi-factor authentication (MFA) and the data itself is end-to-end encrypted. Protection is guaranteed from Typeform (Typeform Security Guidelines).

This will be retained in secure storage for a period of five years, after which it will be destroyed. If it needs to be kept longer, your consent will be secured.

Can participants change their minds and withdraw from the project?

You can decline to participate without any disadvantage to yourself of any kind. If you choose to participate, you may withdraw from the project at any time, without giving reasons for your withdrawal.

You can also withdraw any information that has already been supplied, until the stage agreed on the consent form. You can also refuse to answer any particular question.

What if participants have any questions?

If you have any questions about the project, either now or in the future, please feel free to contact either:

Mr. Mickail Lim (REDACTED)
Professor Lorraine Skelton (lorraine.skelton@op.ac.nz)
Professor Farhad Mehdipour (farhad.mehdipour@op.ac.nz)

Any additional information given or conditions agreed to will be noted on the consent form.

Appendix 3: Consent Form

Project Managers in Scrum Teams:
A Quantitative Report of Software Development Conditions that Influence the Relative Presence of a Project Manager Role within Agile Scrum Teams in Oceania and Southeast Asia

Consent Form

I have read the Participant Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:

- My participation in the project is entirely voluntary and I am free to refuse to answer any particular question
- I am free to stop participating at any time
- I can choose to withdraw information provided without giving reasons and without any disadvantage
- I cannot withdraw any information I have supplied after the data has begun analysis on 1 February 2021.
- My data will be destroyed at the conclusion of the project but any raw data on which the results of the project depend will be retained in secure storage for five years after which it will be destroyed. If it is to be kept longer than five years, my permission will be sought.

- I will have access to the research findings once the study is completed, which will be available in public cloud-based folder and access made available to me at the end of the survey.
- The results of the project may be published and/or used at a presentation in an academic conference but my anonymity / confidentiality will be preserved.
- I can also ask to receive a personal copy of the research findings emailing the researcher, Mickail Lim, at limm4@student.op.ac.nz.

By clicking on the “I wish to participate” in the survey link, the participant expresses his/her consent to take part in this project under the conditions set out in the Information Sheet and this Consent Form.

This project has been reviewed and approved by OPREC

Appendix 4: Ethics Approval Letter

REDACTED