

**Autonomy in Remote Working Scrum Development Teams' Productivity
Post-COVID-19 Pandemic in New Zealand**

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Abstract

The software development industry experienced both advantages and disadvantages of remote working, particularly during the COVID-19 pandemic, especially in terms of Scrum Development Team collaboration and productivity. While remote work is not a new phenomenon in this industry, extensive research has explored its impact on both workers and organisations, shedding light on various aspects of the remote working experience. However, majority of these research were conducted primarily during the COVID-19 pandemic, when mobility restrictions were imposed, resulting in limited access to schools, non-essential workplaces, and recreational activities. Workers found themselves confined to their homes, navigating the delicate balance between personal and organisational responsibilities, relying on autonomy as a benefit of remote working to manage their daily routines effectively. Analysing the outcomes of these research was intriguing as it explored the unique circumstances of workers shifting to remote working with the uncertainties brought about by the COVID-19 pandemic. Nevertheless, there has been no specific research conducted to investigate the impact of remote working on the software development organisations in New Zealand, particularly focusing on the adoption of the Scrum Framework and the productivity of Scrum Development Teams post the COVID-19 pandemic in New Zealand.

Employing Snowball Sampling and Purposive Sampling techniques, the study ensured a targeted and representative respondent sample. The collected qualitative and quantitative data were subjected to Thematic and Descriptive Analysis methods. Notably, Deductive Reasoning permeated the analysis process, extracting valuable insights and fostering innovative conclusions from the dataset. This encompassing methodological framework facilitated a nuanced grasp of autonomy's impact on the productivity of remote Scrum Development Teams in New Zealand. The research findings demonstrated that while remote work offers advantages like flexibility, autonomy, and access to diverse talents, it also

presents challenges concerning team dependency, communication hurdles, and distractions. Despite these challenges, the Scrum Development Teams exhibited resilience and adaptability, maintaining productivity and achieving their objectives. The research underscored the importance of clear expectations, individual goal-setting, and the Scrum Framework in surmounting obstacles and amplifying remote team performance.

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Chapter 1: INTRODUCTION

1.1 Background of the Research

In New Zealand's software development industry, the number of remote workers has increased significantly in recent years. According to Statistics New Zealand (2020), the number of remote working professionals in New Zealand increased from 16% in 2018 to 40% in the second quarter of 2020. Moreover, research conducted by University of Otago in 2020 among remote working professionals in New Zealand found that 92% were fully working during the COVID-19 pandemic, with 18% having prior experience while remote working (O'Kane et al., 2020). The COVID-19 pandemic has had a significant impact on this shift toward remote working, as many organisations have adopted remote working policies in an effort to follow social distancing guidelines and ensure workers' safety (Anderson & Kelliher, 2020; Cucolaş & Russo, 2021; Ford et al., 2021; Parker et al., 2020). The result of this has been the transition of many software development organisations in New Zealand to remote working, allowing their workers to work from home and collaborate remotely (Anderson & Kelliher, 2020). Although this shift to remote working has provided many advantages, it has also presented some challenges, such as the management of remote working Scrum Development Teams, ensuring productivity, and ensuring remote workers' well-being (Cucolaş & Russo, 2021; Ford et al., 2021).

This shift to remote working was complex and required the right tools, training, and management approach to handle the transition, such as employer-worker relationship, teamwork, meeting deliverables, productivity, and managing remote workers (Garzon, 2022; Nguyen & Armoogum, 2021; Parker et al., 2020). In addition to this, a research by McKinsey & Company in 2020, organisations that adopted digital technologies prior to the COVID-19 pandemic were better positioned to adapt to remote working, with 78% of digitally advanced

organisations reporting that they were able to move to remote working seamlessly (Bailey et al., 2020).

Managing remote workers is a constant challenge in any organisation. However, among the management processes, Cucolaş & Russo (2021), Dorda et al. (2020) and Garzon (2022) have recognised the Agile Methodology as highly valuable for comprehending the prevailing remote working setups in organisations. This methodology emphasises rapid progress, continuous learning, and the ability to adapt swiftly to changing circumstances (Cucolaş & Russo, 2021). It is one of the project management approaches that is focused on providing requirements iteratively and progressively throughout a project life cycle, where requirements and solutions change via cooperation amongst self-organising cross-functional teams (Garcia, 2022).

In several studies, Agile Methodology's characteristics such as flexibility, open communication, continuous development, and self-organisation have been shown to enhance the effectiveness of dispersed teams regardless of their location (Dorda et al., 2020; Srivastava & Jain, 2017). The Agile Methodology has several frameworks that may be employed depending on the needs of an organisation, such as Extreme Programming, Information Technology Infrastructure Library (ITIL), and Scrum (Louisnord, 2021; Trapani, 2020). Of all the frameworks, Scrum is the most widely used, particularly within the software development industry, due to its simplicity and high level of performance within the organisation (Harris, 2022; Srivastava & Jain, 2017), as well as how it emphasises communication, transparency, and adaptability as important factors for team success (Grebic & Stojanovic, 2021). By utilising the Scrum Framework, Hayat et al., (2019) claim that software requirements and development can be controlled and managed, and thus processes are improved, responsibilities are dispersed more evenly, and products are delivered faster and more effectively.

1.1.1 An Overview of the Scrum Framework

The Scrum Framework was first implemented in 1993 by Jeff Sutherland, John Scumniotales, and Jeff McKenna at the Easel Corporation where it derives its name from the crowd in rugby (Rigby et al., 2016). It is defined by Sutherland & Schwaber (2020), co-creators of the Scrum Framework, as a framework that enables teams, and organisations to build value via adaptable solutions for challenging issues. This framework, which is the most extensively used Agile Methodology by software development organisations (Fowler, 2019; Grebic & Stojanovic, 2021), offers an iterative and incremental approach to product development (Iqbal, 2021; Rahman, 2021). It works by breaking down large components into small chunks that can be delivered in short cycles by a cross-functional and self-managing team (Rahman, 2021; Sutherland & Schwaber, 2020).

The Scrum Framework's elements serve specific purposes that contribute significantly to the overall value and results (Sutherland & Schwaber, 2020). These elements are Scrum Pillars and Values, Scrum Team, Scrum Events, and Scrum Artifacts (Sutherland & Schwaber, 2020).

Sutherland & Schwaber (2020) mentioned in the Scrum Guide 2020 that there are three pillars in the Scrum Framework: transparency, inspection, and adaptation. As the Scrum Team's knowledge and skills are dependent on individual experiences, evidence, and facts (Cantillo, 2022), these three pillars cannot function unless they are used in combination. However, in order to form a strong foundation, these should be combined with the Scrum Values, which are commitment, focus, openness, respect, and courage (Sutherland & Schwaber, 2020). These will lead the team in the right direction not just in accomplishing one's respective work but also guide their actions and behaviour (Sutherland & Schwaber, 2020).

The three components of a Scrum Team as defined in The Scrum Guide 2020 (Sutherland & Schwaber, 2020) are: (1) the Product Owner manages the Product Backlog, (2) the Scrum Master ensures the team follows and understands the Scrum Framework, and (3) the Scrum Development Team, which is a cross-functional group of professionals responsible for assessing the complexity, configuring, and determining how to meet the requirements described in the Product Backlog, specific to each User Story (Sutherland & Schwaber, 2020). Rehkopf (2023) explains that a User Story is a casual document that presents a software feature from the perspective of the end user. These User Stories are communicated in simple, non-technical language to provide the development team with context and understanding of the user's needs and expectations (Rehkopf, 2023). The Scrum Development Team, in essence, outlines the tasks necessary to deliver each User Story (Sutherland & Schwaber, 2020) on time during each Sprints (Singh, 2022), while the Product Owner defines the requirements needed for each User Story (Fowler, 2019).

Scrum Events are established as the foundation of the Scrum Framework (Singh, 2022); hence, the facilitating Scrum Master must ensure that the Scrum Team is implementing the empirical Scrum Pillars for these events to be productive and meaningful. Scrum Events enable the Scrum Team to evaluate how the team is working towards the Product Goal and how the Scrum artefacts are being changed (Sutherland & Schwaber, 2020). Simply said, if the Scrum Team is unable to organise these events, the chance for inspection and improvement is lost (Fowler, 2019). The five Scrum Events are the Sprint, Sprint Planning, Daily Scrum, Sprint Review, and Sprint Retrospective (Sutherland & Schwaber, 2020). These events are time-boxed, which means they each have a set schedule and maximum duration (Sutherland & Schwaber, 2020) and assist in the management, planning, capturing, reporting,

and tracking of stories and problems throughout and after a product release cycle, which consists of three to four Sprints (Singh, 2022).

1.1.2 Remote Working in the Software Development Industry

Many opportunities have arisen as connection to the internet has been more widely available to the public, including online enterprises, distance learning, and remote working, all of which primarily require an internet connection and a computer or tablet to operate (Flores, 2019; Gibbs et al., 2022). It was during COVID-19 pandemic that these practices were given the opportunity to accelerate, particularly when lockdowns were implemented throughout the globe, requiring organisations to operate remotely, schools to offer online classes (Koh, 2020).

One of the industries that adapted to remote working abruptly and thrived to survive is the software development industry (Christoffersson & Djup, 2021; Cucolaş & Russo, 2021; DeFilippis et al., 2022; Özkan & Mishra, 2019). This industry is known for highly skilled workers who are experienced in remote work, collaborating via digital tools (Özkan & Mishra, 2019). They work independently, whether from the office, the country, or even globally (Anderson & Kelliher, 2020; DeFilippis et al., 2022). The software development industry has been well-prepared to move to remote working, as many organisational operations had already been digitised and cloud-based technologies were being used to facilitate communication and collaboration (Christoffersson & Djup, 2021; DeFilippis et al., 2022). As a result, the industry has been able to continue to produce high-quality work, despite the changes and challenges caused by the COVID-19 pandemic (Christoffersson & Djup, 2021; DeFilippis et al., 2022).

Although this shift was not a new thing to the software development industry, several researchers are still debating its advantages and disadvantages (Aleem et al., 2022; Anderson

& Kelliher, 2020; Bailey et al., 2020; Cucolaş & Russo, 2021). Organisations that are highly focused on innovation and collaboration to produce high-quality products and that consider customer feedback as a basis for product features have encountered significant challenges as a result of this transition due to the lack of communication and engagement (Anderson & Kelliher, 2020; Dorda et al., 2020). Secondly, management expects that remote workers remain online and accessible at all times, monitoring them as they complete their tasks, process is known as micromanagement (Forbes et al., 2020; Garvin, 2022). As a result of this process, remote workers become less confident in their work quality and feel that management lacks trust in them (Houghton, 2021; Parker et al., 2020; Staglin, 2021). It has been observed in Dorda et al.'s (2020) research that more challenges such as lack of face-to-face contact, difficulty collaborating with Scrum Teams, and miscommunication between teams can arise making it important for management to set clear expectations and provide adequate training for their teams in order to resolve these issues. However, these challenges were exacerbated when organisations abruptly changed from occasional to full remote working without adequately preparing management and workers to handle the changing work environment (Christoffersson & Djup, 2021; Dorda et al., 2020; Larson et al., 2020).

In the software development industry, workers are expected to perform technical tasks, maintain high-quality output, and constantly collaborate with team members and stakeholders (Ford, 2020). However, remote working poses challenges in terms of routing information promptly to the relevant team members compared to a co-located setting (Dorda et al., 2020; O'Connor et al., 2021). These findings contrast with Christoffersson & Djup's (2021) research, which observed increased productivity when teams are remote working due to reduced office distractions that allowed for better task focus.

During the shift to remote working, Scrum Teams commonly employ two types of communication: synchronous and asynchronous (Schneider, 2020). Synchronous

communication occurs during Sprint Events like Daily Scrum, Sprint Planning, Sprint Review, and Sprint Retrospective, where real-time collaboration is essential for discussing progress, issues, and plans (Sutherland & Schwaber, 2020). On the other hand, asynchronous communication is used for informal and non-time-sensitive tasks, such as emails or messages in project management tools, enabling team members to communicate without needing simultaneous availability (Schneider, 2020). However, it is important to acknowledge that asynchronous communication has potential disadvantages, including the risk of miscommunication or delayed responses, which can lead to frustration or confusion among Scrum Team members (Christoffersson & Djup, 2021; Masood et al., 2022). Schneider (2020) argues that maintaining effective communication in remote working Scrum Teams necessitates striking a balance between synchronous and asynchronous communication methods.

As previously mentioned, an important concern is the issue of micromanagement, which can result in elevated stress levels and burnout among software developers who constantly feel monitored and pressured to perform (Forbes et al., 2020; Gibbs et al., 2022; Houghton, 2021). A research conducted in 2021 by University of Birmingham researchers examined managerial experiences during the COVID-19 pandemic and found that when managers stopped micromanaging their teams, they became more motivated and productive (Forbes et al., 2020)

When managers engage in micromanagement, they inadvertently erode trust and collaboration, which are vital for the success of Agile Methodologies like the Scrum Framework (Christiansen, 2020; Gibbs et al., 2022). Instead of empowering the Scrum Team and fostering effective collaboration, micromanagement breeds resentment, burnout, and disengagement among team members (Dorda et al., 2020).

The impact of the COVID-19 pandemic on the productivity of Scrum Development Teams has yielded mixed findings. While some studies suggest that remote working has not had a detrimental effect on productivity (Cucolaş & Russo, 2021), others indicate that challenges in communication and micromanagement may have had a negative impact (Garzon, 2022; Dorda et al., 2020). As Scrum Development Teams transition to remote working it is crucial for them to adapt practices and discover effective methods of virtual communication and collaboration to maintain productivity (Harris, 2022). One approach to address these challenges is the implementation of new tools and technologies that facilitate remote working collaboration (King, 2020). By leveraging suitable platforms, Scrum Teams can enhance communication, coordination, and information sharing, thereby supporting productivity in a remote working environments (Fullscale, 2020).

1.1.3 Implementation of Scrum Framework with Dispersed Scrum Development Teams

Software development organisations have widely embraced Agile Methodologies, such as the Scrum Framework, to enhance team productivity, project management, and software quality (Dorda et al., 2020; Grebic & Stojanovic, 2021). However, the emergence of the COVID-19 pandemic necessitated a shift to remote working, posing distinctive challenges for software development organisations (Cucolaş & Russo, 2021; Karamichalis, 2022). Consequently, the implementation of the Scrum Framework in dispersed Scrum Development Teams during the COVID-19 pandemic has become a significant subject of research (Cucolaş & Russo, 2021; Fowler, 2019; Kadenic et al., 2023).

A key advantage of employing the Scrum Framework in a dispersed team is that it provides a structured approach to communication and collaboration, which can help address some of the challenges associated with remote working (Cucolaş & Russo, 2021; Grebic & Stojanovic, 2021). The Scrum Framework promotes regular and frequent communication

among Scrum Team members, ensuring that they stay connected and engaged despite the physical distance (Cucolaş & Russo, 2021; Fowler, 2019). The emphasis on communication aids in maintaining team cohesion and enables effective coordination of tasks and progress updates (Cucolaş & Russo, 2021).

Furthermore, the utilisation of Agile project management tools such as JIRA, Azure DevOps, and Trello, VersionOne can greatly facilitate collaboration and enhance transparency within the team (Garcia et al., 2020; Mihalache, 2017; Özkan & Mishra, 2019). These tools allow Scrum Development Team members to track progress, assign tasks, and share relevant information in real-time, providing a centralised platform for seamless collaboration and improved visibility of project status (DeFilippis et al., 2022; King, 2020; Wu, 2021).

However, implementing the Scrum Framework to dispersed Scrum Development Teams during the COVID-19 pandemic also presented significant challenges. One of the primary challenges were maintaining effective communication and collaboration (Cucolaş & Russo, 2021; DeFilippis et al., 2022, Masood et al., 2022). Virtual meetings and asynchronous communication methods may lack the same level of interpersonal connection as face-to-face interactions, making it more challenging for team members to stay engaged and motivated (Cucolaş & Russo, 2021; Garcia et al., 2020; Masood et al., 2022; Özkan & Mishra, 2019).

To mitigate these challenges, Scrum Development Teams must establish clear communication channels, foster a culture of open and proactive communication, and leverage technology to facilitate virtual interactions (Dorda et al., 2020; Forbes et al., 2020; Özkan & Mishra, 2019). Regular virtual meetings, collaborative tools, and dedicated communication platforms can help bridge the gap and maintain effective communication within the dispersed remote working team (Flores, 2019; Forbes et al., 2020). According to Forbes et al. (2020),

establishing clear goals, providing support and guidance, and fostering a sense of shared responsibility are crucial factors that can enhance worker determination and accountability among Scrum Development Teams in a remote working environment. These elements, as highlighted by Gibbs et al. (2022), play a significant role in promoting improved productivity and successful project outcomes.

Additionally, while there are commonalities in how Scrum Teams practice the Scrum Framework's pillars and values, there is also significant variation due to the unique challenges faced by remote workers. Virtual meetings, for example, often lack the same level of connection, making it harder for Scrum Team members to remain engaged and motivated (Cucolaş & Russo, 2021; Masood et al., 2022). The remote working environment can create distractions, allowing Scrum Development Teams to be less attentive and engaged in the discussion (Dorda et al., 2020; Gibbs et al., 2022; Masood et al., 2022). Masood et al. (2022) highlights that when Scrum Development Teams are co-located, it is easier for everyone to concentrate on the meeting, with the added benefit of subtle cues such as body language helping to maintain engagement (Fowler, 2019). Physical presence also promotes openness and collaboration, as it facilitates easier and more direct interactions among team members (O'Connor et al., 2021; Srivastava & Jain, 2017).

Overcoming these challenges requires deliberate efforts to foster effective communication and collaboration in remote working Scrum Teams (Cucolaş & Russo, 2021; Fowler, 2019). Employing strategies such as setting clear expectations, establishing regular check-ins, and utilising collaboration tools can help enhance engagement and maintain a sense of connection among team members (Jensen et al., 2018; Özkan & Mishra, 2019). According to David Mills, Chief Executive Officer (CEO) of Ricoh Europe, building trust through transparent communication, shared decision-making, and providing opportunities for

meaningful contributions can also mitigate the need for excessive micromanagement and promote a sense of autonomy within the team (Houghton, 2021).

The difficulties of being less proactive and collaborative in virtual meetings has resulted in most meetings exceeding their expected duration (Dorda et al., 2020; Christoffersson & Djup, 2021). Teams have reported that the difficulties in keeping team members focused and encouraging active participation and input have resulted in longer meetings, as facilitators need extra time to engage remote workers, according to Dorda et al. (2020). While effective team communication and transparency are crucial for the success of the Scrum Team, developers view these meetings as time-wasting, as they have to endure lengthy meetings instead of focusing on their tasks (Nundlall & Nagowah, 2022). Nonetheless, these meetings provide the Scrum Team with opportunities to address and resolve various issues that hinder project development or require the sharing of new information (Rizmalidi & Jayadi, 2022). Longer meetings allow team members to express their opinions, devise solutions, and propel the project forward (Russo, 2021). It also provide ample time for discussing project-related concerns and generating innovative ideas (Staglin, 2021). Grebic & Stojanovic (2021) emphasises the importance of ensuring that the team understands the purpose and direction of each meeting agenda before diving into the discussion. This way, important points can be noted, and meetings can be more effective rather than unproductive (DeFilippis et al., 2022).

Dorda et al. (2020) propose a practical solution to address the challenge of lengthy meetings by suggesting the splitting of meetings into multiple sessions. This approach helps maximise productivity and allows for a reassessment of each worker's necessity to attend every meeting. For instance, Daily Scrums, which are intended to be brief status update meetings, can be strictly limited to 15 minutes and focused solely on addressing the three essential questions outlined in the Scrum Guide (Grebic & Stojanovic, 2021). By adhering to

the core purpose of these meetings and avoiding unnecessary tangents, valuable time can be saved (Dorda et al., 2020). To further optimise time utilisation, any discussions or topics that do not require the participation of the entire team can be separated into additional meetings (Mustajab, 2020). This way, Scrum Team members who are not directly involved in a specific discussion can continue working on their assigned tasks, avoiding unnecessary disruptions (Grebic & Stojanovic, 2021; Mustajab, 2020). By carefully considering the relevance and inclusiveness of each meeting, the team's productivity can be enhanced (Dorda et al., 2020).

While it is crucial to leverage Scrum Events as platform for team engagement and collaboration, it is equally important to acknowledge that these meetings can sometimes consume a significant portion of the team's available working hours (Parker et al., 2020; Mustajab, 2020). Therefore, Scrum Masters and team leaders need to strike a balance between the value derived from these meetings and the time invested in them (Rehkopf, 2023).

Creativity plays a vital role in optimising the effectiveness of Scrum Events (Pattnaik & Sahoo, 2021; Sutherland & Schwaber, 2020). Scrum Masters can devise different activities tailored to the specific needs of their team, ensuring that the most critical topics are addressed and the team's objectives are achieved (Fowler, 2019; Pattnaik & Sahoo, 2021). By identifying the primary goals of each meeting and focusing on key topics, Scrum Masters can design engaging and productive activities that foster collaboration and drive progress (Grebic & Stojanovic, 2021). Moreover, Scrum Masters should maintain awareness of the time allocation for these meetings (Harris, 2022). It is essential to ensure that the meetings are efficient, and result-oriented, and do not encroach upon the time required by the team to perform their actual work and complete their tasks (Grebic & Stojanovic, 2021; Dorda et al., 2020). By actively managing the duration and effectiveness of the meetings, Scrum Masters

can safeguard the team's productivity and prevent unnecessary delays in project execution (Bunning, 2020).

1.1.4 Relationship between Autonomy and Productivity

Autonomy, as argued by Dee (2022) and Krohn (2022), plays a crucial role in motivating developers and fostering happiness and creativity in the workplace. The concept of autonomy empowers workers to take on complex tasks, adapt to evolving requirements, and explore innovative solutions without the constraints of micromanagement (Dee, 2022; Forbes et al., 2020; Krohn, 2022; Noll et al., 2017). As noted by Noll et al. (2017), when organisations provide workers with the freedom to experiment and express their ideas, they reap the benefits of enhanced creativity and the emergence of novel problem-solving approaches.

Additionally, Pattnaik and Sahoo (2020) reported that when workers perceive recognition and appreciation for their contributions, it cultivates a feeling of loyalty, resulting in enhanced workers retention rates and a lasting dedication to delivering exemplary work. This aligns with the findings of several other studies in the field, emphasising the significance of acknowledging and valuing the efforts of developers in maintaining a motivated and productive workforce (Cordery et al., 2010; Noll et al., 2017).

The Software Development Teams demonstrates a deep understanding of problem-solving and handling complex responsibilities through self-organisation and innovative approaches, as highlighted by Krohn (2022). This sense of ownership within the team motivated active engagement and a proactive attitude (Krohn, 2022). Additionally, team's enhanced collaboration and streamlined decision-making processes contribute to the timely delivery of high-quality software (Sutherland & Schwaber, 2020). By collectively taking ownership of the development process, the team foster a culture of innovation and creativity,

resulting in more efficient and superior outcomes (Grebic & Stojanovic, 2021; Johanssen & Zak, 2020; Krohn, 2022).

1.1.4.1 Fostering Autonomy and Trust to Boost Productivity

Merely having autonomy is insufficient for organisational success (Houghton, 2021; Keller et al., 2020). According to Pattnaik & Sahoo (2021), in addition to autonomy, fostering a culture of trust is crucial. By nurturing a trusting environment, teams can effectively communicate and collaborate, creating a productive atmosphere where they can leverage their autonomy (Keller et al., 2020). Krohn (2022) emphasises the significance of granting autonomy to workers in software development organisations, enabling them to self-organise and make independent decisions regarding their work. This autonomy not only empowers workers but also contributes to the overall quality of the software (Houghton, 2021; Keller et al., 2020). Additionally, Forbes et al. (2020) highlight the role of trust in enhancing software quality by fostering knowledge sharing and facilitating prompt problem reporting among team members.

The absence of autonomy and trust can result in feelings of helplessness and a lack of control, negatively impacting workers psychological well-being (Houghton, 2021). Furthermore, Noll et al. (2017) pointed out that experienced software developers may experience frustration or demoralisation when their ideas and solutions are consistently ignored or undervalued. Conversely, the same research found that junior developers often seek guidance and mentoring, valuing the inputs of senior colleagues as a valuable resource due to their relative newness to the team (Noll et al., 2017). This dichotomy can lead to a lack of collaboration between the two groups, which in turn stifles productivity and innovation (Ford, 2020; Pattnaik & Sahoo, 2021).

1.1.4.2 Detrimental Effects of Micromanagement on Productivity

While remote working offers increased control over workers' daily activities, some managers perceive it as a threat to organisational productivity, particularly during the COVID-19 pandemic (Forbes et al., 2020). According to Parker et al. (2020), 38% of managers believe on-site workers are more productive than remote workers, with 22% being unsure, while 40% disagree with this notion. This demonstrates lack of trust in workers among managers, resulting in micromanagement and close monitoring of progress and availability (Houghton, 2021; Kamali, 2021). This lack of trust translates into low autonomy for workers, which often leads to stress, apathy, depression, and a decline in confidence (Houghton, 2021; Parker et al., 2020).

The issue of trust is further supported by Fowler (2019), Parker et al. (2020) and O'Connor et al. (2021). In software development organisations, where remote working poses challenges, including a shift in management style from requesting team attendance in meetings, in addition to Scrum Events, to utilising passive-aggressive language as a supposed motivator (Fowler, 2019; Parker et al., 2020). However, contrary to managers' beliefs, this approach often makes remote workers uncomfortable and consumes time that could have been dedicated to actual work (Masood et al., 2021). As Parker et al. (2020) discovered, remote workers may become demotivated and unproductive due to a lack of trust and judgment from their managers. Consequently, they experience excessive level of micromanagement and a lack of support and understanding from their managers (Staglin, 2021).

The concern in micromanagement have arisen due to the limited visibility managers had in the productivity of remote workers, making it challenging to assess progress and ensure the timely completion of tasks (Collins & Collins, 2002; Parker et al., 2020). Apart from that, this micromanagement approach contradicts the principles of the Scrum

Framework (Christiansen, 2020), which advocates for self-organising teams and empowers team members to take ownership of their work (Sutherland & Schwaber, 2020). The negative effects of micromanagement can undermine the advantages offered by the Scrum Framework, such as enhanced autonomy and ownership among team members (Christiansen, 2020).

According to Christiansen (2020), micromanagement is incompatible with the principles of Agile Manifesto, which emphasises self-organisation within the Scrum Team. Thus, engaging in micromanagement can hinder the organisation from fully realising the benefits of the framework and can be seen as sabotaging the effectiveness of Scrum (Christiansen, 2020; Houghton, 2021; Staglin, 2021).

1.2 Significance of the Research

As the world enters the post-COVID-19 pandemic era, some organisations are urging their workers to return to the office after transitioning from working from the office to remote working at the onset of the COVID-19 pandemic (Sandoval-Reyes et al., 2021; Staglin, 2021; Wang et al., 2020). Other organisations have opted for a complete remote working or hybrid working arrangement where workers are required to be physically present in the office a few times per week (Masood et al., 2022; O'Connor et al., 2021; Staglin, 2021).

Several studies on how remote working has affected a wide range of organisations in recent years have been conducted across the globe, and the results have been highly intriguing because of the different results and observations to its impact on work productivity (Masood et al., 2022; O'Connor et al., 2021). These studies, conducted by various researchers in different regions, have resulted in diverse observations regarding the impact of remote working on workers' organisational and personal responsibilities (Staglin, 2021; Wang et al., 2020). However, to the best of the researcher's knowledge, no research has been conducted specifically examining the impact of remote working on the software development industry in

New Zealand that have adopted the Scrum Framework for remote working Scrum Development Teams.

Therefore, this research will evaluate the impact of autonomy, a perceived benefit of remote working (Pattnaik & Sahoo, 2021), on the productivity of Scrum Development Teams in New Zealand-based software development organisations, specifically as they work towards the completion of tasks such as coding, code reviews, software testing, and bug fixes while adopting the Scrum Framework. The completion of tasks during a Sprint, a timebox period for the Scrum Development Teams to work on their tasks (Sutherland & Schwaber, 2020), will be judged as a metric of productivity. It's worth highlighting that these tasks, coding, code review, software testing, and issue resolution, are core activities for the Scrum Development Team, which includes software developers and testers, to achieve Sprint Goals (Fowler, 2019). Focusing on organisations that embrace the Scrum Framework was pivotal, as it stands out as the most widely adopted Agile Methodology across industries, attributed to its iterative and incremental approach to product development (Sutherland & Schwaber, 2020).

Additionally, an investigation on how the Scrum Framework can be effectively adapted on remote working Scrum Development Teams was also analysed and explored the impact of the principles of collaboration, trust, transparency, inspection, and open communication on team performance (Sutherland & Schwaber, 2020), and whether these principles were still effective when they were not in the same physical space.

1.3 Research Objectives

This research aims to assess the impact of autonomy on the productivity of remote working Scrum Development Teams and the effectiveness of the Scrum Framework in the software development organisations in New Zealand. The focus on productivity is centred

around the completion of core tasks such as coding, code review, software testing, and issue resolution during the Sprint. These activities are justified because these directly contribute to the overall development process of the Scrum Development Teams and play a vital role in achieving the product goal.

The following are the research objectives:

1. To evaluate the impact of autonomy on remote working Scrum Development Teams' productivity in terms of completing activities such as coding, code review, software testing, and issue resolution.
2. To identify the advantages and disadvantages that Scrum Development Teams in New Zealand's software development organisations encounter in adapting the Scrum Framework to dispersed teams post-COVID-19 pandemic.
3. To present recommendations that will assist software development organisations and remote workers in overcoming the challenges associated with adapting the Scrum Framework to dispersed workforces.

1.4 Research Questions

To achieve the research objectives, a set of research questions were formulated. These questions aim to address the impact of remote working on both the Scrum Development Teams and software development organisations in New Zealand, considering various aspects such as productivity and organisational advantages.

The following are the research questions:

1. What are the factors that disrupt concentration and task focus of Scrum Development Team members when remote working?
2. How do the values and principles of Scrum Framework support software development organisations in adjusting from the shift to remote working arrangements especially in managing dispersed Scrum Development Teams?
3. What are the advantages and disadvantages of adopting the Scrum Framework in managing dispersed Scrum Teams post-COVID-19 pandemic?

1.5 Research Structure

The research is structured into five chapters, as shown in Figure 1, with each chapter focusing on a particular aspect of the research. A concise description of the content of each chapter is provided below.

Figure 1

Research Structure



Note: Structure of this research. Adapted from *Basic Structured Guide for Writing Academic Research*, by B.Muma, 2020, The Technical University of Kenya. Copyright 2020 by Bernard Muma.

Chapter 1: Introduction

This chapter provides the background and context of this research. The research objectives and questions are discussed and defined.

Chapter 2: Literature Review

This chapter provides an overview of the relevant literature related to the research objective. The literature review served to support the researcher in the data analysis process by presenting insights and findings from past studies on topics such as the relationship between autonomy and remote working, the responsibilities of Scrum Development Teams, the tools and techniques utilised, and diverse approaches to work.

Chapter 3: Research Methodology

This chapter provides an overview of the research methodology employed in this research. It outlines the research paradigm, approach, sampling methods, and criteria for selecting respondents. Additionally, it presents the data collection and analysis techniques utilised in the research.

Chapter 4: Data Analysis and Findings

This chapter presents the findings of the research and analysis. The collected data were analysed using various data analysis techniques that were defined in Chapter 3. The analysis sought to extract significant insights and trends from the gathered data, which support the research objectives and questions.

Chapter 5: Conclusion and Recommendations

The final chapter summarises the key findings of the research and its relevance to the research objectives and questions. The findings are then compared with prior research to establish links with existing knowledge and identify any disparities or novel insights that emerged from this research. By comparing the results to previous studies, the aim was to

extend the scope and strengthen the validity of the findings. The limitations of the research were also discussed, along with suggestions for future research.

1.6 Chapter Summary

In the software development industry today, the Scrum Framework has become an increasingly popular Agile Methodology (Iqbal, 2021; Rahman, 2021). This framework has proven to be effective and important in dealing with a wide variety of circumstances, especially since it emphasises team collaboration, communication, and autonomy (Sutherland & Schwaber, 2020). This provides the Scrum Team with the freedom to use their skills and creativity to achieve goals through an incremental and iterative approach (Fowler, 2019; Pattnaik & Sahoo, 2021).

With the Scrum Development Team being the ones working to transform the ideals and specifications into reality, it is essential for them to execute and have the aforementioned qualities in order to deliver the desired output (Fowler, 2019; Sutherland & Schwaber, 2020). Nevertheless, due to the shift from face-to-face to virtual communications, various advantages and disadvantages have been identified through the extant literature that could either result in increased or decreased productivity (Aleem et al., 2022; Cucolaş & Russo, 2021; Fowler, 2019).

As a framework for teamwork and autonomy, Scrum has many interesting aspects; however, as stated in the Scrum Guide 2020, trust is essential for this framework to work and for the team to benefit from it (Sutherland & Schwaber, 2020). However, the nature of direct collaboration and communication has changed considerably since organisations have shifted from face-to-face interactions to virtual ones (Aleem et al., 20223; Cucolaş & Russo, 2021).

During the COVID-19 pandemic, numerous elements and factors have emerged that highlight the impact of this shift on the productivity and well-being of Software Development

Teams (Aleem et al., 2022; Cucolaş & Russo, 2021; Rizmaldi & Jayadi, 2022). This includes examining whether remote working has facilitated progress and increased productivity, or conversely, led to burnout and screen fatigue (Rizmaldi & Jayadi, 2022). In addition to the Scrum Framework, remote working provides Software Development Teams with the ability to manage their own time, which has posed challenges for management due to the absence of a physical office (Dee, 2022; Pattnaik & Sahoo, 2021; Rizmaldi & Jayadi, 2022). This lack of visibility makes it difficult for management to monitor team functioning and progress, often leading to micromanagement and hindering team members' concentration and task focus (Houghton, 2021; Parker et al., 2020).

However, diving deeper into the challenges that workers face behind their screens is equally important as diving into the organisational challenges (Cucolaş & Russo, 2021; Rizmaldi & Jayadi, 2022). These results in distractions, lack of structure, and difficulty maintaining a healthy work-life balance which could result in decreased productivity (Gibbs et al., 2022; Sutarto et al., 2021). The implementation of the Scrum Framework and the shift to remote working provides the researcher with a better understanding of how the Scrum Development Teams' productivity has been impacted by investigating the impact of autonomy as the team progressed on their organisational responsibilities (Cantillo, 2020; Cucolaş & Russo, 2021).

Chapter 2: LITERATURE REVIEW

2.1 Introduction

The goal of this chapter is to provide more information about remote working, including its origins, widely recognised advantages, and disadvantages, and how it was adopted by the software development industry, as well as how Scrum was able to serve as a mediator for remote workers. Furthermore, it also investigated the foundations of the Agile Manifesto and conducted a comparative analysis of three prominent Agile Frameworks: Extreme Programming, Information Technology Infrastructure Library (ITIL), and Scrum. This analysis offered valuable insights into the distinctions between Scrum and other Agile frameworks, shedding light on why Scrum has emerged as a preferred methodology for remote working arrangement. This assists the researcher in identifying the distinct challenges faced by Software Development Teams in remote working environments and understanding how the Scrum Framework can effectively address these challenges.

This chapter will also delve into the comparison of two different working approaches: Deep Work and Shallow Work. The aim is to determine which of these approaches could be more beneficial for remote working Scrum Development Teams. Deep Work refers to a focused, uninterrupted and intensive work style (Newport, 2016), whereas Shallow Work is characterised by less concentration and more frequent distractions (Lashbrooke, 2021; Mailman, 2022). By comparing these two approaches, it aims to provide insights into how the remote working Scrum Development Team can work more effectively and efficiently.

2.2 History of Remote Working

Remote working, previously known as telecommuting, has a diverse history that spans several decades (Niles, 1976). The term was first coined by Jack Nilles, a National

Aeronautics and Space Administration (NASA) engineer (Niles, 1976), in 1973, in his book “The Telecommunications-Transportation Trade off”. Back then, workers who could do remote working with little contact with others in the office and could get by with just a phone and a computer (Nilles, 1976), which laid the foundation for telecommuting (Oliver, 2021; Sroka, 2018). Nilles believed that this approach could address issues like traffic congestion, urban sprawl, and resource depletion (King, 2020). Since then, remote working has developed considerably, with technological advances facilitating work from various remote locations, such as home offices, coworking spaces, and other remote working arrangements (Sroka, 2018; Useem, 2017).

In the 1980s, remote working gained momentum with the increasing availability of personal computers and the internet (Johns & Gratton, 2013). One of the early pioneers of remote working, International Business Machines Corporation (IBM), introduced a policy in 1983 that allowed workers to engage in a remote working arrangement for one or two days per week (Useem, 2017; Sroka, 2018). A significant factor in IBM’s decision to begin remote working was the oil embargo in 1970s that resulted in shortages and high prices of oil, which had a significant impact on the United States (US) economy and its industries (King, 2020).

Initially, in 1979, only five workers were remote working, then by 1983, the number had expanded to 2,000 (Useem, 2017). The advent of personal computers and terminal emulators revolutionised communication for remote workers, enabling them to connect and collaborate with workers located in branch offices (Sroka, 2018). This technological advancement played a pivotal role in bridging the physical distance between workers, allowing for seamless interactions and efficient information exchange (Sroka, 2018).

As IBM recognised the potential cost savings, it began promoting remote working and selling its prominent buildings, and not long after in 2009, IBM had an increase of 40% of its total workers to 386,000 remote working, representing 173 countries (Useem, 2017). By

selling its office buildings, IBM has generated approximately \$2 billion (Goman, 2017). Other organisations such as J.C. Penney, American Express and General Electric, soon followed suit, and remote working became increasingly common in the 1990s as organisations realised the advantages of allowing workers to work from home or other remote locations (Allen, 2020).

However, despite having been remote working for more than a decade, IBM called its workers back into the office in 2017 (Allen, 2020; Goman, 2017; Useem, 2017). This move aimed to boost creativity and collaboration among workers since face-to-face interaction sparks new ideas and builds strong relationships in inspiring locations according to Michelle Peluso, IBM's Chief Marketing Officer (Allen, 2020; Useem, 2017). There has been some disagreement over IBM's decision, with some arguing that remote work is good for productivity, innovation and work-life balance, and others saying it hurts innovation and teamwork (Allen, 2020; Goman, 2017; King, 2020). In addition to IBM organisations such as Yahoo, Aetna, and Best Buy had similar objectives, which were to bring back brilliant minds who work collaboratively while emphasising the significance of face-to-face interaction and body language as contributors to the organisation's success (Goman, 2017).

Despite the return to office-based work by some of the early pioneers of remote working, the practice of remote working has continued to experience a surge in popularity in recent years (Golden et al., 2021). While some organisations remain hesitant to adopt remote working policies, others have embraced them and experienced positive outcomes in managing dispersed teams (Barrero et al., 2021; Noll & Beecham, 2017). Virtual collaboration has been shown to be equally, if not more, effective than face-to-face communication in certain contexts (Christoffersson & Djup, 2021; Flores, 2019; O'Connor et al., 2021). However, virtual collaboration also comes with its challenges, such as potential

breakdowns in communication and difficulties in fostering strong connections among team members who are geographically dispersed (Noll & Beecham, 2017; Wang et al., 2020).

The COVID-19 pandemic marked a significant turning point for remote working, leading to its widespread adoption (Ågren et al., 2022; Anderson & Kelliher, 2020; Cucolaş & Russo, 2021; Elgan, 2022). Organisations around the world were compelled to implement remote working policies as a response to social distancing requirements and the need to ensure the well-being of their workers (Anderson & Kelliher, 2020; Dingel & Neiman, 2020; Karamichalis, 2020).

This sudden shift to remote working was not without its challenges, and some organisations struggled to adapt to the new work arrangements (Forbes, 2019; Ford et al., 2021; Gibbs et al., 2022). According to a survey conducted by Gartner in 2020, only 30% of organisations had a remote working policy in place before the COVID-19 pandemic, and many were not prepared for the rapid shift to remote working (Gartner, 2020). This sudden shift highlighted the need for organisations to be more flexible and adaptable in their work arrangements, and many have since realised the advantages of remote working (DeFilippis, et al., 2022; Dingel & Neiman, 2020).

As remote working became more popular because of its advantages, numerous challenges were arising as well that leads to affecting productivity, health and even profit (Ågren et al., 2022; Christoffersson & Djup, 2021; O'Connor et al., 2021; Flores, 2019; Mustajab et., 2020). An overview of the advantages and disadvantages of remote working is shown in Table 1.

Table 1*Advantages and Disadvantages of Remote Working*

	Advantages	Disadvantages
Organisations	Cost savings (e.g., rent, utilities) (Ford et al., 2021)	Difficulty monitoring worker productivity (Ågren et al., 2022; Mustajab, 2020; Sutarto et al., 2021)
	Access to a larger pool of job candidates (Cucolaş & Russo, 2021; Flores, 2019)	Communication and collaboration challenges (Flores, 2019; Mustajab et al., 2020; Sutarto et al., 2021)
	Improved worker retention and morale (Russo, 2021)	Potential for social isolation (Ågren et al., 2022; Sutarto et al., 2021)
Workers	Flexibility in work schedule and location (Flores, 2019; Ford et al., 2021)	Difficulty separating work and personal life (Flores, 2019)
	Reduced commuting time and expenses (Ford et al., 2021)	Limited access to resources and support (Ågren et al., 2022)
	Improved work-life balance (Flores, 2019)	Potential for distractions (Ford et al., 2021)
Environment	Reduced carbon emissions from commuting (King, 2020)	Increased energy use in homes (Flores, 2019, Ford et al., 2021)
	Less waste from disposable office supplies (King, 2020)	Increased reliance on electronic devices (Flores, 2019, Ford et al., 2021)
	Reduced need for office space and supplies (Szumilo & Wiegelmann, 2021)	Potential for increased e-waste (King, 2020)

Note. Advantages and disadvantages of remote working categorised by organisations, workers, and environment.

The stability of communication and collaboration among workers is a crucial issue that organisations face when transitioning to remote working (Cucolaş & Russo, 2021; Flores, 2019; Mustajab et al., 2020; Sutarto et al., 2021). In addition to the difficulty in maintaining a sense of connection and shared purpose among team members, remote working can also lead to feelings of isolation, loneliness, and disengagement (Golden et al., 2008; Sroka, 2018).

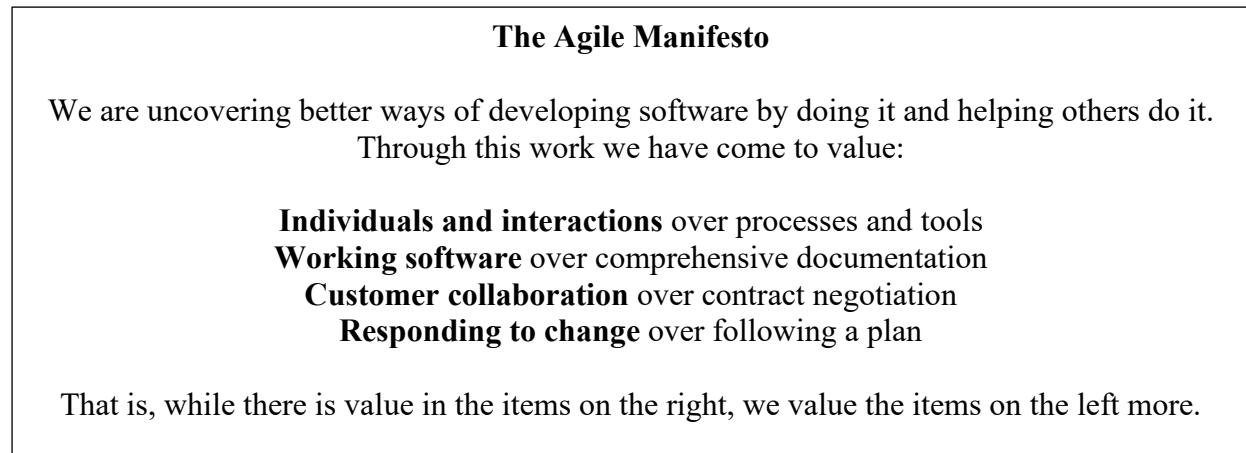
Organisations have embraced remote working because of the advantages it provides to both remote workers and the organisations, such as better work-life balance and lower overhead expenses (Barrero et al., 2021; Ford et al., 2021; Gibbs et al., 2022). However, worries about the impact of remote working on productivity remains (Ågren et al., 2022; Mustajab, 2020; Sutarto et al., 2021). Sutarto et al. (2021) discovered that while remote workers reported greater job satisfaction, they also reported more distress and less autonomy over their work. Another problem is tracking and supervising remote workers as managers struggle to ensure that their remote workers make deadlines and complete duties successfully without in-person supervision (Purvanova & Bono, 2009).

2.3 Understanding the Agile Methodology

Agile is a way of working (WoW) and a mindset founded on the values and principles of the Agile Manifesto, according to Project Management Institute (2022) and Agile Alliance (2022). These values and principles, shown in Figure 2 below, provide direction on how to create and respond to change, as well as how to cope with agility (Drumond, 2023). A group of 17 software practitioners gathered in the Wasatch Mountains of Utah in February 2001 to discuss and share individual perspectives on software development processes (Hazzan & Dubinsky, 2014). It was agreed by these software practitioners that the traditional, document-heavy approach to software development was hindering the process and impeding the delivery of high-quality products to customers (Hazzan & Dubinsky, 2014; Sacolick, 2022).

Figure 2

The Agile Manifesto



Note: The Agile Manifesto. Text reproduced from *Agile Anywhere*, (1st ed., p.10), by O.Hazzan & Y.Dubinsky, 2014, Springer Briefs in Computer Science. Copyright 2014 by Orit Hazzan & Yael Dubinsky.

The Agile Manifesto emerged from these discussions (Hazzan & Dubinsky, 2014). It outlines four values and 12 principles that stress the significance of people, collaboration, working software, and adaptability to change (Hazzan & Dubinsky, 2014). The emphasis was placed on prioritising collaboration over excessive documentation, fostering self-organisation instead of rigid management practices, and embracing adaptability to handle continuous change rather than being bound by a fixed development process (Hazzan & Dubinsky, 2019; Moe et al., 2008).

The focus on collaboration, communication and respect for people are the crucial elements of Agile Methodology (Harris, 2022; Hazzan & Dubinsky, 2014; Moe et al., 2008). Agile teams in the software development industry prioritise close collaboration and open communication to foster a shared understanding of goals and facilitate effective teamwork (Drumond, 2023). By breaking down projects into smaller, more manageable tasks, agile

teams are able to work collaboratively and respond swiftly to feedback and changes in requirements (Pattnaik & Sahoo, 2021; Harris, 2022).

Another key feature of the Agile Methodology is its emphasis on rapid revisions (Hazzan & Dubinsky, 2014). Agile teams produce functional software in short Sprints which enables teams to rapidly iterate and respond to changing requirements as they emerge (Harris, 2022; Kettunen & Laanti, 2017). Agile teams can get input from clients early in the development process by providing small amounts of value regularly (Moe et al., 2008).

This collaborative approach in Agile teams promotes regular interactions and promotes transparency among team members, enabling them to address challenges and make adjustments throughout the development process (Conboy & Fitzgerald, 2004). Agile Methodology frameworks, such as Scrum, emphasise iterative development and frequent feedback loops, allowing teams to adapt and refine their work based on continuous learning and improvement (Sutherland & Schwaber, 2020). This iterative nature of agile development ensures that teams can respond quickly to evolving customer needs and market dynamics (Pattnaik & Sahoo, 2021). Furthermore, Agile practices encourage cross-functional collaboration, where team members with diverse skill sets and expertise work together to deliver high-quality software products (Harris, 2022). By promoting collective ownership and shared responsibility, Agile teams harness the collective intelligence and creativity of the entire team, resulting in innovative solutions and improved outcomes (Hazzan & Dubinsky, 2014).

Kanban is another Agile Methodology framework that emphasises visualising work, limiting work in progress, and focusing on continuous improvement (Agile Alliance, 2023). According to Kanbanize (2023) and Agile Alliance (2023), Kanban involves using a board or other visual tools to represent the workflow, with cards indicating the status of each task. This approach can help teams to identify bottlenecks and improve the development process

over time (Kanbanize, 2023). Although each framework has its own set of practises and procedures, they share the same ideals and principles stated in the Agile Manifesto (Conboy & Fitzgerald, 2004).

2.3.1 Advantages and Disadvantages of Agile Methodology

One of the benefits of Agile Methodology is its customer-centric strategy, which includes ongoing consumer input throughout the development process, which Moe et al. (2008) believed that it results in end products that are more likely to be adopted because they better satisfy the requirements of customers (Hayat et al., 2019).

Several studies have verified the advantages of involving customers in Agile development (Hoda et al., 2011; Kettunen & Laanti, 2017; Lindvall et al., 2004; Moe et al., 2008). For example, Moe et al. (2008) discovered that involving customers in Agile projects improved satisfaction with the completed outcome. On the otherhand, Hoda et al. (2011) argues that involving customers in Agile projects resulted in a better grasp of requirements and a lower chance of project failure. Another benefit of Agile Methodology is its emphasis on cooperation and teamwork, which results in improved communication and comprehension among team members however not advisable for large development organisations because of delays in decision-making when working with multiple teams, as projects become complex (Kettunen & Laanti, 2017). However, Lindvall et al. (2004) claim that this should not stop organisations from using Agile Methodology as the results of using this are still promising. One of the promising results of this is quicker decision-making and problem-solving, as well as increased job happiness (Lindvall et al., 2004).

Nevertheless, the Agile Methodology does have certain limitations. One prominent disadvantage is the lack of extensive upfront planning and documentation, which can pose challenges in managing project scope and budget (Radzik, 2022). This may lead to scope

creep, where project requirements expand beyond the initial plan and cost overruns (Dzanic et al., 2022; Radzik, 2022). Additionally, the fast-paced nature of Agile development can make it more demanding to uphold high-quality standards (Conboy & Fitzgerald, 2004).

Several recent studies have examined the challenges associated with maintaining quality standards when applying Agile Methodology in the development process (Conboy & Fitzgerald, 2004; Dzanic et al., 2022; Fitzgerald et al., 2013; Kandebo, 2015). For instance, Dzanic et al. (2022) found that the lack of documentation in Agile projects can make it more difficult to identify and address errors. While Agile Methodology can be beneficial for other organisations apart from software development industry, it may not be suitable for highly regulated industries that value high quality and extreme documentation (Dzanic et al., 2022; Fitzgerald et al., 2013). According to Kandebo (2015), the Agile Manifesto suggests that it promotes minimal documentation and a lack of formal processes, which can be problematic, particularly in highly regulated industries where audits and compliance are crucial (Conboy & Fitzgerald, 2004). This approach has the potential to create chaos and challenges in maintaining regulatory requirements (Dzanic et al., 2022).

2.3.2 Comparison of Agile Frameworks

Extreme Programming (XP), Information Technology Infrastructure Library (ITIL), and Scrum are all notable Agile frameworks that have distinct characteristics and applications. XP emphasizes programming excellence, continuous integration, and rapid feedback cycles (Trapani, 2020). ITIL, on the other hand, focuses on IT service management and aligning IT services with business needs (Louisnord, 2021). Scrum, as compared to XP and ITIL, offers a flexible and iterative approach to project management, fostering collaboration and adaptability (Harris, 2022; Srivastava & Jain, 2017).

Scrum's preference when working remotely can be attributed to its core principles. Scrum places a strong emphasis on clear communication, frequent feedback, and adaptability, making it well-suited for distributed teams (Sutherland & Schwaber, 2020). The framework's structured ceremonies, such as Daily Scrums and Sprint Reviews, provide regular touchpoints for remote teams to synchronise and address challenges (Singh, 2020). Moreover, Scrum's focus on self-organisation and autonomy allows remote team members to take ownership of their work, promoting accountability and motivation (Kadenic et al., 2023). The Scrum Master role, dedicated to removing impediments and facilitating communication, becomes even more vital in remote settings (Fowler, 2019; Pattnaik & Sahoo, 2021).

Additionally, Scrum's iterative approach aligns well with the dynamic nature of remote work. The iterative development cycles, known as Sprints, enable teams to deliver incremental value and adapt to changing requirements, minimizing risks associated with remote project management (Sutherland & Schwaber, 2020). Scrum's emphasis on continuous improvement encourages remote teams to reflect on their processes and make necessary adjustments, fostering efficiency and collaboration over time (Sutherland & Schwaber, 2020).

2.4 Previous Findings

This section provides a review of current literature on the impact of remote working on the productivity and progress of Scrum Development Teams. It compares various claims made in previously published literature, taking into account different working styles and environmental factors.

2.4.1 Who are the Scrum Development Team?

The Scrum Guide 2020 defines the Scrum Development Team as members of the Scrum Team that are committed to creating any aspect of a usable increment each Sprint (Sutherland & Schwaber, 2020). The team is composed of three to nine skilled technical professionals who work together with the primary responsibility of transforming the ideas provided by the Product Owner into tangible outcomes that are ready to be delivered to the customer (Fowler, 2020). As emphasised by Sutherland & Schwaber (2020), the Scrum Development Team operates in a self-organising and cross-functional manner, implying that team members possess the necessary skills and knowledge to fulfil the required work (Fowler, 2020).

The Scrum Development Team plays a pivotal role in the Scrum Framework, encompassing various responsibilities (Baijens et al., 2020; Baumgart et al., 2015). Firstly, they are accountable for delivering a potentially functional product increment at the conclusion of each Sprint, ensuring thorough testing, integration, and readiness for customer delivery (Baumgart et al., 2015). Additionally, the Scrum Development Team collaborates closely with the Product Owner to estimate the required effort for each item on the Product Backlog, enabling accurate forecasting and prioritisation (Baumgart et al., 2015; Sutherland & Schwaber, 2020). Lastly, the Scrum Development Team must be adaptable, responding to changes in product specifications and Sprint objectives (Baumgart & Holten, 2015; Nazir et al., 2022). The effectiveness of the Scrum Development Team is influenced by several factors; effective communication, cooperation, and a shared understanding of the product strategy and goals are critical for their productivity (Baumgart et al., 2015; Sutherland & Schwaber, 2020; O'Connor et al., 2021).

Efficient communication and collaboration among team members contribute to faster and more effective work, reducing the risk of delays and defects (Baumgart et al., 2015;

Dorda et al., 2020; Nandwani, 2020). Research suggests that effective communication and collaboration are positively associated with project success and team performance (Baumgart et al., 2015; O'Connor et al., 2021). However, it is important to strike a balance in communication to prevent excessive time spent on Scrum Events (Dorda et al., 2020). Baumgart & Holten (2015) and Dorda et al. (2020) both cautioned that overly lengthy meetings can be counterproductive, and the Scrum Master can play a role in facilitating efficient communication (Bunning, 2020). Strategies such as breaking up meetings into smaller sessions or inviting only relevant team members can help maintain focus and prevent unproductive discussions (Dorda et al., 2020). By ensuring effective communication practices, the Scrum Development Team can optimise their performance and contribute to successful project outcomes (Grebic & Stojanovic, 2021).

The productivity of the Scrum Development Team is influenced by various factors, and effective communication and collaboration have been identified as critical contributors to team performance (Baumgart et al., 2015). When the Scrum Development Team have a clear understanding of the product strategy and goals, they can align their efforts and avoid working in isolation, ensuring that everyone is working towards a common objective (Grebic & Stojanovic, 2021; O'Connor et al., 2020). Moreover, possessing advanced technical skills and knowledge of project tools and best practices in software development enables the team to deliver high-quality work efficiently (King, 2020).

Creating a supportive and collaborative work environment is also crucial for the success of the Scrum Development Team (Keller et al., 2020; Masood et al., 2022). This includes providing opportunities for continuous growth and development, ensuring access to necessary resources, and fostering a positive team attitude (Grebic & Stojanovic, 2021). Motivation and commitment play significant roles in the productivity and success of the team (Cordery et al., 2010). To maintain the Scrum Development Team members' engagement and

dedication to the project, organisations should offer autonomy, challenging tasks, establish clear goals, and provide opportunities for personal and professional growth (Baumgart & Holten, 2015; Noll et al., 2020; O'Connor et al., 2021). By ensuring these factors are evident, organisations can enhance the productivity and effectiveness of their Scrum Development Teams, leading to successful project outcomes (O'Connor et al., 2021).

2.4.2 What is the Role of a Scrum Master?

The role of the Scrum Master is crucial in ensuring the efficiency of the Scrum Development Team (Bunning, 2020). The Scrum Master's primary responsibility is to support the Scrum Framework and facilitate the team's progress by removing any challenges they may encounter (Sutherland & Schwaber, 2020). They work closely with the Scrum Development Team, providing them with the necessary resources, and tools, removing impediments and providing a conducive work environment to successfully complete their tasks (Bunning, 2020).

Additionally, the Scrum Master plays a vital role in ensuring that the Scrum Development Team adheres to Scrum practices and principles (Bunning, 2020). This includes facilitating Daily Scrum, Sprint Review, and Sprint Retrospective, which are essential components of the Scrum Framework (Fowler, 2019; Grebic & Stojanovic, 2021). By diligently adhering to the prescribed Scrum Events, the Scrum Development Team can optimise productivity and ensure the successful completion of the product development, meeting the predefined criteria by the Product Owner (Sutherland & Schwaber, 2020).

The leadership style of the Scrum Master also significantly impacts on the performance and determination of the Scrum Development Team (Rehkopf, 2023). Their ability to effectively manage and supervise the team's progress in each sprint is crucial (Bunning,

2020). This requires the Scrum Master to adapt to various team dynamics and conditions, as different teams may have unique challenges and requirements (Flores, 2019).

2.4.3 Scrum Development Team During the COVID-19 Pandemic

The COVID-19 pandemic has had a significant impact on the way Software Development Teams operate, and Scrum Development Teams are no exception. Several studies have investigated the challenges faced by Scrum Development Teams during the COVID-19 pandemic and how they have adapted to the new reality (Dorda et al., 2020; Fowler, 2019; O'Connor et al., 2021).

One of the most major issues encountered by Scrum Development Teams during the COVID-19 pandemic, according to studies by O'Connor et al. (2021) and Dorda et al. (2020), is maintaining good communication and cooperation, resulting in delays and lowered productivity. On the other hand, Agren et al. (2022) claim that Scrum Development Teams' productivity decreased as a result of the COVID-19 pandemic, mostly owing to communication challenges and the inability to work together in person. However, research conducted by Christoffersson & Djup (2021) suggests that Scrum Development Teams were able to adapt to the new work environment imposed by the COVID-19 pandemic restrictions while maintaining a high level of productivity. Christoffersson & Djup's (2021) also found that digital communication tools were crucial in facilitating remote collaboration and keeping the team in sync with one another and that in the absence of office location distractions, they were able to focus on their tasks, allowing them to complete work on time.

Another challenge that Scrum Development Teams encountered during the COVID-19 pandemic was a lack of face-to-face engagement, which made it harder to create and retain trust within the team (O'Connor et al., 2021; Agren et al., 2022). According to Masood et al. (2022), the absence of social connection and the inability to understand body language during

virtual meetings made it more difficult for team members to create trust with one another. Other research, such as that conducted by O'Connor et al. (2021), discovered that Scrum Development Teams were able to sustain trust through frequent communication and the establishment of defined roles and duties for each team member.

Scrum Development Team members have reportedly experienced heightened stress and burnout as a result of the COVID-19 pandemic (Mustajab et al., 2020; Nandwani, 2020). According to Sandoval-Reyes et al. (2021), greater workload and blurring of work-life boundaries have resulted in higher levels of stress and burnout among Software Development Team members especially during the COVID-19 pandemic. However, by utilising measures such as flexible work arrangements and regular check-ins with team members, Scrum Development Teams were able to minimise stress and burnout (Forbes et al., 2020; Ford et al., 2021; Rehkopf, 2023).

In terms of adaptation, Scrum Development Teams have had to modify their processes and practices to accommodate remote working (Rizaldi & Jayadi, 2022). In a recent study conducted by Christoffersson & Djup (2021), it was discovered that Scrum Development Teams successfully adapted to their changing needs by implementing various new processes and practices. These included embracing asynchronous communication, shortening Sprint cycles, and increasing the frequency of check-ins with team members (Christoffersson & Djup, 2021). The same research also found that Scrum Masters played a crucial role in facilitating the adaptation process by providing support and guidance to team members (Christoffersson & Djup, 2021).

2.4.4 Deep Work versus Shallow Work in the Remote Working Environment

As remote working in software development organisations becomes more popular (Anderson & Kelliher, 2020; Karamichalis, 2022), so does the need to adapt to new methods

of working (Flores, 2019; Forbes et al., 2020). Deep Work and Shallow Work are two common work approaches that have been extensively discussed in terms of productivity (Newport, 2016; Mustajab et al., 2020; Lashbrooke, 2021), particularly during the COVID-19 pandemic.

The concept of Deep Work was introduced by Cal Newport and refers to the ability to concentrate on a cognitively demanding task without any distractions (Newport, 2016). It involves immersing oneself in a subject for an extended period of time, achieving a state of flow, and avoiding interruptions from external factors like emails, notifications, or social media. Reclaim.ai (2022) describes this state as being in the zone, where workers are fully engaged in a specific activity, whether it is debugging code, writing an essay, or crafting a strategic plan, to the extent that they lose track of time (Amzah, 2015).

The COVID-19 pandemic necessitated a widespread transition to remote working as a means to adhere to social distancing measures (Agren et al., 2022; Christoffersson & Djup, 2021; McKinsey & Company, 2020). This sudden shift raised concerns about the feasibility of achieving Deep Work in a home environment, where distractions and time constraints abound (Lashbrooke, 2021). While it is true that Deep Work can pose challenges in certain household situations, research indicates that workers can still attain Deep Work in a remote working environment by adopting the appropriate mindset and employing effective strategies (Staglin, 2021; Crossover, 2023). For instance, a pre-COVID research conducted by Gajendran & Harrison (2007) revealed that workers who were able to establish clear boundaries and create a dedicated workspace were more likely to engage in Deep Work compared to those who were unable to do so.

According to a survey conducted by OwlLab in 2019 and highlighted in an article by Crossover (2023), the 'State of Remote Work' survey revealed that 90% of respondents experienced increased productivity by engaging in Deep Work without the distractions of

office interruptions (Crossover, 2023). This suggests that remote working can provide an opportunity for workers to engage in more Deep Work, as long as they have the right environment and mindset to support it. This aligns with the findings of Gajendran & Harrison (2007) who discovered that creating clear boundaries and a separate workspace contributed to the ability to engage in Deep Work.

Nevertheless, as highlighted in Reclaim.ai's article from 2022, it is important to acknowledge that Deep Work also carries certain disadvantages. One notable disadvantage is the potential for individuals to become excessively engrossed in their tasks, leading them to lose track of time and inadvertently extend their work hours beyond the usual limits (Reclaim.ai, 2020). This can lead to a blurring of boundaries between work and personal life, potentially leading to burnout and reduced overall well-being (Sutarto et al., 2021). Therefore, it is crucial for remote workers to also establish a healthy work-life balance and set clear limits on their work hours to ensure that Deep Work is productive and sustainable in the long run (Lashbrooke, 2021).

Moreover, the benefits of Deep Work when remote working extend beyond individual productivity (Mustajab et al., 2020). When workers are able to engage in Deep Work, it often leads to higher quality work outcomes, increased innovation, and greater job satisfaction (Newport, 2016). By immersing themselves in focused, undistracted work, workers are more likely to generate creative solutions, achieve higher levels of mastery, and experience a sense of accomplishment (Lashbrooke, 2021). This can have a positive impact on team collaboration and overall organisational success (Amzah, 2015). Therefore, embracing Deep Work practices in a remote working environment cannot only benefit workers but also contribute to enhanced team performance and organisational outcomes (Lashbrooke, 2021; Mailman, 2022; Reclamai, 2023).

Various studies have underscored the significance of Shallow Work in specific contexts (Elgan, 2022; Reclamai, 2023; Newport, 2016). Shallow Work refers to tasks that are more routine and require less cognitive effort compared to Deep Work (Newport, 2016). For example, Elgan (2022) discovered that breaks and engaging in Shallow Work were crucial for fostering effective communication and collaboration within certain organisations. This indicates that there are instances where Shallow Work can play a valuable role in supporting overall productivity and teamwork (Mailman, 2022; Reclam.ai, 2023).

Furthermore, Amzah (2015) highlighted that participating in Shallow Work can yield a sense of accomplishment and help alleviate the stress associated with demanding cognitive tasks. By allocating time to less cognitively demanding activities, workers can recharge, maintain determination, and experience a positive psychological state (Reclamai, 2022). This suggests that incorporating periods of Shallow Work into a worker's workflow can contribute to overall well-being, focus and sustainable productivity (Mailman, 2020).

In contrast to Deep Work, which involves cognitively challenging tasks, Shallow Work encompasses activities that are less demanding in terms of mental effort and may appear trivial or unimportant (Reclaim, 2022). While Deep Work is crucial for tasks that require concentration and creativity, Shallow Work can still hold value in the workplace, as stated in Waber et al.'s (2014) article in Harvard Business Review. It is important to recognise that both deep and Shallow Work have their roles and can contribute to overall productivity and efficiency (Mailman, 2022).

While Mailman (2022) and Crossover (2023) perceived Shallow Work as a contributor to stress and tasks that can easily fill up a worker's time, Mailman (2022) on the other hand found that engaging in Shallow Work can facilitate teamwork and communication within organisations. These activities, which may involve routine tasks or brief interruptions, can serve as opportunities for collaboration, information sharing, and coordination among team

members (Mailman, 2022; Reclaim.ai, 2022). Additionally, Amzah (2015) highlighted that Shallow Work can provide a sense of accomplishment when completing mundane or administrative tasks. This sense of achievement can contribute to overall job satisfaction and reduce the perceived burden of high-level cognitive tasks (Reclaim.ai, 2022).

Table 2

Examples of Deep Work and Shallow Work

Task	Deep Work Examples	Shallow Work Examples
Writing	Writing a research paper, composing an essay or a book (Reclaim.ai, 2022)	Responding to emails or writing memos (Amzah, 2015; Reclaim.ai, 2022)
Designing	Creating a new product, developing a website or an App (Amzah, 2015; Hawkins, 2021)	Formatting documents or creating presentations (Reclaim.ai, 2022)
Coding	Developing complex software programmes, debugging code (Reclaim.ai, 2022)	Attending meetings or updating a task list (Hawkins, 2021; Reclaim.ai, 2022)
Research	Conducting original research, analysing data, writing reports (Reclaim.ai, 2022)	Browsing social media or reading news articles (Hawkins, 2021)
Learning	Studying complex subjects, acquiring new skills or knowledge (Hawkins, 2021)	Scanning online articles or watching instructional videos (Reclaim.ai, 2022)
Problem-solving	Developing innovative solutions to complex problems, brainstorming sessions (Reclaim.ai, 2022)	Filling out forms or processing paperwork (Reclaim.ai, 2022)

Note. Examples of Deep Work and Shallow Work categorised by different tasks.

Table 2 shows a compilation of task examples classified as either Deep Work or Shallow Work. It is important to note that the distribution of Deep and Shallow Work can vary depending on factors such as the worker's preferences, job requirements, and the specific context of the activity (Amzah, 2015; Hawkins, 2021). Different workers thrive in different work environments, with some excelling in settings that prioritise Deep Work

exclusively, while others perform best when a combination of Deep and Shallow Work is embraced (Newport, 2016). Table 2 serves as a reference point to illustrate the types of tasks that can fall under each category, but flexibility is key in determining the appropriate balance for optimal productivity and performance (Amzah, 2015; Lashbrooke, 2021).

2.4.5 Tools and Techniques of In-Person Scrum versus Online Scrum

The COVID-19 pandemic has accelerated the global adoption of online Scrum and remote working practices, leading many software development organisations to adapt and rely on digital technology to manage teams and projects (DeFilippis et al., 2022; Juliet, 2022). This shift has brought significant challenges since many practices that were beneficial in face-to-face communication were judged ineffective when implemented online, and vice versa (Bunning 2020; Dorda et al., 2020). As a result, organisations have been compelled to strike a balance and experiment with various tools and techniques in order to bridge the gap created by this shift (Postelnyak, 2023).

According to various studies, there are several areas where differences exist between face-to-face and online Scrum practices, including communication tools, project management tools and document management systems (DMS) (DeFilippis et al., 2022; Juliet, 2022; Postelnyak, 2023). These differences can vary based on the requirements of the team and project (Golden et al., 2008).

2.4.5.1 Communication Tools

With the COVID-19 pandemic sweeping the world, organisations have had to make considerable modifications to their operations (Karamichalis, 2022). One of these modifications has been the Scrum Team's transition from typical face-to-face interaction to online communication (Nandwani, 2020; Karamichalis, 2022; Nazir et al., 2022). Face-to-

face communication has long been a key component of Scrum, allowing team members to meet and contribute in person (Staglin, 2021; DeFilippis et al., 2022). However, with the COVID-19 pandemic making physical meetings difficult, organisations have had to find new ways to keep their Scrum Teams connected (Christoffersson & Djup, 2021; Dorda et al., 2020; Rizmaldi & Jayadi, 2022).

According to DeFilippis et al. (2020), remote Software Development Teams heavily rely on communication tools such as Slack, Zoom, Microsoft Teams, Google Hangouts, GoToMeeting, Asana, and Trello to conduct Scrum Events (Climer, 2017; FullScale, 2020). These tools offer features like whiteboards and screen sharing that enable effective dissemination of information and a better understanding of crucial points (Ford et al., 2021). However, in the studies by Ford et al., (2021) and Dorda et al., (2020) showed that there is a need for improvement in communication skills and tools, as not all team members are familiar with these tools, and some are more accustomed to informal communication within the office (Climer, 2017). Although face-to-face communication is irreplaceable, Jensen et al., (2018) found no significant differences in ideation outcomes when using digital communication tools compared to traditional methods like physical whiteboards and sticky notes.

Some Scrum Teams had already adopted online communication tools to facilitate collaboration among team members who were not physically located in the same place before the COVID-19 pandemic (Dorda et al., 2020; Christoffersson & Djup, 2021; O'Connor et al., 2021). These tools made it easier for remote working across different locations and provided flexibility in terms of work arrangements (Jensen et al., 2018; Özkan & Mishra, 2019). As a result, these teams were able to transition to full remote working with relative ease during the COVID-19 pandemic since they were already familiar with the tools and processes required to collaborate effectively online (Agren et al., 2022; Cucolaş & Russo, 2021;).

It is crucial to acknowledge that the selection of communication tools and techniques utilised in Scrum can differ based on the needs of the team and the requirements of the project (Jensen et al., 2018). According to Dorda et al. (2020), there is no one-size-fits-all approach to communication in Scrum, and it is up to the team to determine which tools and techniques are most effective for them. Postelnyak (2023) emphasises that choosing the right communication tools and techniques is crucial to the success of Scrum implementation, and teams should be open to experimenting with various methods to identify what works best for them. It is essential to evaluate and adjust the approach continually, as teams, projects, and circumstances change over time (Jensen et al., 2018). This flexibility and willingness to adapt are key to ensuring effective communication and collaboration within the team, regardless of whether they are working face-to-face or remotely (DeFilippis et al., 2022; Dorda et al., 2020; Golden et al., 2008; Postelnyak, 2023).

2.4.5.2 Project Management Tools

Project management tools play a critical role in Agile Methodologies, such as Scrum, by facilitating communication, collaboration, and progress tracking among Scrum Team members (Abramova et al., 2016; Mihalache, 2017; King, 2020; Özkan & Mishra, 2019). The rise of remote working and online collaboration has significantly emphasised the significance of project management tools in Scrum environments, whether conducted in face-to-face or online (King, 2020). These tools have assumed an ever-increasing importance, enabling teams to effectively coordinate and streamline their efforts, regardless of their physical location (Rossberg, 2019). By leveraging such tools, teams can enhance their productivity, foster seamless communication, and ensure smooth project execution, thereby adapting to the evolving landscape of modern work dynamics (Kaur, 2018; Mihalache, 2017; Rossberg, 2020; Özkan & Mishra, 2019).

In a research by Rossberg (2019), it was found that Jira, Trello, Asana, Monday.com, VersionOne and Azure DevOps were among the most popular project management tools used by Scrum Teams. These tools were effective in documenting requirements, tracking progress, and facilitating communication among Scrum team members (Kaur, 2018; Özkan & Mishra, 2019). Additionally, in a research by Bunning (2020), it was found that online collaboration tools like Miro, Mentimeter, Mural, and Trello had become increasingly popular among Scrum Teams. These tools allowed team members to visualise their discussions and remove the need for physical task boards (Rossberg, 2019; Özkan & Mishra, 2019). According to Mihalache (2017), these Agile project management tools aid Software Development Teams in planning their work and project managers in achieving the intended results in terms of team communication and resource allocation as necessary.

Table 3*Commonly Used Agile Project Management Tools*

Tool	Description	Company
Jira	A project management tool for Agile teams to efficiently handle various aspects such as scrum management, software development, bug tracking, professional service management, marketing, content management, and more (Atlassian, 2023).	Atlassian
Trello	A project management tool that uses boards, lists, and cards to organise tasks and projects (Kaur, 2018).	Atlassian
Asana	A cloud-based service that aids project managers in organising teams, tracking deadlines, facilitating project collaboration, enhancing productivity, prioritising tasks, and providing various other functionalities (Simonson & Bottorff, 2023).	Asana
Monday.com	A cloud-based work management platform that assists organisations in automating Agile team workflows and efficiently managing projects, tasks, and resources within a unified platform (Haan, 2023).	Monday.com
VersionOne	A cloud-based solution for agile application lifecycle management (ALM) that enables organisations to effectively engage stakeholders and monitor and report on software portfolios, programs, and projects (Software Advice, 2023).	Microsoft
Azure DevOps	A cloud-based service for managing the entire software development lifecycle, from planning to deployment (Rossberg, 2019).	Microsoft

Note. Commonly used agile project management tools by software development organisations

Table 3 shows the project management tools which support Agile Methodology. Each of these tools possesses distinct features that cater to various Agile frameworks, including

Scrum (Atlassian, 2023; Haan, 2023; Kaur, 2018; Rossberg, 2019; Simonson & Bottorff, 2023). According to Mihalache (2017), the crucial aspect of selecting a project management tool is to determine which one is the most suitable for the organisation.

Özkan and Mishra (2019) found that the transition to online Scrum during the COVID-19 pandemic did not result in any significant differences in the utilisation of project management tools compared to face-to-face Scrum. According to Özkan & Mishra's (2019) research, there has been a general continuity in the adoption and use of project management tools in Scrum, with some Scrum Development Teams even claiming an increase in usage owing to the transition to remote working (Mihalache, 2017). The same research did find, however, that some teams had difficulty adapting old tools to the online environment, particularly when it came to connecting them with video conferencing services.

In a separate research by Masood et al. (2022), it was found that the usage of project management tools was influenced by factors such as team size, project complexity, and organisational culture. Mihalache (2017) concurred, stating that larger teams tended to use more modern technology, whilst smaller teams relied on simple tools such as spreadsheets. Similarly, teams working on more complex projects tended to utilise more specialised tools capable of handling more advanced features, whilst teams working on smaller projects used more basic tools (Rossberg, 2019).

2.4.5.3 Document Management Systems

The shift towards digital document management systems in software development organisations has become increasingly popular due to the convenience and environmental benefits it offers (Jordan et al., 2022). Tools such as SharePoint, Google Docs and Confluence by Atlassian are commonly used to store documents and information necessary

for the software process, including requirements, knowledge transfer information, and basic organisational information (Jordan et al., 2022; Aleem et al., 2022).

One advantage of using digital document management system within both face-to-face and online Scrum Teams is the facilitation of seamless access and efficient sharing of documents among team members, regardless of their physical proximity or remote working arrangements (Jordan et al., 2022). Team members can easily collaborate and update documents real-time, making it more efficient and effective to share information and track progress (Özkan & Mishra, 2019). Additionally, digital document management systems provide a centralised and organised repository for storing important project documents, making it easier to search, retrieve, and manage information (Bunning, 2020; Jordan et al., 2022).

On the other hand, in the context of online Scrum Teams, digital document management systems also offer additional advantages (Garcia et al., 2022). They provide a virtual space for Scrum Team members to store and access documents remotely, which is particularly useful when team members are geographically dispersed and remote working (Özkan & Mishra, 2019). This allows for seamless collaboration and knowledge sharing, managing projects, even in a remote working arrangement (Garcia et al., 2022).

However, there are also some potential disadvantages of using digital document management systems in both face-to-face and online Scrum Teams (Access Records Management, 2019; Bunning, 2020; Raith et al., 2017). One potential disadvantage is the reliance on technology and potential technical issues that may arise, such as system downtime or connectivity problems, which can hinder access to documents and impact team productivity (Bunning, 2020). Another potential concern argued by Access Records Management (2019) is data security, privacy and cost, as digital document management

systems may pose risks in terms of unauthorised access or data breaches, requiring organisations to implement appropriate security measures.

2.6 Chapter Summary

Research has shown that face-to-face interaction and collaboration are important for team cohesion, innovation, and creativity (Allen, 2020; Goman, 2017; King, 2020). Remote working Scrum Development Team members may miss out on important nonverbal cues and social interactions that are critical for building strong relationships and fostering teamwork (Flores, 2019; Mustajab et al., 2020; Sutarto et al., 2021). This lack of interaction can also lead to feelings of isolation and disconnection, which can negatively impact worker engagement and determination (Ågren et al., 2022; Sutarto et al., 2020).

The experience of IBM with remote working highlights the importance of finding a balance between remote and in-person work (Useem, 2017). While remote working can offer many benefits, it is important to ensure that there are still opportunities for face-to-face interaction and collaboration, whether that is through occasional team meetings or regular video conferencing (Dorda et al., 2020).

Ultimately, the success of remote working depends on the specific needs and culture of the organisation, tools and techniques used (Fitzgerald et al., 2013; Mihalache, 2017), as well as the individual preferences of workers such as which approach they are most comfortable with, may it be Deep Working or Shallow Working (Lashbrooke, 2017). By considering these factors and finding the right balance between remote and in-person work, organisations can reap the benefits of remote working while still maintaining strong Software Development Team cohesion and performance (Allen, 2020; Elgan, 2020).

While existing literature have emphasised the positive impact of autonomy on Scrum Development Team's performance and productivity (Shahzad et al., 2021; Man et al., 2019),

there appears to be a gap in the literature regarding the potential challenges or limitations that excessive autonomy might pose within organisations that adapt the Scrum Framework.

Although some studies have acknowledged that an inappropriate level of autonomy could lead to coordination issues (Savolainen et al., 2018), further research is needed to comprehensively explore the potential downsides of granting high levels of autonomy to Scrum teams. Additionally, limited research has examined the role of autonomy in various types of Scrum projects, such as those involving complex technical tasks or cross-functional teams, warranting further investigation to understand how autonomy influences team dynamics and project outcomes in diverse Scrum contexts. Thus, exploring the potential drawbacks of autonomy and its effectiveness in different Scrum project scenarios can contribute to a more nuanced understanding of its role and impact within Agile software development methodologies.

Chapter 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides an overview of the research paradigm and methods employed in the research. It encompasses various aspects such as research paradigm, approach, methods, and techniques. Each section offers a detailed explanation of the research methodology employed to conduct the research.

3.2 Research Approach (Mixed-Method)

There are several different research approaches, including quantitative, qualitative, and mixed methods research (Creswell & Creswell, 2018)

- **Quantitative research:** seeks to obtain numerical data and conduct statistical analysis to quantify or measure a phenomenon or the relationship between variables (Creswell & Creswell, 2018). The process involves the use of structured and standardised methods, including surveys or experiments, to collect data (Creswell & Creswell, 2018). The gathered data is then analysed using statistical techniques to identify trends, patterns, and relationships (Allen, 2017).

- **Qualitative research:** involves collecting non-numerical data from open-ended questions from surveys and analysing it through thematic analysis or other qualitative techniques (Saldana, 2021). Qualitative research aims to gather non-numerical data and gain an in-depth understanding of complex phenomena, such as attitudes, beliefs, and experiences (Creswell & Creswell, 2018).

- **Mixed methods research:** involves combining both quantitative and qualitative methods to answer research questions (Damyanov, 2023). The goal of mixed-method research

is to combine both quantitative and qualitative research methods to gain a more comprehensive understanding of a research topic (Damyanov, 2023; Timans et al., 2019).

To gain a comprehensive and in-depth understanding of the research topic, as suggested by Damyanov (2023) and Timans et al. (2019), a mixed-method research approach has been chosen for this research. By using a mixed-method approach, this research aims to provide a comprehensive understanding and answer the research questions (Damyanov, 2023) regarding the ways in which the COVID-19 pandemic has facilitated the software development industry in New Zealand to transition to remote working and offer autonomy to Scrum Development Teams, as well as to investigate the remote adaptation of the Scrum Framework.

Another major reason why a mixed methods approach is often appropriate is that it can help to address some of the limitations of both quantitative and qualitative research (Schoonenboom & Johnson, 2017). For example, while quantitative research can provide precise numerical data, it may not capture the complexity and richness of human experiences (Creswell & Creswell, 2018). Qualitative research, on the other hand, can provide detailed and nuanced descriptions of human experiences, but may lack statistical power (Saldana, 2021). By combining both approaches, researchers can address these limitations and provide a more comprehensive understanding of the research question (Damyanov, 2023).

3.3 Research Paradigm (Pragmatism)

Thomas Kuhn's book, "The Structure of Scientific Revolutions", published in 1962, is considered a seminal work in the history and philosophy of science (Naughton, 2012).

According to Kuhn, scientific research and thinking are characterised by paradigms, which are conceptual frameworks that include formal theories, trusted methods, and experiments.

Creswell (1998), however, used the term worldview rather than paradigm as it is a

philosophical and conceptual framework that contains and guides the researcher's ideas, beliefs, and prejudices in the context of the research.

According to McChesney's argument in 2017, neglecting to explicitly state the research paradigm within a research can lead to illogical statements or actions. Neglecting to consider the underlying research paradigm may lead to contradictions within different parts of the research, ultimately compromising the coherence, validity, and credibility of the research (McChesney, 2017). It is essential to acknowledge and align with the chosen research paradigm to ensure the integrity and rigor of the research process (McChesney, 2017).

In the case of this research, the chosen research paradigm is Pragmatism. Pragmatism is a research paradigm that values the use of multiple methods to answer research questions and achieve research goals, as well as practical solutions to real-world problems (McChesney, 2017). It recognises that no single method or approach can provide a complete understanding of a complex phenomenon. Therefore, it advocates for the use of multiple methods, including both quantitative and qualitative methods, to triangulate and complement findings (Coghlan & Brydon-Miller, 2014). This aligns well with the goals of mixed-method research to provide a more comprehensive understanding of a phenomenon and to answer research questions that cannot be fully addressed by a single method (McChesney, 2017).

3.4 Research Instrument (Online Survey)

An online survey (survey) was used to collect both qualitative and quantitative data from respondents across New Zealand, as the research scope extends throughout the country and not just one specific region. The survey contained all necessary information and instructions, including the research aim, respondent consent, and guidance on how to complete the online survey.

The closed-ended questions in the survey collect quantitative data through the use of multiple-choice options. However, due to the complexity of the research questions that were outlined in section 1.4, “Research Questions”, and the requirement to capture respondents' individual experience with remote working and Scrum Framework adaptation, each closed-ended query is supplemented by an optional section. This space allows respondents to furnish supplementary explanations, which serve as a source of qualitative data. These open-ended questions provide an opportunity for the respondents to elaborate on their answers based on their own discretion (Regmi et al., 2017).

The survey questions underwent a thorough peer review by the researcher's supervisors to ensure questions were appropriate, able to answer the research questions and aligned with ethical considerations before being disseminated to the target respondents. After the questions were approved by the supervisors, an application for this research was then submitted for ethics approval to OPAIC Research Ethics Committee. Once approved, the survey was created using Qualtrics, a recommended tool by OPAIC for academic surveys that offers various features that would aid in data analysis, such as data filtering and charts.

A trial run of the survey was conducted by distributing it to a small group of students from OPAIC to assess the suitability of the survey structure and questions and gather feedback for further improvement. The final form of the research instrument hosted on Qualtrics can be found in Appendix A.

3.5 Research Sampling (Snowball and Purposive Sampling)

Sampling is an important part of research because it ensures that the data acquired from the population under assessment is representative (Fraenkel et al., 2022). Thus, improves the research findings' validity and generalisability. Creswell & Creswell (2018) argues that good sampling procedures are critical to the success of any research project because they allow

researchers to choose respondents who are relevant to the research topics, eliminating bias, and increases the dependability of the findings. Meanwhile, Fraenkel et al. (2022) argued and agreed that sampling is important because it ensures that the respondents chosen for the research are appropriate for the research and that the results can be generalised to the population of interest.

Probability sampling and non-probability sampling are distinct methods for selecting samples from populations for research purposes. These methods differ in their approaches to ensuring representativeness and generalizability (Fraenkel et al., 2022). Probability sampling involves equal chances of selection for every population member, facilitating representation and statistical inference. Common methods include simple random, systematic, stratified, and cluster sampling. In contrast, non-probability sampling aligns with the research's objectives by allowing targeted exploration of specific experiences and behaviours within a contextual setting, and it provides flexibility and feasibility advantages in collecting data from a subset of the larger population (Creswell & Creswell, 2018). Non-probability sampling is deemed suitable for this research due to specific research objectives and criteria of respondents as specified in section 3.6, "Research Respondents".

There are different types of non-probability sampling, including Convenience Sampling, Purposive Sampling, Quota Sampling, and Snowball Sampling (Ayhan, 2011).

- Convenience Sampling: involves selecting respondents who are readily available or easily accessible, such as students in a classroom or customers in a store (Ayhan, 2011).
- Purposive Sampling: involves selecting respondents based on specific characteristics relevant to the research question (Ayhan, 2011).
- Quota Sampling: involves selecting respondents to ensure that the sample reflects certain characteristics of the population, such as gender or ethnicity (Ayhan, 2011).

- **Snowball Sampling:** involves selecting respondents based on referrals from other respondents (Ayhan, 2011).

Due to the specificity of the research questions and the research respondents limited to a specific group, therefore, to effectively gather data, the research has opted to use Snowball Sampling and Purposive Sampling. The first approach was the Snowball Sampling used to reach out to existing network through online platforms such as Facebook and LinkedIn messaging, and the members of OPAIC Community to determine who within the researcher's existing network meets the requirements for participation in the research (Ayha, 2011). In the second approach, Purposive Sampling will be used to gather respondents who meet the criteria to participate in the survey through platforms such as LinkedIn (Ayha, 2011).

3.6 Research Respondents

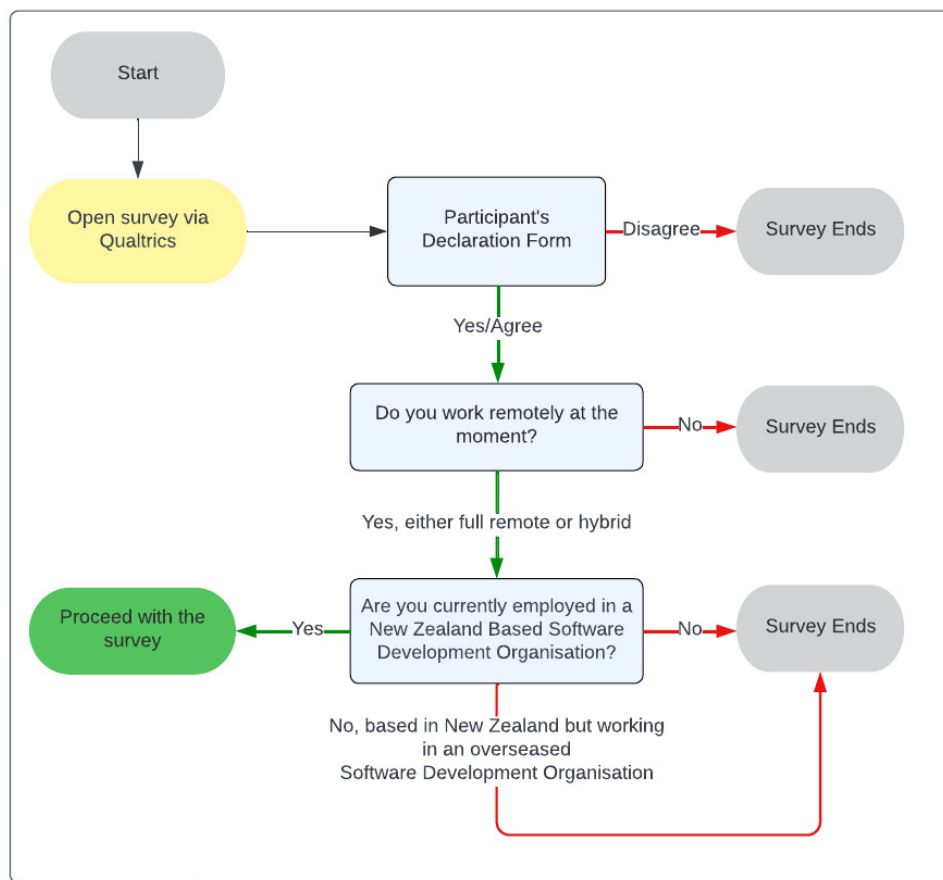
This research has a sample size of 103 respondents from different New Zealand software development organisations who are currently remote working. The sample size was determined based on the confidence of the researcher's ability to gather enough respondents through the chosen sampling methods, Snowball Sampling and Purposive Sampling and the given timeline for this research.

The research gathered data from a specific group of respondents to ensure that the findings are relevant to the research questions. The criteria for respondents' selection are as follows:

- **Currently remote working within New Zealand at least 30% or twice a week:** this criterion is important as the research is focused on the experience of remote workers who were currently remote working and based in New Zealand. This ensured that the respondents had

first-hand experience with the advantages and disadvantages of remote working within the country.

- Professionals from different software development organisations that adapt the Scrum Framework: this criterion ensured that the respondents were familiar with the Scrum Framework, which is the key focus of the research. By selecting respondents from different software development organisations, the researcher could gather a range of perspectives and experiences with the framework.
- Currently employed in any New Zealand-based software development organisations, with roles that include but are not limited to employer, manager/executive, and active member of a Scrum Team: this criterion ensured that the respondents had relevant experience in the software development industry, with different levels of responsibility and expertise. This could provide a comprehensive understanding of the impact of remote working on different roles within the software development industry and within the country.

Figure 3*Embedded Survey Logic*

Note. Embedded survey logic created by the researcher.

The rigorous selection process for respondents was important to ensure that the research produced credible and valid findings that could be used to draw accurate conclusions about the impact of remote working on productivity in the software development organisations in New Zealand after the COVID-19 pandemic. To achieve this, the researcher applied an embedded logic in survey, which is shown in Figure 3. The embedded survey logic aims to ensure that the set criteria for respondents' selection were met and that only relevant data were collected (Smith et al., 2006). This approach was essential for ensuring that the research results were reliable and could be used to make informed decisions about the subject matter.

By employing such a rigorous selection process, the researcher was able to maintain a high level of quality control throughout the data collection process.

3.7 Data Analysis

Data analysis is an essential aspect of any research project that involves interpreting and processing collected data to draw significant conclusions and make informed decisions (Saldaña, 2009). To identify patterns, trends, and relationships, various analytical techniques are applied after organising and cleaning the data, according to Creswell and Creswell (2018). These analytical techniques include inferential statistics, descriptive statistics, grounded theory analysis, thematic analysis, and content analysis, among others (Fraenkel et al., 2022; Saldaña, 2016).

3.7.1 Primary Data Analysis (Thematic and Descriptive Analysis)

When conducting research using surveys that include both closed and open-ended questions, a mixed-method approach is recommended for data analysis (Kwon & Kim, 2012). Thematic Analysis is one way to analyse qualitative data obtained from open-ended questions by identifying patterns, themes, and meanings in the data (Braun & Clarke, 2006). For quantitative data obtained from closed-ended questions, Descriptive Analysis is a suitable technique that provides an overall summary of the data, identifies key trends, patterns, and relationships, and allows for meaningful conclusions (Fraenkel et al., 2022).

Thematic Analysis is a robust and flexible method that enables the generation of rich, nuanced insights into the research questions by identifying patterns, themes, and meanings in the data (Braun & Clarke, 2006). By using this technique, the researcher identified key insights and drew meaningful conclusions from the qualitative data gathered from the survey's open-ended questions (Braun & Clarke, 2006).

Descriptive Analysis, on the other hand, is a commonly used quantitative data analysis method that computes summary statistics to describe the data characteristics, such as measures of central tendency, variability, and visual presentation of the data (Creswell & Creswell, 2018; Fraenkel et al., 2022).

There are two main types of reasoning required for critical thinking: Inductive and Deductive Reasoning (Shin, 2019). While Deductive Reasoning starts with a theory and seeks to confirm or refute it through the collection and analysis of data, Inductive Reasoning begins with observation and analysis of data to generate a theory or hypothesis (Creswell & Creswell, 2018).

Deductive Reasoning was applied in this research by collecting and analysing both open-ended and close-ended responses, employing Thematic and Descriptive data analysis methods. This approach aimed to generate insights and draw conclusions (Shin, 2019) on the potential impacts of autonomy on the productivity of remote working Scrum Development Teams in New Zealand, based on the data collected.

3.7.2 Secondary Data

Alongside the collection of primary data, a secondary research approach was employed to gather relevant literature from various sources such as Google Scholar, the Robertson Library, online journals, blogs, and dictionaries. This enabled the researcher to enhance the knowledge and understanding of the research objectives by incorporating insights from previous studies and analyses. As noted by Creswell & Creswell (2018), secondary data can offer valuable insights, context, and comparisons that contribute to the interpretation and analysis of primary data (Fraenkel et al., 2022).

Utilising secondary data is a time and cost-effective method, as it allows the researcher to benefit from themes and analyses already explored by others, albeit in different

circumstances, such as prior to or during the peak of the COVID-19 pandemic (Fraenkel et al., 2022). However, it is crucial for the researcher to exercise critical judgment when selecting and utilising secondary data to ensure its quality, relevance, and reliability, as emphasised by Fraenkel et al. (2022).

3.8 Ethics Consideration

This research underwent the necessary ethical procedures, including obtaining approval from the OPAIC Research Ethics Committee, with Reference Number AC114.

Prior to the data collection process, the research aim was clearly explained to the respondents, and a formal consent was obtained as part of the survey. The respondents were not coerced or pressured to answer any of the survey questions and were informed that all questions were optional, and they had the freedom to opt out of the survey at any point. Furthermore, respondents were assured that data gathered will be kept confidential and used solely for academic purposes, with the data being analysed collectively. These are presented to the respondents through the survey as indicated in Appendix A.

To maintain confidentiality and anonymity, qualitative data analysis employed codes to identify the respondents' current roles being either Scrum Master#, Product Owner#, Software Tester#, Software Developer# and Project Manager# where # represents the respondent number rather than using respondent's name. This practice is employed in any research to safeguard research respondents' privacy (Creswell & Creswell, 2018).

Secondary data sources, such as online journals, blogs, dictionaries, and databases, were utilised to supplement the primary data gathered through the survey. This approach facilitated a more comprehensive understanding of the research topic and helped validate the findings (Bell et al., 2022).

To ensure data security, a copy of the research data was stored in Qualtrics, while the analysis was stored in the researcher's One Drive storage. Access to the One Drive is restricted to the researcher and research supervisors to ensure confidentiality and data security.

3.9 Chapter Summary

The chapter presented an overview of the methodologies employed in the research, which aimed to evaluate the impact of autonomy on the productivity of remote working Scrum Development Teams in New Zealand. A mixed-method approach was utilised, incorporating both qualitative and quantitative research methods to comprehensively investigate the research questions (Damyanov, 2023). Snowball Sampling and Purposive Sampling techniques were employed to identify and recruit relevant respondents (Ayha, 2011; Fraenkel et al., 2022).

Thematic and Descriptive Analysis methods were applied to examine the qualitative and quantitative data collected, employing Deductive Reasoning in the data analysis process to generate novel insights and conclusions (Braun & Clarke, 2006).

The chapter also discussed the significance of obtaining ethical approval from OPAIC Research Ethics Committee, ensuring that respondents were fully informed about the research purpose and rights, and that the collected data was treated confidentially and stored securely.

Chapter 4: DATA ANALYSIS AND FINDINGS

4.1 Introduction

In this chapter, the Thematic and Descriptive Analysis of the data collected from the survey is presented. Prior to exploring the results, the researcher conducted an analysis of the respondents' demographic characteristics to gain valuable insights into the distribution of survey responses and provide contextual information. The research then proceeded to examine the quantitative data obtained from the survey's close-ended questions and the qualitative data obtained from the open-ended questions. The techniques used in the analysis process, which were discussed in Chapter 3, served to guide throughout the analysis.

4.2 Demographics

The survey was successful in obtaining a sample size of 103, with 110 respondents completing the survey. However, after conducting data scrubbing and following the embedded logic outlined in Figure 3 from Chapter 3, to filter out responses that did not meet the set criteria, only 103 responses were considered eligible for data analysis. Thus, the computation of percentage distribution is based on $N=130$, where N is the sample size.

Additionally, it is important to note that not all survey questions were mandatory for respondents to answer. Therefore, the sample size for each section may vary and could potentially be lower than the sample size of 103 respondents. This is explicitly mentioned within each section whenever applicable.

4.2.1 Respondents' Distribution by Age Range

Table 4 shows the distribution of survey respondents by age range, providing insights into the age group of software development workers who commonly undertake remote working.

Table 4*Respondents' Distribution of Respondents by Age Range*

Age Range	n	%
18 – 24 years old	2	2%
25 – 34 years old	60	58%
35 – 44 years old	40	39%
45 – 54 years old	0	0%
More than 55 years old	1	1%

The data reveals that majority of respondents, accounting for 58% (n=60) of the total, are within the age range of 25-34 years old. The next highest percentage, comprising 39% (n=40) of the respondents, falls within the age range of 35-44 years old. Only 2% (n=2) of the respondents are in the age range of 18-24 years old. Interestingly, respondents above the age of 55 years old represent just 1% (n=1) of the total respondents and are the least represented group. It is worth noting that there were no (n=0) respondents in the age range of 45 to 54 years old.

4.2.2 Respondents' Distribution by Family Status

Table 5 shows the distribution of respondents based on family status, listed in descending order.

Table 5

Respondents' Distribution by Family Status and Home Arrangements in Percentage

Family Status	n	%
Married with school age children (more than 5 years old)	20	19%
Married without children	18	18%
Single and living alone	17	17%
Married with preschool age children (0-5 years old)	16	16%
Single without children	15	14%
Single and living with family	9	8%
Others	6	6%
Single parent	2	2%
Married with children who have left home	1	1%
Married with children undertaking home school	0	0%
Married with children who have accomplished school	0	0%

Table 5 shows that there are relatively close percentages for respondents who are 'Married with school-age children' at 19% (n=20), 'Married without children' at 18% (n=18), 'Single and living alone' at 17% (n=1), 'Married with preschool-age children' at 16% (n=16), and 'Single without children' at 14% (n=15). Additionally, there are 8% (n=9) of respondents who are 'Single and living with family', 6% (n=6) categorised as 'Others', 2% (n=2) as 'Single parent', and 1% (n=0) as 'Married with children who have left home'. Notably, no respondents met the criteria for 'Married with children doing home school and/or distance learning'.

4.2.3 Relationship between Age Range and Frequency of Remote Working

Figure 4 shows the relationship between age group and the frequency of remote working among respondents, considering both full-time remote working and hybrid working arrangements.

Figure 4

Respondents' Age Range versus Frequency of Remote Working in Percentage

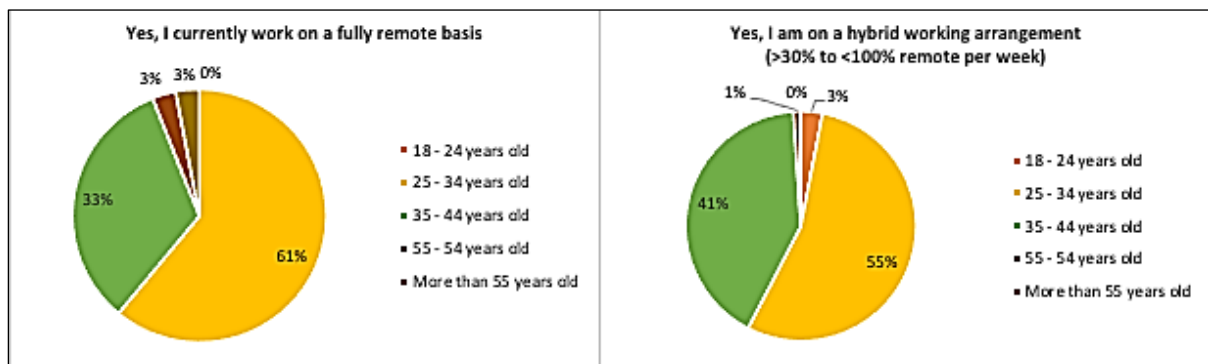


Figure 4 shows that a significant proportion of respondents who engage in remote working, either in a hybrid remote working arrangement (55%) or a full remote working arrangement (61%), fall within the age range of 25 to 34 years old. Additionally, within the age range of 35 to 44 years old, 41% are in a hybrid remote working arrangement, while 33% are in a full-time remote working arrangement.

However, significant differences can be observed in the frequency of between the age ranges of 18-24 years old and those above 55 years old. Within the 18-24 years old age range, 3% of respondents both in hybrid remote working and full-time remote working arrangements. On the other hand, among respondents aged more than 55 years old, only 1% are in a hybrid remote working arrangement, while 3% are in a full-time remote working arrangement.

4.2.4 Respondents' Distribution by Region

Table 6 shows the distribution of respondents according to the region in New Zealand where they are currently based and remote working.

Table 6*Respondents' Distribution by Region*

Which region in New Zealand are you currently based?	n	%
Auckland	50	48%
Wellington	15	15%
Otago	14	14%
Canterbury	13	13%
Hawke's Bay	2	2%
Marlborough	2	2%
Southland	2	2%
Waikato	2	2%
Gisborne	1	1%
West Coast	1	1%
Bay of Plenty	0	0%
Nelson – Tasman	0	0%
Northland	0	0%
Taranaki	0	0%
Whanganui – Manawatu	0	0%

The data shows that majority of respondents, accounting for 48% (n=50) of the total, reside in Auckland. Wellington follows with 15% (n=15), Otago with 14% (n=14), and Canterbury with 13% (n=13). Followed by Hawke's Bay, Marlborough, Southland, and Waikato, each with 2% (n=2) of the total respondents. While, Gisborne and West Coast have the least representation, each comprising 1% of the total respondents for their respective regions.

There are notably no respondents that are from regions Bay of Plenty, Nelson-Tasman, Northland-Taranaki and Whanganui–Manawatu.

4.2.5 Respondents' Distribution by Industry

Table 7 shows the distribution of respondents across various industries, with the Information and Communications Technology (ICT) industry accounting for the highest

number of respondents at 78% (n=80). The remaining industries such as, Information Media and Telecommunications, Education and Training, Construction, Financial and Insurance Services, Professional Scientific and Technical Services, Electricity Gas Water and Waste Services, and Retail Trade, lower percentages, ranging from 1% (n=1) to 5% (n=5) of the total sample size.

Table 7

Respondents' Distribution by Industry

Industry	n	%
Information and Communications Technology	80	78%
Health Care and Social Assistance	5	5%
Information Media and Telecommunications	4	4%
Other.	4	4%
Education and Training	2	2%
Construction	2	2%
Financial and Insurance Services	2	2%
Professional, Scientific and Technical Services	2	2%
Electricity, Gas, Water and Waste Services	1	1%
Retail Trade	1	1%

Table 8 shows the list of industries that were not listed as options in the survey and provided by the respondents in 'Others' category, these have total responses of 4% (n=4) as shown in Table 7.

Table 8

Respondents' Responses to the 'Others' Category

Others
Electronics
Sports Data and Analytics
Road Assessment and Maintenance Management
Software

Table 9 shows the list industries where none of the respondents were able to participate in the research.

Table 9

Industries with No Data Gathered

Industry
Accommodation and Food Services
Arts and Recreation Services
Administrative and Support Services
Agriculture, Forestry and Fishing
Personal Services
Mining
Rental, Hiring and Real Estate Services
Public Administration and Safety
Manufacturing
Transport, Postal and Warehousing
Thematic Reports
Wholesale trade

These industries require either personal collaboration, patient care, customer service, and manufacturing, which are jobs that are not well-suited for remote work. According to Radzik (2022), while the Scrum Framework, along with the concept of Agile Manifesto, may be ideal for improving satisfaction and productivity without sacrificing outcomes, it may not be suitable for industries that require extensive documentation and managing, such as those represented in Table 9.

4.2.6 Respondents' Distribution by Organisations' Remote Work Policy

Table 10 shows the distribution of organisations' remote working policies among the organisations where the respondents are employed.

Table 10

Respondents' Distribution by Organisations' Remote Working Policies

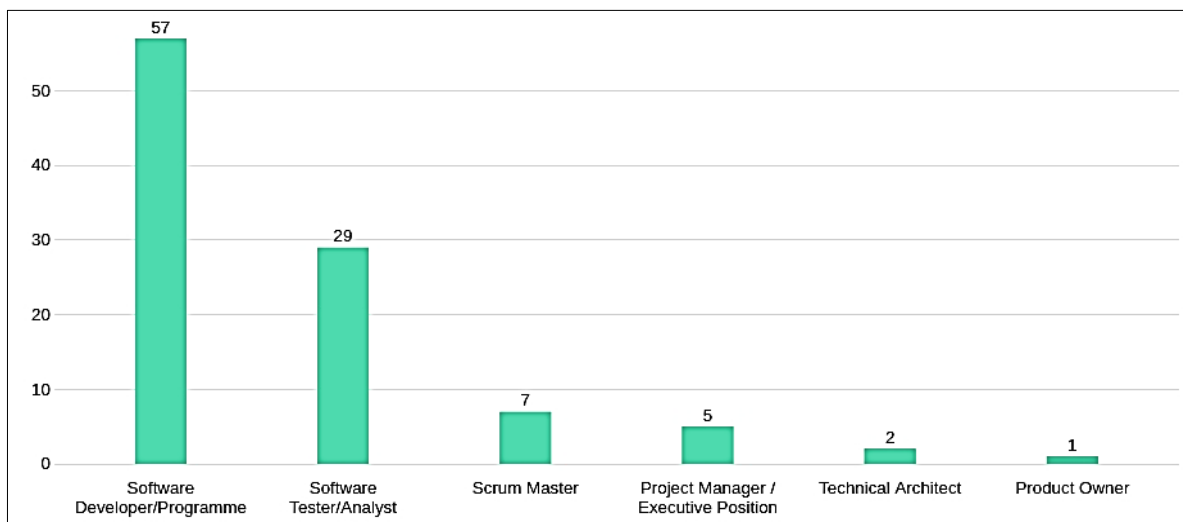
Remote Working Policy	n	%
Exclusively Remote Working	15	15%
Hybrid (>30% to <100% remote per week)	88	85%

The data shows that majority of 85% (n=88) worked in organisations that adopted a hybrid remote working arrangement. Meanwhile, 15% (n=15) of the respondents are from organisations that are exclusively remote working, and there is no need for them to be physically present in the office.

4.2.7 Respondents' Distribution by Current Role

Figure 5 shows the distribution of responses on the survey questions '*What is your current role in the organisation?*'. While the primary focus of this research was on the productivity of the Scrum Development Teams, which consists of Software Developers/Programmers and Software Testers/Analysts, data was also collected from workers in supporting roles, including Scrum Masters, Product Owners, Project Managers/Executives, and Technical Architects. This broader inclusion of roles allows for a comprehensive assessment of the potential impact of different roles on the productivity of the remote working Scrum Development Teams.

Total responses for the survey question are 101 as two of the respondents opted not to disclose their current roles.

Figure 5*Respondents' Distribution by Current Role*

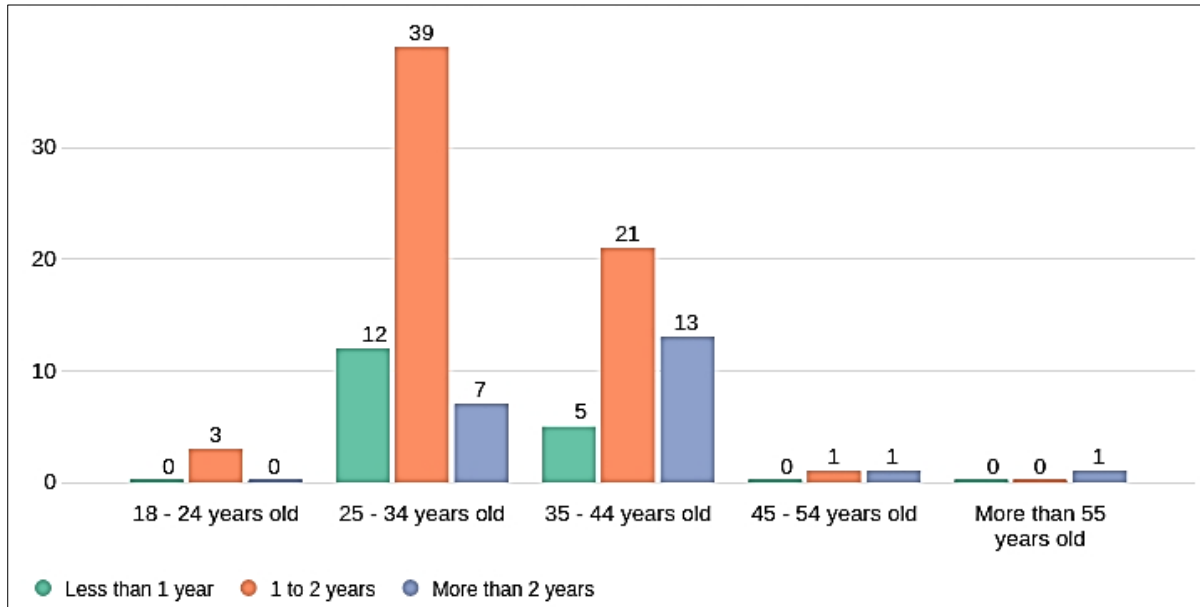
Note. Values in the figure are in 'n' where it represents the number of responses for each category.

The majority of respondents in this research were Software Developers/Programmers, comprising a total of n=57 respondents. Software Testers/Analysts represented the second-largest group with n=29 respondents. Additionally, there were n=1 Product Owner, n=7 Scrum Masters, n=2 Project Managers, and n=2 Technical Architects.

4.2.8 Respondents Age and Remote Work Experience

In this section, a comparison was made between the age range of survey respondents and the number of years' experience in remote working. Since the survey was conducted in 2023, the categories indicating the duration of remote working are as follows:

- Less than a year: refers to respondents who have been remote working from 2022 to 2023.
- 1 to 2 years: refers to respondents who have been remote working from 2021 to 2023.
- More than 2 years: refers to respondents who have been remote working since 2019.

Figure 6*Relationship between Age and Remote Working Experience*

Note. Values in the figure are in ‘n’ where it represents the number of responses for each category.

Figure 6 shows that most respondents have been in a remote working arrangement from ‘1 to 2 years’ at n=64, regardless of age, except for one respondent who is over 55 years old. This implies that majority of respondents started remote working during the height of the COVID-19 pandemic and when restrictions were still in place.

However, among those in the age range of 35 to 44 years old, n=13 have been remote working for ‘more than two years’, indicating that they had prior experience with remote work before the COVID-19 pandemic.

On the other hand, those in the age range of 25 to 34 years old had majority of respondents at n=12 who have been in a remote working arrangement for ‘less than a year’, suggesting that they started in this arrangement after the restrictions were lifted. Furthermore,

the data shows that respondents aged 45 to 55 years old and over 55 years old have been in this arrangement respectively from '1 to 2 years' and 'more than 2 years'.

4.3 Thematic and Descriptive Analysis of Data

In this section, a thorough analysis was conducted on the data collected from the survey, encompassing both quantitative and qualitative data from open-ended and closed-ended questions. The researcher employed Thematic and Descriptive Analysis techniques to examine and interpret the data.

4.3.1 Factors Influencing the Productivity of Scrum Development Team

4.3.1.1 Recognising Struggles and Distractions Faced in Remote Working

Struggles in remote working refer to the challenges or difficulties that Scrum Development Team encountered while working in a virtual environment while distractions refer to external or internal factors that divert respondents' attention from work, negatively impacting productivity, and ability to deliver outputs on time.

Table 11*Struggles Experienced when Remote Working*

What are your struggles of remote working?	%	n
Missing out on social interactions that often occur in an office environment.	81%	83
Building and maintaining relationship with co-workers	62%	64
Blurred lines between work and personal life, making it difficult to disconnect from work	57%	59
Working with colleagues in different time zones and/or core work hours	45%	46
Screen fatigue due to multiple virtual meetings	35%	36
Difficulty with communicating and collaborating with coworkers, particularly when working on complex projects that require frequent collaboration and feedback.	23%	24
Lack of designated working space, exposure to distractions when remote working	22%	23
Lack of structure, leading to procrastination and distraction	16%	16
Easily gets tap to go online again after logging off for the day to support and resolve issues	10%	10
Need to constantly drink coffee and/or energy drinks to fight drowsiness	8%	8
Feeling supervised all the time and the need to be available most times	4%	4
Others. Please specify	2%	2

Table 11 showed that majority of 81% (n=83) respondents reported that ‘Missing out on social interactions that often occur in an office environment’ as a primary struggle experienced in remote working. Followed by 62% (n=64) ‘Building and maintaining relationships with co-workers’.

It also showed that 57% (n=59) of respondents struggled with having ‘Blurred boundaries between their work and personal lives’ and 45% (n=46) reporting experiencing ‘Difficulty in working with colleagues in different time zones and/or core work hours’. While ‘Virtual meetings have become a regular occurrence’ for remote workers, and 35% (n=36) of respondents reported experiencing ‘Screen fatigue due to multiple virtual meetings. Then followed by 23% (n=24) ‘Difficulties in communicating and collaborating with their co-workers, especially when working on complex projects that require frequent collaboration

and feedback’ and 22% (n=23) ‘Lack of designated working space, exposure to distractions when remote working’.

A ‘Lack of structure can also lead to procrastination and distraction’ was also identified as a struggle, according to 16% (n=16) of respondents. Some remote workers find it ‘Challenging to stay offline after logging off for the day to support and resolve issues’ with 10% of respondents reported this as a struggle. Moreover, 8% (n=8) of respondents reported ‘Needing to consume coffee or energy drinks constantly to fight drowsiness when remote working’. While 4% (n=4) of respondents reported ‘Feeling supervised all the time and the need to be available most times’. The remaining 2% (n=2) of respondents reported experiencing ‘other’ challenges not mentioned in the survey and respondents provided no explanation as to what these challenges are.

Table 12

Distractions of Remote Working

What are your common distractions in remote working?	%	n
Social media, instant messaging, email notifications, or browsing the internet	75%	77
Needs time to be back in the work zone after coming back from a lunch break and/or quick errand	70%	72
Noise, interruptions, or other people’s conversations	59%	61
Home-related distractions such as household chores, caring for family members, pets, or roommates	25%	26
Urge to do household chores even if not needed	23%	24
Having visitors at home during core hours	17%	18
Less movement often makes one sleepy and unable to concentrate at work	15%	15
Mental distractions such as stress, anxiety, or depression	13%	13
Technical issues, such as computer malfunctions, slow internet connections, or software glitches	11%	11
Others	2%	2

Table 12 shows that the primary distraction reported by respondents is the ‘Use of digital platforms like social media, instant messaging, and email’, with 75% (n=77) of respondents identifying this as a significant distraction. Followed by 70% (n=72) of respondents reporting the ‘Challenge of refocusing after taking breaks, such as lunch or quick errands’ and 59% (n=61) reported ‘Noise, interruptions, and conversations as distractions’ being a distraction.

The remaining distractions reported by 25% (n=26) and below of the total respondents are typically related to engaging in routines at home and technical issues. These include distractions such as ‘Household chores, caring for family members, pets or roommates’ at 25%, (n=26) ‘Urge to do household chores even if not needed’ at 23% (n=24), ‘Having visitors’ at 17% (n=18), ‘Less movement often makes one sleepy and unable to concentrate at work’ at 15% (n=15), ‘Mental distractions such as stress, anxiety, or depression’ at 13% (n=13), ‘Technical issues’ at 11% (n=11) and ‘Others’ 2% (n=2). Notably, there are no explanations provided by the respondents as to what these distractions that fall under the ‘Other’ category.

4.3.1.2 Perceived Advantages in Remote Working

Table 13 shows the distribution of responses on the survey question ‘*What are the advantages of remote working?*’.

Table 13*Advantages of Remote Working*

What are the advantages of remote working?	%	n
Ability to work independently, make decisions, and manage own work schedule	78%	80
Flexibility to work during most productive times	64%	66
Saved a significant amount of time that would otherwise be spent on commuting to and from the office	56%	58
Provides greater flexibility in terms of when and how to clean and organise the living space	44%	45
Have greater control over work environment, allowing to minimise distractions and focus on tasks	43%	44
Working for an organisation that is located outside the local area, providing access to a wider range of job opportunities.	43%	44
Allowed to spend more time with family and friends, pursue hobbies, and engage in other activities that can't be carried out while at the office	36%	37
Have the option to wear comfortable clothing, and don't necessarily need to dress up as needed for a typical office job	33%	34
Communication through messaging or chat channels are sometimes clearer and more effective than in-person communication	30%	31
Others.	1%	1

Majority of 78% (n=80) reported that the common advantages to remote working were the 'Ability to work independently, make decisions and manage own work' and 64% (n=66) 'Flexibility to work during most productive times'. Followed by 56% (n=58) 'Saving significant amount of time that would otherwise be spent on commuting to and from the office' comes next after flexibility.

The next advantages that followed were 44% (n=45) 'Provides greater flexibility in terms of when and how to clean and organise the living space', 43% (n=44) 'Have greater control over work environment, allowing to minimise distractions and focus on tasks', 43% (n=44) 'Working for an organisation that is located outside the local area, providing access to a wider range of job opportunities', 36% (n=37) 'Allowed to spend more time with family

and friends, pursue hobbies, and engage in other activities that can't be accomplished while at the office', 33% (n=34) 'Have the option to wear comfortable clothing, and don't necessarily need to dress up as needed for a typical office job and 30% (n=31) 'Communication through messaging or chat channels are sometimes clearer and more effective than in-person communication'.

The least advantage 'Others' at 1% (n=1) with respondent explaining that remote working can remote working can 'Save money when not paying for food and travel'.

4.3.1.3 Expectations, Productivity Levels, and Identifying Causes of Delays

This section aims to explore the respondents' opinions on the possible actions that organisations can take to support remote workers in delivering high-quality outputs. To achieve this, the researcher has identified three key areas that will be evaluated: expectations, productivity levels, and potential reasons for delays.

The tables in this section provide information on the distribution of responses for each option, represented by 'n' (number of responses), and the corresponding percentage (%) indicating the proportion of respondents who answered the question.

Clarity of expectations

Expectation clarity for remote workers is defined in this research as the degree to which Scrum Development Team remote workers understand the specific tasks, goals, and performance standards that are expected of them. It is categorised and defined by the researcher as:

- Yes, everything is crystal clear to me: refers to remote workers who have a complete understanding of what is expected of them in terms of working hours, availability, output, and other relevant tasks.

- Almost, I feel expectation have not been formalised: refers to remote workers who have a partial understanding of what is expected of them though not fully communicated or formalised.

- Not really, I'm only accountable for my own productivity: refers to remote workers who do not have a clear understanding of what is expected of them and only accountable for their own productivity.

- Not at all, I do not feel we have set standards for remote work availability and productivity: refers to remote workers who do not feel that there are set standards for remote work availability and productivity. They have no clear understanding of what is expected of them in terms of working hours, availability, output, and other relevant tasks.

- Others: a space provided for the respondents to provide answers that are not listed in the categories provided.

Table 14 shows the distribution of responses from the survey question “*Do you know clearly what is expected as you work remotely?*”. Out of the 103 total respondents, only 100 provided an answer to this question, thus the percentage distribution is based on sample size N=100.

Table 14

Clarity of Expectations when Remote Working

Do you know clearly what is expected as you work remotely?	%	n
Yes, everything is crystal clear to me	74%	77
Almost, I feel expectation have not been formalised	17%	17
Not really, I'm only accountable for my own productivity	9%	9
Not at all, I do not feel we have set standards for remote work availability and productivity”	0%	0
Others	0%	0

Table 14 show that the majority of 74% (n=77) ‘Yes, everything is crystal clear’ when remote working. However, 17% (n=17) reported that ‘expectations have not been formalised’. Followed by 9% (n=9) reported that they are only ‘accountable for their own productivity’. While none of the respondents selected 0% (n=0) ‘not at all’.

Productivity Level

Productivity level in the context of remote working is defined in this research as the amount and quality of work that a remote worker can produce within a Sprint. It is categorised and defined by the researcher as:

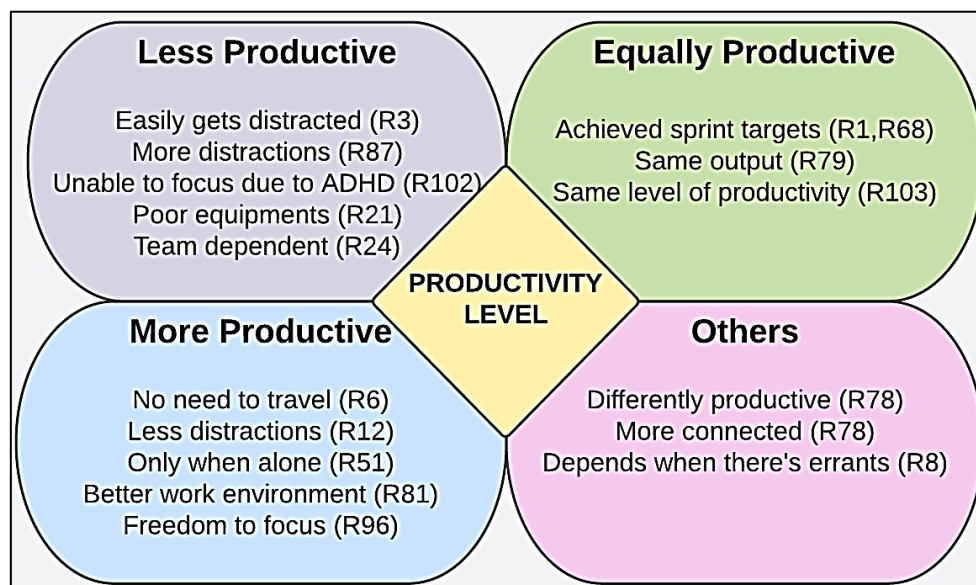
- Less productive: means that the remote worker produces a lower amount and/or quality of work compared to when working in a traditional office setting.
- Equally productive: means that the remote worker can maintain the same level of productivity whether remote working or working in a traditional office setting.
- More productive: means that the remote worker can produce a higher amount and/or quality of work when remote working compared to when working in a traditional office setting.
- Others: a space provided for the respondents to provide answers that are not listed in the categories provided.

Table 15 shows the distribution of responses from the survey question “*How to you describe your productivity level when remote working?*”. Out of the 103 total respondents, only 99 provided an answer to this question, thus the percentage distribution is based on sample size N=99.

Table 15*Distribution of Respondents' Productivity Levels*

How do you describe your productivity level when remote working?	%	n
Less productive	5%	5
Equally productive	69%	68
More productive	24%	24
Others. Please specify	2%	2

Table 15 shows that the majority of 69% (n=68) considered themselves 'equally productive' when remote working while 24% (n=24) were 'more productive'. However, a small percentage 5% (n=5) reported being 'less productive' and remaining 2% (n=2) provided other responses not specified in the survey which are shown in Figure 7.

Figure 7*Thematic Analysis on Productivity Level when Remote Working*

Note. R represents the respondent that provided explanation on the chosen level of productivity.

Figure 7 shows the result of the Thematic Analysis of the productivity level experiences reported by the respondents. The codes shown in the figure were based on the explanations provided by the respondents, which helped to understand the factors behind their choice of productivity level. It is important to highlight that the themes represented in the figure were extracted from the respondents' inputs and may not align with the figures displayed in Table 15, as providing an explanation for each option was not obligatory.

The themes are categorised by the level of productivity as defined in Table 15. Respondents who reported less productivity cited distractions (R8), inadequate equipment (R21), and dependence (R4) on the team as the primary reasons for their lower performance. Furthermore, one respondent (R102) reported having disabilities mentioned that it's challenging to focus on remote working.

The respondents who reported being more productive when remote working attributed increased productivity to saved travel time (R6), fewer distractions (R12), a more focused mindset (R96), a better work environment and can progress on other tasks when work is idle (R81).

Causes of delay

Table 16 shows the distribution of respondents' answer to the survey question '*What are the most common causes of delays in remote working, leading the team to defer tasks to the next Sprint?*'.

The survey question in this section is presented with multiple-choice options, allowing respondents to select more than one option if applicable to them. The percentage distribution is calculated based on the total number of responses across all options, which in Table 16 amounts to 333.

Table 16*Common Delays Caused by Remote Working*

What are the most common causes of delays when remote working, leading the team to defer tasks to the next Sprint?	%	n
Team dependency in dealing with issues	68%	70
Scope changes in the middle of the Sprint	63%	65
Communication breakdowns that lead to misunderstandings, misinterpretations, or delays in resolving issues	50%	51
Difficulty in brainstorming and working through challenges when not in the same physical location	37%	38
Sprint velocity is too high to be achieved	36%	37
Lack of accountability of a physical office, team members not feeling as responsible for their tasks, leading to delays in progress	23%	24
Lack of visibility into team member's progress or challenges	16%	16
Interruptions from personal or home-related responsibilities	15%	15
Poorly written emails, missed messages, or unclear instructions	10%	10
Technical problems, such as poor internet connectivity or software issues	5%	5
Others.	2%	2

Table 16 shows the common causes of delays when remote working. Both 68% (n=70) 'Team dependency in dealing with issues' and 63% (n=65) 'Scope changes in the middle of the Sprint' are the reported by majority of the respondents that commonly caused tasks to be deferred to the next Sprint. Followed by 50% (n=51) 'Communication breakdowns that lead to misunderstandings, misinterpretations, or delays in resolving issues' at 51%, 37% (n=38) 'Difficulty in brainstorming and working through challenges when not in the same physical location', 36% (n=37) 'Sprint velocity being too high to be achieved due to team capacity issues' and 16% (n=16) 'Lack of accountability of a physical office, which can lead to team members not feeling as responsible for their tasks, resulting in delays in progress'.

In terms of individual factors, 'Interruptions from personal or home-related responsibilities' are reported by 15% (n=15) of respondents, followed by 5% (n=5) 'technical problems, such as poor internet connectivity or software issues', 10% (n=10) 'Poorly written

emails, missed messages, or unclear instructions can cause delays’ and 5% (n=5) ‘Technical problems, such as poor internet connectivity or software issues’.

The least common delays as reported by 2% (n=2) of the respondents falls in the ‘Others’ category. However, explanations were not provided.

4.3.1.4 Impact of Working with Dispersed Teams on Productivity and Work Quality

Figure 8 shows the distribution of responses, in percentage, to the survey question “*Would you agree that working with dispersed teams impacts one’s productivity and quality of work in any way?*”. This question aims to explore the respondents’ perspective on how remote working arrangement and working with dispersed teams affects their productivity and the quality of their work.

Figure 8

Potential Impact of Working on Productivity and Work Quality

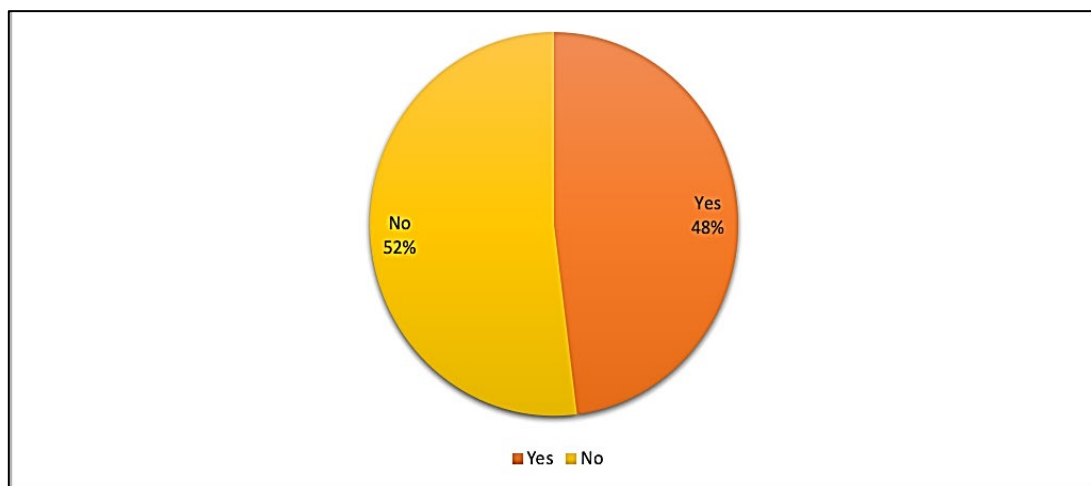
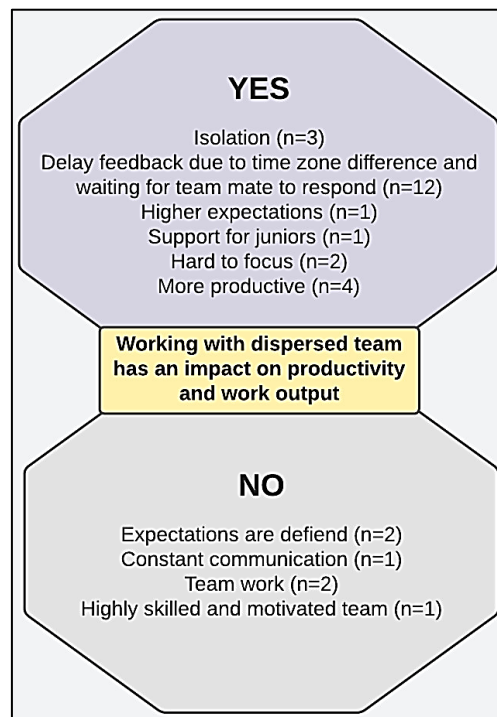


Figure 8 shows that the responses are closely split between those who answered Yes and No, with a slight majority of 52% answering No and 48% answering Yes.

Figure 9*Thematic Analysis on the Impact of Remote Working on Productivity*

Note. n represents the number of respondents that mentioned each specific theme

Figure 9 shows the Thematic Analysis of the responses regarding the perceived impact of working with dispersed Scrum Teams on productivity and work output. The analysis of respondents who answered ‘Yes’ indicated several factors that they believed could influence productivity and work output. These factors encompassed feelings of isolation (n=4), feedback delays caused by time zone differences (n=12), challenges in maintaining focus (n=2), lack of support for junior team members (n=1), and increased productivity (n=4).

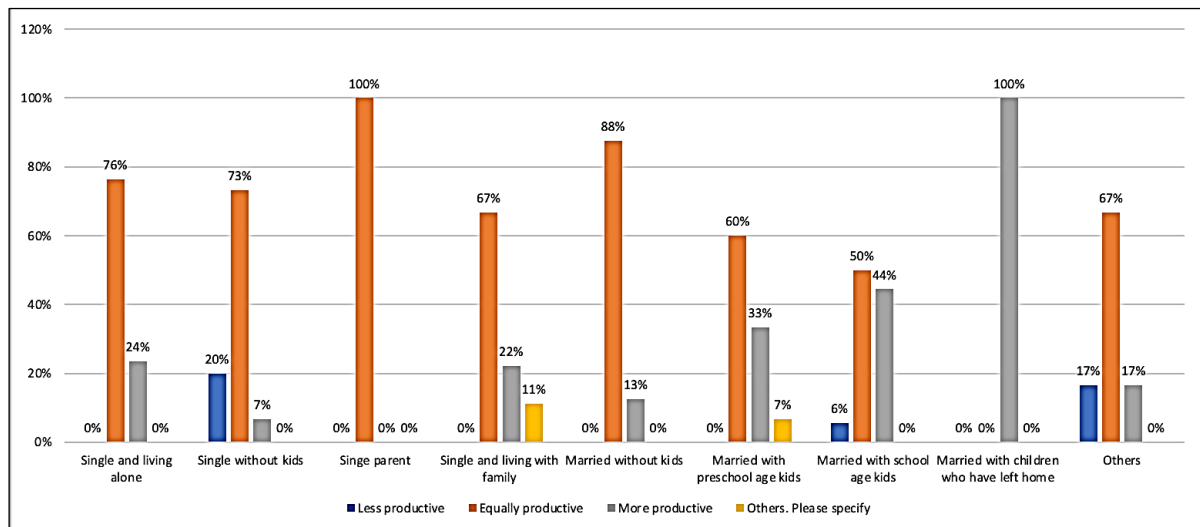
Conversely, respondents who answered ‘No’ cited themes such as having well-defined expectations (n=2), maintaining constant communication (n=1), fostering teamwork (n=1), and having a highly skilled and motivated team (n=1) as factors that can positively impact productivity and work output.

4.3.1.5 Relationship between Productivity and Family Status

Figure 10 shows the relationship between productivity levels and respondents' family status in percentage.

Figure 10

Relationship Between Productivity Level and Family Status



The data shows that there are more categories reported claiming that they were 'Equally productive' when working remotely. The highest being in 100% 'Single parent' category at 100%, 'Married without children' category at 88%, 'Single and living alone' category at 76%, 'Single with out children' category at 73%, 'Single and living with family' category at 67%, 'Others' category at 63%, 'Married with preschool children' category at 60% and 'Married with school aged children' category at 50%.

However, majority of the respondents who claimed to be 'More productive' were those in the 'Married with children who have left home' category at 100%. Followed by 'Married with school-age children' category at 44%, 'Married with preschool-a children' category at 33%, 'Single and living alone' category at 24% and in the 'Others' category at 17% and least were those in the 'married without children' category at 13%.

While there were only three categories that reported being 'Less productive'. These included 20% 'Single without children', 17% 'Others' category, and 6% 'Married with school-age children' category.

4.3.2 Significance of the Scrum Framework's Values and Pillars in Remote Working

This section presents the analysis of responses obtained from a 5-point Likert scale, which consists of five response options that represent varying degrees of agreement or disagreement with a particular statement or question: always, most of the time, about half the time, sometimes, and never. The options in the Likert scale are categorised and defined by the researcher as:

- Always: means that the team communicates openly and effectively everyday among each other while remote working on a consistent basis.
- Most of the time: means that the team communicates openly and effectively for a significant portion of the of their remote working week.
- About half the time: means that the team communicates openly and effectively approximately 50% time while remote working week.
- Sometimes: means that the team communicates openly and effectively sporadically or on occasion during their remote working week.
- Never: means that the team does not communicate openly and effectively at all while remote working.

4.3.2.1 Open and Effective Communication among the Scrum Development

Teams

Figure 11 shows the distribution of responses, in percentage, on the survey question ‘How often do you believe the team communicates openly and effectively amongst each other?’

Figure 11

Communication Among Remote Working Scrum Development Teams

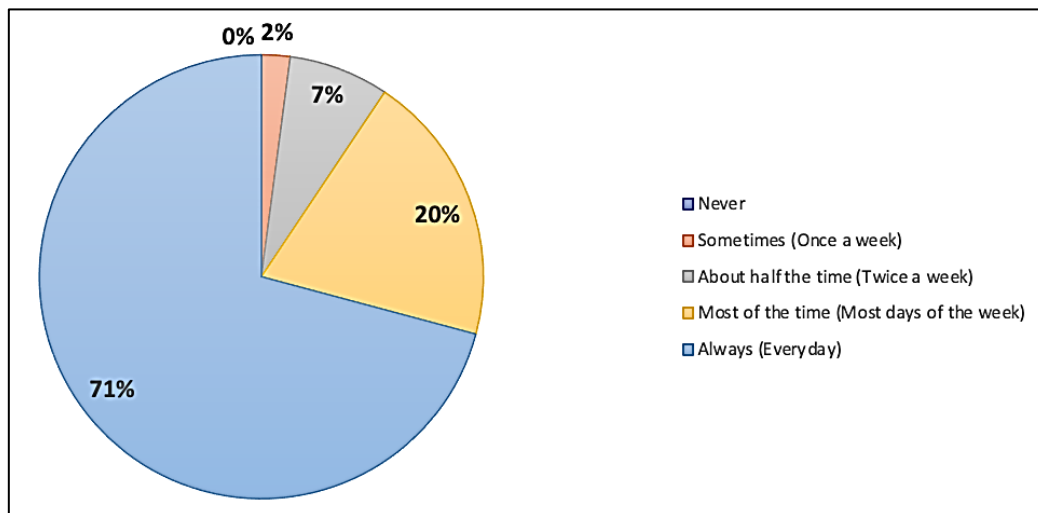


Figure 11 shows that majority of 71% respondents reported that they have both open and effective communication within the Scrum Team on a daily basis when remote working. Additionally, 20% indicated that they communicate ‘most of the time,’ although not necessarily every day. Only 7% reported communication occurring about half of the time, and a small percentage of 2% stated that they only communicate ‘sometimes’ while remote working.

4.3.2.2 Assistance Provided to Scrum Development Team Members Having Task Difficulties

Figure 12 shows the distribution of responses, in percentage, on the survey question: ‘How often does the team offer assistance to those individuals who are having difficulties in progressing on their tasks?’.

Figure 12

Providing Assistance to Scrum Development Team Members Experiencing Task Difficulties

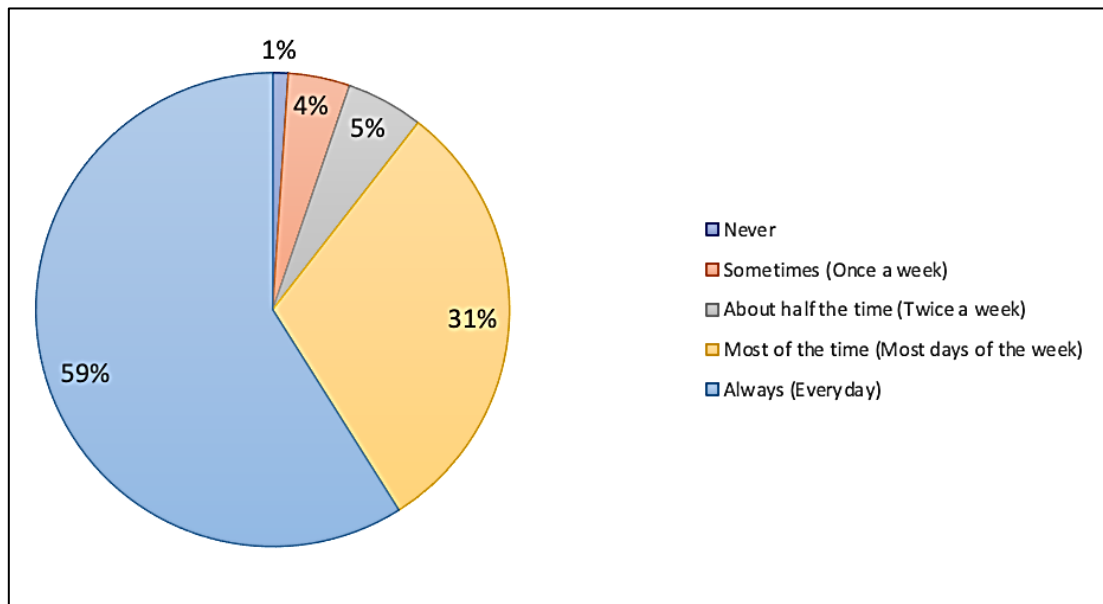


Figure 12 shows that majority of 59% respondents reported that the Scrum Development Team members ‘always’ provides assistance, demonstrating consistent support. Additionally, 31% reported that they received help from the team ‘most of the time’, indicating regular assistance throughout the week. Furthermore, a smaller percentage of respondents mentioned that the Scrum Development Team offer assistance ‘about half the time’ at 5%, ‘sometimes’ at 4%, and only 1% reported ‘never’ receiving or providing assistance within the team.

4.3.2.3 Scrum Events as Communication and Collaboration Forum

Figure 13 shows the distribution of responses, in percentage, on the survey question *'How often are the Scrum Events serve as a forum for communication and collaboration among Scrum Development Team members?'*. These Scrum Events are Sprint Planning, Daily Scrum, Sprint Review, and Sprint Retrospective (Sutherland & Schwaber, 2020).

Figure 13

Scrum Events as a Forum for Communication and Collaboration

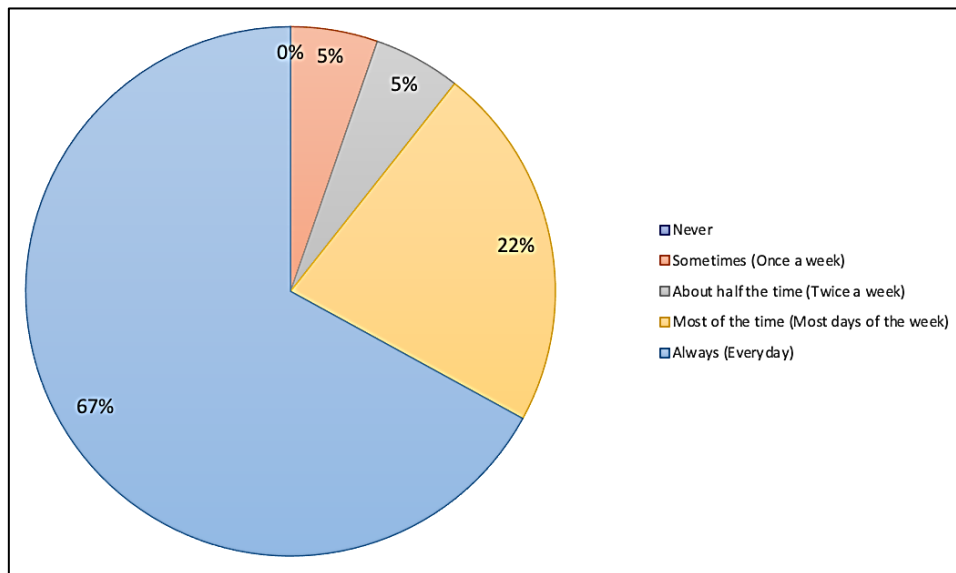


Figure 13 shows that majority of 67% respondents reported that Scrum Events function as a platform for daily communication and collaboration among team members, while 22% mentioned that it occurs 'most days of the week'. Conversely, a smaller percentage of 5% reported 'about half the time' used for communication and collaboration.

While n=2 respondents have reported that doing Scrum Events virtually is challenging, saying,

“It takes time to adapt all the team to effective Scrum processes, but once everyone is clear about the process, the progress is obvious, and convenience of such method is very high” Software Tester#75

“It’s more challenging, but the benefits of working in a scrum outweigh the challenges of remote working” Scrum Master#87

Both respondents also acknowledged that initially, having these meetings may present some challenges. However, they also emphasised that the Scrum Development Team can greatly benefit from the outcomes.

4.3.2.4 Discussing Requirements within the Scrum Team

Figure 14 shows the distribution of responses, in percentage, on the survey question *‘How often are vague area of the requirements thoroughly discussed among the Scrum team so as to eliminated confusion and misunderstandings during the development phase?’*.

Figure 14

Discussion of Requirements Among Scrum Development Teams

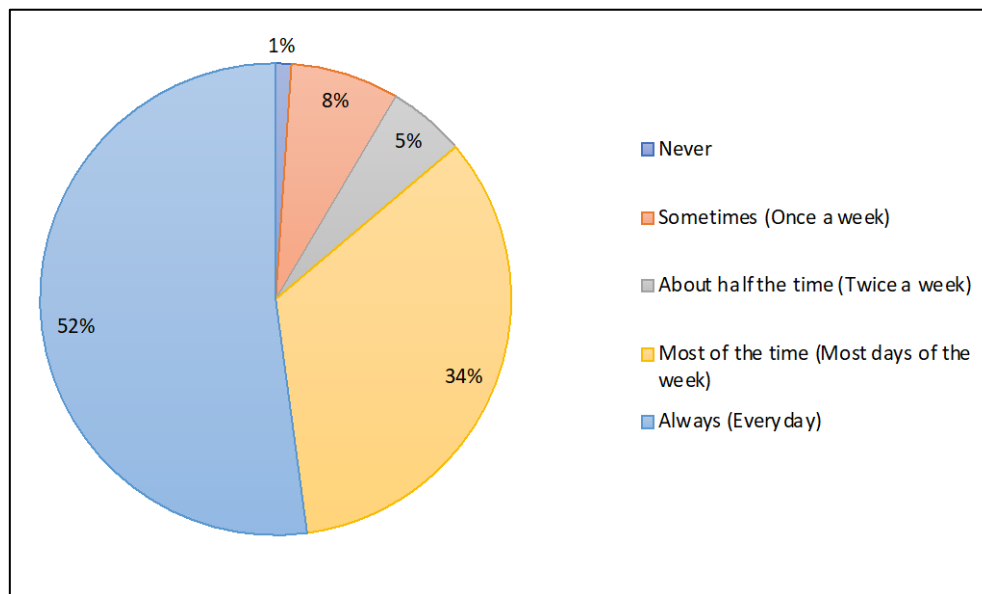


Figure 14 shows that majority of 52% respondents reported that discussions to on requirements are ‘always’ carried out, followed by 34% reported that it occurs ‘most of the time’. A smaller percentage of 7% reported that these discussions ‘sometimes’ carried out, while 5% reported it happens ‘about half the time’. While only 1% reported that such discussions ‘never’ occur.

Comparing these results to Figure 13, where majority of 67% reported that Scrum Events ‘always’ serve as a forum for communication and collaboration, it can be inferred that the team utilises these events as an opportunity to thoroughly discuss and clarify vague areas of requirements.

4.3.2.5 Issue Resolution and Discussion without Formal Meetings

Figure 15 shows the distribution of responses, in percentage, on the survey question ‘How often does the Scrum Development Team discuss and resolves issues and impediments

on a regular basis through a group channel, emails or informal communication without waiting for formal meetings to be held?'

Figure 15

Discussion and Resolution of Issues and Impediments Among Scrum Development Teams

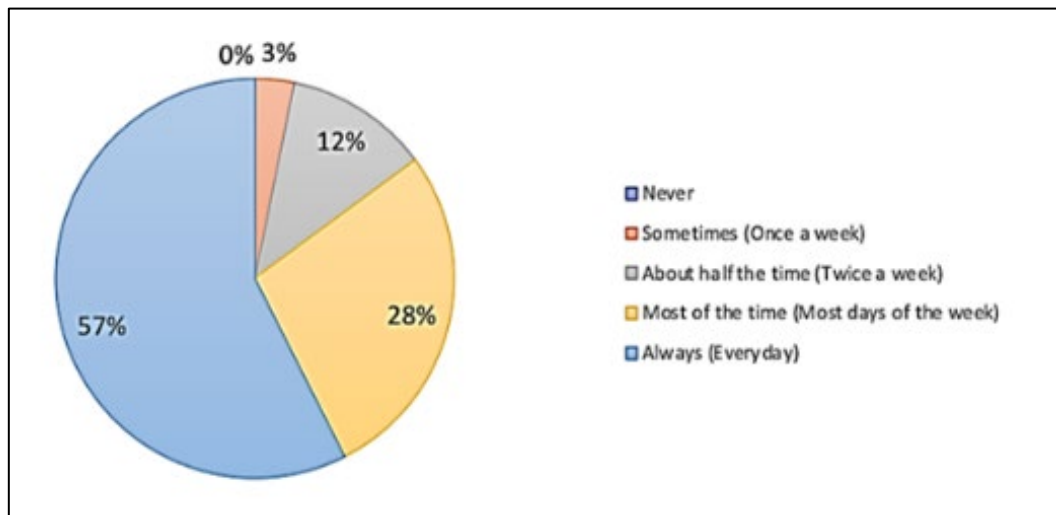
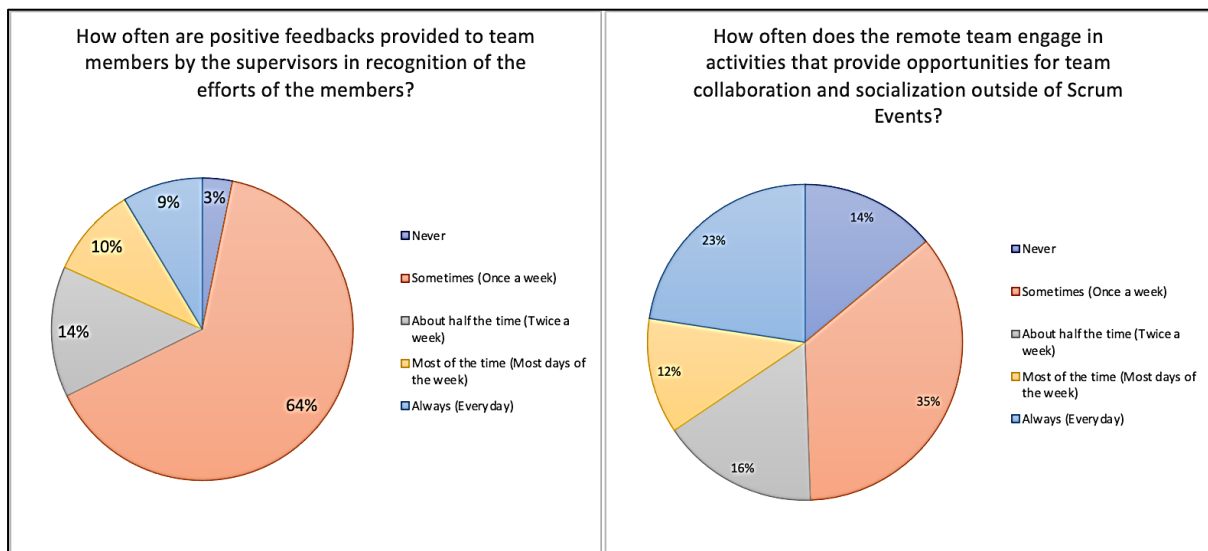


Figure 15 shows that majority of 57% respondents reported that the Scrum Development Team discusses and resolves issues and impediments on a daily basis without waiting for formal meetings to be held. Followed by 28% reported that this occurs 'most of the time'. Comparatively, a smaller percentage of 12% reported that such discussions happen 'about half the time', while only 3% reported that it occurs 'sometimes'. None of the respondents indicated that these discussions 'never' take place.

4.3.2.6 Team Collaboration and Socialisation outside of Scrum Events

Figure 16 shows the distribution of responses, in percentage, on the frequency of collaboration and communication between supervisors and subordinates, as well as the frequency of activities that promote collaboration among the Scrum Development Team outside of Scrum Events (Sutherland & Schwaber, 2020).

Figure 16*Collaboration Between Supervisors and Subordinates*

The majority of 65% respondents reported that positive feedback is ‘sometimes’ provided, indicating that recognition of Scrum Development Team members’ efforts occurs at least once a week. Comparatively, smaller percentages reported positive feedback occurring ‘about half the time’ at 14%, ‘most of the time’ at 10% and ‘always’ at 9%. Only 3% reported that positive feedback is ‘never’ provided.

Regarding activities that provide opportunities for team collaboration and socialisation outside of Scrum Events, Figure 16 shows that a significant proportion of 35% reported engaging in such activities ‘sometimes’, indicating that team members have opportunities for collaboration and socialisation at least once a week. Additionally, 23% reported that these activities occur ‘always’. However, 14% reported that these activities ‘never’ take place.

This was substantiated by the findings in Table 12 from section 4.2.2.1, which revealed that the most common challenge reported by remote workers was the absence of social interactions typically found in an office environment. Approximately 81% of respondents acknowledged experiencing this.

4.3.3 Advantages and Disadvantages of Implementing the Scrum Framework Post-COVID-19 Pandemic

This section presents the analysis of the data collected to address the research's third research question: "*What are the advantages and disadvantages of adopting the Scrum Framework in managing dispersed Scrum Teams post-COVID-19 pandemic?*"

By examining the collected data, the analysis aimed to identify and understand the advantages and disadvantages associated with the implementation of the Scrum Framework in managing dispersed Scrum Teams in the post- COVID-19 pandemic period. The responses provided by the respondents were explored to gain valuable insights into the advantages experienced and the challenges encountered when utilising Scrum practices in a remote work environment.

4.3.3.1 Presence of Scrum Team in Scrum Events

Figure 17 shows the distribution of responses, in percentage, on the survey questions '*Does the Scrum Team always attend all Scrum Events in a timely manner?*'. These Scrum Events, including the Sprint Planning, Daily Scrum, Sprint Review, and Sprint Retrospective (Sutherland & Schwaber, 2020).

Figure 17

Presence of Scrum Development Team in Scrum Events

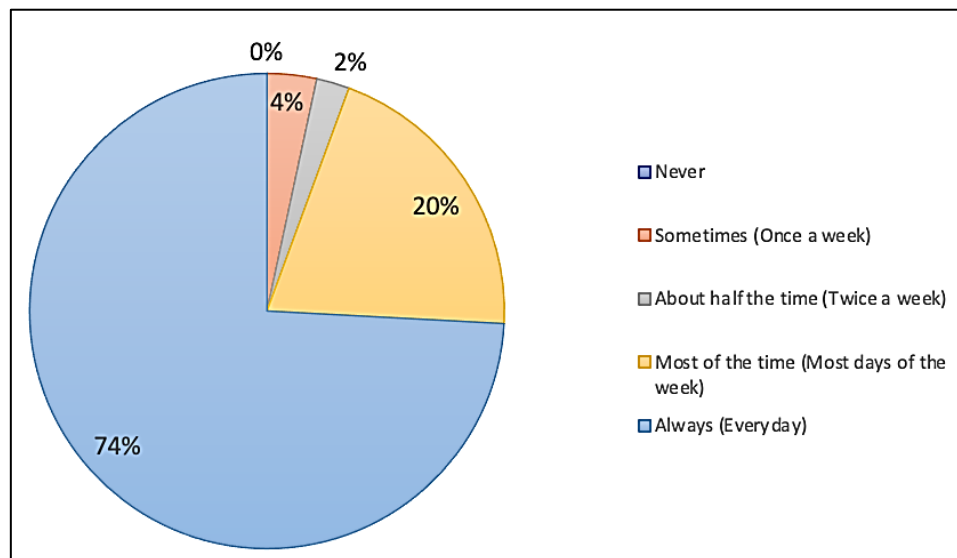


Figure 17 shows the high level of commitment among the Scrum Development Team members in attending Scrum Events in a timely manner as the majority of 74% of respondents reported that they attend these events on a daily basis. Followed by 20% of the respondents agreeing that Scrum Development Team participates in ‘most of the events’, while not as ideal as the ‘always’ category, it still demonstrates a significant level of engagement from the team. A small portion of respondents at 2% reported that the Scrum Development Team attends only half of the events, suggesting some inconsistency and 4% of the team attends Scrum Events only once a week.

4.3.3.2 Scrum Development Teams’ Availability to Discuss Urgent Matters

Figure 18 shows the distribution of responses, in percentage, on the survey question ‘Do you, at one point, wait for a Scrum Development Team member to be available so that you can get in touch with them and discuss urgent matters?’.

Figure 18

Distribution of Scrum Development Teams' Availability

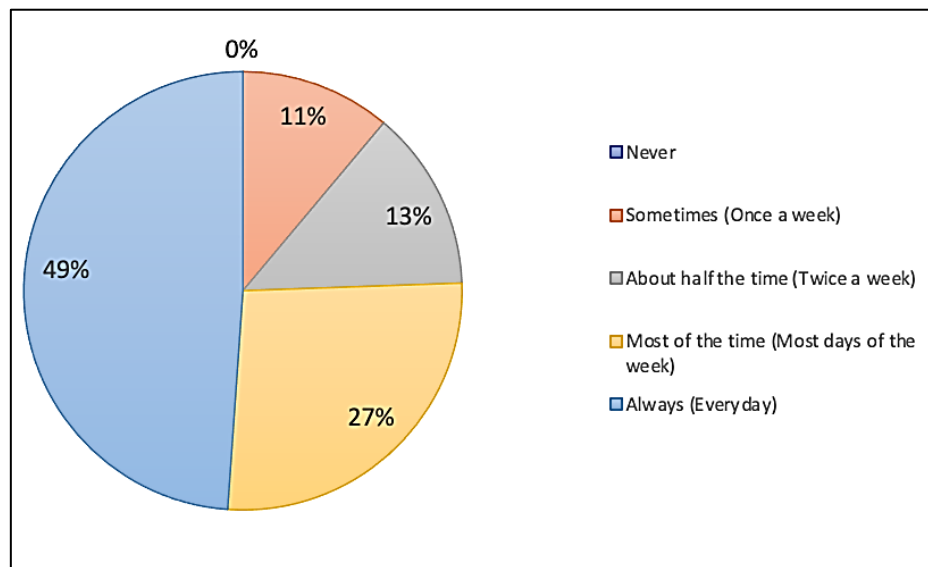


Figure 18 shows that majority of 49% of the respondents reported that the Scrum Development Team members experienced instances where they consistently had to wait for their colleagues to be available for discussing urgent matters. Followed by 27% of the respondents reported that this waiting period happened ‘most of the time’. Notably, 13% respondents reported that such waiting occurred ‘about half the time’, while 11% mentioned that it happened ‘sometimes’.

4.3.3.3 Managers Checking on Remote Working Scrum Development Teams

Figure 19 shows the distribution of responses, in percentage, on the survey question ‘How often are managers checking on the availability and output of remote workers on a regular basis?’.

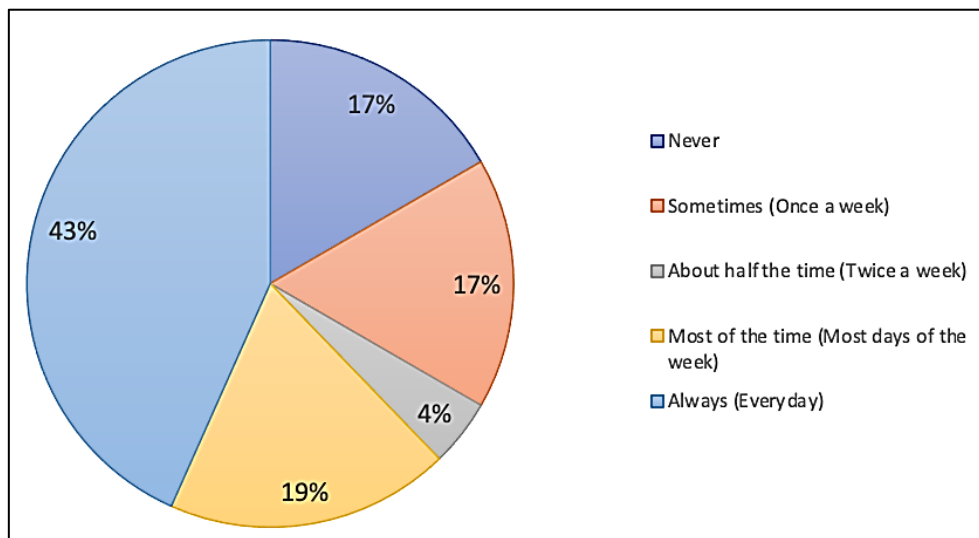
Figure 19*Monitoring Scrum Development Teams' Availability*

Figure 219 shows the level of monitoring experienced by the respondents in terms of their availability and output. Data shows that 43% of the respondents reported that managers 'always' monitor Scrum Development Teams' availability and output. Additionally, 19% of the respondents reported that they are being monitored 'most of the time'. However, there is a combined 38% of respondents, with 17% indicating that monitoring occurs 'sometimes' and 21% stating 'never', implying that their availability and output are not monitored as frequently.

4.3.3.4 Reachability of Scrum Team During Regular Working Hours

Figure 20 shows the distribution of responses, in percentage, on the survey question *'Do the members of the Scrum Development Team have the ability to be reached out anytime during the core hours of their regular working day?'*

Figure 20

Availability of Scrum Development Team During Working Hours

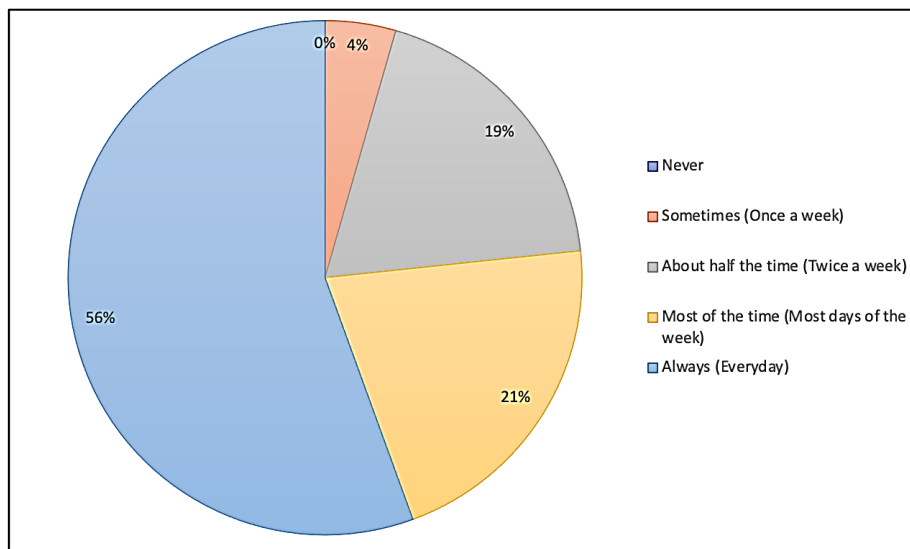


Figure 20 shows that majority of 56% of respondents reported that the Scrum Development Team members can be reached anytime during their regular working day core hours. Additionally, 21% of the team members are reachable 'most of the time'. However, a combined 23% of the team members, comprising 4% for 'sometimes' and 19% for 'about half the time', have limited availability. This limited availability could potentially impact the team's ability to respond promptly to urgent matters, resulting in delays in decision-making and communication.

4.3.3.5 Monitoring and Discussion of Issues and Impediments

Figure 21 shows the distribution of responses, in percentage, on the survey question *'As far as software quality if concerned, how often are issues and bug monitored and discussed before a User Story can be closed in order to ensure software quality?'*

Figure 21

Monitoring and Discussion of Issues and Impediments

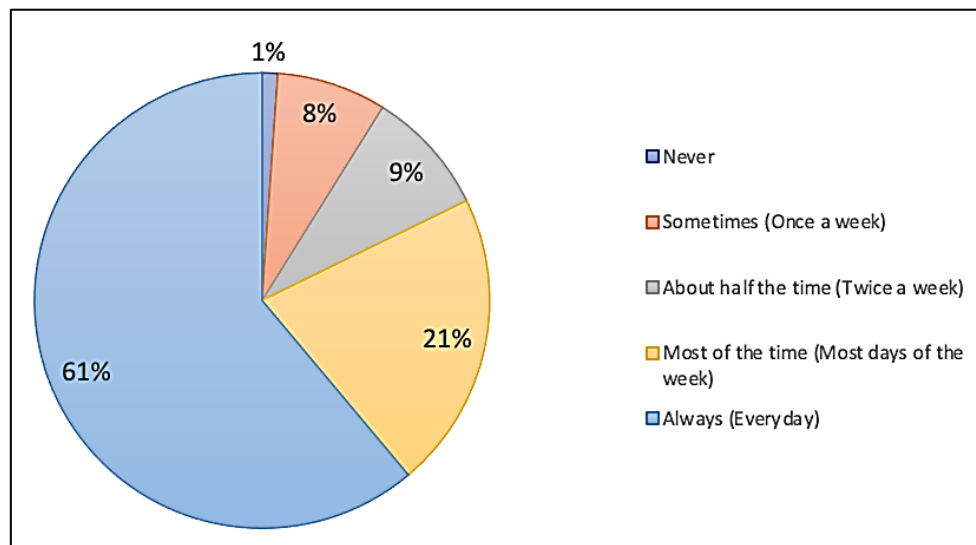


Figure 21 shows that majority of 61% of respondents reported that the Scrum Development Team 'always' monitor and discuss issues and bugs before closing a User Story, while 21% reported that it is carried out 'most of the time'. However, a combined 18% of respondents, with 8% 'sometimes' and 9% 'about half the time', reported monitoring and discussing issues and bugs less frequently. This has the potential to impact software quality and lead to issues in the future if not addressed promptly.

4.3.3.6 Benefits in Accessing Skilled Remote Workers

Figure 22 shows the distribution of responses, in percentage, on the survey question *'Do you think the organisation benefits from having a dispersed team by reaching out to skilled remote workers located outside the location of the organisation's head office in order to gain access to the best talent within the country?'*

Figure 22

Benefits in Accessing Skilled Remote Workers

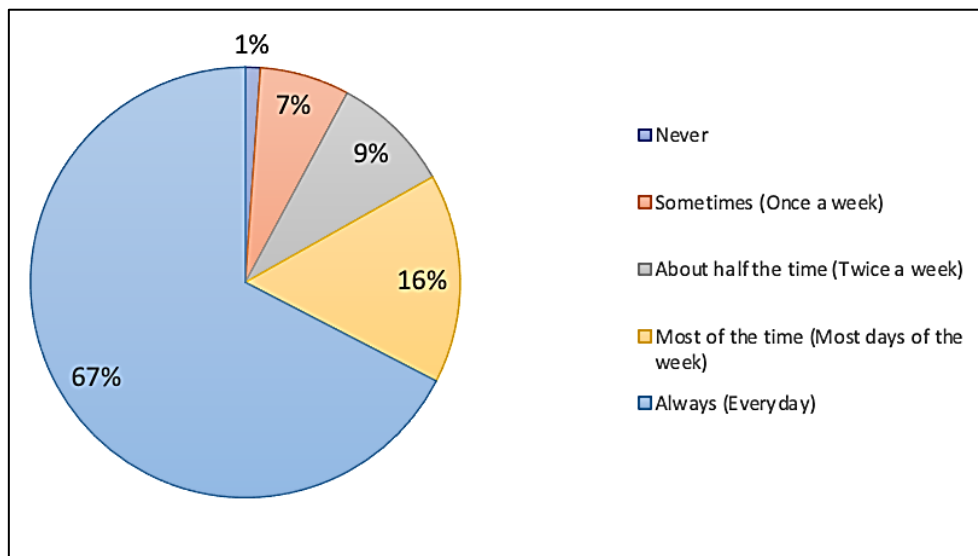


Figure 22 shows that majority of 67% of respondents reported that the organisation benefits from having a dispersed team and reaching out to skilled remote workers located outside the location of the organisation's head office. Followed by 16% of the respondents reported that the organisation benefits from dispersed teams 'most days of the week'. This high percentage suggests that the respondents recognise the value of accessing the best talent within the country or not overseas, even if they are not physically present at the head office.

However, a combined 17% , with 7% 'sometimes' and 9% 'about half the time, reported organisations only occasionally benefits from having skilled dispersed team.

4.3.3.7 Utilisation of Group Channel for Urgent Discussions

Figure 23 shows the distribution of responses, in percentage, on the survey question '*Does the team have a group channel which everyone can be kept informed of any urgent matters and to discuss informal questions that arises during the Sprint?*'

Figure 23

Group Channel Utilisation for Urgent Matters and Informal Discussions

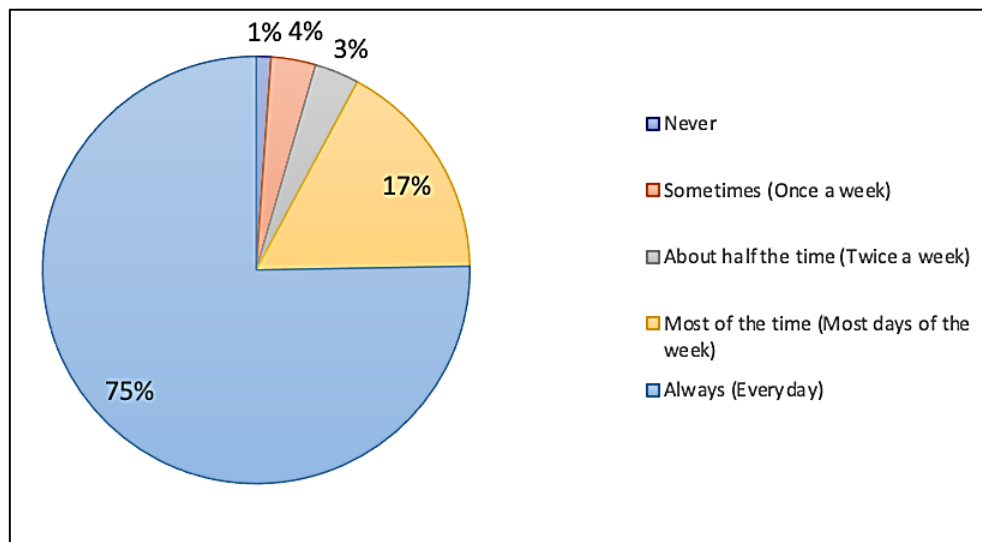


Figure 23 shows that a majority of 75% of respondents reported that a group channel was used 'always' in discussing urgent matters and informal discussions. Followed by 17% reported 'most of the time'. While 4% reported using a group channel 'sometimes' and 3% reported using the group channel 'about half the time'. Notably, only 1% of respondents reported 'never' using a group channel.

4.4 Summary of Results

This section provides a comprehensive summary of the findings obtained for each of the research questions defined in Chapter 1. It highlights the key results and insights obtained from the data analysis and presented a clear and concise overview of the findings for each question.

4.4.1 Factors Disrupting Scrum Development Team Members' Task Concentration in Remote Workspaces

According to the respondents, the primary challenges faced while working from home are the lack of social interaction (n=83) and the inability to build relationships with co-workers (n=64). While there may not be a direct correlation between these challenges to productivity, it is important to recognise their significance in creating a positive and supportive work environment, these are reported by n=3 respondents.

“For me, having a hybrid work setup helps with reconnecting with colleagues and increase morale from time to time...” (R1)

“Humans need real life connection; we need co-regulation. That takes care of the human side, the tech side is easier to reach to someone in same room as online” (R68)

“It is nice to visit the office from time to time to create connection with colleagues, it is far more better than catching up online.” (R96)

While majority recognised the advantages of remote working, such as the ability to work independently (n=80) and the flexibility to work during their most productive times (n=66), they also acknowledged certain distractions that hinder their focus. Specifically, the use of social media (n=77), the time required to refocus after running an errand (n=72), and background noises (n=72) were identified as the main reasons for respondents being diverted from their work. Among the respondents, a total of five (n=4) respondents provided explanations on how these distractions resulted in decreased productivity, saying,

“Get distracted easily.” (R3)

“It depends when there’s urgent errands.” (R8)

“When there’s something that needs to be carried out apart from work, it’s hard to focus.” (R1)

“Due to more distractions” (R87)

Respondents also recognised the advantages of having flexibility in organising their home (n=45) and spending more time with family (n=37) while remote working. However, an equivalent number of respondents also considered these factors as distractions, such as caring for family (n=26) and household chores (n=24). For instance, three (n=3) respondents have said,

“I am more productive at home but only I am the only one and the kids are not at home. Else, I wouldn’t be able to focus” (R51)

“2.5-week-old son when to Starship hospital, I had to work remotely from hospital bed as well as attend dev academy.” (R68)

“Working and looking after a toddler is challenging.” (R95)

4.4.2 The Role of Scrum Framework in Supporting Remote Scrum Development Teams

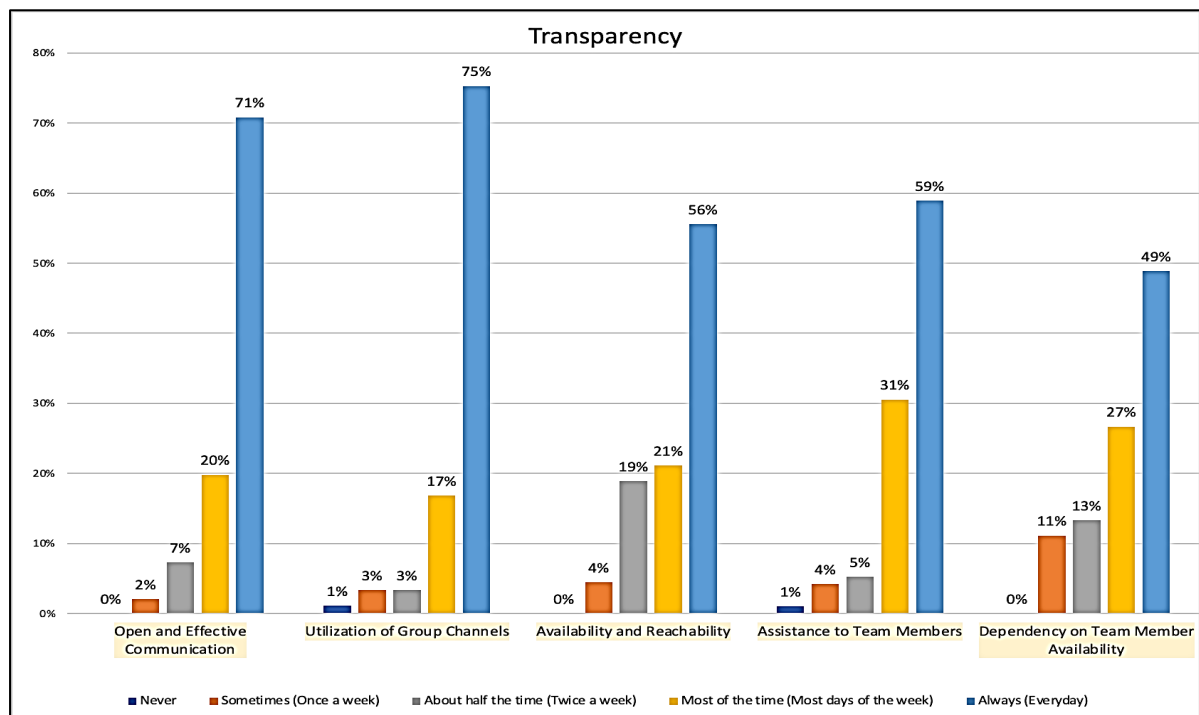
The findings in this section are categorised into three key areas: transparency, inspection, and adaptation.

4.4.2.1 Transparency

Figure 24 shows the distribution in percentage on how often the Scrum Development Team engaged in activities related to promoting transparency within the Sprint. The 'transparency' pillar emphasises the importance of openness, clear communication, and visibility of project information to all stakeholders (Sutherland & Schwaber, 2020).

Figure 24

Scrum Development Teams' Transparency



The data shows that the Scrum Development Team members consistently engage in ongoing communication, as indicated by the majority of respondents who reported open and effective communication (71%) and regular utilisation of group channels (75%) on a daily basis.

However, there is a lower level of agreement among respondents regarding the availability and reachability of team members (56%), extending assistance to colleagues (59%), and the dependency on team members' availability (49%). These findings are consistent with the challenges mentioned by some respondents, such as dealing with different time zones (n=45) being one of the struggles experienced when remote working and team dependency (n=70) as one of the causes of delays, which impacts the frequency of interactions.

“Especially if you’re working in different time zones. Also, there are a lot of time spends in meetings which usually take time to do other works and the waiting time for exchange information takes time too.” (R24)

“Difference in time zones affects project progress since there can be delays with the responses, or in case of very complex issue we somehow need to catch up online in timing which suits for both sides,” (R75)

“When remote working, Scrum Teams may be spread across different time zones, which can make it challenging to schedule meetings and collaborate effectively.” (R79)

“There are occasions when dealing with geographically dispersed people that it's hard to find a good time to meet” (R81)

The issue of team dependency extended beyond working with colleagues in different time zones. Respondents also highlighted the challenge of waiting for responses, even when colleagues were online but not actively engaging or not in the same work zone.

“Longer turnaround time for communication to occur in a virtual setting” (R3)

“When people you need to work with is not available at the moment” (R8)

“There are times that I must wait for them to be free before I can call them. however, that only happens over crucial times.” (R22)

“Seeing someone “online” but not replying to messages sometimes creates anxiety” (R68)

“Late responses from team members although available in Teams” (R84)

These challenges can impact productivity by slowing down information exchange, hindering collaboration, and creating a sense of unease or uncertainty among team members. It underscores the importance of establishing effective communication channels, managing availability expectations, and fostering a responsive and supportive virtual work environment to mitigate these challenges and maintain productivity in remote settings.

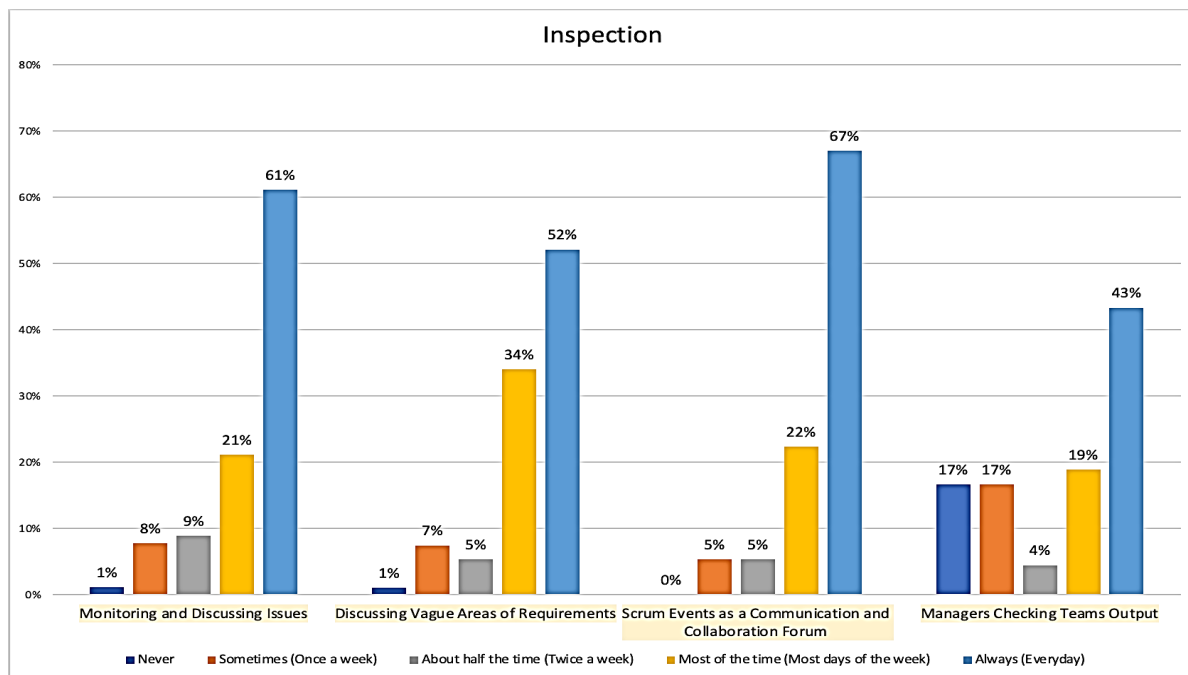
4.4.2.2 Inspection

Figure 25 shows the distribution in percentage on how often the Scrum Development Team engaged in activities related to inspection within the Sprint. The 'Inspection' pillar in the Scrum Framework emphasises the importance of regularly reviewing and evaluating the

progress, quality, and adherence to the project's goals and requirements (Sutherland & Schwaber, 2020).

Figure 25

Scrum Development Teams' Inspection



The data shows that the majority of respondents consistently engaged in ‘monitoring and discussing issues’, accounting to 61%, reported that they ‘always’ participate, while 21% reported doing so ‘most of the time’. Similarly, a significant portion of the team, accounting to 52% ‘always’ dedicated time to ‘discussing vague areas of requirements’, while 34% did so most of the time.

The respondents commonly engaged in effective communication through Scrum Events, with 67% indicating that these events were always utilised and an additional 22% reporting regular usage. However, significant proportion of the respondents, accounting to 47%, reported that these meetings took longer than expected, and 39% of the respondents mentioned conducting more virtual meetings than usual and resulted to experiencing ‘screen

fatigue due to multiple virtual meetings' experienced by 35% respondents. One respondent stating,

"Too much time spent on scrum meeting, getting too much on details and the frequency of done daily" (R17)

Additionally, managers played a role in inspecting the team's output, as reported by 43% of the respondents agreeing that 'managers always check work output' and 19% reported that this occurred 'most of the time'. However, 'Trust' have been mentioned by six (n=6) respondents in various open-ended questions, saying,

"Expectations are a lot higher but so is trust." (R5)

"I really like the trust in people to get the job done." (R80)

"Management trusts us to get the job done. We're very fortunate to have servant leadership (They get rid of impediments for us rather than micro-managing us)." (R81)

"We trust each other to have good time management and inform the team when a task isn't going to be achieved in the sprint. We have good communication with each other." (R87)

"I'm trusted with how I'll go about my task" (R92)

"It's all based on trust" (R103)

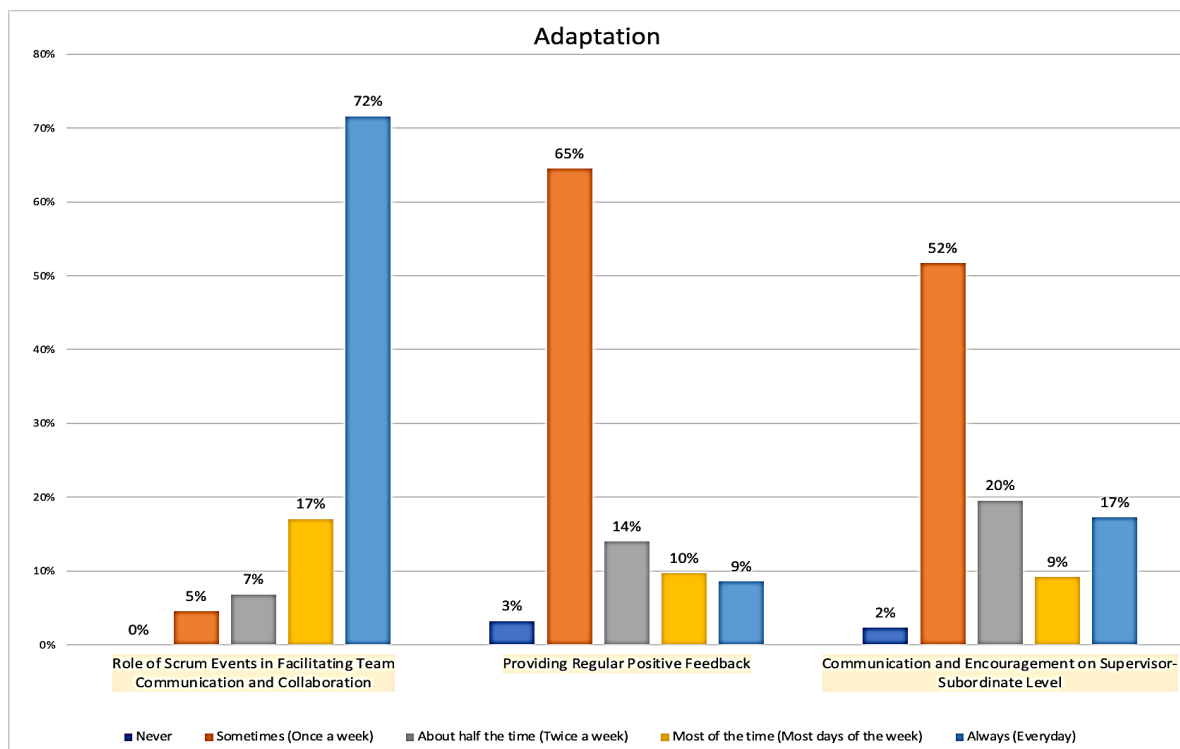
The establishment of a trust-based environment within the remote working Scrum Development Team cultivates an atmosphere of autonomy and empowers individual team members to take ownership of their work, as mentioned by R81 and R92. This environment enabled them to make decisions and prioritise tasks based on their expertise and understanding of the project requirements, according to R92.

4.4.2.3 Adaptation

Figure 26 shows the role of the Scrum Framework in promoting team communication and collaboration. The ‘adaptation’ pillar emphasises the importance of continuous learning, flexibility, and the ability to adjust plans and approaches based on feedback and changing circumstances (Sutherland & Schwaber, 2020).

Figure 26

Scrum Development Teams’ Adaptation



The majority of 72% respondents reported that the Scrum Events ‘always’ facilitates the Scrum Development Team in communication and communication. An additional 17% mentioned experiencing it ‘most of the time’ and a portion of 5% reported experiencing it ‘sometimes’.

In terms of receiving regular positive feedback, 65% of the respondents reported receiving it ‘sometimes’, followed by 45% reported receiving it ‘about half the time’. Additionally, 10% reported receiving positive feedback ‘most of the time’, and 9% reported receiving it ‘always’. Only 3% of the respondents reported ‘never’ receiving positive feedback.

Similarly, communication and encouragement on the supervisor-subordinate level had relatively lower levels of engagement. Notably, 17% of respondents experienced this type of communication ‘always,’ and 9% experienced it ‘most of the time’. However, it is noteworthy that 52% of respondents reported having this type of communication ‘sometimes’, indicating that regular communication and encouragement from supervisors are present in their work environment. On the other hand, 2% of the respondents reported ‘never’ receiving any form of communication and encouragement from supervisors.

4.4.3 Advantages and Disadvantages of Adopting the Scrum Framework for Dispersed Scrum Teams Post-COVID-19 Pandemic

This section provides the insights on the advantages and disadvantages of implementing the Scrum Framework for dispersed Scrum Teams in a post-COVID-19 pandemic context as revealed in this research.

4.4.3.1 Team Dependency

A significant number of respondents, at 68%, have identified 'team dependency' as a prominent challenge encountered in a remote working arrangement. This research has revealed that this disadvantage is a significant cause of delays in work progress.

Having longer turn around when in remote working arrangement was reported by n=4 respondents. For instance, R3 R24 and R75 reported that the virtual communication taking longer turn around time was challenging especially when dealing with complex issues.

“Somewhat, due to the longer turnaround time for communication to occur in a virtual setting.” (R3)

“Waiting time for exchange information takes time too.” (R24)

“In case of very complex issue we somehow need to catch up online in timing which suits for both sides, which is very complicated” (R75)

Additionally, R87 emphasised that there's a lack of accountability observed when Scrum Development Teams are in a remote working arrangement, saying that,

“No accountability. Hard to get a hold of product owner when needed.” (R87)

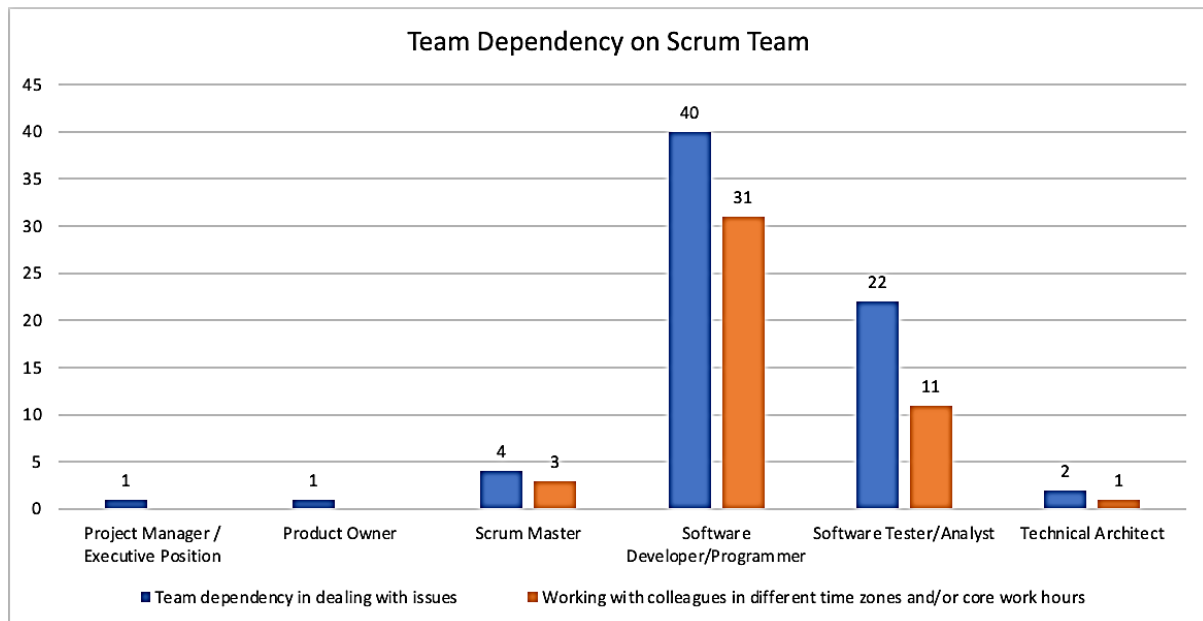
Furthermore, R22 and R84 have emphasised the significance of face-to-face communication due to its ease and the advantage of receiving instant responses.

“Well, it's easier to communicate in person when there's a problem.” (R22)

“Face to face discussions definitely has a greater advantage when collaborating as communications are clearer and response is almost instant.” (R84)

Figure 27

Scrum Development Teams’ Dependency and Difference in Time Zone



Note. Values in the figure are in ‘n’ where it represents the number of responses for each category.

Figure 27 shows the distribution of respondents by current roles and respective perception of ‘Team dependency in dealing with issues’ and ‘Working with colleagues in different time zones and/core hours’ as challenges when working with dispersed teams. Data shows that majority of the respondents n=40 Software Developers and n=31 Software Testers, identified both ‘Team dependency in dealing with issues’ and ‘Working with colleagues in different time zones and/core hours’ as significant challenges in remote working.

Among the respondents, a total of n=62 reported that ‘team dependency’ could potentially cause delays in task completion, while ‘difference in time zone’ emerged as a common struggle faced when remote working.

This research revealed that there are mixed views and experiences regarding communication and collaboration in a remote working setup. Some respondents acknowledged the challenges associated with virtual communication, such as longer turnaround times, difficulties in exchanging information, and the complexity of scheduling synchronous discussions. On the other hand, R87 emphasised the lack of accountability and the difficulty in reaching the Product Owner when needed, indicating a potential challenge in remote working collaboration, and accessing necessary resources.

4.4.3.2 Remote Working on Shared Tasks

While 30% of the respondents from Table 13 highlighted the advantages of virtual communication, it is noteworthy that 50% of the respondents from Table 16 expressed that it led to delays in tasks due to miscommunications and misinterpretations. Furthermore, Table 16 also revealed that 37% of the respondents’ reported having difficulties in brainstorming, which contributed to further delays.

These challenges were particularly evident when tasks were performed in pairs. For example, n=2 Software Developers acknowledged that working in pairs posed difficulties in adhering to timelines and addressing issues when both team members were not in the same work zone simultaneously.

“Tasks are sometimes shared and flexibility by other remote workers can hinder timelines.” (R21)

“When it needs to be done in pairs or dealing with testers who are not in the office, it may be an issue in case they are not in the focus mode yet.” (R103)

R21 emphasised that tasks are sometimes shared among team members, but the flexibility of other remote workers can potentially hinder timelines. While R103 mentioned the challenge of working in pairs or collaborating with testers who are not physically present in the office, this absence of face-to-face interaction or immediate access to Scrum Development Team members can potentially hinder certain aspects of the work process.

4.4.3.3 Visibility of Scrum Development Teams’ Progress

Approximately 59% of the respondents expressed concerns about overseeing others and providing assistance when needed, as the team tends to prioritise individual output. As highlighted by R87, this aspect requires attention and consideration.

“Harder to ask for help because you don’t know how much that person has on their plate.”(R87)

Additionally, R103 expressed that Scrum Development Team members tend to focus on individual goals rather than team goals when working remotely.

“Having a full remote setup tend to make the team members to only care about their tasks and ignore others’. (R103)

On the other hand, according to R22, remote working and having defined individual goals offer a significant advantage as they grant Scrum Development Team members the

autonomy to decide when and how they work on their individual goals while still meeting deadlines.

“I got more freedom to do my stuff but is still able to finish my tasks before the deadlines.” (R22)

This research revealed that these challenges arise due to the uncertainty surrounding the workload and availability of others. Unlike in a traditional office setting where workers can easily gauge the busyness or availability of other workers, remote working lacks the visibility into the tasks and schedules of team members. In a remote working arrangement, where face-to-face interactions are limited, the respondents claim that the natural tendency is to concentrate on individual responsibilities and prioritise personal workloads.

4.4.3.4 Individual Autonomy

Referring to Table 13, the advantages of remote working include the ability to work independently (78%) and flexibility in choosing productive hours (64%). Additionally, a notable advantage mentioned by n=3 respondents is the significance of having individual tasks clearly defined and assigned during Sprint Planning. This clarity allows them to concentrate on their assigned responsibilities and ensures that they understand what is expected of them.

“Because everyone’s expectations are clearly defined within the Sprint” (R6)

“I got more freedom to do my stuff but is still able to finish my tasks before the deadlines.” (R22)

“Remote work allows team members to work from anywhere with an internet connection. This gives them the freedom to manage their work-life balance more effectively, which can increase job satisfaction and reduce stress.” (R37)

This research revealed that while remote working with dispersed Scrum Development Teams presents its challenges, the adoption of the Scrum Framework brings several distinct advantages. These include clear expectations, autonomy, and improved work-life balance, which ultimately lead to positive outcomes for Scrum Development Teams.

4.4.3.5 Clear Distribution of Tasks

Despite facing challenges, the respondents recognised that the benefits of implementing Scrum outweighed the difficulties encountered. One notable advantage was the clarity of expectations and outputs. A significant majority of 77% expressed a clear understanding of expectations, while only 17% indicated that their understanding was somewhat clear.

R1 mentioned the importance of collaboration and keeping an eye on the task board to ensure timely completion of tasks and goals. This indicates that despite the remote setup, team members are still actively engaged in tracking progress and finding ways to collaborate effectively.

“While everyone still has their eye on the task board and collaborate on ways to complete the tasks and/or goals on time.” (R1)

Another respondent (R17) expressed that if tasks are assigned properly, remote working should not have a significant impact and that clear task assignment and proper planning can mitigate some of the challenges associated with remote work.

“If tasks are assigned properly then no impact is expected” (R17)

However, n=4 respondents highlight the value of occasional support and assistance from team members and working together as a team to resolve impediments and issues, emphasising the significance of regular communication and availability of help when needed.

“We just have to sort things out together and balance everything as a team.” (R8)

“They don’t pressure me on finishing my tasks, but they occasionally check how I’m doing or if I need help or assistance.” (R21)

“In our team, we help each other when one cannot solve an issue the team will always lend a hand even the team has loaded of tasks within that Sprint.” (R44)

“Having a scrum master helps our lives in work, helps monitor issues and tickets backlogs. Makes our work easy to maintain and visibility monitor.” (R44)

In contrast, R17 mentioned that despite delegating tasks and setting priorities, there were still instances where some team members experienced low output. This indicates that simply assigning tasks and establishing priorities may not guarantee optimal productivity.

“Some members have low output even though priorities have been set.” (R17)

Additionally, R28 and R75 recognised the challenges associated with remote working, but they expressed a positive perception of the effectiveness of the Scrum Framework and the benefits it brings to remote teams.

“It’s more challenging, but the benefits of working in a scrum outweigh the challenges of remote working” (R87)

“It takes time to adapt all the team to effective Scrum processes, but once everyone is clear about the process, the progress is obvious, and convenience of such method is very high” (R75)

These insights highlight the significance of properly distributing tasks during Sprint Planning and addressing challenges to optimise productivity in remote working environments.

4.4.3.6 Too Much Time Spent on Virtual Meetings

While efficient Scrum meetings allow team members to provide updates, discuss progress, address challenges, and align on priorities, 47% of the respondents said that meetings are now taking longer than expected in a remote setting and they are conducting more virtual meetings than usual while led to 35% of the respondents experiencing screen fatigue due to multiple meetings.

“Too much time spent on scrum meeting, getting too much on details and the frequency of done daily” (R17)

R17 mentioned that the Scrum meetings tend to take up a significant amount of time. One aspect mentioned is that there is a perception of too much time being spent in Scrum meetings. Another concern expressed is the tendency to delve into excessive detail during Scrum meetings. While it is important to have thorough discussions, excessive focus on details can lead to longer meetings and may not be the most efficient use of time.

Striking a balance between providing necessary information and avoiding unnecessary granularity is crucial for effective Scrum meetings. While the exact frequency is not specified, the implication is that too many daily meetings can disrupt the workflow and potentially lead to reduced productivity.

4.4.3.7 Availability of Wide Range of Talents

Remote working with the Scrum Development Team offers the advantage of having a self-organising team that can work independently, leveraging their skills and expertise (Cucolaş & Russo, 2021). This arrangement is seen as beneficial by 43% of the respondents, as it allows organisations to tap into a broader pool of talented workers and explore opportunities beyond the local area. These are supported by the statements made by R81 and R102, saying,

“We are a highly skilled, highly motivated group.” (R81)

“A highly motivated and stable team that has developed consistent working relationships with each other means that it isn’t necessary to “be in the same place”.” (R81)

“We have a really great team, I love the people I work with – and I feel that if the talent pool we’ve been hired from was just one city, we wouldn’t be near as good at what we do”
(R102)

These responses suggests that remote working and having a talented team from diverse locations is highly beneficial. As R81 emphasises that their team is not only highly skilled but also motivated, it highlights the importance of consistent working relationships within the team, stating that physical proximity is not necessary for effective collaboration.

Furthermore, R102 expressed the admiration for the team they work with and believes that the team’s excellence is attributed to the diverse talent pool they have been able to recruit from. They suggest that if their talent pool were limited to a single city, their team’s capabilities would be significantly diminished.

This research revealed the advantage of having access and ability in assembling a highly skilled and motivated Scrum Development Team, regardless of physical location.

4.5 Relevant Keywords

In this section, the extracted keywords from the qualitative data are presented along with the frequencies as mentioned by the respondents in the open-ended questions. Figure 30 presented below was created using monkeylearn.com, a text analytics software that enables users to extract valuable insights from unstructured text data (Garreta, 2023).

Figure 28

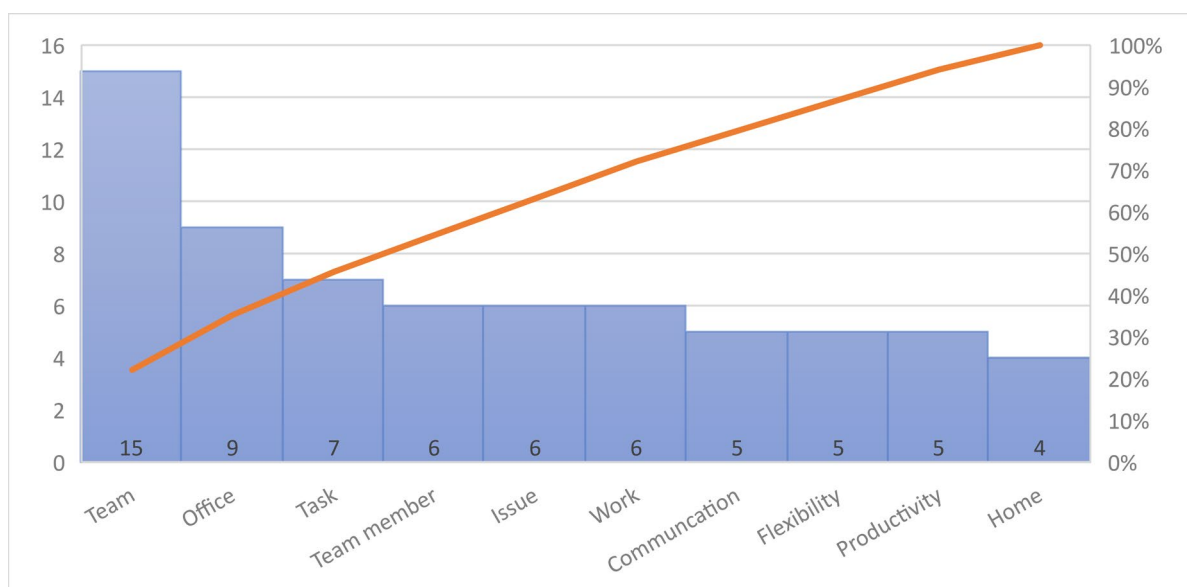
Relevant Keywords from Qualitative Data



Note. Relevant keywords generated by the researcher using monkeylearn.com.

Figure 29

Frequency and Relevance of Each Keyword



Note. Frequency and relevance of each keyword graph created by the researcher based on the outputs from Figure 28. The values are represented by 'n', indicating the frequency at which the keyword was mentioned by the respondents.

The data presented in Figure 29 shows the frequency and relevance of specific keywords extracted from the qualitative data, as shown in Figure 28. Among the mentioned keywords, the most frequently occurring one is 'team' (n=15), indicating that it plays a significant role among the respondents when remote working. The keyword 'office' (n=9) also garnered a substantial number of mentions, suggesting that the physical work environment was of relevance. Other noteworthy keywords include 'task' (n=7), 'issue' (n=6), 'work' (n=6), 'communication' (n=5), 'flexibility' (n=5), 'productivity' (n=5), and 'home' (n=4). These keywords indicate the key themes and concerns raised by the respondents, including task-related challenges, communication issues, flexibility in remote work, and productivity considerations that was mentioned in this Chapter and further explained in Chapter 5.

4.6 Reliability and Validity Data Testing

This section presents an assessment of the reliability and validity of the data collected through the responses on the 5-point Likert Scale. The reliability and validity of the data were examined to ensure the accuracy and consistency of the measurements obtained from the survey respondents (Warmbrod, 2014).

4.6.1 Data Reliability

Reliability refers to the precision and consistency of measurement (Warmbrod, 2014). In this research, Cronbach's Alpha was chosen as the reliability measure because it considers the interrelationships among the items within the scale (Gliem & Gliem, 2003). It assesses the degree to which the items in the scale exhibit consistent measurement of the same underlying construct or concept (Gliem & Gliem, 2003). By calculating Cronbach's Alpha, the researcher

was able to determine how well the items in the scale were interconnected and measure the intended construct reliably.

A statistical measure, with a sample size of 103 respondents and 18 questions represented as variables. The respondents used a 5-point Likert Scale, with values ranging from 1 to 5, where 1 represented 'always,' 2 represented 'most of the time,' 3 represented 'about half the time,' 4 represented 'sometimes,' and 5 represented 'never.'. These are indicated in Appendix B.

Figure 30

Cronbach's Alpha Reliability Testing Result

Reliability Statistics	
Cronbach's Alpha	N of Items
.715	18

Note. Reliability testing results generated by the researcher using SPSS

Through the analysis of the data presented in Figure 30 from Appendix B, the research obtained a reliability score of 0.715 using Cronbach's Alpha, which was analysed and tested using the IBM SPSS software. According to the conventional interpretation of Cronbach's Alpha Rule of Thumb, this value falls within the range of 'acceptable' internal consistency (Warmbrod, 2014). This suggests that the survey questions and corresponding responses demonstrate a reasonably reliable measure of the intended constructs or variables (Warmbrod, 2014).

4.6.2 Data Validity

This section demonstrates the correlation between variables by employing Spearman's Rho, which is analysed using IBM Statistical Package for Social Sciences (SPSS) software. Spearman's Rho is utilised for testing the correlation in the data, with the ordinal data sourced from the 5-point Likert Scale as presented in Appendix B.

Figure 31

Correlation Coefficient for the Role of Scrum Framework in Supporting Remote Working Scrum Development Teams

			Correlations						
			Team Communication Frequency	Team Assistance Availability	Scrum Events for Communication and Collaboration	Thorough Discussion of Requirement Ambiguities	Regular Issue Resolution in the Scrum Team	Supervisors' Feedback Frequency	Engaging Remote Team Activities
Spearman's rho	Team Communication Frequency	Correlation Coefficient	1.000	.657**	.448**	.464**	.454**	-.067	.455**
		Sig. (2-tailed)	.	<.001	<.001	<.001	<.001	.504	<.001
			N	103	103	103	103	103	103
	Team Assistance Availability	Correlation Coefficient	.657**	1.000	.354**	.634**	.476**	-.209*	.427**
		Sig. (2-tailed)	<.001	.	<.001	<.001	<.001	.034	<.001
			N	103	103	103	103	103	103
	Scrum Events for Communication and Collaboration	Correlation Coefficient	.448**	.354**	1.000	.519**	.608**	-.062	.100
		Sig. (2-tailed)	<.001	<.001	.	<.001	<.001	.532	.314
			N	103	103	103	103	103	103
	Thorough Discussion of Requirement Ambiguities	Correlation Coefficient	.464**	.634**	.519**	1.000	.554**	-.255**	.223*
		Sig. (2-tailed)	<.001	<.001	<.001	.	<.001	.009	.024
			N	103	103	103	103	103	103
	Regular Issue Resolution in the Scrum Team	Correlation Coefficient	.454**	.476**	.608**	.554**	1.000	.029	.207*
		Sig. (2-tailed)	<.001	<.001	<.001	<.001	.	.771	.036
			N	103	103	103	103	103	103
	Supervisors' Feedback Frequency	Correlation Coefficient	-.067	-.209*	-.062	-.255**	.029	1.000	.095
		Sig. (2-tailed)	.504	.034	.532	.009	.771	.	.340
			N	103	103	103	103	103	103
	Engaging Remote Team Activities	Correlation Coefficient	.455**	.427**	.100	.223*	.207*	.095	1.000
		Sig. (2-tailed)	<.001	<.001	.314	.024	.036	.340	.
			N	103	103	103	103	103	103

** . Correlation is significant at the 0.01 level (2-tailed).
* . Correlation is significant at the 0.05 level (2-tailed).

Figure 31 illustrates the correlation coefficients among variables related to the Scrum Framework's role in supporting work and managing dispersed Scrum Development Teams. Among these variables, Supervisor's Feedback Frequency stands out with a negative correlation, signifying a noteworthy relationship with other variables. For instance, it exhibits weak negative correlations with team communication (-0.067), team availability (-

0.209), Scrum Events communication (-0.062), and team discussions (-0.255). This suggests that when Supervisor's Feedback Frequency decreases, there is a tendency for these variables to decrease as well. This negative correlation implies that lower frequency of supervisor feedback aligns with reduced levels of team communication, availability, Scrum Events communication, and team discussions. Such insights emphasise the importance of consistent and constructive feedback from supervisors to enhance various aspects of team interaction and collaboration within dispersed Scrum Development Teams.

However, it is worth noting that Supervisor's Feedback Frequency shows a positive correlation with issue resolution (0.029) and team engagement (0.095), implying that an increase in Supervisor's Feedback Frequency is associated with higher levels of issue resolution and team engagement.

4.7 Chapter Summary

The Thematic and Descriptive Analysis presented in this chapter has provided valuable insights into addressing the research questions outlined in Chapter 1. Through the utilisation of inductive reasoning in the analysis, the researcher was able to draw conclusions regarding the influence of autonomy on the productivity of remote working Scrum Development Teams, as well as the adaptation of the Scrum Framework within the context of the post-COVID-19 pandemic in New Zealand. These drawn conclusions and findings will be further examined in Chapter 5 through a comparison with the results of previous research.

Chapter 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter, the conclusion and discussion of the findings from Chapter 4 are presented and discussed. The research findings are summarised, and the implications are discussed considering the research questions. Then, a comparison is made between the results of this research and findings from other research studies and reports, providing a broader context for the research findings. After that, the limitations of the research are discussed, highlighting the constraints and boundaries within which the research was conducted. This serves to provide transparency and ensure the validity and reliability of the research findings. Finally, recommendations for future research are provided to address the identified limitations and to further explore and expand on the research topic. These recommendations aim to guide future researchers in conducting more comprehensive studies and exploring different aspects related to the impact of remote working on Scrum Development Teams' productivity.

5.2 Overview and Comparison of Research Findings

In this section, the researcher has provided an overview and comparison between the findings of the current research and previous research mentioned in Chapter 2. This comparative analysis aimed to provide a broader context and deepen the understanding of the research findings and their implications for the research questions.

The overview and comparison of research findings were focused on addressing the research questions defined in Chapter 1, which are:

1. What are the factors that disrupt concentration and task focus of Scrum Development Team members when remote working?

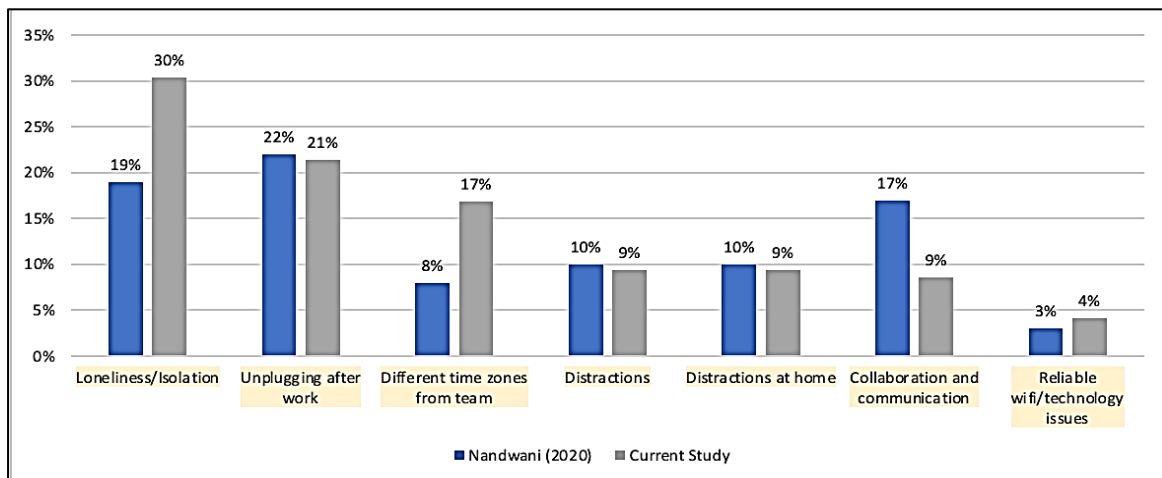
2. How do the values and principles of Scrum Framework support software development organisations in adjusting from the shift to remote working arrangements especially in managing dispersed Scrum Development Teams?
3. What are the advantages and disadvantages of adopting the Scrum Framework in managing dispersed Scrum Teams post-COVID-19 pandemic?

This comparative analysis shed light on the effectiveness of the Scrum Framework in supporting remote working and managing dispersed Scrum Development Teams in New Zealand-based software development organisations post-COVID-19 pandemic, providing valuable insights for software development organisations in similar contexts.

5.2.1 Research Question 1

Extensive research has identified numerous advantages that can have a significant impact on productivity (Gibbs et al., 2022; Johannsen & Zak, 2020; Mustajab et al., 2020; Sutarto et al., 2021). In the context of remote working, various factors play a role, and one such factor is autonomy (Dee, 2022; Khron, 2022; Pattnaik & Sahoo, 2021). While autonomy can be advantageous in allowing remote workers to allocate more time to personal activities like hobbies, errands, and family, it can also have negative implications when it comes to maintaining focus on organisational duties (Johannsen & Zak, 2020).

Figure 32 compares the findings of Nandwani's (2020) research on 'How To Maintain Team Agility in Covid-19 Era' with the results of the current research.

Figure 32*Struggles Experienced in Remote Working*

The four highest responses were selected for comparison, as they shared the same criteria with the current research and these advantages were consistently identified in the Thematic Analysis of the current research. In Nandwani's (2020) research, respondents primarily recognised the advantage of having a flexible schedule, which accounted for 32% of the responses. In contrast, the highest reported advantage in the current research was the ability to work from any location, comprising 33% of the responses. It is noteworthy that Nandwani's (2020) research was conducted during the peak of the COVID-19 pandemic when strict restrictions were enforced, whereas the current research took place post-COVID-19 pandemic, enabling workers to freely move and visit different places, as observed in New Zealand.

While in research conducted by Mustajab et al. (2020), ten factors were identified as being influenced when remote working categorising to either a positive or negative influence. These factors include work-life balance, flexibility, timesaving, quality time, comfort, multitasking, decreased work motivation, additional costs, distractions, and limited communication (Mustajab et al., 2020). However, it is important to note that the current

research did not cover two of these factors specifically, namely decreased motivation and additional costs.

Table 17

Comparison of Factors Affected when Remote Working

	Mustajab et al.(2020)	Current research
Work-life balance	Positive	Negative
Flexibility	Positive	Positive
Time saving	Positive	Positive
Quality time	Positive	Positive
Comfort	Positive	Positive
Multitasking	Negative	Positive
Distractions	Negative	Negative
Limited Communication	Negative	Negative
Decreased Motivation	Negative	
Additional Cost	Negative	

Table 17 shows the impact of various factors, either positive or negative, as identified in the research conducted by Mustajab et al. (2020) and the current research. According to Mustajab et al.'s (2020) findings, 'work-life balance' was reported to have a positive impact, while 'multitasking' was perceived as having a negative impact. In the current research, it was concluded that 57% of the respondents struggled with 'work-life balance' when remote working. The blurring of boundaries between work and personal life due to having a single location for both work and rest contributed to this challenge. On the other hand, 'multi-tasking' was seen as an advantage by respondents, as it allowed them to engage in other activities while working or during idle work periods. Despite the negative impact of distractions reported in the current research, it is worth noting that a significant majority (64%) of the respondents agreed that remote work offered them the flexibility to operate during their most productive hours. Additionally, 43% of the participants acknowledged that remote work provided them with greater control over their work environment, enabling them

to minimise distractions and concentrate on their tasks. Consequently, the current research indicates that the advantages of remote working outweigh its disadvantages, which include challenges in achieving work-life balance, managing distractions, and limited communication.

In contrast to the current research, Mustajab et al. (2020) specifically examined the experiences of different genders. While the current research did not explicitly focus on gender, it explored the impact of remote working based on factors such as the number of years of experience, current role, and family status of the respondents.

Mustajab et al. (2020) categorised work-life balance as a positive impact, but their findings indicated that this was applicable mainly to men rather than women. While the current research did not explicitly investigate gender disparities, it is important to highlight that 25% of the respondents raised a notable concern regarding the impact of caregiving responsibilities for family members on their ability to focus effectively on their work while remote working. Furthermore, an overwhelming 70% of the participants acknowledged the struggle of regaining productivity after returning from a lunch break or completing quick errands. These findings are consistent with the research conducted by Gibbs et al. (2022), which found that the gender disparity in remote working experiences cannot be solely attributed to the presence of children in the home. According to Gibbs et al.'s (2022) conjecture, this discrepancy may be linked to the additional demands placed on women in the domestic setting while working remotely. These findings underscore the unique challenges faced by working parents, particularly women, as they strive to balance their professional responsibilities with the demands of childcare and household management while working remotely (Gibbs et al., 2022; Mustajab et al., 2020).

The constant connectivity that remote workers experience has indeed led to the blurring of boundaries between work and personal lives, posing challenges when it comes to

fully disconnecting from work (Cucolaş & Russo, 2021). However, a recent research conducted by Kadenic et al. (2023) focusing on remote Scrum Teams revealed a positive perception of work-life balance among remote workers. The findings of the current research revealed that a significant portion, 36% of the respondents, considered the ability to spend quality time with their families and participate in other activities while remote working as an advantage. This suggests that these individuals perceived multitasking as a positive outcome of remote working, which contrasts with the conclusion drawn by Mustajab et al. (2020).

Moreover, in the current research, a significant 70% of the respondents expressed the challenge of transitioning back into the work zone after running errands or engaging in non-work activities. This indicates that interruptions and distractions disrupted their focus and productivity (Lashbrooke, 2021). In Mustajab et al.'s (2020) research, it was discovered that respondents encountered difficulties when trying to balance their work responsibilities while simultaneously handling errands.

Mustajab et al. (2020) highlights that the challenges faced in remote working can vary significantly depending on individual circumstances and gender dynamics. Although this research did not specifically examine the gender factor, the insights provided by the respondents offer valuable insights into how family responsibilities and work expectations may impact on the dynamics of remote working. It highlights the importance of considering individual contexts when addressing the challenges associated with remote working arrangements (Kadenic et al., 2023).

5.2.2 Research Question 2

In Agile Methodology projects, specifically, those adopting the Scrum Framework, the involvement of the Product Owner, leadership from the Scrum Master, top management

commitment, and the skills of the developers are recognised as crucial success factors (Cucolaş & Russo, 2021).

In remote working, effective communication and collaboration play a crucial role in ensuring success (Cucolaş & Russo, 2021; Nundlall & Nagowah, 2022; Rizmaldi & Jayadi, 2022). Previous research specifically that of Cucolaş & Russo (2021), Nundlall & Nagowah (2022) and O'Connor et al. (2021) has consistently highlighted communication and collaboration as significant challenges in remote work settings. In the current research, a majority of respondents, 91%, acknowledged the overall effectiveness of communication, while 86% reported satisfactory discussions on requirements. However, it is important to note that a notable proportion, 68% of respondents, encountered difficulties related to team dependencies. These findings indicate that while communication in general may be effective, there are specific challenges when it comes to coordinating and managing dependencies among team members (O'Connor et al., 2021). Remote working can make it more challenging to address these dependencies promptly, leading to delays and potential bottlenecks in project progress. (O'Connor et al., 2021; Cucolaş & Russo, 2021)

Additionally, 50% of the respondents reported experiencing communication breakdowns resulting in misunderstandings and delays. This finding is consistent with the research by Cucolaş & Russo (2021), which underscores the challenges of communication and collaboration in remote working. It is important to acknowledge that not all remote workers perceive working from home as challenging, as revealed in the research conducted by Cucolaş & Russo (2021).

In the current research, it was evident that remote working presents various challenges and distractions, including social media, background noise, household tasks, and childcare responsibilities. However, the Scrum Framework offers a valuable framework that helps mitigate these challenges and ensures the Scrum Development Team remains focused on

their goals and tasks (Fowler, 2019). By defining clear targets and objectives for both the team as a whole and individual team members, the Scrum Framework acts as a guiding compass that ensures everyone stays aligned and maintains a sense of direction despite the external challenges associated with remote work (Fowler, 2019).

The concept of Deep Work, which refers to a state of uninterrupted and concentrated focus on tasks (Newport, 2016), is crucial in maximising productivity and achieving optimal results within the Scrum Framework (Lashbrooke, 2021; Mustajab et al., 2020; Newport, 2016). However, the nature of remote working introduces additional factors that can disrupt this Deep Work zone (Lashbrooke, 2021). Recognising these challenges, the Scrum Framework emphasises the importance of setting priorities, establishing effective communication channels, and fostering a supportive team environment (Karamichalis, 2022; Rizmaldi et al., 2022).

By clearly defining targets and goals, the Scrum Framework provides a shared understanding of what needs to be achieved collectively as a team and individually (Fowler, 2019). This clarity helps mitigate the impact of distractions and keeps team members aligned and motivated (Rizmaldi et al., 2022).

Furthermore, the Scrum Framework fostered a culture of open communication and collaboration among Scrum Development Team members, allowing them to collectively tackle challenges and provide support to one another (Nundlall et. al, 2022). This finding aligns with the feedback provided by 5% of the respondents, emphasising that managers and supervisors do not exert excessive pressure on completing tasks. Instead, they regularly check in to inquire about progress, extend if needed, and show genuine concern for overall well-being beyond work-related matters. This supportive environment grants Scrum Development Team members the autonomy to manage their tasks while still ensuring that defined goals are met within the Sprint (Christiansen, 2020; Gibbs et al., 2021; (Keller et al.,

2020). Despite occasional distractions, respondents expressed confidence in their ability to remain focused and accomplish their tasks successfully ((Keller et al., 2020).

The current research also revealed that the widely recognised challenges in remote working are communication and collaboration not just within the Scrum Development Team alone but within the Scrum Team. However, the implementation of the Scrum Framework has effectively addressed these issues. The Scrum Events, guided by the values and pillars of Scrum, have provided a structure and framework for the Scrum Development Team to overcome these challenges (Sutherland & Schwaber, 2020).

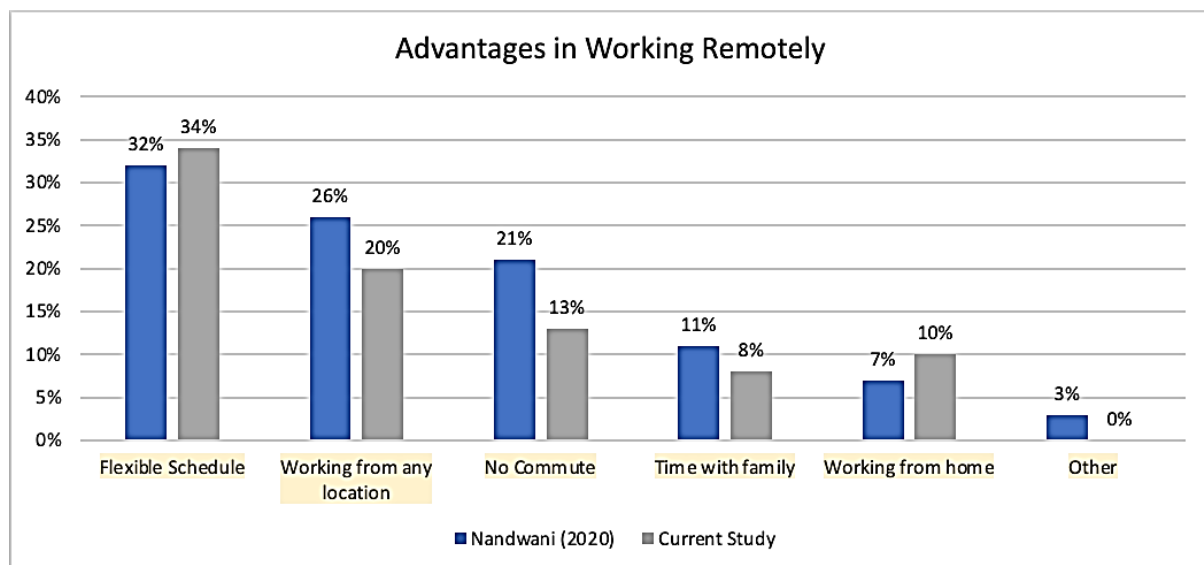
Throughout the Sprints, the Scrum Development Team members demonstrated their ability to consistently achieve their targets, resulting in the successful attainment of project goals (Rizaldi & Jayadi, 2022). The current research revealed that there were no significant issues reported that hindered the overall progress of the product development as respondents recognised the effectiveness of the Scrum Development Team collaborative efforts in resolving any challenges that arose during the Sprints.

The current research findings also unveiled the collaborative synergy within Scrum Development Teams, as they harnessed their combined expertise and the guidance of the Scrum Master to surmount obstacles (Rizaldi & Jayadi, 2022; Russo, 2021). This proactive approach enabled teams to maintain a seamless workflow, ensuring the project's alignment with objectives (Russo, 2021). The Scrum Framework's emphasis on regular events, distinct role definition, and an iterative process significantly contributed to the capability of Scrum Development Teams to conquer challenges and successfully attain their goals (Rizaldi et al., 2022). These findings resonate with the current research results, underscoring the paramount role of effective communication and collaboration in the triumph of remote work (Cucolaş & Russo, 2021; Sutherland & Schwaber, 2020). The structured and adaptable essence of the Scrum Framework equips teams with a robust

foundation to navigate the distinct challenges of remote work, thereby fostering productive teamwork, engagement, and the attainment of objectives (Rizaldi et al., 2022). In this context, the Scrum Framework's inherent principles and values emerge as pivotal resources for software development organisations as they transition towards remote work and steer the management of dispersed Scrum Development Teams, which answers the 2nd Research Question “How do the values and principles of Scrum Framework support software development organisations in adjusting from the shift to remote working arrangements especially in managing dispersed Scrum Development Teams?”.

5.2.3: Research Question 3

Figure 33 shows the comparison of advantages associated with remote working between the respondents of the current research and the research conducted by Nandwani (2020). The categories shown in the figure for the current research were derived from the identified advantages in Table 13, ‘Advantages of Remote Working,’ which were then organised into six themes to facilitate a comparison with Nandwani's (2020) research findings.

Figure 33*Comparison of Advantages in Remote Working*

Both research identified a consistent ranking of benefits, with the two most desirable advantages of remote working being 'flexible schedule', 'working from any location' and 'no commute'. However, a notable distinction between the two research findings is the ranking of 'time spent with family' and 'working from home.' In Nandawani's (2020) research, 'time with family' was ranked first, followed by 'working from home.' Conversely, in the current research, 'working from home' ranked first, followed by 'time with family.' The variation in rankings implies that remote workers value both factors, but their perceived significance and prioritisation may differ across research. For instance, Useem's research provided distinct definitions for the terms 'time spent with family' and 'working from home' (Useem, 2017). The term 'time spent with family' encompassed the invaluable opportunity for remote workers to engage in meaningful interactions with their family members, fostering closer relationships and emotional connections (Useem, 2017). On the other hand, 'working from home' referred to the enhanced flexibility that remote work offers in managing household responsibilities and effectively organising living spaces to create a conducive work environment (Useem, 2017).

Although Nandwani (2020) did not provide explicit definitions for the components included in the categories of 'flexible schedule' and 'no commute,' it can be inferred that the percentages for these factors were slightly lower in Nandwani's (2020) research compared to the current research. This discrepancy could potentially be attributed to the specific timeframe of Nandwani's study, which took place during the prevalence of COVID-19 pandemic restrictions in 2020. It is plausible that the limitations and disruptions caused by the COVID-19 pandemic might have impacted the perceived level of flexibility in work schedules and the absence of a daily commute, resulting in a slightly lower percentage (2% for 'flexible schedule' and 8% for 'no commute') in Nandwani's research compared to the current research.

In addition to the rankings mentioned, it is worth noting another noteworthy category: 'working from any location.' In the current research, this category accounted for 20% of respondents, while Nandwani's (2020) research reported a slightly higher percentage of 26%. Specifically, in the current research, 'working from any location' refers to the respondents' ability to work for an organisation situated outside their local area of residence. This finding underscores the significant impact of remote work, enabling individuals to enjoy the freedom and flexibility of performing their job responsibilities from diverse geographical locations. By transcending the limitations of a traditional fixed workplace, remote work offers new possibilities for both workers and organizations alike.

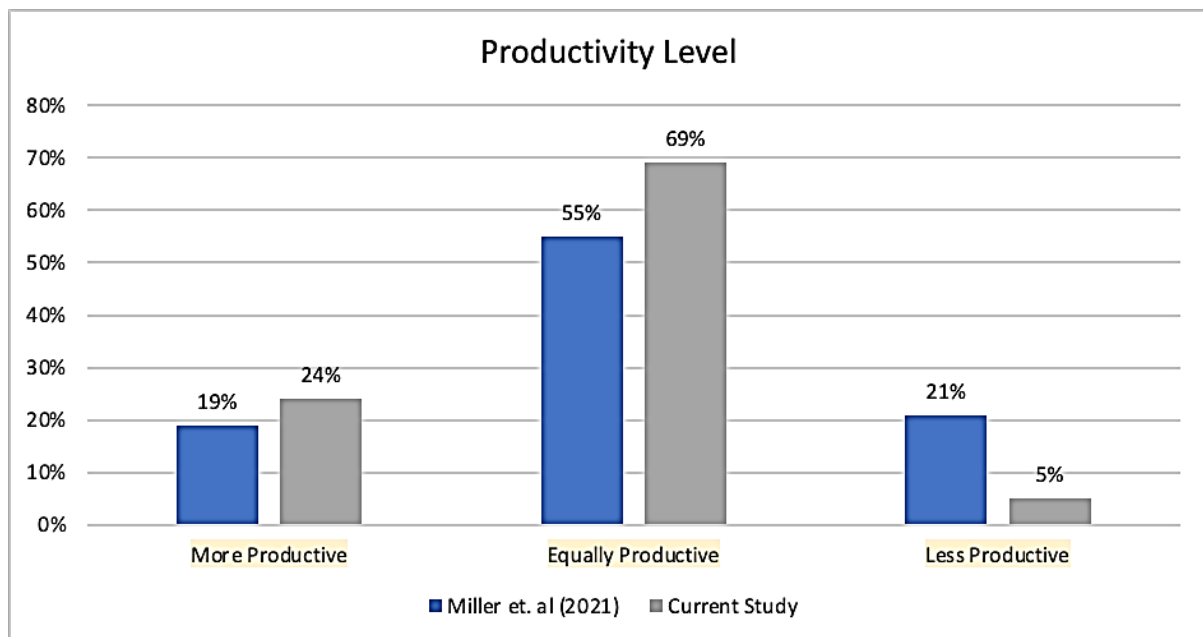
Figure 34*Comparison of Productivity Levels*

Figure 34 shows a comparison between the productivity levels reported in the research conducted by Miller et al. (2021) and the current research. Both research found that the majority of respondents perceived productivity as 'equally productive', respectively 69% in the current research and 55% in Miller et al.'s (2021) research. In the current research, 24% of respondents reported feeling 'more productive', while in Miller et al.'s (2021) research, 19% expressed a similar sentiment. It is worth noting that a relatively small percentage of respondents reported feeling 'less productive', with 21% in the current research and only 5% in Miller et al.'s (2021) research. The findings on both research indicate that a considerable number of remote workers view remote working as a favorable environment for increased productivity. However, it is crucial to acknowledge that maintaining productivity levels in remote working environment can be influenced by individual circumstances, work dynamics, and the availability of appropriate resources and support systems. Factors such as a suitable workspace, effective communication channels, and access to necessary tools and

technologies play a vital role in ensuring optimal productivity in remote work environments (Gibbs et al., 2022; Miller et al., 2021; O'Connor et al., 2021).

The assessment of productivity levels in this context reflects the individual perspective of each respondent. Within the Scrum Framework, where Sprint Goals and targets are established, respondents have the autonomy to structure their day according to their own individual targets (Kadenic et al., 2023); 77% of respondents reported in the current research that expectations have been formalised and discussed within the Scrum Development Team.

Cucolaş & Russo's (2021) research revealed that since these targets are predetermined, respondents were focused on achieving their specific tasks without necessarily being aware of the tasks and progress of others unless they were discussed during the Daily Scrum or Sprint Demo. Cucolaş and Russo's (2021) findings align with the results of the current research, wherein 74% of the respondents acknowledged having clear expectations while working remotely. Additionally, two respondents shared that their productivity levels remained consistent with the predetermined targets set during Sprint Planning, as depicted in Figure 7, titled 'Thematic Analysis on the Productivity Level when Remote Working.' These findings indicate a common trend among the respondents, highlighting the clarity of expectations and the ability to achieve set targets while remote working (Gibbs et al., 2022; O'Connor et al., 2021).

Considering that flexibility is identified as a prominent advantage in Figure 5, each respondent has the freedom and autonomy to enter their productive work zone at any point during the day and focus on their individual tasks, irrespective of the specific timing or approach they choose to adopt. This level of flexibility allows them to accomplish their work effectively (Mustajab et. Al, 2020). However, one potential disadvantage is that if there are dependencies on other team members who are not yet in their own productive work zone, may it be the difference in time zone or individual not being in the productive zone

yet, it can hinder task progression and become an obstacle to productivity (Kadenic et. al, 2023).

Current research reveals that a majority of remote workers face challenges in their team dynamics. Specifically, 68% of the respondents expressed difficulties related to 'team dependency,' while 16% cited a 'lack of visibility' concerning other members within the Scrum Development Team. These findings underscore the significance of improving collaboration and coordination among remote team members to ensure a smooth workflow and maximize productivity.

The current research also highlights the importance of fostering transparency and open communication within the team. A notable percentage of respondents reported a lack of visibility regarding the progress of their fellow Scrum Development Team members. This finding aligns with previous research conducted by Cucolaş & Russo (2021), emphasising the implications of insufficient visibility on remote workers' productivity and teamwork. When remote workers lack knowledge of their colleagues' workload or assigned tasks, it creates uncertainty and doubt when considering whether to seek assistance or contribute to additional tasks (Kadenic et al., 2023). Therefore, it becomes crucial for remote teams to establish clear channels of communication and information sharing, enabling individuals to have a comprehensive understanding of other team members' work and progress. Kadenic et al. (2023) have further supported this notion, asserting that while individual autonomy is valuable, it can also serve as a barrier to self-organising abilities within the Scrum Development Team, ultimately impeding effective teamwork. They identified highly specialised skills among developers and the division of work as the primary barriers to self-organisation within Scrum Development Teams. The findings of the current research align with this perspective, as expressed by two Scrum Developers, saying,

"A highly motivated and stable team that has developed consistent working relationships with each other means that it isn't necessary to 'be in the same place.'"

Software Developer#81

"We are a highly skilled, highly motivated group." Software Developer#79

The reported level of productivity among the respondents was influenced by the presence of trust established by management, enabling them to carry out their tasks even in the absence of physical visibility (Dorda et al., 2020; Houghton, 2021; Parker et al., 2020). In the current research, it was found that only 4% of the respondents felt supervised, indicating a majority of the respondents experienced a sense of autonomy in their work. This finding aligns with the principles of the Scrum Framework, which encourages the formation of skilled, self-organising, and self-managing teams (Christiansen, 2020; Gibbs et al., 2021). Within the Scrum Development Teams, individuals were granted the freedom to work in a manner that best suited their task execution (Sutherland & Schwaber, 2020).

In the current research, 5% of the respondents highlighted the significance of 'working based on trust' as a positive aspect of remote working within the context of the Scrum Framework. This sentiment aligns with the findings of Mustajab et al. (2020), who observed that remote workers no longer felt the direct supervision they would experience in a traditional office setting. Rather than perceiving the absence of continuous supervision as a drawback, remote workers now view it as an opportunity that grants them greater autonomy to work according to their own preferences and effectively deliver results (Mustajab et al., 2020).

However, the current research findings indicate that excessive individual autonomy can hinder effective teamwork and self-organisation within Scrum Teams. While highly

specialised skills among team members and the division of work were identified as potential barriers to self-organisation, it is still important to strike a balance between individual autonomy and collaborative teamwork to ensure successful outcomes (Cucolaş & Russo, 2021; O'Connor et al., 2021). The Scrum Framework emphasises the need for skilled and self-managing teams, but collaboration and effective communication remain essential for cohesive Scrum Development Team productivity (Russo, 2021; Sutherland & Schwaber, 2020). Therefore, while individual autonomy can empower remote workers, it should be complemented by an understanding of team dynamics and a commitment to collaborative work to achieve optimal results as a team rather than individually (Russo, 2021; Dee, 2022).

5.3 Recommendations in Adapting the Scrum Framework Remotely

Based on the research findings discussed in Section 5.2, several recommendations emerge to assist software development organisations and remote workers in effectively addressing challenges while adapting the Scrum Framework to dispersed Software Development Teams. First, enhancing communication strategies by combining virtual tools and synchronous meetings (Cucolaş & Russo, 2021; Nundlall & Nagowah, 2022) can mitigate communication challenges. Second, coordinating time zone differences strategically (Kadenic et al., 2023) and utilising collaborative virtual tools (Fowler, 2019) promote real-time collaboration. Third, empowering self-organising teams (Christiansen, 2020; Gibbs et al., 2021) fosters accountability and autonomy. Clear goal definition and continuous support through training (O'Connor et al., 2021) ensure alignment and proficiency in using virtual tools. Regular retrospective meetings (Sutherland & Schwaber, 2020) facilitate ongoing improvement, while cross-functional collaboration (Sutherland & Schwaber, 2020) enhances project coherence. Balancing individual autonomy and collaboration (Russo, 2021) prevents isolation, and regularly assessing remote work policies (Dorda et al., 2020; Houghton, 2021)

ensures adaptability. By implementing these recommendations, organisations and remote workers can navigate challenges and maintain productivity within dispersed Scrum Development Teams, as highlighted in the research findings.

5.4 Conclusions

In line with the research questions posed in Chapter 1 and elaborated in section 5.2, this research has effectively tackled various dimensions of managing dispersed Scrum Development Teams within the context of remote working. The research outcomes have illuminated critical insights into the challenges that significantly influence productivity, particularly considering the autonomy intrinsic to remote work. Specifically, two prominent challenges—team dependency and communication—have surfaced as integral aspects affecting team dynamics and successful task delivery. A key challenge encountered in managing dispersed Scrum Development Teams pertains to team dependency, marked by variables such as differing time zones and varied core working hours among team members. These variables introduce coordination and collaboration obstacles that necessitate thoughtful resolution to uphold effective teamwork. Another noteworthy challenge in managing dispersed teams is communication. Although remote communication tools offer convenience, they can concurrently introduce potential delays and misinterpretations, especially in the context of intricate requirements and pair collaborations.

These challenges, with their potential to impact productivity and collaboration within the Scrum Development Team, can manifest in longer turnaround times for information sharing and issue resolution. However, the research findings suggest that even amidst these challenges, the Scrum Development Team members adeptly achieved individual targets for both Software Developers and Testers. This implies that team members exhibited adaptability, leveraging their skillsets and the principles underpinning the Scrum Framework

to surmount challenges, thereby sustaining productivity and accomplishing goals. The autonomy inherent in remote work, synergised with the core values and principles of the Scrum Framework, emerged as pivotal assets in overcoming these challenges (Houghton, 2021; Parker et al., 2020). The capacity for autonomous work, in conjunction with the clear delineation of individual targets and priorities, proved pivotal in empowering Scrum Development Team members to maintain concentration while addressing their individual tasks and contributing to the collective achievement of the team's Sprint Goal (Christiansen, 2020; Gibbs et al., 2021).

Despite the array of challenges and distractions intrinsic to remote work, this research has showcased the remarkable resilience and adaptability demonstrated by the Scrum Development Team, underscoring their ability to uphold productivity and meet goals (Dorda et al., 2020; Harris, 2020; Karamichalis, 2022). These findings collectively accentuate the interplay between remote work's autonomy and the tenets of the Scrum Framework, offering a cohesive approach to surmounting challenges encountered in managing dispersed Scrum Development Teams.

5.5 Limitations

The first limitation of this research is the relatively small sample size of 103 respondents. This sample size was chosen based on several factors, including the researcher's confidence in being an international student in New Zealand with a limited network and the specific criteria set for the respondents. While the chosen sample size was considered feasible and sufficient, a larger sample size could provide more comprehensive data on the experiences of remote working Scrum Development Teams.

The second limitation of this research pertains to the chosen research instrument for collecting qualitative data. In this research, the qualitative data was obtained from the open-

ended questions included in the survey. While the use of open-ended questions in the survey yielded valuable insights, incorporating interviews would have offered additional advantages, specifically in facilitating a more in-depth exploration of the challenges faced by remote working Scrum Development Teams. By including interviews, researcher would have gained a deeper understanding of the complex intricacies involved in managing dispersed teams, resulting in more comprehensive and nuanced findings (Pessoa et al., 2019). However, the decision to use open-ended questions in the survey was driven by practical considerations, particularly the time constraints faced by the researcher who was also working full-time. This approach was seen as a feasible alternative to conducting separate interviews, allowing for a broader reach in data collection (Pessoa et al., 2019).

Expanding on this limitation, it would have allowed for a more interactive and dynamic conversations with respondents. The researcher could have probed further into specific areas of interest, sought clarification on responses, and delved deeper into the respondents' thoughts and experiences. It would have facilitated a more comprehensive and nuanced exploration of the challenges, benefits, and strategies related to remote working within the Scrum Development Teams.

5.6 Recommendations for Future Research

The limitations identified in this research provide valuable opportunities for future researchers to build upon. These limitations serve as a starting point for further investigation and improvement in future research endeavours. By acknowledging and addressing these limitations, future researchers can refine methodologies, increase sample sizes, gender, incorporate additional research instruments, or explore alternative approaches to deepen and expand the examination of the impact of remote working, not only in New Zealand but also in other countries. This will contribute to a deeper understanding of the research topic,

specifically the presence of "Autonomy in Remote Working Scrum Development Teams' Productivity Post-COVID-19 Pandemic," and offer valuable insights into the current circumstances surrounding remote working.

These limitations should not be viewed as deterrents but rather as stepping-stones for future research. Building upon the insights gained from this research, future researchers can address these limitations and contribute to the advancement of knowledge in the field. By recognising the areas for improvement and taking them into account, future research can build upon the foundations laid by this research, leading to more comprehensive and robust findings.

REFERENCES

- Abramova, V., Pires, F., & Bernardino, J. (2016). Open source and proprietary project management tools for SMEs. *Journal of Information Systems Engineering & Management*, 1(3). <https://doi.org/10.20897/lectito.201633>
- Access Records Management. (2019). Pros and cons of electronic document storage. *Access Records Management*. <https://www.accessrecordsmanagement.co.uk/electronic-document-storage/>
- Agile Alliance. (2022). *What is Agile software development?* Agile Alliance |. <https://www.agilealliance.org/agile101/>
- Agile Alliance. (2023). *What is a Kanban board?* <https://www.agilealliance.org/glossary/kanban>
- Agile Pain Relief Consulting. (2023). *Scrum anti-patterns: Micromanagement*. <https://agilepainrelief.com/blog/scrum-anti-patterns-micromanagement.html>
- Ågren, P., Knoph, E., & Berntsson Svensson, R. (2022). Agile software development one year into the COVID-19 pandemic. *Empirical Software Engineering*, 27(6). <https://doi.org/10.1007/s10664-022-10176-9>
- Aleem, M., Sufyan, M., Ameer, I., & Mustak, M. (2022). Remote work and the COVID-19 pandemic: An artificial intelligence-based topic modelling and a future agenda. *Journal of Business Research*, 154, 113303. <https://doi.org/10.1016/j.jbusres.2022.113303>
- Allen, N. (2020, November 10). The pioneers of modern remote work. *Wrkfrce*. <https://wrkfrce.com/the-pioneers-of-modern-remote-work/>
- Anderson, D., & Kelliher, C. (2020). face during lockdown. *Gender in Management: An International Journal*, 35(7/8), 677-683. <https://doi.org/10.1108/gm-07-2020-0224>

Amzah, A. (2015, December 23). Deep versus Shallow Work. Neu Entity.

<https://neuentity.com/deep-vs-shallow-work-a-commentary/>

Atlassian. (2023, April 14). What is Jira Software, and Why Use It?

<https://community.atlassian.com/t5/Jira-articles/What-is-Jira-Software-and-why-use-it/ba-p/2323812>

Ayhan, H.Ö. (2011). Non-probability Sampling Survey Methods. *In: Lovric, M. (eds)*

International Encyclopedia of Statistical Science. Springer, Berlin, Heidelberg.

https://doi.org/10.1007/978-3-642-04898-2_41

Baijens, J., Helms, R., & Iren, D. (2020). Applying Scrum in data science projects. *2020*

IEEE 22nd Conference on Business Informatics (CBI).

<https://doi.org/10.1109/cbi49978.2020.00011>

Bailey, D., Clark, J., Colombelli, A., Corradini, C., De Propris, L., Derudder, B., Fratesi, U.,

Fritsch, M., Harrison, J., Hatfield, M., Kemeny, T., Kogler, D. F., Lagendijk, A.,

Lawton, P., Ortega-Argilés, R., Otero, C. I., & Usai, S. (2020). Regions in a time of pandemic. *Regional Studies*, *54*(9), 1163-1174.

<https://doi.org/10.1080/00343404.2020.1798611>

Barrero, J. M., Bloom, N., & Davis, S. (2021, April 22). Why working from home will stick.

Becker Friedman Institute. [https://bfi.uchicago.edu/working-paper/why-working-](https://bfi.uchicago.edu/working-paper/why-working-from-home-will-stick/)

[from-home-will-stick/](https://bfi.uchicago.edu/working-paper/why-working-from-home-will-stick/)

Baumgart, R., Hummel, M., & Holten, R. (2015). Personality Traits of Scrum Roles in Agile

Software Development Teams - A Qualitative Analysis. *ECIS 2015 Completed*

Research Papers, *16*. <https://doi.org/10.18151/7217275>

Bell, E., Bryman, A., & Harley, B. (2022). *Business research methods* (6th ed.). Oxford

University Press.

- Bednarski, D. (2022). Losing to distractions? Boost team focus with deep work. *Taskade Blog*. <https://www.taskade.com/blog/focus-at-home-with-deep-work-remote-teams/>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. <https://doi.org/10.1191/1478088706qp063oa>
- Bunning, R. (2020, November 13). *Scrum masters are struggling with remote working*. Scrum With Style. <https://www.scrumwithstyle.com/scrums-masters-are-struggling-with-remote-working/>
- Cantillo, N. J. (2020). Scrum, a quantitative analysis of functional versus cross-functional teams in digital companies in Thailand. <http://dspace.bu.ac.th/jspui/handle/123456789/4683>
- Christiansen, S. (2020, January 14). Micro-Management: The Path to Disappointment with Scrum. Medium. <https://medium.com/serious-scrum/micro-management-the-path-to-disappointment-with-scrum-3df9d48f8466>
- Christoffersson, E., & Djup, P. (2021). How Covid-19 and working from home have affected agile software development. <https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1576505&dswid=4389>
- Climer, A. (2017, October 25). Tech Tools for Creativity. *Dr. Amy Climer*. <https://climerconsulting.com/tech-tools-creativity/>
- Coghlan, D., & Brydon-Miller, M. (2014). *The SAGE encyclopaedia of action research*. SAGE.
- Collins, S. K., & Collins, K. S. (2002). Micromanagement a costly management style. *National Library of Medicine*. <https://pubmed.ncbi.nlm.nih.gov/12510608>
- Conboy, K., & Fitzgerald, B. (2004). *Toward a conceptual framework of Agile methods | Proceedings of the 2004 ACM workshop on interdisciplinary software engineering research*. ACM Conferences. <https://dl.acm.org/doi/abs/10.1145/1029997.1030005>

- Cordery, J. L., Morrison, D., Wright, B. M., & Wall, T. D. (2010). The impact of autonomy and task uncertainty on team performance: A longitudinal field study. *Journal of Organizational Behavior*, 31(2-3), 240-258. <https://doi.org/10.1002/job.657>
- Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. SAGE Publications.
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches*. SAGE Publications.
- Crossover. (2023). What is Deep Work and how can it push capabilities to the limit? <https://www.crossover.com/>. <https://www.crossover.com/perspective/what-is-deep-work-and-how-can-it-push-capabilities-to-the-limit>
- Cucolaş, A., & Russo, D. (2021). The impact of working from home on the success of Scrum projects: A multi-method study. *Journal of Systems and Software*, 197, 111562. <https://doi.org/10.1016/j.jss.2022.111562>
- Damyantov, M. (2023, February 20). Mixed methods research guide with examples. *Customer insights platform — Dovetail*. <https://dovetail.com/research/mixed-methods-research/>
- Dee, K. (2022, April 6). Report: Autonomy is essential for developer happiness. *SD Times*. <https://sdtimes.com/softwaredev/report-autonomy-is-essential-for-developer-happiness/>
- DeFilippis, E., Impink, S. M., Singell, M., Polzer, J. T., & Sadun, R. (2022). The impact of COVID-19 on digital communication patterns. *Humanities and Social Sciences Communications*, 9(1). <https://doi.org/10.1057/s41599-022-01190-9>
- Dingel, J., & Neiman, B. (2020). How many jobs can be done at home? <https://doi.org/10.3386/w26948>

- Dorda, S. C., Garg, L., Thareja, S., & McCall, B. V. (2020, April 28). Revisiting Agile teams after an abrupt shift to remote. *McKinsey & Company*.
<https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/revisiting-agile-teams-after-an-abrupt-shift-to-remote>
- Drumond, C. (2023, March 20). *Is the Agile manifesto still a thing?* Atlassian.
<https://www.atlassian.com/agile/manifesto>
- Dzanic, A., Toroman, A., & Dzanic, A. (2022). Agile Software Development: Model, Methods, Advantages and Disadvantages. *Bulletin of Engineering*, 15.
- Elgan, M. (2022, June 2). Why remote work will lead to greater success. *Computerworld*.
<https://www.computerworld.com/article/3662768/why-remote-work-will-lead-to-greater-success.html>
- Fitzgerald, B., Stol, K., O'Sullivan, R., & O'Brien, D. (2013). Scaling Agile methods to regulated environments: An industry case study. *2013 35th International Conference on Software Engineering (ICSE)*. <https://doi.org/10.1109/icse.2013.6606635>
- Flores, M. F. (2019). Understanding The Challenges of Remote Working and Its Impact to Workers. *International Journal of Business Marketing Managemen*, 4, 4-40. [ISSN: 2456-4559](https://doi.org/10.1109/ijbmm.2019.2456-4559)
- Forbes, S., Birkett, H., Evans, L., Chung, H., & Whiteman, J. (2020, November 26). Managing employees during the COVID-19 pandemic: flexible working and the future of work. *Centre for Responsible Business*. University of Birmingham.
<https://www.birmingham.ac.uk/Documents/college-social-sciences/business/research/responsible-business/managerial-experiences-during-covid19-2020-accessible.pdf>
- Ford, D., Storey, M., Zimmermann, T., Bird, C., Jaffe, S., Maddila, C., Butler, J. L., Houck, B., & Nagappan, N. (2021). A tale of two cities: Software developers

working from home during the COVID-19 pandemic. *ACM Transactions on Software Engineering and Methodology*, 31(2), 1-37.

<https://doi.org/10.1145/3487567>

Fowler, F. M. (2018). Scrum events. *Navigating Hybrid Scrum Environments*, 73-76.

https://doi.org/10.1007/978-1-4842-4164-6_11

Fraenkel, J., Wallen, N., & Hyun, H. (2022). *ISE how to design and evaluate research in education* (8th ed.). McGraw Hill.

ISBN: 978-0-07-809785-0

Fullscale. (2020, May 08). Work from home communication tools. *Full Scale*.

<https://fullscale.io/blog/work-from-home-communication-tools/>

Gajendran, R. S., & Harrison, D. A. (2007). The good, the bad, and the unknown about telecommuting: Meta-analysis of psychological mediators and individual consequences. *Journal of Applied Psychology*, 92(6), 1524-1541.

<https://doi.org/10.1037/0021-9010.92.6.1524>

Garcia, H. (2022, December 19). *Why do we need Agile project management?* Association for Project Management. <https://apm.org.uk/blog/why-do-we-need-agile-project-management/>

Garreta, R. (2023, May 30). What is MonkeyLearn?

<https://help.monkeylearn.com/en/articles/2174206-what-is-monkeylearn>

Gartner, M. (2020, July 14). *Gartner survey reveals 82% of company leaders plan to allow employees to work remotely some of the time*. Gartner.

<https://www.gartner.com/en/newsroom/press-releases/2020-07-14-gartner-survey-reveals-82-percent-of-company-leaders-plan-to-allow-employees-to-work-remotely-some-of-the-time>

Garvin, L. (2022, September 9). How to stop Micromanaging and start empowering.

Harvard Business Review. <https://hbr.org/2022/09/how-to-stop-micromanaging-and-start-empowering>

Garzon, A. (2022, April 12). *Agile: 3 ways your organization can benefit during hybrid work*. The Enterprisers Project | A community helping CIOs and IT leaders solve problems. <https://enterpriseproject.com/article/2022/4/agile-hybrid-work-benefits>

Gibbs, M., Mengel, F., & Siemroth, C. (2022). Work from home & Productivity: Evidence from personnel & Analytics data on it professionals. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3846680>

Gigauri, I. (2020). Challenges HR managers facing due to COVID-19 and overcoming strategies: Perspectives from Georgia. *Archives of Business Research*, 8(11), 1-18. <https://doi.org/10.14738/abr.811.9313>

Gliem, J., & Gliem, R. (2003). Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales. *2003 Midwest Research to Practice Conference in Adult, Continuing, and Community Education*.

Golden, T. D., Veiga, J. F., & Dino, R. N. (2008). The impact of professional isolation on teleworker job performance and turnover intentions: Does time spent teleworking, interacting face-to-face, or having access to communication-enhancing technology matter? *Journal of Applied Psychology*, 93(6), 1412-1421. <https://doi.org/10.1037/a0012722>

Goman, C. K. (2017, October 12). Why IBM brought remote workers back to the office -- And why your company might be next. *Forbes*. <https://www.forbes.com/sites/carolkinseygoman/2017/10/12/why-ibm-brought-remote-workers-back-to-the-office-and-why-your-company-might-be-next/>

- Grebic, B., & Stojanovic, A. (2021). Application of the Scrum Framework on Projects in IT Sector. *European Project Management Journal*, 11(2).
<https://doi.org/10.18485/epmj.2021.11.2.4>
- Haan, K. (2023, May 3). Monday.com review 2022: Features, Pros & Cons. Forbes Advisor.
<https://www.forbes.com/advisor/business/software/mondaycom-review/>
- Harris, C. (2022). *How to manage Scrum remote teams*. Atlassian.
<https://www.atlassian.com/agile/scrum/distributed-scrum>
- Hayat, F., Wanab, K., Arif, K. S., & Abbas, M. (2019, July 19). *The Influence of Agile Methodology (Scrum) on Software Project Management*. ResearchGate | Find and share research.
https://www.researchgate.net/publication/338074789_The_Influence_of_Agile_Methodology_Scrum_on_Software_Project_Management
- Hawkins, T. (2021, October 3). Productivity Life Hacks for Software Engineers. DEV Community. <https://dev.to/thawkin3/productivity-life-hacks-for-software-engineers-and-all-knowledge-workers-flm>
- Hazzan, O., & Dubinsky, Y. (2014). The Agile Manifesto. In *Agile Everywhere* (pp. 9-14). Springer International Publishing. https://doi.org/10.1007/978-3-319-10157-6_3
- Hoda, R., Noble, J., & Marshall, S. (2011). The impact of inadequate customer collaboration on self-organizing Agile teams. *Information and Software Technology*, 53(5), 521-534. <https://doi.org/10.1016/j.infsof.2010.10.009>
- Houghton, B. (2021, August 25). *Two-thirds of employers do not trust their staff to work remotely, survey finds*. People Management.
<https://www.peoplemanagement.co.uk/article/1745149/two-thirds-employers-do-not-trust-staff-work-remotely-survey-finds>

- Immigration New Zealand. (2022). *Information technology*. Live & Work New Zealand. <https://www.live-work.immigration.govt.nz/work-in-new-zealand/job-market-key-industries/information-technology>
- Jensen, M. M., Thiel, S., Hoggan, E., & Bødker, S. (2018). Physical versus digital sticky notes in collaborative ideation. *Computer Supported Cooperative Work (CSCW)*, 27(3-6), 609-645. <https://doi.org/10.1007/s10606-018-9325-1>
- Johanssen, R., & Zak, P. J. (2020). Autonomy raises productivity: An experiment measuring neurophysiology. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.00963>
- Johns, T., & Gratton, L. (2013). The third wave of virtual work. *Harvard Business Review*. <https://hbr.org/2013/01/the-third-wave-of-virtual-work>
- Jordan, S., Zabukovšek, S. S., & Klančnik, I. Š. (2022). Document management system – A way to digital transformation. *Naše gospodarstvo/Our economy*, 68(2), 43-54. <https://doi.org/10.2478/ngoe-2022-0010>
- Juliet, R. (2022, May 19). *Covid vs. technology: The pandemic has boosted demand for developers*. Bocasay. <https://www.bocasay.com/covid19-boosted-global-demand-software-developers/>
- Kadenic, M. D., Koumaditis, K., & Junker-Jensen, L. (2023). Mastering Scrum with a focus on team maturity and key components of Scrum. *Information and Software Technology*, 153, 107079. <https://doi.org/10.1016/j.infsof.2022.107079>
- Kanbanize. (2023). What is a Kanban board and how to use it? Basics explained. *Kanban Software for Agile Project Management*. <https://kanbanize.com/kanban-resources/getting-started/what-is-kanban-board>

- Kandebo, D. (2015, August 19). Agile/Scrum adoption in regulated industries. *LinkedIn*.
<https://www.linkedin.com/pulse/agile-scrum-adoption-regulated-industries-deborah-kandebo/>
- Karamichalis, K. (2022). The impact of enforced remote working due to COVID-19 restrictions on Agile Software Development teams in Greece.
<https://apothesis.lib.hmu.gr/handle/20.500.12688/10285>
- Kaur, A. (2018). App review: Trello. *Journal of Hospital Librarianship*, 18(1), 95-101.
<https://doi.org/10.1080/15323269.2018.1400840>
- Keller, A., Knight, C., & Parker, S. K. (2020, July 30). *Remote managers are having trust issues*. Harvard Business Review. <https://hbr.org/2020/07/remote-managers-are-having-trust-issues>
- Kettunen, P., & Laanti, M. (2017). Future software organizations – Agile goals and roles. *European Journal of Futures Research*, 5(1). <https://doi.org/10.1007/s40309-017-0123-7>
- King, B. K. (2020, July 5). The history of telecommuting and how to best manage remote teams in 2020. *Business Training and Continuing Education | Live Webinars, Seminars, On-demand and Online Training Courses*.
<https://www.lorman.com/blog/post/history-of-telecommuting-best-tools-for-remote-work>
- Koh, D. (2020). COVID-19 lockdowns throughout the world. *Occupational Medicine*, 70(5), 322-322. <https://doi.org/10.1093/occmed/kqaa073>
- Kononenko, I., & Sushko, H. (2021). Method of the IT project team creation based on maximizing it's competencies. *Bulletin of NTU "KhPI". Series: Strategic management, portfolio, program and project management*, (1(3)), 9-15.
<https://doi.org/10.20998/2413-3000.2021.3.2>

- Krohn, R. (2022, April 6). Autonomy is the future of software development. *Work Life by Atlassian*. <https://www.atlassian.com/blog/software-teams/state-of-the-developer-2022>
- Kwon, K., & Kim, C. (2012). How to design personalization in a context of customer retention: Who personalizes what and to what extent? *Electronic Commerce Research and Applications*, 11(2), 101-116. <https://doi.org/10.1016/j.elerap.2011.05.002>
- Larson, B., Vroman, S., & Makarius, E. (2020, March 18). A guide to managing your (Newly) remote workers. *Harvard Business Review*. <https://hbr.org/2020/03/a-guide-to-managing-your-newly-remote-workers>
- Lashbrooke, B. (2021, July 26). *Should Hybrid Workers Do Deep Work At Home And Creative Tasks At The Office? Not Necessarily...* Forbes. <https://www.forbes.com/sites/barnabylashbrooke/2021/07/26/should-hybrid-workers-do-deep-work-at-home-and-creative-tasks-at-the-office-not-necessarily/?sh=3da824e85298>
- Lindvall, M., Muthig, D., Dagnino, A., Wallin, C., Stupperich, M., Kiefer, D., May, J., & Kahkonen, T. (2004). Agile software development in large organizations. *Computer*, 37(12), 26-34. <https://doi.org/10.1109/mc.2004.231>
- Louisnord, N. (2021, May 18). *ITIL 4 vs. Agile – A growing friendship*. EasyVista | Enterprise Service Management | Self-Help Technology. <https://www.easyvista.com/blog/itil-4-vs.-agile-a-growing-friendship-easyvista>
- Mailman. (2022, September 14). Deep work vs shallow work- How to get better at them? *Mailman Library*. <https://library.mailmanhq.com/what-is-deep-work-vs-shallow-work/>

Masood, Z., Damian, D., & Blincoe, K. (2022). How New Zealand software companies are adapting work settings with changing times. *IEEE Software*, 39(3), 77-84.

<https://doi.org/10.1109/ms.2021.3129066>

McChesney, K. (2017). *Paradigms for mixed methods research*. SRA Social Research Association. <https://the->

[sra.org.uk/SRA/SRA/Blog/Paradigmsformixedmethodsresearch.aspx](https://the-sra.org.uk/SRA/SRA/Blog/Paradigmsformixedmethodsresearch.aspx)

McKinsey & Company. (2020, October 5). *How COVID-19 has pushed companies over the technology tipping point--and transformed business forever*.

<https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever>

Mihalache, A. (2017). Project management tools for Agile teams. *Informatica Economica*, 21(4/2017), 85-93. <https://doi.org/10.12948/issn14531305/21.4.2017.07>

Miller, C., Rodeghero, P., Storey, M., Ford, D., & Zimmermann, T. (2021). How Was Your Weekend? Software Development Teams Working From Home During COVID-19. *2021 IEEE/ACM 43rd International Conference on Software Engineering (ICSE)*.

<https://doi.org/10.1109/icse43902.2021.00064>

Moe, N. B., Dings, T., & Dyb, T. (2008). Understanding self-organizing teams in Agile software development. *19th Australian Conference on Software Engineering (aswec 2008)*. <https://doi.org/10.1109/aswec.2008.4483195>

Mustajab, D., Bauw, A., Rasyid, A., Irawan, A., Akbar, M. A., & Hamid, M. A. (2020).

Working from home phenomenon as an effort to prevent COVID-19 attacks and its impacts on work productivity. *TIJAB (The International Journal of Applied Business)*, 4(1), 13. <https://doi.org/10.20473/tijab.v4.i1.2020.13-21>

- Nandwani, G. (2020). Conference Proceeding Issue Published in International Journal of Trend in Research and Development (IJTRD). *How To Maintain Team Agility in Covid-19 Era*.
- Nazir, S., Price, B., Surendra, N. C., & Kopp, K. (2022). Correction to: Adapting Agile development practices for hyper-Agile environments: lessons learned from a COVID-19 emergency response research project. *Information Technology and Management*. <https://doi.org/10.1007/s10799-022-00382-8>
- Newport, C. (2016). *Deep work: Rules for focused success in a distracted world*. Piatkus Books.
- Nguyen, M. H., & Armoogum, J. (2021). Perception and preference for home-based telework in the COVID-19 era: A gender-based analysis in Hanoi, Vietnam. *Sustainability*, 13(6), 3179. <https://doi.org/10.3390/su13063179>
- Nilles, J. M. (1976). *The telecommunications-transportation tradeoff: Options for tomorrow*. Krieger Publishing Company.
- Noll, J., Razzak, M. A., & Beecham, S. (2017, June 17). Motivation and autonomy in global software development. *Proceedings of the 21st International Conference on Evaluation and Assessment in Software Engineering*. <https://doi.org/10.1145/3084226.3084277>
- Nundlall, C., & Nagowah, S. D. (2022). Task allocation and coordination process in distributed Agile software development: An ontology based approach. *Information Technology and Management*, 23(3), 167-192. <https://doi.org/10.1007/s10799-022-00365-9>
- O'Connor, M., Conboy, K., & Dennehy, D. (2021, January 17). COVID-19 affected remote workers: A temporal analysis of information system development during the

pandemic. *Journal of Decision Systems*, 31(3), 207-233.

<https://doi.org/10.1080/12460125.2020.1861772>

Oliver, J. (2021). How Remote Work is Shaking Up the U.S. Workforce: Research on the Recent Shift to Remote Work. *Finance Undergraduate Honors Theses*.

<https://scholarworks.uark.edu/finnuht/61>

O’Kane, P., Walton, S., & Ruwhiu, D. (2020). Remote Working during COVID-19. *New Zealand National Survey: Initial Report July 2020*. ISBN: 978-0-473-53453-0

Özkan, D., & Mishra, A. (2019). Agile project management tools: A brief Comparative view. *Cybernetics and Information Technologies*, 19(4), 17-25.

<https://doi.org/10.2478/cait-2019-0033>

Parker, S., Knight, C., & Keller, A. (2020, July 30). Remote managers are having trust issues. *Harvard Business Review*. <https://hbr.org/2020/07/remote-managers-are-having-trust-issues>

Pattnaik, S. C., & Sahoo, R. (2021). Employee engagement, creativity and task performance: Role of perceived workplace autonomy. *South Asian Journal of Business Studies*, 10(2), 227-241. <https://doi.org/10.1108/sajbs-11-2019-0196>

Pessoa, A. S., Harper, E., Santos, I. S., & Gracino, M. C. (2019). Using Reflexive Interviewing to Foster Deep Understanding of Research Participants’ Perspectives. *International Journal of Qualitative Methods*, 18, 160940691882502.

<https://doi.org/10.1177/1609406918825026>

Postelnyak, M. (2023, May 24). 10 companies with outstanding internal communications. *ContactMonkey*. <https://www.contactmonkey.com/blog/internal-communications-companies>

- Purvanova, R. K., & Bono, J. E. (2009). Transformational leadership in context: Face-to-face and virtual teams. *The Leadership Quarterly*, 20(3), 343-357.
<https://doi.org/10.1016/j.leaqua.2009.03.004>
- Radzik, K. (2022). Does Agile development work for every project? Why not? *Boldare - digital product creators and consultants*. <https://www.boldare.com/blog/does-agile-development-work-for-every-project/>
- Reclaimai. (2022, April 15). Deep work vs. shallow work: 8 tips to maximize productivity. *Reclaim | Smart Scheduling for Busy Teams*. <https://reclaim.ai/blog/deep-work-vs-shallow-work>
- Regmi, P. R., Waithaka, E., Paudyal, A., Simkhada, P., & Van Teijlingen, E. (2017). Guide to the design and application of online questionnaire surveys. *Nepal Journal of Epidemiology*, 6(4), 640-644. <https://doi.org/10.3126/nje.v6i4.17258>
- Rehkopf, M. (2023). *What is a Scrum master?* Atlassian. Retrieved June 11, 2023, from <https://www.atlassian.com/agile/scrum/scrum-master>
- Rizaldi, M., & Jayadi, R. (2022). How remote working can affect employee performance using Scrum in software development companies. *Journal of Theoretical and Applied Information Technology*, 100(4). [ISSN: 1992-8645](https://doi.org/10.3126/nje.v6i4.17258)
- Rossberg, J. (2019). Agile project management in Azure DevOps and TFS. *Agile Project Management with Azure DevOps*, 251-306. https://doi.org/10.1007/978-1-4842-4483-8_8
- Russo, D. (2021, July 13). *The impact of working from home on the success of Scrum projects: A multi-method study*. arXiv.org. <https://arxiv.org/abs/2107.05955>
- Saldaña, J. (2021). *The coding manual for qualitative researchers*. Sage Publications.
- Sandoval-Reyes, J., Idrovo-Carlier, S., & Duque-Oliva, E. J. (2021). Remote work, work stress, and work–life during pandemic times: A Latin America situation.

International Journal of Environmental Research and Public Health, 18(13), 7069.

<https://doi.org/10.3390/ijerph18137069>

Schneider, C. (2020). Setting up a language learning environment in Microsoft teams.

Studies in Self-Access Learning Journal, 263-270. <https://doi.org/10.37237/110312>

Schoonenboom, J., & Johnson, R. B. (2017). How to construct a mixed methods research design. *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 69(S2), 107-

131. <https://doi.org/10.1007/s11577-017-0454-1>

Shin, H. S. (2019). Reasoning processes in clinical reasoning: From the perspective of cognitive psychology. *Korean Journal of Medical Education*, 31(4), 299-308.

<https://doi.org/10.3946/kjme.2019.140>

Singh, S. (2022, February 15). *The Scrum ceremonies used by Agile teams | The status hero blog*. The Status Hero Blog. [https://statushero.com/blog/the-scrum-ceremonies-used-](https://statushero.com/blog/the-scrum-ceremonies-used-by-agile-teams)

[by-agile-teams](https://statushero.com/blog/the-scrum-ceremonies-used-by-agile-teams)

Simonson, J., & Bottorff, C. (2023, May 5). Asana Pricing Plans (2023 guide). Forbes

Advisor. <https://www.forbes.com/advisor/business/asana-pricing/>

Smith, S. M., Smith, J., & Allred, C. R. (2006). Advanced Techniques and Technologies in Online Research. *The Handbook of Marketing Research*, 132-158.

<https://doi.org/10.4135/9781412973380.n8>

Software Advice. (2023, June 29). About VersionOne. Business Software Reviews from

Software Advice. <https://www.softwareadvice.com/project-management/versionone-profile/>

Sroka, A. (2018, January). *Is telecommuting the future of business?* [Conference session]

VIII International Scientific Conference, Katowice, Poland.

- Srivastava, P., & Jain, S. (2017). A Leadership Framework for Distributed Self-organized Scrum Teams. *Team Performance Management: An International Journal*, 23(5/6), 293-314. <https://doi.org/10.1108/tpm-06-2016-0033>
- Staglin, G. (2021, August 10). *Why Trust Is Critical For The Future Of Remote And Hybrid Work*. Forbes. <https://www.forbes.com/sites/onemind/2021/08/10/why-trust-is-critical-for-the-future-of-remote-and-hybrid-work/?sh=3570673e5b96>
- Statistics New Zealand. (2020). O’Kane *Four in 10 employed New Zealanders work from home during lockdown* | Stats NZ. <https://www.stats.govt.nz/news/four-in-10-employed-new-zealanders-work-from-home-during-lockdown/>
- Sutarto, A. P., Wardaningsih, S., & Putri, W. H. (2021). Work from home: Indonesian employees’ mental well-being and productivity during the COVID-19 pandemic. *International Journal of Workplace Health Management*, 14(4), 386-408. <https://doi.org/10.1108/IJWHM-08-2020-0152>
- Sutherland, J., & Schwaber, K. (2020). *The Scrum Guide*. Scrum Org. <https://scrumguides.org/scrum-guide.html>
- Timans, R., Wouters, P., & Heilbron, J. (2019). Mixed methods research: What it is and what it could be. *Theory and Society*, 48(2), 193-216. <https://doi.org/10.1007/s11186-019-09345-5>
- Trapani, K. (2020, December 8). *Extreme programming vs. Agile*. Cprime. <https://www.cprime.com/resources/blog/extreme-programming-vs-agile/>
- Useem, J. (2017, October 3). When working from home doesn’t work. *The Atlantic*. <https://www.theatlantic.com/magazine/archive/2017/11/when-working-from-home-doesnt-work/540660/>
- Waber, M., Magnolfi, J., & Lindsay, G. (2014, October 1). *Workspaces that move people*. Harvard Business Review. <https://hbr.org/2014/10/workspaces-that-move-people>

Wang, B., Liu, Y., Qian, J., & Parker, S. K. (2020). Achieving effective remote working during the COVID-19 pandemic: A work design perspective. *Applied Psychology*, 70(1), 16-59. <https://doi.org/10.1111/apps.12290>

Warmbrod, J. R. (2014). Reporting and Interpreting Scores Derived from Likert-Type Scales. *Journal of Agricultural Education*, 55(5), 30-47. <https://doi.org/10.5032/jae.2014.05030>

APPENDIX A: ONLINE SURVEY (QUALTRIX)**Participant Information Sheet**

This survey is part of the requirement for Otago Polytechnic Auckland International Campus' Master's in Applied Management Research program, in which the questions are solely intended to answer the research questions pertaining to the study '**Presence of Autonomy in Remote Working Scrum Development Teams' Productivity Following the Pandemic in New Zealand**'. In this study, we examine how greater autonomy, an important benefit of remote working, impacts the productivity of Scrum Development Teams in New Zealand, as well as how remote workers are managed by adapting Scrum Framework values and principles to dispersed teams. The study defines productivity as the completion of coding, code review, software testing, and issue resolution during a sprint. The rationale for focusing on these activities is that these are the core tasks that Scrum Development teams work on during the sprint, contributing to development and eventually leading to the achievement of a product goal.

Please feel free to contact these individuals if you have any questions or need clarification regarding the research.

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Block 7

The following are the objectives for this study:

1) To evaluate the impact of autonomy when working remotely on Scrum Teams' productivity in terms of completing activities such as coding, code review and functionality testing when working outside of a regular office environment.

2) To identify the benefits and drawbacks that Scrum Development Team in New Zealand's Software Development Industry encounter in adapting the Scrum Framework to distributed teams in post pandemic.

3) To present recommendations that will assist employers and remote workers in overcoming the challenges associated with adapting the Scrum Framework to dispersed workforces.

Consent

PARTICIPANT'S DECLARATION FORM

I have read the 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 understand 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 even when I have already started the, but not completed, the survey.
- 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 submitted in the questionnaire has already been analysed.

• My data will be deleted seven years after the conclusion of the project but any raw data on which the results of the project depend will be retained in secure storage for seven years after which it will be destroyed. If it is to be kept longer than seven years my permission will be sought.

• The results of the project may be published but my anonymity and confidentiality will be preserved.

• I can ask to receive a copy of the research findings once completed.

Any additional information given or conditions agreed to:

• I agree to take part in this project under the conditions set out in this Information Sheet.

This project has been reviewed and approved by the Otago Polytechnic Auckland International Campus Research Ethics Committee.

Reference number: AIC114

Agree

Disagree

Demographic Questions

What is your age?

18 - 24 years old

25 - 34 years old

35 - 44 years old

45 - 54 years old

More than 55 years old

What is your family status?

Single and living alone

Single without kids

Single parent

Single and living with family

Married without kids

Married with preschool age kids (0-5 years old)

Married with school age kids (more than 5 years old)

Married with kids doing home school and or distance learning

Married with kids done with school but lives at home

Married with children who have left home

Others

Which region in New Zealand are you currently based?

Auckland

Bay of Plenty

Canterbury

Gisborne

Hawke's Bay

Marlborough

Nelson - Tasman

Northland

Otago

Southland

Taranaki

Waikato

Wellington

West Coast

Whanganui - Manawatu

Do you work remotely at the moment?

Yes, I currently work on a fully remote basis

Yes, I am on a hybrid working arrangement (>30% to <100% remote per week)

No

Which of the following categories best describes the industry you primarily work in (regardless of your actual position)?

Accommodation and Food Services

Arts and Recreation Services
Administrative and Support Services
Electricity, Gas, Water and Waste Services
Agriculture, Forestry and Fishing
Education and Training
Construction
Financial and Insurance Services
Health Care and Social Assistance
Personal Services
Mining
Information Media and Telecommunications
Professional, Scientific and Technical Services
Rental, Hiring and Real Estate Services
Public Administration and Safety
Manufacturing
Transport, Postal and Warehousing
Thematic Reports
Wholesale trade
Retail Trade
Information and Communications Technology (ICT)

Other. Please specify.

Are you currently employed in a New Zealand Based Software Development Organisation?

I am part of a Software Development organization that is based in New Zealand

I am part of an overseas-based Software Development organisation but currently working remotely in New Zealand

No, I am not connected to any Software Development organisation within or outside New Zealand

What is the current size of your company?

Fewer than 250 employees

Between 250 to 500 employees

Between 500 to 1000

More than 1000 employees

I am not sure

What is your organisation's stance on remote work?

Exclusively Remote

Hybrid (>30% to <100% remote per week)

Fully On-Site

How long have you been working remotely at the moment?

Less than 1 year

1 to 2 years

More than 2 years

What is the size of the Scrum Team you belong to?

Less than 5 members

5-7 members

8-15 members

More than 15 members

What is your current role?

Project Manager / Executive Position

Product Owner

Scrum Master

Software Developer/Programmer

Software Tester/Analyst

Technical Architect

Survey Questions for RQ1

What are the biggest benefit/s you see when working remotely? Select all that apply.

Ability to work independently, make decisions, and manage own work schedule

Saved a significant amount of time that would otherwise be spent on commuting to and from the office

Allowed to spend more time with family and friends, pursue hobbies, and engage in other activities that can't be done while at the office

Have the option to wear comfortable clothing, and don't necessarily need to dress up as needed for a typical office job

Provides greater flexibility in terms of when and how to clean and organize the living space

Communication through messaging or chat channels are sometimes clearer and more effective than in-person communication

Have greater control over work environment, allowing to minimize distractions and focus on tasks

Flexibility to work during most productive times

Working for a company that is located outside the local area, providing access to a wider range of job opportunities.

Others. Please specify

What are your struggles when working remotely? Select all that apply.

Blurred lines between work and personal life, making it difficult to disconnect from work

Missing out on social interactions that often occur in an office environment.

Working with colleagues in different time zones and/or core work hours

Difficulty with communicating and collaborating with coworkers, particularly when working on complex projects that require frequent collaboration and feedback.

Easily gets tap to go online again after logging off for the day to support and resolve issues

Screen fatigue due to multiple virtual meetings

Lack of designated working space, exposure to distractions when working remotely

Building and maintaining relationship with co-workers

Feeling supervised all the time and the need to be available most times

Others. Please specify

What are your common distractions when working remotely? Select all that apply.

Social media, instant messaging, email notifications, or browsing the internet

Noise, interruptions, or other people's conversations

Technical issues, such as computer malfunctions, slow internet connections, or software glitches

Urge to do household chores even if not needed (e.g. passed by clutter and/or unwashed dishes)

Home-related distractions such as household chores, caring for family members, pets, or roommates

Having visitors at home during core hours

Mental distractions such as stress, anxiety, or depression, which can affect the ability to focus and stay motivated

Less movement often makes one sleepy and unable to concentrate at work

Needs time to be back in the work zone after coming back from a lunch break and/or quick errand

Others. Please specify

Do you know clearly what is expected as you work remotely (working hours, availability, output etc.)?

Yes, everything is crystal clear to me

Almost, I feel expectation have not been formalized

Not really, I'm only accountable for my own productivity

Not at all, I do not feel we have set standards for remote work availability and productivity"

Others

How do you describe your productivity level when working remotely?

You may explain your answer if desired.

Less productive

Equally productive

More productive

Others. Please specify

What are the most common causes of delays while working remotely, leading the team to defer tasks to the next Sprint? Select all that apply.

Sprint velocity is too high to be achieved (e.g. team capacity issues)

Scope changes in the middle of the Sprint (e.g. additional tickets/User Stories pulled in)

Team dependency in dealing with issues (e.g. different core hours, waiting for resource's availability and response)

Poorly written emails, missed messages, or unclear instructions

Technical problems, such as poor internet connectivity or software issues

Interruptions from personal or home-related responsibilities

Lack of accountability of a physical office, team members not feeling as responsible for their tasks, leading to delays in progress

Lack of visibility into team member's progress or challenges

Difficulty in brainstorming and working through challenges when not in the same physical location

Communication breakdowns that lead to misunderstandings, misinterpretations, or delays in resolving issues

Others. Please specify

Which of the following applied to you while working remotely? Select all that apply.

Conducted more virtual meetings than usual

Video conferencing during Scrum Events

Meetings take longer than expected

Expected to be available at all times

Increase in workload than usual

Working beyond the core hours

Others. Please specify

Would you agree that working with dispersed teams impacts one's productivity and quality of work in any way?

If Yes, please specify the reason

If No, please specify the reason

Can you recall any personal obstacles you had when working remotely that are not addressed in the previous questions?

Research Question 2

How do the values and pillars of the Scrum Framework support Software Development Organisations in adjusting from the shift of working in the office to working remotely?

	Never	Sometimes (Once a week)	About half the time (Twice a week)	Most of the time (Most days of the week)	Alw (Ever
How often do you believe the team communicates openly and effectively amongst each other while they work remotely?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often does the team offer assistance to those individuals who are having difficulties with completing their tasks as they are assigned to them on a regular basis?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often are the Scrum Events serves as a forum for communication and collaboration among members of the team?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often are vague areas of the requirements thoroughly discussed among the team so as to eliminate confusion and misunderstandings during the development phase?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often does the scrum team discuss and resolves issues and impediments on a regular basis through a group channel, emails or informal communication within the team without waiting for formal meetings to be held?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often are positive feedbacks provided to team members by the supervisors in recognition of the efforts of the members?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often does the remote team engage in activities that provide opportunities for team collaboration and socialization outside of Scrum Events?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please share some insights on your personal experience in adopting the Scrum Framework remotely

Research Question #3

What are the advantages and disadvantages of managing dispersed Scrum Teams after the pandemic?

	Never	Sometimes (Once a week)	About half the time (Twice a week)	Most of the time (Most days of the week)	Alw (Ever
Does the Scrum Team always attend all scrum events in a timely manner?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do you, at one point, wait for a team member to be available so that you can get in touch with them and discuss urgent matters?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often are managers checking on the availability and output of their remote workers on a regular basis?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Did you feel the need to appear available to your leads/managers at all times in case they desire output and/or had questions?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do the members of the Scrum Team have the ability to be reached out anytime during the core hours of their regular working day?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
As far as Software Quality is concerned, how often are issues and bugs monitored and discussed before a User Story can be closed in order to ensure Software Quality?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often does the Scrum Events becomes a venue for the team to communicate and collaborate?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Did you have a chance to communicate with one another on a supervisor and subordinate level to show encouragement in one's work?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do you think the organisation benefits from having a dispersed team by reaching out to skilled individuals located outside the location of the organisation's head office in order to gain access to the best talent within the country?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never	Sometimes (Once a week)	About half the time (Twice a week)	Most of the time (Most days of the week)	Always (Every day)
Does the team have a group channel through which everyone can be kept informed of any urgent matters and to discuss informal questions that arise during the sprint (for example, a group channel within Microsoft Teams or Zoom)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
What are the challenges you encountered as a result of the way your team is being managed remotely?	<input type="text"/>				
What do you like most about the way your team is managed remotely?	<input type="text"/>				

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APPENDIX B: RELIABILITY AND VALIDITY DATA TESTING

Column1	Q32_1	Q32_2	Q32_3	Q32_4	Q32_5	Q32_6	Q32_7	Q35_1	Q35_2	Q35_3	Q35_4	Q35_5	Q35_6	Q35_7	Q35_8	Q35_9	Q35_10	Q35_11	Sum
1	1	2	1	2	1	2	3	1	2	4	5	1	3	1	4	5	5	1	44
2	2	3	3	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	46
3	2	2	2	2	1	3	4	1	2	2	2	2	1	1	3	2	4	37	
4	1	1	1	1	1	1	1	1	4	4	5	1	1	1	1	1	5	32	
5	1	2	1	2	2	3	4	2	3	3	2	2	2	3	2	2	3	41	
6	1	1	1	2	3	3	4	2	3	4	2	4	1	3	4	1	4	40	
7	2	2	2	2	2	2	4	3	2	2	1	2	3	3	1	5	1	40	
8	1	2	1	3	2	4	4	1	2	2	2	2	2	2	4	4	4	43	
9	1	2	1	2	1	2	3	1	2	4	5	1	3	1	4	5	5	44	
10	3	2	1	1	1	4	4	1	1	4	4	2	1	1	4	1	4	40	
11	2	2	1	3	2	4	5	1	1	4	4	1	1	1	1	2	2	38	
12	3	2	1	1	2	4	5	1	1	4	4	1	1	1	1	2	2	37	
13	3	2	4	3	3	3	3	1	1	4	4	1	1	1	1	2	2	39	
14	2	2	1	2	1	4	5	1	2	2	2	2	4	1	2	2	4	41	
15	1	2	1	2	1	2	3	1	2	4	5	1	3	1	4	5	5	44	
16	1	2	1	2	1	2	3	1	2	4	5	1	3	1	4	5	5	44	
17	1	2	1	2	2	4	3	1	4	1	1	1	3	1	4	5	1	36	
18	1	2	1	2	1	2	3	1	2	4	5	1	3	1	4	5	5	44	
19	1	2	2	2	1	1	4	1	1	4	4	1	1	1	4	1	5	37	
20	1	2	2	2	2	3	4	2	3	1	5	1	2	1	4	1	5	42	
21	4	2	1	2	1	2	4	2	4	1	2	1	1	1	1	3	2	35	
22	2	2	3	1	2	1	1	5	1	4	4	4	2	1	1	1	4	41	
23	2	3	1	2	2	3	4	1	4	4	5	2	2	3	2	3	2	45	
24	3	3	2	2	2	4	4	2	3	4	2	3	4	3	4	2	4	53	
25	2	2	1	1	1	3	5	1	3	4	4	1	1	1	4	1	5	41	
26	1	1	1	1	1	1	1	2	4	1	2	2	2	2	1	1	3	27	
27	2	2	1	1	1	1	5	1	2	5	1	1	1	1	4	1	5	36	
28	1	1	1	1	1	4	5	1	1	5	5	1	1	1	3	1	5	39	
29	1	2	1	2	1	2	3	1	2	4	5	1	3	1	4	5	5	44	
30	1	1	1	1	1	4	1	1	3	4	5	1	1	1	4	1	5	37	
31	1	1	1	1	1	1	4	1	1	2	5	5	1	1	4	1	5	37	
32	1	1	1	1	1	4	1	1	1	5	1	1	1	1	1	1	1	25	
33	1	1	1	1	1	4	1	1	1	5	5	1	1	1	4	1	5	36	
34	1	1	1	1	1	4	4	1	2	5	5	1	1	2	4	1	5	41	
35	1	1	1	1	1	4	4	1	1	5	5	1	1	1	1	1	5	36	
36	2	1	2	3	3	2	2	1	2	2	1	1	4	2	3	2	4	39	
37	2	2	3	4	3	3	4	1	4	3	2	2	1	2	3	1	4	38	
38	1	1	1	1	1	5	5	2	1	5	5	2	1	1	4	1	5	42	
39	1	1	2	2	2	4	4	2	2	5	5	2	1	1	4	1	5	46	
40	1	2	1	1	1	4	4	1	1	5	5	3	1	1	4	1	5	38	
41	1	1	1	1	1	4	4	1	1	5	5	3	1	1	4	1	5	38	
42	1	2	1	2	1	2	3	1	2	4	5	1	3	1	4	5	5	44	
43	1	1	1	1	1	4	3	1	2	4	5	3	1	1	4	5	5	44	
44	2	2	2	2	2	2	4	1	1	4	4	1	4	1	1	1	4	39	
45	1	2	1	2	1	2	3	1	2	4	5	1	3	1	4	5	5	44	
46	1	1	1	1	1	4	4	1	1	5	5	3	1	1	4	1	5	38	
47	1	2	2	2	3	3	3	1	1	1	1	1	1	1	4	4	5	40	
48	1	2	3	2	3	4	5	1	1	2	2	2	2	1	4	4	5	43	
49	1	1	1	1	1	4	4	1	1	1	1	1	1	1	4	1	4	33	
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51	1	1	1	2	1	1	4	1	2	2	3	3	2	2	4	3	5	40	
52	1	2	1	2	1	2	3	1	2	2	5	1	3	1	4	5	5	43	
53	1	2	2	2	2	2	2	1	1	1	1	1	1	2	2	2	2	33	
54	1	1	1	1	2	4	4	1	1	1	1	1	1	2	3	1	5	36	
55	1	1	2	2	2	4	4	1	1	1	1	1	1	1	1	1	5	31	
56	1	1	1	1	1	4	4	1	1	1	1	1	1	1	1	1	5	28	
57	1	1	1	1	1	4	3	1	1	1	1	1	1	1	1	1	5	31	
58	1	1	1	1	1	4	4	1	1	1	1	1	1	1	1	1	5	31	
59	1	1	1	1	1	4	2	1	1	1	1	1	1	1	4	1	4	28	
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64	1	1	1	1	1	4	1	1	1	1	1	1	1	1	4	1	5	28	
65	1	1	1	1	1	4	4	1	1	1	1	1	1	1	4	1	4	30	
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98	1	1	2	1	4	2	1	1	2	2	4	2	2	2	3	1	4	36	
99	1	1	1	2	2	4	1	1	3	1	2	3	4	1	3	2	2	35	
100	1	2	1	2															