



**Universiteit Leiden**

## **ICT in Business and the Public Sector**

Agile frameworks outside IT: current state and  
influence on team performance

Name: Mitch Knoop  
Student-no: 2789930

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1st supervisor: Dr C.J. (Christoph) Stettina  
2nd supervisor: Dr. G.J. (Guus) Ramackers  
Prof.dr.ir J. (Joost) Visser

MASTER'S THESIS

Leiden Institute of Advanced Computer Science (LIACS)  
Leiden University  
Niels Bohrweg 1  
2333 CA Leiden  
The Netherlands

## Preface

In the last ten years, I have gone through the multiple layers of the Dutch school system. I started an MBO 4 ICT study where I first became familiar with both the practical and technical side of the field and eventually became curious about the theoretical considerations of management in ICT. So, after completing this study, I followed an HBO study in Information Media Studies.

Through this education, I learned what aspects there are to provide strong service and how a solid foundation, in theory, can improve the output of the providing party. During this study, I first encountered the idea of Agile and the implementation of Scrum while gathering the customer needs and identifying links between these and the technical requirements, all to deliver the best suitable solution for the project while recognising that each project has different needs.

With this idea of ‘Different Needs,’ I started the master’s studies of ICT in Business to complete my already attained knowledge, so I will offer the most salient solution, improving corporations’ effectiveness, efficiency, and operations. So, when I came across this topic about Agile outside IT, I immediately saw this as an opportunity to increase my knowledge on a topic that I could use for my entire career while not being bound to just the IT domain.

## Abstract

Over the past decade, there has been a market trend towards adopting agile methodologies in organizations and teams across various industries, particularly in the software development industry. In response to the need for greater efficiency and the ability to adapt to rapidly changing markets, this trend has extended beyond the realm of information technology (IT) and into other domains, resulting in an increase in the utilization of agile ways of working.

For companies and researchers, it is interesting to see how organisations learn from these trends. A previous study by Oprins et al. (2019) on using agile methodologies outside of IT to better understand this phenomenon provided insights into its direction and usage. The findings of this study provided a foundation for the current research. However, this was a multiple-case study with a small number of cases that were only analysed qualitatively. Now based on this study, a new, more quantitative study is performed based on 72 cases into the actual impact of agile methodologies on team performance which the previous study did not do.

Our study aims to understand the current state of the impact of agile across various domains, including the methods being used and any recent developments. A research model was constructed through an extensive literature review, experience reports, and non-academic web sources. The research question for this study was: "In which domains outside of IT are agile methods applied, and what is the impact on team performance?".

A quantitative approach, specifically a survey, was chosen to collect data for this study. The survey consisted of four parts, with 14 demographic questions and 73 questions measured using a 1-5 Likert scale. The first part of the survey assessed demographic information, the usage of agile practices, and experiences with agile. The second part of the survey focused on the agile mindset, the third on teamwork quality, and the fourth on team performance.

The results of the study were based on 82 complete responses to the survey. The findings revealed that the use of agile positively impacted the different aspects of team performance moderately to strongly. Additionally, the results indicate that agile keeps expanding into domains outside of IT, such as marketing, education, and financial services. The study also found that a team's level of agile maturity has a small impact on the agile mindset. Lastly, a grouping of the reasons for using agile was made, resulting in seven distinct categories: 'Encouraging individual decision-making', 'Becoming more efficient', 'Improve time-to-market', 'Becoming more flexible', 'Improving communication', 'Creating an overview of tasks', and 'Allowing for easier receiving and processing of feedback', indicating that reasons for agile usage are not just tied to technical specifications from the software industry. However, the study did not provide any conclusions on the impact of individual agile practices. Instead, it showed that having the right mindset is crucial for successfully implementing agile methods.

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# 1. Introduction

Global competition exists, prospects constantly change, and company procedures become more complicated (Williams, 2005). This global competition forces organisations to look for new methods, such as agile methods. Many management practices are invented for physical labour like manufacturing or construction work. According to typical management techniques, managers always try to prepare and anticipate all potential details and demands before the execution of decisions (Williams, 2005). However, in today's quickly changing world, manual labour is becoming more and more automatised through the years (Degryse, 2016), with an estimation of 375 million workers globally (14 per cent of the global workforce) forced to change occupation (Manyika, et al., 2017).

This shift in the workforce can be seen as the Fourth Industrial Revolution (Kowalsky, 2015): the first was that of the steam engine, the second was electrification and mass production, the third that of the computer, and the fourth was the digital revolution (Kowalsky, 2015) which means that more and more of the workforce moves away from jobs where the typical project management has been suitable to jobs where this no longer applies.

Businesses will be forced to make changes faster to successfully manage dynamic projects and demands in this new environment. Business agility will become increasingly essential to accomplish this (Oosterhout, 2010). This agility can be described as the capacity of a company to adapt swiftly to changes in a dynamic business environment. Agility began as a notion for software development and IT projects, but it has evolved into one of modern businesses' most important competitive advantages. Agility is the ideal balance between the necessity for stability and enough flexibility (Ciric, et al., 2019).

One of these global trends to help businesses with this is the agile way of working. Agile methods were introduced around 2001 and have been predominantly used by the software industry, where they have been successfully prompting business. However, a growing need and increased competition for quicker delivery of products and services pressure businesses, prompting businesses to adapt and seek new ways and models to increase their agility. This has resulted in more and more companies trying to implement agile methods in their core processes to overcome these challenges (Digital.ai, 2021)

Since agile approaches are no longer restricted to start-ups and small development shops but are being adopted as a new way of working outside IT by enterprises like ING and Vistaprint (Denning, 2018) (Calnan & Rozen, 2019). Scrum is one of these methods businesses can apply to improve team-based work and work that allows for flexible feedback like marketing since it has shown to be quite effective in the IT industry (Schwaber & Sutherland, Scrum, 2010).

However, agile outside of the IT domain is still relatively new, and little research has been done about it. In 2019 a study was conducted on how agile methods have transcended beyond the IT domain (Oprins, Frijns, & Stettina, 2019). This study showed that agile methods are being used in other non-IT domains



like Healthcare, Marketing and Education. However, this study was relatively small and more explorative orientated to provide a basis for more studies on this subject. Based on that study, this study will dive deeper into this agile outside IT topic.

### 1.1. The research aims and objectives

Regardless of the vast amount of research that has been done on business agility and agile inside the IT domain, there has not been as much research performed on the application of agile and the impact outside of the IT domain. The previous research, *Evolution of Scrum Transcending Business Domains and the Future of Agile Project Management*, by Oprins et al. (2019), forms the cause for this study.

With the goal from a business perspective, this research will provide a broader view of agile methods in domains outside IT. The goal is to measure these methods' impact on the processes in these domains and how organisations have been inspired by agile's effect on the IT industry. With the insights from this research, other organisations could be intrigued to start working with agile when results show that agile positively impacts business processes.

From an academic point of view, this research will further explore the scope of the original research on agile use outside IT domains performed by Oprins et al. (2019). The research question that is addressed to comply with the goals is as follows:

*In which domains outside of IT are agile methods applied, and what is the impact on team performance?*

To help answer the research question, two guiding questions are defined:

- When implementing agile in a non-IT organisation, how is the approach used?
- What impact do these agile approaches have on a team's team performance?

### 1.2. Scope

Since agile can be broad and viewed from different viewpoints, this study needs to set boundaries (scope). This study's main topics will be utilising agile practices inside teams and the justification for doing so. The methods used will be described in paragraph 2, Literature review. Besides the use, this study will look at the mindset that comes with the use of agile practices.

Subject	In scope	Out of scope
<b>Application of agile</b>	Enterprise (business) functions outside IT (e.g., Marketing, Sales)	Software teams supporting these functions
<b>Unit of analysis</b>	Teams and teams of teams	Individual experience (e.g., personal Kanban board)
<b>Domain</b>	Non-IT domain	IT domain

Table 1: Research scope

### 1.3. Structure of the thesis

This paper is constructed as follows; Chapter 1 presents the introduction to the research subject and explains the study's motivation, goals, and scope. Chapter 2 focuses on the theoretical framework and highlights what the literature says about agile management practises like, what is agile? In what domains is it already used? What methods of agile are being used?

In Chapter 3, the theoretical framework will be described. This paragraph will define all the measuring models of this study, the research model itself and the hypotheses.

Chapter 4 presents the methodology we applied and explains the procedure, data collection, and analysis methods. Chapter 5 shows the descriptive results of this research, like what kind of domains are working in agile, what methods they are using and what reasons they have to use it.

Chapter 6 will contain the hypothesis testing from this study with the help of statistical analysis. Chapter 7 will revisit and discuss the research question by examining the data and findings. This Chapter will also mention the possible limitations of this research. The conclusions and recommendations for future study are presented in Chapter 8, which brings the study to a close.

## 2. Literature review

This chapter provides the basis of this study. It consists of a comprehensive literature review on business agility, agile and agile usage. In paragraph 2.1, business agility and agile will be described along with different agile methods. In paragraph 2.2, agile usage in various domains like marketing or education will be described.

### 2.1. What does Business Agility and being agile mean?

Business Agility is a managerial view related to staying ahead of the competitors, corporate structures, and business practices that a business should have in the twenty-first century (Oosterhout, 2010). Business Agility is built on management concepts related to business success, like market orientation and flexibility. There is no consensual definition of what Business Agility is. In these paragraphs, the ideas of Business Agility will be discussed.

Business Agility came into existence in the late 1980s in the United States (US). It was created as a new concept for manufacturing goods and a successor to the LEAN concept. In the US government, there was a growing concern that the US manufacturing industry would lose its competitiveness and thus result in the loss of American competitiveness. This concern led to the creation of a task force under the Department of Defense (DOD) to develop a new concept to ensure American competitiveness. The results of this task force were published in a report, “21st Century Manufacturing Enterprise Strategy” (Goldman et al., 1991), published by the Lacocca Institute at Lehigh University (Kidd, 2004).

In this report, Goldman et al. (1991) defined Business Agility as the following *“the ability to thrive in a competitive environment of continuous and unanticipated change and to respond quickly to rapidly changing, fragmenting global markets that are served by networked competitors with routine access to a worldwide production system and are driven by demand for high-quality, high performance, low-cost, customer-configured products and services”*.

Following the recommendations from the report, the Agility forum was created to dive further into these newfound Agile phenomena. With Agile manufacturing being born, managements were given a new concept to shape their organisations in the Agile way. This way, they could respond better and quicker to the new volatile markets of the 21<sup>st</sup> century. Agile manufacturing “integrates the entire spectrum of flexible manufacturing technologies, as well as lessons learnt from comprehensive quality management, just-in-time manufacturing, and lean manufacturing” (Goldman & Nagel, 1991)

Based on this report from Goldman and the Agility forum that originated from it, four strategic elements were prescribed to achieve Business Agility: Enriching customers, cooperating to compete, leveraging recourses and mastering change. More researchers developed their concepts, views, and definitions of Business Agility based on this work. So is Business Agility described as *“The ability to detect opportunities for innovation and seize those competitive market opportunities by assembling requisite assets,*

*knowledge and relationships with speed and surprise*” (Zhang & Sharifi, 2000). In the PhD by Marcel Van Oosterhout, multiple definitions and views of different researchers are analysed and based on that. He describes Business Agility as follows (Oosterhout, 2010): “*Business agility is the ability of an organisation to swiftly change businesses and business processes beyond the normal level of flexibility to effectively manage highly uncertain and unexpected but potentially consequential internal and external events, based on the capabilities to sense, respond, and learn*”.

Business Agility started as an answer for new manufacturing methods in the US in the 20<sup>th</sup> century, but through the years, Business Agility is becoming redefined. So, it can again provide a solution for organisations to cope with the new high, changing markets of the 21<sup>st</sup> century.

Heisterberg and Verma (2014) mention in their book *Creating Business Agility* that organisations are again experiencing a new paradigm created by technological advances and the information domain. The emergence of big data, cloud services, portable devices, and social media are forming new markets and forcing businesses to adapt quicker, even faster than in the 1980s. According to Heisterberg and Verma, Business Agility is crucial in helping organisations adapt to these technological advancements and survive as a company. In this new era, achieving long-term relationships and customer loyalty is becoming increasingly essential as providing more support in the shortest amount of time possible. Heisterberg and Verma (2014) define Business Agility as “*innovation via collaboration to be able to anticipate challenges and opportunities before they occur*” (Heisterberg & Verma, 2014). This definition can be seen as a relatively broad one.

In a report by the Scaled Agile Framework, the definition of Business Agility is more focused on the 21<sup>st</sup> century and resembles the one Heisterberg describes but points out what makes Business Agility more directly. The Scaled agile Framework defines Business Agility as the following:

*“Business Agility is the ability to compete and thrive in the digital age by quickly responding to market changes and emerging opportunities with innovative, digitally enabled business solutions.”*

In addition to this definition, they mention achieving Business Agility as an organisation. It is required that all organisational parts, such as development, IT operations, legal, marketing, finance, support, and Human Resource Management – use agile thinking and methods to ensure continuous delivery of high-quality, innovative products and services faster than the competition (Scaled Agile Framework, 2021).

Over time, the concept of agility has been applied more broadly to the business context, from just the non-IT manufacturing domain to the software engineering IT domain. Now, it’s moving back into the non-IT domains again. Business agility refers to an organization's ability to respond quickly and effectively to changing market conditions, customer needs, and internal and external factors. It involves adapting to new opportunities and challenges, innovating rapidly, and continuously improving operations (Taylor & Gogate, 2021).

With this definition, agile methods and thinking are linked to Business Agility and how it can be achieved. During the Agile conference of 2019 from the Agile Alliance, speaker Al Shalloway also talked about Business Agility and mentioned that agile is a crucial factor for achieving this. He also mentions five steps necessary to achieve Business Agility (Prikladnicki, Lassenius, & Carver, 2019). According to Shalloway, organisations should focus on a more incremental approach to their business value streams and optimise this. Second, organisations should move towards system thinking to organise their organisational networks. Third, organisations must start thinking Agile in their departments and culture. Fourth, the agile way should be implemented from an opinion point of view rather than a theoretical one. The fifth and final step is that organisations have to move to a more flexible organisational set where people are naturally forced to work together and contribute to the parts where their expertise fits best instead of being highly structured with pointed-out tasks (Shalloway, 2019).

With these definitions, agile becomes more and more of a part of what Business Agility is and how it should be achieved in this new era of information systems. However, this leaves room for discussing whether Business Agility is achieved as an organisation if agile is implemented within the business. John Orvos gave his view on this question in his book “Achieving Business Agility” (Orvos, 2019).

Orvos argues that achieving Business Agility differs from simply implementing agile throughout the organisation. An agile business ties everything together to create goods that consumers appreciate. As a result, all operations are aligned around the single objective of developing and deploying the highest helpful product. In comparison, Business Agility is focused on making the organisation detect and react to changes in the market. As a result, business operations are linked to creating goods that provide value to the client. So, according to Orvos, achieving Business Agility does not necessarily have to mean adopting agile throughout the entire organisation (Orvos, 2019).

### 2.1.1. What is agile?

In practice, the term agile can be interpreted differently. It can also be challenging to describe agile methods since they encompass a variety of well-defined techniques that differ in practice. This section will examine how other scholars and specialists define this term in the literature.

According to several studies, agile can be seen as a philosophy or a mindset. Alistair Cockburn defines “agile” as “effective and manoeuvrable.” Where agile processes can be seen as lightweight and self-sufficient, the lightweight serves as a method of manoeuvrability, as sufficiency can be seen as a condition of remaining competitive (Highsmith & Cockburn, 2001). While agile methods, according to Barry Boehm, can be seen as “an offshoot of quick prototyping and swift development experiences, as well as the rebirth of a viewpoint that programming can be seen more as a skill than an industrialized process (Boehm & Turner, 2003).

Agile methodologies can also be characterised by listing the common practices shared by all methods. As stated by Craig Larman, “ agile methods cannot be precisely defined since individual practises differ”. However, brief timed iterations with adaptive revisions of plans and goals are a fundamental practice shared by several Agile methodologies” (Larman, 2004).

While the definition of Larman can be seen as a more theoretical definition, Boehm provides a more practical definition: “Agile approaches are highly lightweight procedures that utilise short iteration cycles; actively include users in establishing, prioritising, and verifying requirements; and depend on tacit and explicit knowledge inside a team instead of documentation” (Boehm & Turner, 2003).

Following an online workshop focused on agile hosted by the Centre of Experimental Software Engineering (CeBASE). The following attributes were described for agile methods: iterative, incremental, self-organising and adaptive (Cohen & Costa, 2004). In addition, Boehm proposed a similar description since he thought an agile method must incorporate all the preceding criteria. Additionally, Boehm gave a similar formulation, believing that an agile approach must meet all the previously given requirements (Boehm & Turner, 2003).

Based on this review and more literature, a definition of agile is formed. An agile method is characterised by adaptability, people-oriented, iterative, and incremental attributes.

*Adaptive* means that agile methods embrace change in requirements and technological needs. It focuses on responsiveness to change rather than avoiding change (Hanssen, Stålhane, & Myklebust, 2018). According to Fowler, an adaptive process will enable control over unpredictability in a project. (Fowler, 2005). Additionally, it incorporates input from prior work (Larman, 2004).

*People-oriented* means that the quality of the people participating in a process is more important than the quality of the actual process. High-quality people with lousy processes will achieve more than low-quality people with good processes (Todorović et al., 2018). Indicating that people are critical factors in the success of an agile method (Highsmith & Cockburn, 2001). Thus, the Agile process’s role is to help the project team find the most effective way to accomplish the team’s tasks (Fowler, 2005).

*Iterative and incremental* means that the project is carried out through multiple iterations, beginning with planning and ending with delivery. Each iteration completes reviews and improves a portion of the project (Fowler & Highsmith, 2001). Additionally, the project outcomes expand progressively as additional targets are accomplished after each iteration. Finally, results can be presented to the customer or stakeholder for feedback following each iteration, making this even more appropriate for change (Beck, et al., 2001).

To summarise, agile can ultimately be seen as a mindset based on and guided by certain beliefs and principles. These beliefs and principles all guide initiating methods, responding to change in a project, and managing ambiguity in an agile way (Abbas, Gravell, & Wills, 2008).

### 2.1.2. History of agile methods and the fundament

The agile idea was founded in 2001 by a group of seventeen people with the creation of the Agile manifesto for software development (Beck, et al., 2001). In this manifesto, twelve principles were written down, e.g., “*Welcome changing requirements, even late in development. agile processes harness change for the customer’s competitive advantage*” and “*Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale*” the complete list can be found in Appendix A – Agile manifest.

When a project is started, it is hard to predict the entire outcome from the start, and this is even more of a challenge with a software project. With the more traditional project management methods like the waterfall method, the customer's wishes must be correct from the beginning since there is no or little opportunity for changes and feedback during the project (Thesing, Feldmann, & Burchardt, 2021).

The twelve Agile manifesto principles focus on continuously ensuring software delivery and doing it differently from traditional methods. To accomplish this, the iterative characteristics of agile create a kind of feedback loop. In this so-called feedback loop, the following four values of the Agile manifesto are applied (Beck, et al., 2001):

Individuals and interactions	<b>over</b>	Processes and tools
Working software	<b>over</b>	Comprehensive documentation
Customer collaboration	<b>over</b>	Contract negotiation
Responding to change	<b>over</b>	Following a plan

This feedback loop is one of agile’s primary distinctions compared to traditional ways. Agile practises often discourage long-term planning; the project is evaluated incrementally/iteratively (Figure 1). One of the benefits of this method is the opportunity to learn as the project progresses rather than receiving feedback later. This way, stakeholders can request changes through this feedback loop instead of pre-determining the project’s design and scope. This way, stakeholder collaboration is enhanced and ensures that team members engage at a higher level (Serrador & Pinto, 2015).

This feedback loop idea is not the only difference between Agile and traditional methods. According to Dyba & Dingsøyr (2008), agile distinguishes itself in the following areas: management style, knowledge management, communication, development model, desired organisational structure, quality control, and basic development assumption.

These differences are that traditionally, ‘systems are completely specified, predictable, and produced via thorough and lengthy planning.’ In comparison, agile assumes “high-quality adaptable software generated by small teams following the concepts of the continuous improvement of design and testing based on quick feedback and change” (Dybå & Dingsøyr, 2008). Table 2 on the next page displays other differences within these stated areas.

<b>Fundamental assumption</b>	<b>Traditional development</b> Systems are fully specifiable and predictable and are built through meticulous and extensive planning	<b>Agile development</b> High-quality adaptive software is developed by small teams using the principles of continuous design improvement and testing based on rapid feedback and change
<b>Management style</b>	Command and control	Leadership and Collaboration
<b>Knowledge management</b>	Explicit	Tacit
<b>Communication</b>	Formal	Informal
<b>Development model</b>	Life-cycle model (waterfall, spiral or some variation)	The evolutionary-delivery model
<b>Desired organisational form</b>	Mechanistic (bureaucratic with high formalisation), aimed at large organisations	Organic (flexible and participative encouraging cooperative social action), aimed at small and medium-sized organisations
<b>Quality control</b>	Heavy planning and strict control. Late, heavy testing	Continuous control of requirements, design, and solutions. Continuous testing

Table 2: differences between traditional and agile development (Dybå & Dingsøy, 2008)

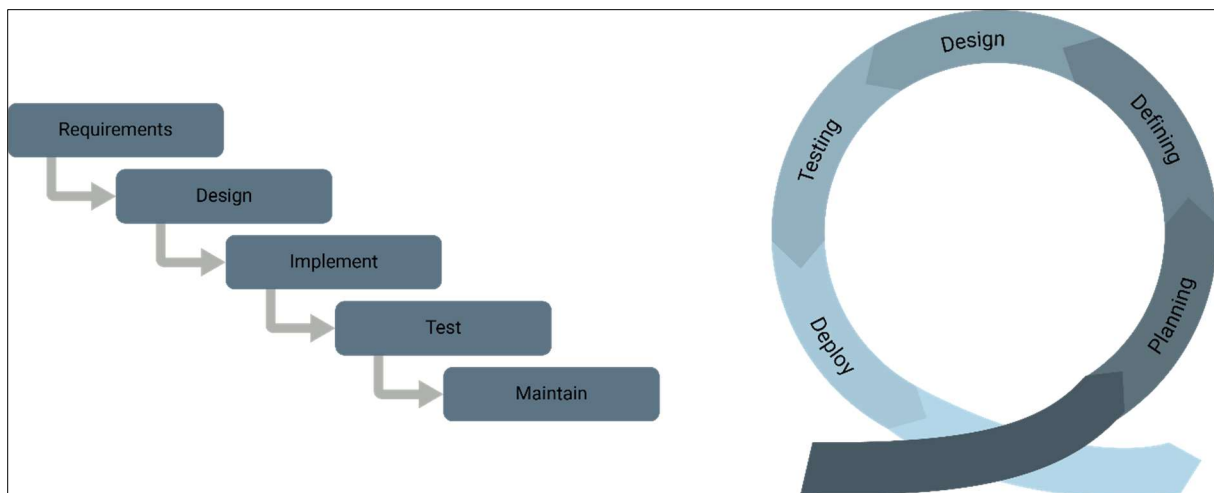


Figure 1: Traditional (Waterfall) project method VS agile project method

Based on all these ideas, the software development domain has created different methods to work in an agile way. These methods include Scrum, Extreme Programming (XP), Kanban, Lean Development, Scrumban, Crystal and Scrum/XP Hybrid (15th State of Agile Report, 2021). The most widely used agile methods are Scrum, Kanban, Scrumban and XP (Digital.ai, 2021). Since this study's goal is not to explain agile methods, not all methods will be described. This paper will only describe the most used agile methods of Scrum, Kanban, Scrumban and XP.

These methods are not necessarily the best. Each method has its strengths and weaknesses, or in some cases, some of these methods get combined with working with, like Scrumban (Nikitina, Kajko-Mattsson, & Stråle, 2012)



### 2.1.2.1. Scrum

Scrum is a method that enables individuals, teams, and organisations to create value by solving complex issues adaptively. Scrum was founded in 1990 by Jeff Sutherland and Ken Schwaber (Schwaber & Sutherland, 2020) based on best practices from the Japanese industry, specifically lean development ideas (The Scrum papers, 2007). Scrum is not a method or process; it compresses worldwide best practices within the software development industry.

Scrum is built upon two principles those are empiricism and lean thinking. When thinking about empiricism, knowledge is gained through experience and decision-making is established through observations. On the other hand, Lean thinking focuses on the necessary and eliminates waste. Scrum works with an iterative, incremental strategy for increasing predictability and risk management in a project. Scrum teams consist of individuals with the necessary skills and experience to complete the job and share or gain more abilities.

With Scrum, the inspection and adapting events are contained within a single event, the so-called sprint. These sprints are based on the three empirical pillars of Scrum, transparency, inspection, and adaptation (Schwaber & Sutherland, 2020). Transparency is all about ensuring that the work and processes are visible to those who are performing and receiving the work. Transparency will open the way for trustworthy inspection.

The inspection ensures that the agreed goals in a so-called definition are being inspected frequently. Inspection is also strengthened by frequent deliveries and active stakeholder involvement to ensure changes can be made and undesirable outcomes can be avoided. This inspection form will be the basis of the third pillar adaption.

Adaption is about changing how the process is applied, or the resources used when the results deviate from the set goals or go outside the project's acceptable limits. These adaptations must be made as early as possible to ensure that the divergence from the desired product is as slight as possible. In Figure 2, the complete scrum process is displayed.

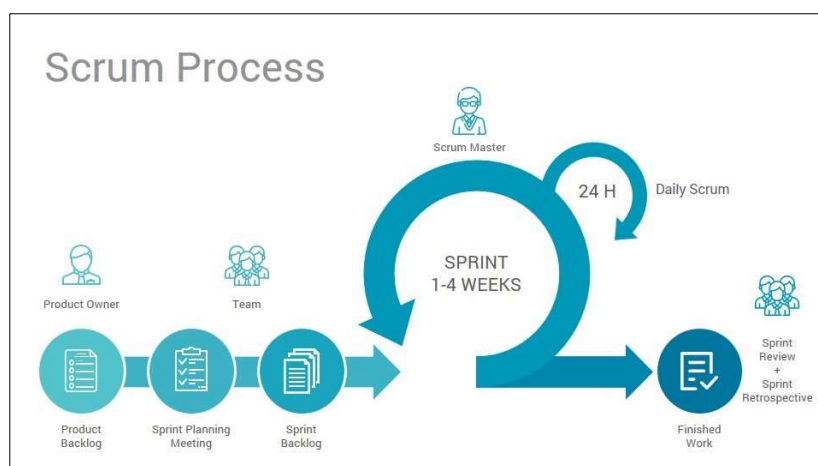


Figure 2: The scrum process

The scrum team is assumed to be self-managing, determining who does what, when, and how. A scrum team contains three roles: The Scrum master, the product owner, and the development team. The role of the scrum master is responsible for making sure that the Scrum principles and processes are followed correctly. The product owner represents customers and other stakeholders and keeps track of the backlog. How this is achieved can differ between organisations. The development team comprises professionals who work incrementally to create a viable product that satisfies the agreed-upon definition of “done.” There is no hierarchy; it is seen as one unit focusing on one goal at a time (Schwaber & Sutherland, The Scrum Guide, 2020).

There are four major Scrum events within a Scrum process: Sprint Planning, Daily Stand Up, Sprint Review, and Sprint Retrospective. The scrum team’s work is completed in sprints, meaning they are time-boxed, varying from 1 week to a maximum of 4 weeks. Each planned activity should be completed within this timeframe.

#### 2.1.2.2. Kanban

The Kanban board can be seen as one of the most popular lean project management tools. Toyota originally developed Kanban, and thus was first applied in the car manufacturing industry (Al-Baik & Miller, 2014). The value of Kanban is expressed in six core practices (Schwaber & Sutherland, The Scrum Guide, 2020):

- Visualisation of work.
- Limit work-in-progress.
- Manage the workflow.
- Make process policies explicit.
- Implementation of feedback loops.
- Improve collaborating.

The work of a team is placed on a Kanban board. A Kanban board can be defined as the following: *“A scheduling system that optimises the use of visuals in order to plan out work, schedule deliveries, and more.”* (Barnard, 2020). On the Kanban board, the team can visualise their work and let it serve as a central point for information where all the tasks can be placed. This visualisation enables effective communication and optimisation of the workflow among individuals. The basic Kanban board consists of three columns: “To-Do”, “In Progress”, and “Complete”. Depending on the team, the board may vary in size, structure, and objective. A Kanban board with all features is displayed in Figure 3.

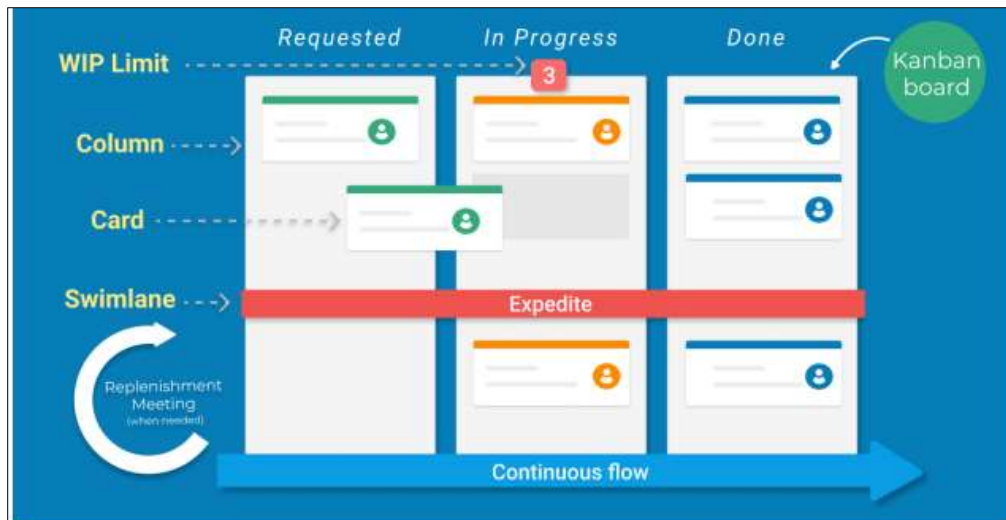


Figure 3: Kanban Board (Schwaber & Sutherland, *The Scrum Guide*, 2020)

With Kanban, the focus is on the team's capacity and adjusting the work in progress to this capacity (WIP). With WIP, the team limits the amount of work placed on each board column. For example, there is a maximum of four tasks (Cards) "In progress," and to add a new task to this column, a task has to be moved to "Complete". The WIP allows the team to focus on what needs to be done and have a faster output of results (Al-Baik & Miller, 2014). Additionally, the WIP helps identify a project team's inefficiencies. A process bottleneck may be identified before it causes harm or delay (Atlassian, 2019).

In contrast to Scrum, Kanban does not use fixed iterations. The task is completed when it is completed. This means that the quality of people aspect is even more critical to ensure delivery within an acceptable time. However, since Kanban does not have specific roles or rules, it can be applied by any team, in any organisation, from the IT department to the sales department. Kanban requires no drastic changes or revolutions to existing roles making it highly adaptable. It suggests that the team pursue incremental, evolutionary change and continuously improves.

### 2.1.2.3. *Scrumban*

With the rising popularity of Kanban, a part of the agile community took this as an opportunity to develop a new method (Alqudah & Razali, 2018). This new method aimed to improve Scrum teams on moving forward with a focus on evolutionary change and continuous improvements. This combination started Scrumban. According to the Scrum Master Trends Report survey 2019(Scrum.org, 2019), with more than 2100 scrum masters divided over 87 countries, 81 per cent of the participants use Scrum and Kanban together. Scrumban incorporates Kanban's concept and practises into Scrum while removing some rules.

Scrumban takes the following properties of Kanban Visualization of work, The limit on work in progress (WIP), Prioritizing, Extension of the board, Stop estimations and planning on demand.

The *visualisation of work* is compulsory with Scrumban, which can be seen as one of the main aspects since Scrum does not dictate the use of a board, while Kanban does. As mentioned in 2.1.2.2, the *Limit*

*Work in Progress* is one of the essential parts of Kanban. Scrumban applies this metric to Scrum, making it possible to focus on completing tasks. With WIP, scrum becomes suited for deployment in a pull system where tasks only get pulled when ready instead of being pushed in.

With Scrumban, *Prioritising* tasks becomes important. The teams organise the tasks in the Requested (To Do) column according to a straightforward rule: the task with the highest priority is at the top of the column. This way, the team works their way down along the tasks. The *Extension of the board* means adding more workflow columns to the visualisation board. This way, the team can have a more in-depth view of the progress of tasks on the board.

The *Stop estimations* property indicates that work does not have to be estimated. Any tasks that add no direct value to the product are considered waste in lean. Scrumban planning sessions must be quick and focused on prioritisation rather than estimation from this perspective. The last Scrumban property is *Plan on demand* (Al-Baik & Miller, 2014). Between Scrum and Scrumban, planning on demand is among the more significant distinctions. With Scrumban, the sprint planning sessions are removed, and the team only plans when necessary. Meaning that work comes straight out of the backlog until it becomes empty. This event signals to the team that more tasks should be scheduled.

With these properties, Scrumban enables teams to maximise output and minimise waste while increasing visibility and productivity. Additionally, it allows teams to maximise the benefits of agile planning, as seen in Figure 1: Traditional (Waterfall) project method VS agile project method. In Figure 4, an overview of Scrumban is displayed.



Figure 4: Scrumban (Schwaber & Sutherland, The Scrum Guide, 2020)

#### 2.1.2.4. *Extreme Programming (XP)*

Extreme programming (XP) is an agile process developed by five signers of the Agile manifesto; all were software developers. It was first started on March 6, 1996. It has been one of Agile's most popular and successful methods. The method was deemed quite successful because it focuses more on actual customer satisfaction than what it could be in the future. Within XP, the focus is on teamwork; customers, programmers, and managers are all considered equal partners. XP improves a software project in five fundamental ways: communication, simplicity, feedback, respect, and courage (Wells, 2013). The programmers in an XP team communicate with their customers and other programmers continuously. They maintain a basic and clean design. Feedback is obtained through testing their programme from the very beginning. The customer gets the results as quickly as possible and implements changes if needed; this process is displayed in Figure 5.

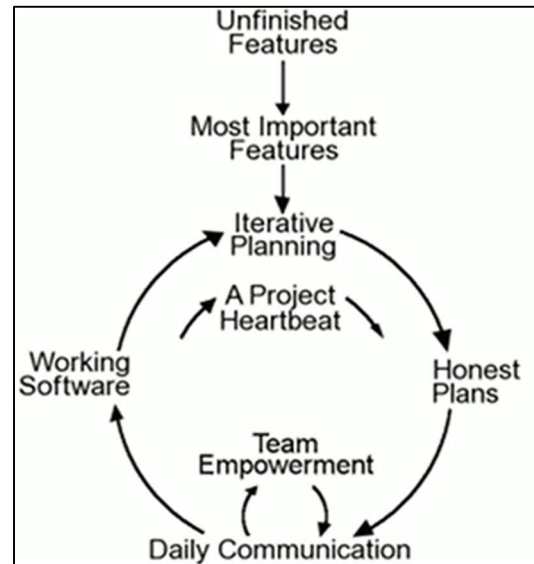


Figure 5: The process of eXtreme Programming (Wells, 2013)

Within XP, rules are applied in five parts: planning, managing, designing, coding, and testing. These five rules are implemented to reduce risks within a software project. With these rules, XP becomes highly usable in an environment with many changes in requirements and functional demands.

### 2.1.3. The success of Agile Software Development

The success of agile revolutionised the software industry, and the way projects were being addressed. In the study by Dikert, et al. (2016) on challenges and success factors when implementing agile, the following categories are mentioned as the most important success factors management support, choosing and customizing the agile model, training and coaching, and mindset and alignment. This study shows that agile is not an implemented off-shelf with a one size fits all solution. These factors and others mentioned in the research have to be respected and followed up if an agile implementation is deemed to succeed (Dikert, Paasivaara, & Lassenius, 2016).

Another study by Noteboom et al. (2021) mentions other factors that made agile successful. These are reduced costs, time, and increased quality (Noteboom, Ofori, Sutrave, & El-Gayar, 2021). These factors are all achieved by the dynamic properties of Agile project management methods.

This research investigated success factors for agile projects and divided them into three groups: project, team, and culture (Noteboom, Ofori, Sutrave, & El-Gayar, 2021).

Regarding the project group, it was mentioned that it is essential to break down large projects into smaller tasks, define clear product definitions, frequent updates, and describe precise criteria for a product. The team group's collaboration, expertise, and equal division of work were deemed the success factors. Finally, the culture section pointed out that the management must be on board with the agile way, and appropriate employee training was considered the success factor.

These success factors are not technical or only deemed possible in projects within the software industry. Thus, making it likely that Agile project management could also be applied outside of IT domains. Numerous studies state this application seems to be happening in the past decade. For example, the studies of (Oprins, Frijns, & Stettina, 2019) and (Zingoni, 2021). In paragraph 2.2, Agile use in other domains, research on this topic will be analysed and summarised.

#### 2.1.4. Large scale agile

The agile methods described in paragraph 2.1.1 apply to single teams or small departments. However, if multiple teams, departments, or the entire organisation work with agile, this can be seen as large-scale agile. Studies have been consulted to identify when to speak about large-scale agile. Some researchers address the required size for being large-scale agile regarding personnel size or project features, others in terms of project duration or budget size.

Dikert et al. (2016) research shows that these different large-scale agile interpretations are mentioned. A group of 40 employees divided into seven teams was called large-scale agile by Paasivaara et al. (2014). Berger and Beynon-Davies (2009) mentioned a group of 50 employees and a budget of over 10 million being large-scale agile. In research by Bjarnason et al. (2011), large-scale agile is described as a project with a lifespan of 2 years and over 80 features without explicitly mentioning the number of people involved in the project. In two other articles, large-scale agile is also described just on the number of people and teams. Moe et al. (2016) mention five teams of 50 people, and Moore and Spens (2008) mention 300 people divided over three sites.

Dingsoyr et al. (2014) define large-scale agile in their research as follows. If two to nine teams are agile, it can be seen as large-scale agile. If more teams are involved, it becomes even larger than large-scale agile. Based on these findings, Dikert et al. (2016) defined large-scale agile: as *“organisations with 50 or more people or at least six teams”*. They also mention one key difference between agile and large-scale agile. In the Agile Mindset, there is an emphasis on focusing on the product instead of the documentation. This is doable in small agile, but when agile is applied to large-scale organisations, this becomes a challenge since multiple departments must exchange information. So, the creation of documentation is a must. Contradicting the agile way of working and reducing the agility, the larger the agile scale gets (Dikert, Paasivaara, & Lassenius, 2016).

Multiple frameworks have been created to support the use of large-scale agile across organisations. Numerous frameworks are mentioned in the 15th State of Agile Report (2021), such as the Scaled Agile Framework (SAFe) and Scrum@Scale/Scrum of Scrums. These two frameworks are noted as the most used in this report. For this reason, only these two will be described in the next paragraph.

#### *2.1.4.1. SAFe Agile Framework (SAFe)*

The Scaled Agile Framework (SAFe) is the most well-known and commonly used framework (Digital.ai, 2021). SAFe served as a container (framework) for various agile methodologies and was created mainly for managing agile activities at a bigger scale. Scrum, XP, and Lean principles are applied within SAFe.

Within the framework, specific roles and activities help organisations work towards large-scale agile implementation. Besides these roles, the corresponding artefacts and activities are mentioned (Knaster & Leffingwell, 2020). Knaster and Leffingwell mention in a recent book on SAFe that there are three primary levels within a SAFe implementation: Essential (one project), Large Solution (several projects), and Portfolio (aligning strategy with execution).

In a whitepaper on SAFe (Scaled Agile Inc, 2021), it is described that SAFe is created around seven so-called core competencies. These are the following competencies: Lean-Agile Leadership, Team and Technical Agility, Agile Product Delivery, Enterprise Solution Delivery, Lean Portfolio Management, Organisational Agility, and a Culture of Continuous Learning.

The Lean-Agile Leadership competency focuses on the organisation's leadership and how they should guide their decisions by applying the Lean-Agile mindset, values, principles, and practices. The Team and Technical Agility competence define the essential Lean-Agile concepts and practices that agile teams should possess to ensure high-quality solution standards for their customers.

The Agile Product Delivery competency is a customer-centric methodology for creating, developing, and delivering a constant stream of valuable customer goods and/or services. The Enterprise Solution Delivery competency explains how Lean-Agile concepts are applied to develop, deploy, and operate applications and networks in modern organisations (Scaled Agile Inc, 2021).

The Lean Portfolio Management competency explains strategy and execution alignment on subjects such as finance, Agile portfolio, and governance by applying system thinking and Lean-Agile thinking. The Organisational Agility competency is about the capability that outlines how organisations can change company processes and strategy through clear and decisive commitments and rapidly adjust the organisation to benefit from new opportunities. The last competency, Continuous Learning Culture, outlines principles and practices that help motivate individuals and organisations to constantly improve their knowledge, competence, performance, and creativity (Scaled Agile Inc, 2021).



#### 2.1.4.2. *Scrum of Scrums (SoS)*

Scrum of Scrums (SoS) is a large-scale version of the Scrum method, as Paasivaara et al. (2012) mentioned. With SoS, multiple Scrum teams collaborate the same way they would with the standard Scrum. Additionally, each team has a designated individual who oversees the SoS meeting. Paasivaara also mentions that SoS is most effective with two to three weekly sessions.

The SoS teams decide internally which team member will be the so-called ambassador. These people participate in the larger scrum meeting of all the scrum teams. The SoS meeting will be conducted as the members are accustomed to; the primary difference with standard Scrum is that it will be conducted on behalf of the team's interests they represent instead of their interests (Agile Alliance, 2019). In a book on Large scale scrum, Larman and Vodde (2010) propose that each of these ambassadors should prepare what their team should do before the next meeting, how this is relevant for the other teams, and if there are any obstacles which help is needed from the other teams (Larman & Vodde, 2017). Figure 6 shows a visualisation of the scrum of scrums method.

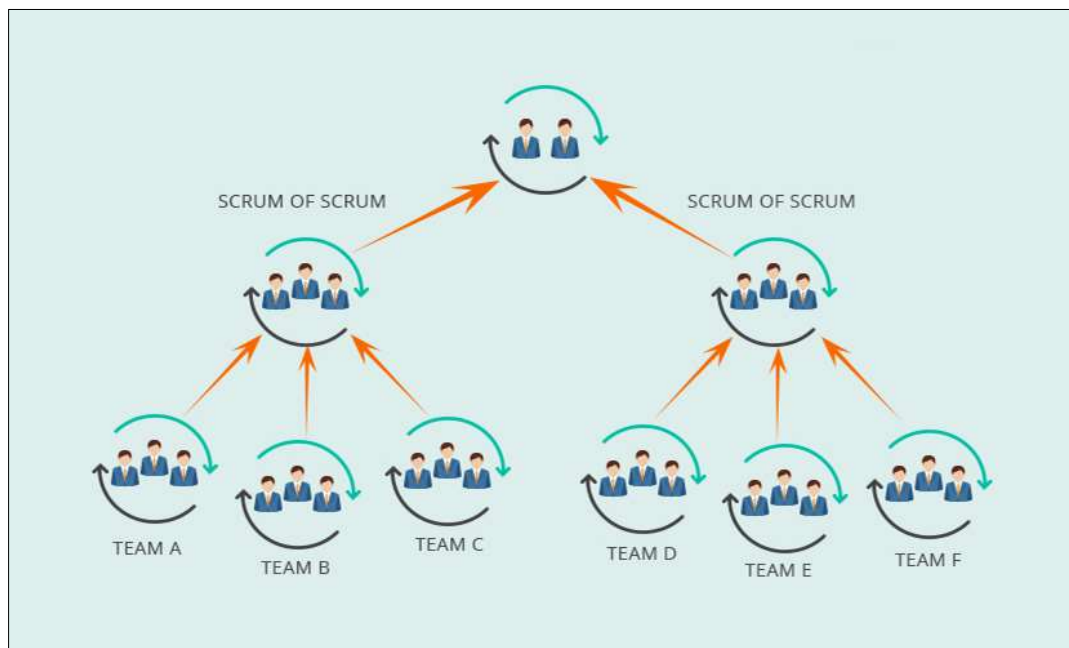


Figure 6: *Scrum of Scrums visualisation*

## 2.2. Agile use in other domains

In recent years, agile has expanded beyond software development boundaries into other domains outside of the IT domain. The goal for this expansion is the same as when the agile movement began: to become more adaptable and competitive (MIT Sloan Management Review, 2019). With a study in 2004 on agility across several domains, Conboy developed and assessed the Agile framework in the context of software development, resulting in the discovery of “Agile supply chains,” “Agile decision support systems,” and “Agile workforces.” These words were used consistently throughout organisations (Conboy & Fitzgerald, 2004). Conboy argues that agile should be seen from a “business-wide perspective,” implying it should not be seen as just a software development method.

The study by Oprins et al. (2019) found that agile methods are being used in various domains beyond information technology (IT). The study involved 18 interviews with individuals from various domains and revealed that businesses and departments often adopted agile practices inspired by their effectiveness in IT settings. These practices included short iterations of work, daily stand-ups, retrospectives, sprint planning, sprint review, and backlogs. Additionally, the study found that enablers of agile usage included team-based practices, a collaborative culture, flexible feedback, and development in sprints, which were organized into four categories: structure, process, culture, and work type.

The domains in which agile usage was identified included marketing, sales, communication, education, human resources, and research projects, as well as four new fields: management, business and finance; computer, engineering and science; education, legal, community service, arts and media; and healthcare, practitioners and technical (Oprins, Frijns, & Stettina, 2019).

In this study, we conducted further research on these domains and fields for agile usage. The following were picked domains: marketing, healthcare, education, sales, finance, and human resource management. Findings from this research, drawn from both academic literature and other sources such as experience reports and use cases, will be presented in the following sections.

### 2.2.1. Marketing

In the marketing domain, there were several cases where the introduction of agile impacted how marketing was performed. In a report by Jim Ewel (Ewel, 2013), a list of Agile marketing values is presented in the same way the agile values are shown in the Agile manifesto:

Focus on customer value and business outcome	<b>over</b>	Activity and outputs
Delivering value early and often	<b>over</b>	Waiting for perfection
Numerous small experiments	<b>over</b>	Opinions and conventions
Cross-function collaboration	<b>over</b>	Silos and hierarchies
Responding to change	<b>over</b>	Following a static plan

Ewel also describes a process for agile marketing. This process is described as iterative and must accommodate change. Out of this process, new features and changes for the product should become clear. It also explains that revisions should be made to the agile marketing model if this becomes clear from observations during this process. These observations apply to the scrum sprint and review (Schwaber & Sutherland, Scrum, 2010).

In another blog post by Jim Ewel (Ewel, 2020), Ewel writes about the application of the marketing portfolio Kanban. This application is described as a hierarchy of multiple Kanban boards to enable teams and individuals to view multiple projects and tasks and the relationships these projects and tasks have to the company's fundamental strategy and programs. It provides a good overview of the projects, their status, and where things stand in execution and deliverables for the executives. This way, the portfolio Kanban replaces status meetings and reports.

A new marketing operating model is described in another report by researchers from Mckinsey (Gregg et al., 2018). This model assumes that organisations embrace agile marketing and have established small, agile, cross-functional located close to each other and mainly independent teams that work only on a few specific business objectives. These teams comprise employees from different departments, like marketing, operations, finance, legal and IT and work together daily. It points out that this kind of Business Agility has three significant advantages(Robinson & Heller, 2017):

- Data analysts are placed inside the marketing team(s).
- Cross-functional agile teams can do more in less time. Without obstacles like interdepartmental approvals, the team can test new ideas, content, messaging, and value propositions more quickly and frequently. It reduces the required time from months to weeks or even days to develop new marketing campaigns or activities.
- IT-related solutions can be implemented faster and more efficiently because of IT and Marketing integration.

### 2.2.2. Healthcare

Most of the literature about agile and healthcare is about Agile software development and how this is used to deliver healthcare systems. However, some studies pointed out some agile management in the Healthcare Domain.

A report by Bain & Company in 2019 (Jonnalagadda et al., 2019) described redesigning a care delivery process inside one of the largest US health providers. It is not mentioned which one it is. The company created multidisciplinary teams of nurses, doctors, and apothecaries. Employees were asked to rethink their roles and responsibilities within these teams to reduce burnout and turnover.

The teams could also remove low-value but time-consuming operations (like redundant paperwork), automate routine tasks, implement procedures to save time, and reduce work-related stress (Jonnalagadda et al., 2019). These changes resulted in nurse turnover declining by one-third and work satisfaction increasing, positively affecting patient care and efficiency.

The same report mentioned that another company noticed its pricing was inconsistent with its customer segments. In search of a way to solve this, the company deployed agile teams to enhance their segmentation of clients, price guidelines, approval procedures, use of tools, reporting, and financial objectives.

For each of the mentioned areas, solutions were provided through the process of sprints. In these sprints, tiny modifications and innovations got tested with the help of prototypes. Based on feedback acquired from these actions, changes were made to sales operations and management. The results were that the company's performance improved on these small operations when the company started testing. The results eventually led to changes in the main processes and pricing of the company (Jonnalagadda et al., 2019).

There is another excellent example of agile application to healthcare teams in the Netherlands. The "Buurtzorg" healthcare organisation works based on agile principles (Leferink, 2018), with over 10.000 employees and 80.000 clients nationwide. This home care organisation comprises small teams of district nurses with a maximum size of twelve who independently provide home care. The teams are entirely self-managing and primarily organise their work themselves. The organisation removed most of the managerial layers of a typical company and made the organisation flat and cross-functional. The teams are supported by handheld devices that streamline the daily routines.

The technology was developed by a software engineer, some of the first Buurtzorg nursing teams. The engineer used a Scrum-like methodology, except they executed six sprints in one week instead of sprints lasting one or two weeks. The engineer listened to the team's needs and addressed them. Nurses contacted the engineer if they needed anything not already included in the system. The engineer would design it and then consult the nurses to ensure their needs (Linders, 2017).

### 2.2.3. Education

In the education domain, agile use is also reported. The paper by Oprins et al. (2019) describes the results of interviews with participants with an educational background. Participants used common agile practices such as daily Scrum, retrospectives, sprint planning and sprint reviews. This utilisation of scrum at schools was based on a modified version of Scrum to assist students with task organisation (Reehorst et al., 2019). To make the practices fit into the student schedules, they were shortened. At the same time, the teacher was executing the combined role of product owner and scrum master to guide the students in this whole scrum process. It is stated that the students experienced more fun in their classes and added benefit of being familiar with Scrum. Something that could be very helpful when applying for a job at places where scrum is used. In this context of Scrum at School, there is also a manifesto for agile education with its values (Reehorst et al., 2019).

Responsibility by students	<b>over</b>	Control by teacher
Kaizen mindset	<b>over</b>	Comply to rules
Cooperation	<b>over</b>	Individual excellence
Feedback	<b>over</b>	Grading
Move with changes	<b>over</b>	Following a static plan

Another study on agile use in the classroom mentioned that classroom roles are used differently from standard agile teams (Cubric, 2013). In this case, the teacher acts as the product owner and scrum master. In this role, the teacher reviews each student's work at the end of an educational sprint and provides feedback.

In a paper by Guillermo Rodríguez, Álvaro Soria, and Marcelo Campo, another implementation of agile coaching with Scrum on students produced positive results (Rodríguez, Soria, et al., 2016). According to Rodríguez, student performance was increased by at least 22% compared to students not receiving agile coaching. It increased how students could handle problems by having so-called checkpoint meetings as a version of the sprint review and sprint retrospectives.

One of the other agile methods of eXtreme Programming (XP) stirred the interest of researchers Domenico Lembo and Mario Vacca. Lembo and Vacca devised a method for instructional design based on the fundamentals of XP (Lembo & Vacca, 2012). They discovered that the concept of XP is remarkably suited for education because educational settings are continuously changing. Since students are humans, their learning responses are not completely predictable. This can also vary over time and across different types of students.

The primary focus of their method is to please students and parents by constantly developing unique projects and achieving results. Each project iteration involves collaboration between instructors, students, and parents, with a preference for face-to-face contact. According to Lembo and Vacca, the projects had to be based on real-world problems and have a short duration. This way, it is presumed that the projects would generate enough knowledge, skills, and capabilities (Lembo & Vacca, 2012).

The projects had most XP activities, such as analysing, solution forming, and problem-solving skills that may be used independently or collectively. The projects were handed out to students and parents as stories in which the parents acted as fictional stakeholders.

#### 2.2.4. Sales

Agile in the sales domain has some applications described in the literature, such as the book *Agile Sales: Delivering Customer Journeys of Value and Delight* by Brad Jeavons and Emily Jeavons (Jeavons & Jeavons, 2020), which describes the use of Scrumban within a sales team. With the introduction of the Kanban board, teams can improve their productivity and sales output. The improvement in the aforementioned book was accomplished by introducing the WIP limit, thus removing the possibility of overburdening or empty sales pipelines. The determination of the WIP is seen as a dynamic process and is adjusted with sprints. In these sprints, the sales team reviews their processes and projects. They can raise the WIP for a certain time if possible.

The other possibility is that a salesperson's pipeline becomes clogged with more significant and sophisticated sales opportunities. This resulted in a period of reducing the WIP in the Kanban pipeline to concentrate on the more substantial prospects. To keep the system filled and flowing without creating bottlenecks or accumulating breaks at any point.

Another study by Solingen, Sutherland, and de Waard (2011) introduced the usage of Scrum in the sales domain. They described the use of sprint reviews, iterations, and retrospectives. Three significant findings from the study are:

- The perceptions of the unpredictable nature of sales shifted, and the causal relationship between actions and order intake became visible.
- The sales teams increased their attention to how their processes worked and how they could be better managed. Resulting in constant prioritising and reprioritisation, emphasising the tasks that generate the most value.
- The use of scrum demonstrated how critical it is to maintain connections and referrals in sales. It made future business opportunities emerge from existing accounts.

Additionally, today's sales managers view an agile mentality as a good notion since it may be viewed as a response to the changing sales environment. The study demonstrates how sales managers may increase their businesses' adaptability and speed by increasing transparency, salespeople autonomy, self-leadership, and collaborative team-selling.

### 2.2.5. Financial

In the application of agile in the financial domain, the results were minimal. Most of the literature about agile in finance is about applying agile within the IT domain of financial companies. Therefore, it can be concluded that it is not valid for this research.

In the book '*Scrum for Dummies*', a section on finance describes the use of Scrum in the form of incremental funding (Layton & Morrow, 2015). With incremental funding, the focus is on maximising returns by delivering iterative portioned customer-valued functionality to maximise a project's net present value in contrast to what used to happen in companies when a team needed funding. The team would develop a business proposal containing a prospected return on investment (ROI) for the appropriate manager to request funding. If the funds were granted, the team would spend the total budget, deliver the project when done, or ask for more funding. Even if the project failed, most of the budget would probably be allocated or spent already. (Layton & Morrow, 2015).

With the incremental funding approach based on Scrum, a project team would only get 500k from the 3000k the team applied for. Then the team would first have to complete some of the earlier stages of the project and analyse if the ROI of 500k was still positive. If yes, then more funding would be allocated. If not, the choice can be made to drop the project without further losses.

With this approach to a financial scrum, companies have three advantages. First, the reduction of risk: stakeholders and product owners can evaluate the expected ROI at a low cost to see if it is still achievable. The second is the reduction of costs, and minimal investment is used at the start. The third is to maximise profits, early monetisation results in increased revenue (Layton & Morrow, 2015).

Incremental financing enables product owners and stakeholders to evaluate their ROI release-by-release. At each release, if issues arise, stakeholders can choose to invest in remedies or stop the project before more money is lost (Layton & Morrow, 2015).

Another source is Christine Hegarty's blog post article on September 6, 2011 (Hegarty, 2011). Hegarty describes scrum methods inside a team of accountants, like story maps, sprints, backlogs, and retrospectives. She explains that most financial activities are repetitive and follow a cycle. Bank statements arrive each month, and quarterly and annual tax returns must be filed. This area of finance lends itself very well to Scrum.

Hegarty proposed that standardising these procedures facilitates and accelerates data movement into and out of accounting. Working from a single backlog, the team can assist finance in operating quicker and more effectively. The blog post was written as an ongoing trial, but no further results were disclosed.

### 2.2.6. Human Resource Management

Agile is not just for IT anymore. It has entered other domains, and human resource management (HRM) is one. According to Peter Cappelli and Anna Tavis from Harvard Business Review (HBR) (Cappelli & Tavis, 2018), agile transforms how organisations attract, hire, develop, and manage their employees. The role of HRM is evolving from an administrative to a more strategic one. In the traditional sense, human resource management is focused on enforcing standards and rules. It now places a greater emphasis on managing internal staff. In this report, it is stated that HRM has two perspectives from an agile point of view. HRM has two perspectives, the first is how HRM should work internally, and the second is what HRM should deliver to the business (Ranasinghe & Sangarandeniya, 2021).

It is stated that agile Human Resources focuses on how human resources may apply an agile mentality to various work processes within a team, group, or company. Organisations must not be fully agile to practise agile human resource management. This entails increased collaboration, shorter work cycles, and a greater emphasis on collective contribution. Instead of each employee acting autonomously in response to top management orders, an agile strategy would require teams to collaborate to conceive, develop, and contribute to HR initiatives. Table 3 shows some of the differences between traditional and agile HRM.

<b>Traditional HRM</b>	<b>Agile HRM</b>
Top-down, hierarchical organisations can be seen. Decisions making power is not delegated among the parts of the organisation.	Practice a bottom-up approach where effective communication and the decision making foster
There are episodic processes that are standardised and reactive.	There are ongoing processes that are proactive. Processes are implemented on a need basis.
The HR role is to control and implement standards	The HR role is to support and coach organisational agility
Seldom feedbacks are present	Frequent feedbacks are present

Table 3: Difference between Traditional HRM and agile HRM source: (Thoren, 2017)

In their report, Ranasinghe and Sangarandeniya suggest that agile HRM comprises six core components (Ranasinghe & Sangarandeniya, 2021): agile recruitment, agile performance management, agile coaching, agile compensation, agile learning and development and agile career paths and succession management.

Some improvements within the aforementioned components state that recruiting new employees should move from a detailed process with fixed steps and responsibilities to a more flexible and straightforward process. Another improvement states that performance management, usually done annually, should move to continuous coaching and feedback-giving that can be seen in the organisation. Furthermore, rewarding an employee for good results should be done openly and transparently, instead of just the manager secretly giving his recognition and reward. This agile way of rewarding can inspire other employees in their work.



In another study by Zingoni, challenges are described when implementing the agile Scrum method in an HR environment to improve employee selection, performance management, and learning and career development processes (Zingoni, 2021), such as implementing cross-functional HR processes to ensure fast and dynamic results. However, human resource procedures are usually slow to progress on an organisation level, which can be quite challenging when implementing agile HR, Zingoni states.

In the third article by Stephen Denning, Denning suggests that talented workers within an organisation should be given a central role when formulating the strategy (Stephen, 2018). This role is accomplished by dividing the organisation into so-called 'units' with their own set of customers and work methods. All centred around achieving the highest customer value. This way, the organisation could contain the more talented workers while not promoting everyone to a managerial role and boosting the company's results.

### 2.3. Research Gap

After reviewing professional and theoretical literature on the use of agile methods outside of IT, it has become clear that there are plenty of non-IT applications of the agile methodology. However, most of the found sources are experience reports and are isolated to single cases. The link between the theoretical literature and different case studies is missing. There is also little work on the actual impact of using agile methods from a statistical or performance point of view.

### 3. Theoretical Framework

This chapter details the topics of agile and team performance that are being measured and the tools used to measure them. In paragraph 3.1, all the models that are used are described. In paragraph 3.2, the research model and the hypotheses being tested within this model are described.

#### 3.1. Building the research model

Proven research models have been used to construct the survey to measure the impact of Agile methods on team performance. The first model is the agile mindset model by Eilers, Peters, & Leimeister (2022) to measure the agile mindset. This model is followed up by a scientific description of the agile practices used in this study, based on the study of So & Scholl (2009). The second model is the teamwork quality model created by Hoegl and Gemuenden (2001) and used to measure the impact on team performance. The third and last model described is the agile maturity model by Laanti (2017).

##### 3.1.1. The Agile mindset

The agile mindset is a way of thinking and behaving that values and prioritizes adaptability, flexibility, and continuous improvement. It is centred on the belief that it is often more important to respond quickly to change and continuously improve rather than strictly adhering to a rigid plan (Ozkan, Ozdenizci Kose, & Gok, 2020). Measuring the agile mindset can be challenging, as it is a mindset, not a method. In a study by Ozkan et al. (2020), two main groups were created to understand better the agile mindset: agile principles that are process-relevant and agile principles that are people-relevant. In another study by Jakub Miler and Paulina Gaida (2019), 26 agile mindset elements were identified through surveying agile practitioners and literature research. These elements included attitudes towards customer satisfaction and needs, helping each other, openness to change, and transparency in decision-making and actions (Miler & Gaida, 2019).

A third study by Eilers, Peters, and Leimeister (2022) conceptualized the agile mindset in four dimensions: attitude towards empowered self-guidance, co-creation, learning spirit, and collaborative exchange. These dimensions were based on various literature on the agile mindset, including the studies by Ozkan et al. (2020) and Miler and Gaida (2019). The study provided questions for each dimension on a 1 to 5 Likert scale, which could be used to measure these four aspects of the agile mindset. For this reason, the study by Eilers et al. is chosen to use in this study since it can effectively be used to measure the Agile mindset. A more detailed description of each dimension is provided in the following subparagraphs.

#### *3.1.1.1. Attitude towards empowered self-guidance*

The first dimension is called “attitude towards empowered self-guidance” It is characterised by how much actors value reflection on themselves and their work processes, how well they arrange themselves, and to what extent responsibility is taken. Actors with this mindset like making proactive decisions about their work and reflecting on their practices (Eilers, Peters, & Leimeister, 2022). In the Agile manifesto, this is also mentioned (Beck, et al., 2001). Team members place a higher emphasis on achieving a goal (the “what?”) than keeping to a detailed strategy to accomplish the goal (the “how?”). Thinking and acting this way ensures that team members take responsibility for achieving the set goals and can adapt to adjustments on their own. This way of thinking is also typical for working in an agile environment, where employees are typically free to operate this way (Schwaber & Sutherland, 2020).

People with an elevated level of this mindset are often involved in practices that support a company’s digitalisation. They usually use digital tools to monitor their work, making it easy to improve it where needed, resulting in better results (Dingsøyr & Lindsjörn, 2013). This tooling usually goes hand in hand with project management and digital cooperation between team members to help organise the team, themselves, or the project.

#### *3.1.1.2. Attitude towards customer co-creation*

The second dimension is called “Attitude towards customer co-creation”. It is characterised by how much an actor is positively oriented towards value creation for the customer and how much communication goes with the customer. The actor should continuously involve the customer to acquire feedback on the project or product. Actors with an elevated level of this dimension believe it is important to always align with the value of the consumer to detect and respond to changes fast (Eilers, Peters, & Leimeister, 2022).

The actor is inclined to promote organisational digitalisation with behaviour from this dimension. An example of this is using digital communication channels with customers to acquire feedback from them quickly. This channel will enhance customer communication speed and result in faster feedback processing. It also gives the customer the feeling of involvement in the project (Thesing, Feldmann, & Burchardt, 2021).

#### *3.1.1.3. Attitude towards learning spirit*

The third dimension is called “attitude towards learning spirit”. This dimension is defined by how an actor values openness and actively seeks information relevant to their task (Eilers, Peters, & Leimeister, 2022). Mistakes and lack of knowledge are seen as opportunities to gain new knowledge instead of seeing it as an obstacle. This mindset appears to be especially vital in fast-changing environments because of the dynamic nature of the work (Oosterhout, 2010). Additionally, according to Kane et al. (2015), the actor must appreciate experimenting and trying new ideas to deal positively with this uncertainty.

People with this mindset are eager to develop new actions that create new value for the organisation or team. They are receptive to using new technologies to actively gain professional knowledge and skills that can help further advance their work, which positively influences their organisation's digitalisation process. Furthermore, they are more willing to accept more ambitious and possibly risky projects where many factors are uncertain or changing rapidly to work on (Thoren, 2017).

#### 3.1.1.4. *Attitude towards collaborative exchange*

The fourth and final dimension is called “attitude towards collaborative exchange”. This dimension relates to how much an actor values open communication and knowledge sharing to solve challenges by sharing ideas and information with co-workers. When working in fast-changing environments or agile teams, employees often have to work with people from other departments or specialities (cross-functional). This kind of work also brings different perspectives to the table. To make this work effective, teammates must be open about their work and communicate clearly (Misra, Kumar, & Kumar, 2009). Actors with a high level of this fourth dimension know to understand this way of working and are not bothered by the fact that they sometimes have to ask for help or help out a teammate (Eilers, Peters, & Leimeister, 2022).

The attitude that comes with this dimension often makes actors willing to share their work and knowledge through online platforms, such as an online workspace such as Microsoft Teams or Stack overflow (Morton, Stacey, & Mohn, 2018). They will also be inclined to promote this kind of behaviour and use these tools within an organisation, making them a supportive factor in the digitalisation of an organisation. In Figure 7, the entire model shows how the different attitudes correspond.

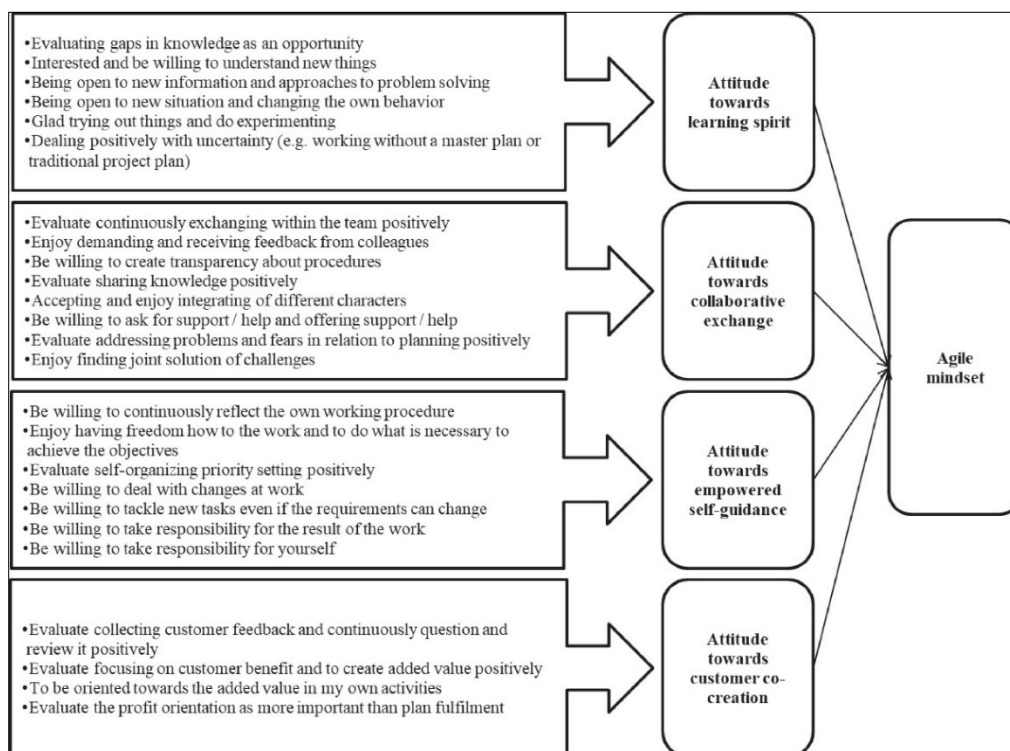


Figure 7: Data structure of the agile mindset (Eilers, Peters, & Leimeister, 2022)

### 3.1.2. Common agile practices

For this study, research has been conducted on the most commonly used agile practices in software development. To compile this list, multiple studies on these practices were consulted. In the study "Agile Software Development Methodologies and Practices" by Laurie Williams (2010), the author discusses the use of agile methodologies in software development and their benefits and challenges. Some of the agile practices mentioned in this study include customer collaboration, responding to change, and face-to-face communication. The study suggests that these practices can help teams deliver better results and improve the software development process, but they require careful planning and implementation.

In another study by Philipp Diebold and Marc Dahlem (2014), a mapping study was conducted to identify and classify commonly used agile practices in software development. The study found that the most commonly used agile practices were related to planning and coordination, such as sprint planning and daily stand-ups, and requirements engineering practices, such as user stories and acceptance testing.

In a study by Chaehan So and Wolfgang Scholl (2009), a tool was developed to measure the use of agile practices and their effects. This study grouped agile practices into eight categories: iteration planning, iterative development, continuous integration and testing, stand-up meetings, customer access, customer acceptance tests, retrospectives, and co-location. So and Scholl (2009) tested these practices for quantitative use. For this research, the So and Scholl practice list was used as a baseline, as these eight practices represent the most commonly used agile practices for quantitative use. A short description of each of these practices will be provided.

#### 3.1.2.1. *Iteration Planning*

Iteration Planning is a meeting where team members agree on the tasks to work on during the next iteration. Their actions are described through the use of committed iteration goals. Generally, the procedure is divided into two phases: the first phase involves the collection of requirements, usually in the form of user stories that work as a vehicle for communication from the team to the customer. The second phase involves revising, estimating, and prioritising the stories for inclusion in an iteration backlog (Gren, Knauss, & Stettina, 2018).

#### 3.1.2.2. *Iterative Development*

Iterative development is when teams continuously deliver sub-results of the project in short iterations of a fixed length. In most cases, a basic version of each result (feature) is then iteratively improved depending on the feedback generated from the basic version by the customer. The two fundamental standards for an organisation to be considered agile are iterations of four weeks or less and continuous integration (Williams L, 2012). Iterative development is a common approach in both agile development and user-centred design.

#### *3.1.2.3. Continuous integration & testing*

Continuous integration is mainly a coding philosophy and a set of procedures that encourages development teams to make minor code changes regularly and commit them to a version control repository. Holek and Jørgensen (2003) describe it according to two principles: the ability of development team members to contribute to the development version at any time and the second being the team members' responsibility to integrate their contributions correctly. To support continuous integration, the techniques are frequently coupled with (automatic) testing methods that enable the system to be verified on a timely basis (Hellmann, Sharma, Ferreira, & Maurer, 2012).

#### *3.1.2.4. Stand-up meetings*

A stand-up is a meeting that involves the core team of a project. In the case of a software project, this core consists of product owners, developers, and the scrum master. During these meetings, the team members provide each other with a status update on their tasks. As the name implies, stand-up meetings are held standing up and are generally timed between 5 to 15 minutes to emphasise their brief and intense character. During these meetings, the following three questions or lookalikes are generally discussed "How did I spend my time yesterday?", "What am I focusing my efforts on today?" and "What difficulties are impeding my progress?"(Radigan, 2018).

#### *3.1.2.5. Customer acceptance tests*

An acceptance test is a formal explanation of a product's behaviour or outcome, often given as an example of a use case. These scenarios or examples are usually established with the client. With these acceptance tests, the project team can determine which goals are met at the end of each iteration (Agile Alliance, 2008).

#### *3.1.2.6. Customer Access*

Customer access is all about the availability of the customer involved with the project. The goal is that the team can ask the customer for feedback and clarification on the project or product requirements in case this is needed. This feedback from the customer is deemed essential to an effective agile team. It is considered a fundamental success factor for successfully implementing the agile methodology (Misra, Kumar, & Kumar, 2009). However, gaining this kind of access to a customer can prove challenging to accomplish as an organisation.

#### *3.1.2.7. Co-location*

Members of the same team who share a physical location where face-to-face cooperation is feasible and encouraged can be seen as co-location (Innolution, 2022). Being close to each other as a team is also a critical success factor for successfully implementing agile (Lindvall, et al., 2002). Co-location is also seen as an easy way to improve communication among team members, improving knowledge sharing (Mudrack, 1989).

#### 3.1.2.8. Retrospectives

The retrospective is an activity that all agile teams must do when an iteration has ended. During this activity, the entire team describes in their own words how the iteration went to determine what went well and wrong. The goal is to let the team incorporate the successful practices into the next iteration and know what must be improved. This way, the team continuously improves their work (Paasivaara, Lassenius, & T., 2012).

#### 3.1.3. Measuring team performance and team quality

Teamwork Quality (TWQ) has been the subject of various frameworks in literature, including those proposed by Mathieu et al. (2008) and Rasmussen and Jeppesen (2006). Rasmussen and Jeppesen posit that psychological factors such as effective communication, strong leadership, trust among team members, conflict resolution skills, and team member training and support can impact teamwork and subsequently lead to positive organisational outcomes. Mathieu et al. (2008) argue that team composition, training and development, leadership, diversity, and technology can affect team effectiveness. In particular, they emphasize the importance of strong leadership, effective communication and collaboration, and diverse team perspectives.

A study by Hoegl and Gemuenden (2001) suggests that individual team member characteristics and team-level factors influence team performance. According to their model, high team performance is characterized by effective problem-solving, high-quality work, and high levels of innovation. Low team performance is characterized by poor communication, low levels of cooperation, and low levels of productivity. The model includes six subconstructs: communication, coordination, balance of member contribution, mutual support, effort, and cohesion. Hoegl and Gemuenden developed a comprehensive questionnaire to measure these subconstructs and their impact on team performance. This model will be utilized in the present study, and a more detailed description of the subconstructs is provided in the following section.

Subconstruct	Description
Communication	The frequency and formalisation of the information exchange
Coordination	The amount of structure between individual actions in the team
Balance of member contribution	Can all team members work to their maximum potential?
Mutual support	Do team members help each other out if needed
Effort	Are all team members putting enough effort into the tasks
Cohesion	Are the team members happy with the team

Table 4: TWQ construct and their subconstructs ( (Dingsøyr & Lindsjörn, 2013)

##### 3.1.3.1. Communication

The most straightforward element of the TWQ model is communication. Communication is described as the quality of communication within a team regarding the frequency and formalisation of the information exchange (Pinto and Pinto, 1990). Formalisation relates to what extent the communication within the team is spontaneous. Formal communication can be seen as meetings involving planning,



written status updates and reports. In contrast, spontaneous communication can be a brief conversation in the hallway, a quick phone call or talking while sitting at a desk. Frequency describes how team members communicate and how much time they spend communicating (Lindsjörn et al. 2016).

Ideas and contributions are often exchanged, argued, and evaluated faster and more effectively in a more informal manner than during formal communication, like a scheduled meeting. Additionally, team members must speak honestly to ensure the quality of their communication (Gladstein, 1984). Inadequate communication may hamper sharing of necessary knowledge and expertise for collaborative projects. Most agile teams work near one another in open-plan workspaces to encourage informal and transparent communication.

#### 3.1.3.2. Coordination

Coordination is described as the ability to manage dependencies between activities by Malone and Crowston (1994). These dependencies can be shared resources within a company or the need for multiple team members to complete a task. An essential aspect of TWQ is that these dependencies are harmonious and synchronised within a team (Brannick et al. 1995).

To accomplish this successfully and efficiently, teams must decide on standardised job breakdown structures, timetables, budgets, and deliverables. Thus, coordination requires teams to define and agree on a standard task-related objective structure with explicit sub-goals for each team member. When working in agile teams, the tasks are divided and prioritised when preparing the new iteration.

#### 3.1.3.3. Balance of member contribution

Each team member should be able to provide the team with all task-related information and expertise. This aspect is important for the quality of the team. This is even more important in teams where the tasks consist of different expertise areas (Lindsjörn et al. 2016). An excellent example of this is a software team. Such a team has different areas of expertise, like GUI development, testing, and system architecture. When only a few team members dominate the discussions, other team members can become less motivated, thus negatively impacting the TWQ. The daily stand-up meetings within agile are an effective tool to support and increase a healthy balance of team member contribution (Bjarnason, Wnuk, & Regnell, 2011).

#### 3.1.3.4. Mutual Support

Mutual support between group members is an integral part of teamwork quality. A cooperative mindset is better adapted to worker collaboration than a competitive mindset (Tjosvold, 1998). This means that team members should assist one another if requested or necessary and treat each other respectfully instead of outperforming one another. Team members should take the contributions that other members make in mind and appreciate them. Competitive behaviour will only lead to frustration and distrust among the team members.



On the other hand, mutual support facilitates the integration of team members' skills and is thus an essential component of teamwork quality. (Lindsjörn et al. 2016). There is a form of collective task ownership in some agile project methods, which helps promote mutual support and collaboration among the team members. An excellent example of this is joint code ownership.

#### *3.1.3.5. Effort*

An essential aspect of TWQ is that every team member assists the team with its tasks. Hackman (1987) highlights that encouraging effort in team interaction among members is needed to “minimise social loafing” and instead develop mutual commitment norms between team members and the team’s work. Everyone must know and accept these work norms regarding the effort to obtain high TWQ and minimise conflict among team members. A consistent amount of effort from all team members is deemed critical to the collaboration’s quality. A focus group study on what improves or hinders teamwork pointed out that prioritising tasks was identified as another important criterion for improving team effort (Dingsøyr & Lindsjörn, 2013).

#### *3.1.3.6. Cohesion*

The cohesion of teams refers to what extent team members are willing to be part of the team. Mudrack (1989) describes it as “a dynamic process that involves the tendency of a group to stick together and remain united towards its goals and objectives”. In a study, Mullen and Copper (1994) point out three factors impacting team cohesion: interpersonal attraction of team members, commitment to the team tasks, and group pride and team spirit.

In another study among software teams, it was found that cohesion was deemed a fundamental factor in impacting team performance (Lakhanpal, 1993). Agile teams are frequently located near one another in the office. In the agile approach, people and their interactions precede procedures and tools, highlighting the importance of team cohesiveness. Also, in this agile team context, a constant feedback loop contributes to team awareness and dedication to the team objective, contributing to more cohesion in a team.

#### *3.1.3.7. Team performance*

Hoegl and Gemuenden (2001) define team performance as the capability of a team to satisfy stated quality, cost, and time targets. Hoegl and Gemuenden also showed the impact of TWQ on team performance. In 2016 in a study by Lindsjörn et al., the same model was used to analyse agile teams, which showed a comparable impact of TWQ on team performance. Team performance and team effectiveness are frequently considered synonymous. Cohen and Bailey (1997) describe team performance as a part of team effectiveness, and Hoegl and Gemuenden (2001) describe team effectiveness as a part of team performance.

Team performance is defined in this research using the subconstructs effectiveness and efficiency. Effectiveness is to what extent a team satisfies product quality requirements. This subconstruct is mainly characterised by practical characteristics, such as durability, dependability, and performance in terms of more innovative projects, such as services, processes, or products.

Efficiency refers to how a team satisfies the project's quality standards. Efficiency can be measured by starting a marketing project at the right time and staying within budget with the project or desired product. Thus, effectiveness measures actual and desired outputs, whereas efficiency measures the difference between actual and desired inputs (Lindsjörn et al., 2016). The complete model of Hoegl and Gemuenden is displayed in Figure 8. As mentioned, only the team performance measure scales are used for this study.

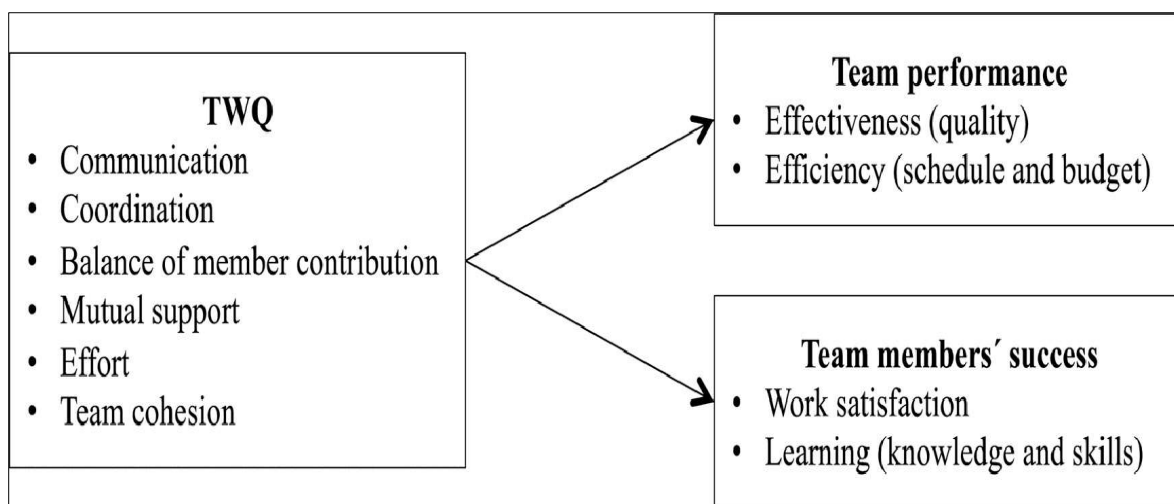


Figure 8: Conceptual model from (Hoegl & Gemuenden, 2001)

### 3.1.4. Agile Maturity

Not every company works agile at the same level. One company can have more skilled agile workers because they are already using the Agile framework for a long time resulting in higher maturity. Another company just started working agile and is not at the same level as the previous company. Multiple studies have been done to measure this ‘agile maturity’ to devise a model to measure it accordingly. One of these models is that of Maarit Laanti (2017). The Laanti model comprises three different layers in which agile maturity is measured. These layers are portfolio, program, and team. Within these layers, a certain level of agile maturity can be measured according to milestones such as ‘agile roles in use’ and practices such as ‘Scrum in use or automatic testing’. The levels in which a company can place itself are called beginner, novice, fluent, advanced, and world-class (Laanti, 2017).

In Figure 9, the entire model is displayed. This model is helpful for this study because it has a layer that focuses on team maturity. This layer can be used along with the team performance factors.

In another model, such as the model of Patel and Ramachandran (2009), there is no distinction between organisation levels. The focus lies on the entire organisation. This model also has five levels in which a company can position itself. These are initial, explored, defined, improved, and sustained. Another model is that of Turetken et al. (2017). This model has five levels: collaborative, evolutionary, effective, adaptive and encompassing. Within each level, essential principles and practices are displayed, such as ‘Collaborative planning’ or ‘Managing highly distributed teams. This model also distinguishes between organisation levels like Laanti, one of them being the team level, which should make it helpful for this study. But the team level of this model is built around using the SAFe framework, making it unsuitable for this study which does not only focus on SAFe.

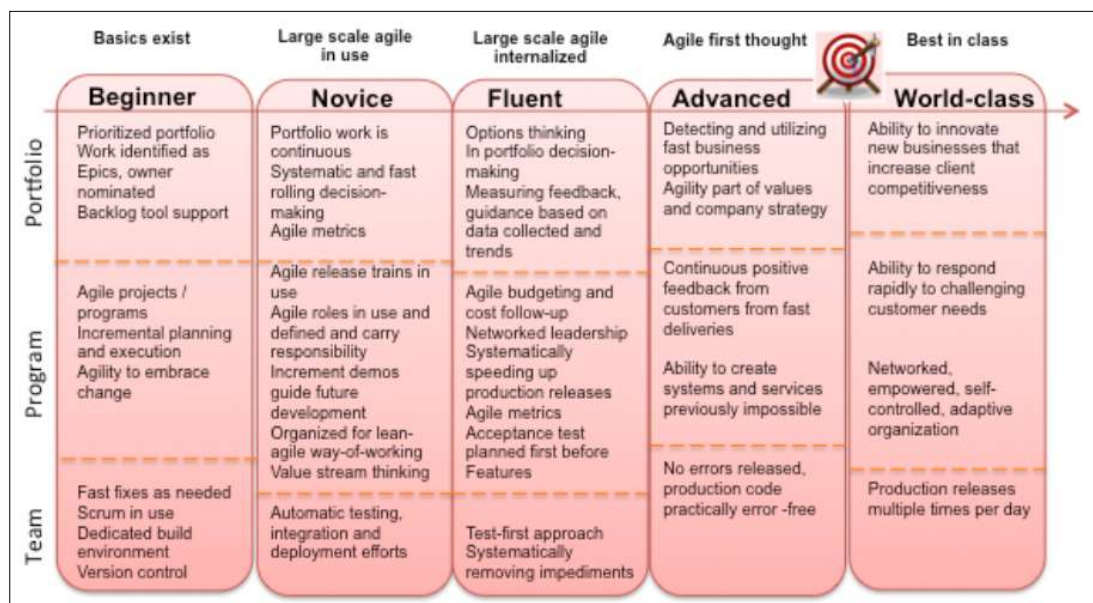


Figure 9: The Laanti maturity model (2017)

### 3.2. Research model

The first study on agile usage outside IT by Oprins et al. (2019) and a literature review on agile and team performance made it clear that agile is used outside IT in many ways. The part that is still unclear and can be seen as a research gap is that there is no research on the actual impact of this agile usage. Based on this research gap, the following research question has been formed for this study:

*In which domains outside of IT are agile methods applied, and what is the impact on team performance?*

Based on the created model, hypotheses can be drawn to find any link between these factors. For each dimension, different hypotheses have been created, with eighteen hypotheses. To make a visualisation of the hypotheses, a conceptual model has been created. This model is displayed in Figure 10.

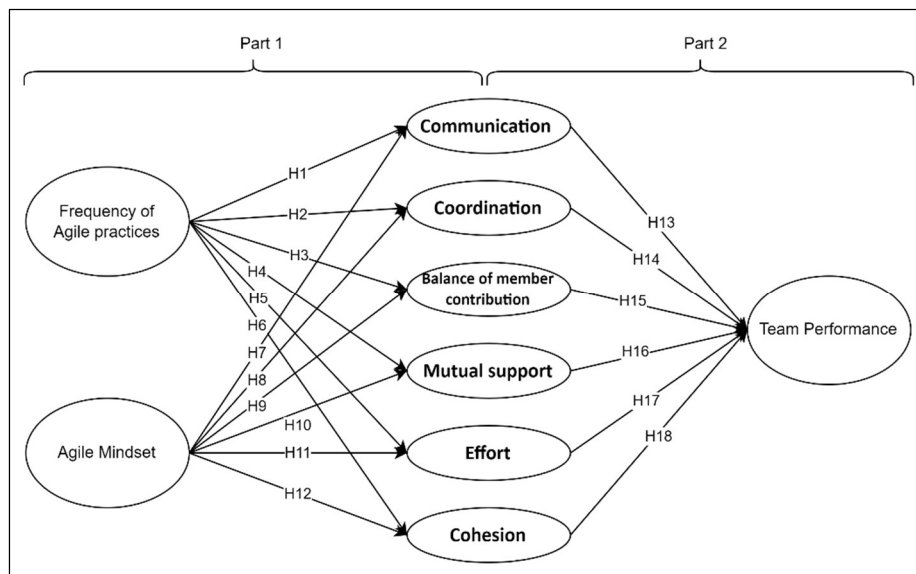


Figure 10: Conceptual model

- ❖ **Communication**
  - H1 – The frequency of the use of agile practices has a positive impact on the quality of communication.
  - H7 – Having an Agile mindset is positively related to the quality of communication.
- ❖ **Coordination**
  - H2 – The frequency of the use of Agile practices has a positive impact on the quality of coordination.
  - H8 – Having an Agile mindset is positively related to the quality of coordination.
- ❖ **Balance of member contribution**
  - H3 – The frequency of the use of Agile practices has a positive impact on the quality of the Balance of member contribution.
  - H9 – Having an Agile mindset is positively related to the quality of the Balance of member contribution.
- ❖ **Mutual support**
  - H4 – The frequency of the use of Agile practices has a positive impact on the quality of Mutual support.
  - H10 – Having an Agile mindset is positively related to the quality of Mutual support.
- ❖ **Effort**
  - H5 – The frequency of the use of Agile practices has a positive impact on the quality of Effort.
  - H11 – Having an Agile mindset is positively related to the quality of Effort.
- ❖ **Cohesion**
  - H6 – The frequency of the use of Agile practices has a positive impact on the quality of Cohesion.
  - H12 – Having an Agile mindset is positively related to the quality of Cohesion.

With Hypothesis ***H1, H2, H3, H4, H5, and H6***, the link between agile practices and the teamwork quality factors by Hoegl and Gemuenden (2001) is researched. With hypotheses ***H7, H8, H9, H10, H11, and H12***, the link between having an Agile mindset and the same teamwork quality factors are being researched. Agile's impact on teamwork quality can be determined with these twelve hypotheses.

The remaining six hypotheses are positioned on the right side of the model. These hypotheses focus on the impact each teamwork quality factor has on team performance according to the team performance model by Hoegl and Gemuenden (2001). This model was also used in their 2016 study by Lindsjorn et al., with a focus on agile teams, and they reported that it was also suited for an agile setup. Thus, the following hypotheses have been created to study this:

❖ **Team performance**

- H13 – the quality of Communication is positively related to team performance
- H14 – the quality of coordination is positively related to team performance
- H15 – the quality of Balance of member contribution is positively related to team performance
- H16 – the quality of Mutual support is positively related to team performance
- H17 – the quality of Effort is positively related to team performance
- H18 – the quality of Cohesion is positively related to team performance

## 4. Methodology

This chapter describes how the research question will be addressed. The study question, the research method used, and the justification for that choice are all presented in paragraph 4.1. In paragraph 4.2, the Unit of Analysis is introduced, focusing on the study group. Finally, paragraph 4.3 explains the research survey by describing its contents and how it is distributed to collect the data.

### 4.1. Research question and method

When deciding what research method to choose, it is essential to look at the data necessary to answer the research question (Kumar, 2014). In the last study on this subject by Oprins et al. (2019) on agile outside IT, a qualitative approach was used in the form of interviews.

In this study, hypotheses are being tested to answer the following research question: *In which domains outside of IT are agile methods applied, and what is the impact on team performance?* Data on factors linked and chosen to the research question are needed to test the hypotheses. All these factors were displayed in paragraph 3.2, Research model.

To gather the required data, a quantitative research method will be needed. This quantitative method will be that of a research survey. By conducting a survey, data can be collected consistently from a group of people on all the research model factors through a series of questions. This method is not uncommon for this kind of study, as seen by Aksekili & Stettina (2021) and Dingsøyr et al. (2016). This research uses some of the same models and methods used in these studies, so reusing elements of earlier surveys is possible. This improves the reliability and external validity of this study (Thomas, 2016)

### 4.2. Unit of analysis

Before starting a study, the unit of analysis must be determined. This will be the group of persons that will be analysed during this study. It is important to remember this while developing the survey to ensure the questions focus on the right kind of people (Thomas, 2016). The unit of analysis of this study will be of people that are part of a team working with agile methods outside of an IT domain. This unit can be deemed quite broad and vague. To clarify this, the following text is written.

*“If you are or have been part of a team not involved with software development, we consider this agile outside IT.*

*E.g., If you are in a team working for a marketing department of a software company, and you use agile methods to create marketing materials, this is considered agile outside IT*

*Why is this important: we want to understand if the product you’re working on is non-IT.”*

### 4.3. Survey design

The survey was designed in a top-down method. Starting with the research question to define the dimensions needed to construct the survey (Thomas, 2016). Based on this, already created and tested research models were found through the literature review and tied together in the research model. The survey consists of four categories. The first part assesses the demography, what agile practices are used, and the experience level with agile. The second part of the survey is about the Agile mindset, the third is about teamwork quality, and the fourth is about team performance.

The choice was to use already tested models and questions to ensure multiple researchers have properly tested the survey components instead of creating the questions and models myself. This would have taken up a substantial amount of time and was not necessarily needed since the materials required to construct the survey are available through online academic sharing (Fecher, Friesike, & Hebing, 2015).

The first part of the survey is constructed by reviewing other surveys combined with the required dimensions for this study. For the later sections of the survey, pre-constructed and tested survey designs are implemented to create a new survey. The three references for these constructs are that of the Perceptive Agile Measurement by Chaehan So (2009), the measuring of the Agile mindset by Eilers et al.(2022) and the teamwork quality model by Hoegl and Gemuenden (2001). All of these are explained in paragraph 3.1.

#### *Survey Design – Demographics*

The respondent's demographic information is asked in the first section of the survey. These questions allow categorising the participants based on experience or industry and looking for potential differences between certain answer groups. This section encompasses questions like job title, industry, experience with agile, and what kind of product/service they were working on. One of the most critical questions from this section would be the question that filters out the participants working with agile inside IT or IT-related tasks, so these can be filtered out for the results.

Within the demographics part is a second section that focuses on the agile usage of the user. This section consists of five questions to determine what methods and practices they use and to what extent they use these practices. The respondent is also asked what level of agile team maturity they would put themselves in, based on the maturity model of Laanti (2017). This allows looking for differences based on Agile maturity.

#### *Survey Design – The Agile mindset*

In the second section, the respondent is asked to answer 20 scale questions in a Likert scale format of 1 to 5, one being strongly disagreed and five strongly agree, divided into four subjects: ' attitudes towards empowered self-guidance, co-creation, learning spirit, and collaborative exchange. These four subjects will measure the Agile mindset of the respondent.

### *Survey Design – Teamwork quality factors*

In the third section, the respondent is asked to answer 38 scale questions in a Likert scale format of 1 to 5, one being strongly disagreed and five strongly agree, divided over six subjects: communication, coordination, balance of member contribution, mutual support, effort, and cohesion. These six subjects will measure the teamwork quality you are experiencing in your work. These six subjects together decide the quality of the teamwork the respondent is experiencing.

### *Survey Design – Team performance*

This is the fourth and final section of the survey. The respondent is asked to answer 15 scale questions in a Likert scale format of 1 to 5, one being strongly disagreed and five strongly agree, divided into two subjects: effectiveness and efficiency. These two subjects will measure the team performance of participants.

### *Survey Design – Closing*

At the end of the survey, there are two more questions for the participants, but these are voluntary. The respondent is thanked for their participation and can fill in their email address to receive the study results and fill in a comments section. This way, the respondent can leave additional information regarding the study, which could provide extra insights. The entire survey has been added to the appendix and can be found under Appendix B – Survey design.

## **4.4. Survey distribution**

The survey for this study was distributed through various online platforms, including LinkedIn, Slack, Facebook, Reddit, and MeetUp, and direct contact with potential participants via email or LinkedIn messages. While surveys can be a valuable tool for collecting data, it is important to be aware of the potential risks that may arise.

One risk is sampling bias, which occurs when the sample population being studied is not representative of the larger population being researched. This can happen if the survey or study is only distributed to specific groups or individuals with a particular attribute or characteristic relevant to the research question. This can lead to self-selection bias, where individuals are more likely to participate in the study if they possess this attribute or characteristic. This can result in a sample that is not representative of the larger population and may be biased in favour of those with the relevant attribute. To mitigate this problem, it is important to distribute the survey or study to a broader range of individuals, those directly related to the topic being studied and those not. This can help to ensure a more representative sample and reduce the potential for bias.



Another risk in survey research is lack of context, which refers to the inability to fully understand the circumstances or surroundings in which a phenomenon occurs. In the context of research, this can be a problem when studying online groups, as surveys and other research methods may not capture the full context of interactions and behaviours within the group. To address this, researchers may include open-ended questions in the survey to allow respondents to provide more context with their answers. This can help provide a complete understanding of the studied phenomena.

#### 4.5. Data analysis

This study uses two main tools for data analysis: Excel and JASP. Excel is a widely known program used for simple data analysis or preparation. The data and variables will be constructed in Excel and then imported into JASP, a statistical analysis tool developed by the Department of Psychological Methods at the University of Amsterdam, with support from other universities such as Nyenrode Business University, Utrecht University, and the University of Leuven. To analyze the data for the conceptual model displayed in Figure 10, the variables shown in Table 5 were created in advance. A darker shade of grey distinguishes the different sections of the model to indicate which parts belong together.

Variable name	Description
<b>Agile practices (AG-PR)</b>	
<b>AG-PR1</b>	Iteration Planning
<b>AG-PR2</b>	Iterative Development
<b>AG-PR3</b>	Continuous integration & Testing
<b>AG-PR4</b>	Stand-up meetings
<b>AG-PR5</b>	Customer acceptance tests
<b>AG-PR6</b>	Customer access
<b>AG-PR7</b>	Co-location
<b>AG-PR8</b>	Retrospectives
<b>Agile mindset</b>	
<b>A-Mind</b>	Total agile mindset score
<b>Teamwork quality factors</b>	
<b>TQ-C</b>	Total score communication
<b>TQ-CO</b>	Total score Coordination
<b>TQ-BMC</b>	Total score Balance of member contribution
<b>TQ-MS</b>	Total score Mutual support
<b>TQ-E</b>	Total score Effort
<b>TQ-COH</b>	Total score Cohesion
<b>TWQ</b>	Total score Teamwork quality
<b>Team performance factors</b>	
<b>TP-EFEC</b>	Total score Effectiveness
<b>TP-EFIC</b>	Total score Efficiency
<b>TEAM-PERF</b>	Total team performance score

Table 5: Variable codes and description

## 5. Survey data and descriptive analysis

The collected data will be examined and discussed in this chapter. Several statistical analyses have been performed on the survey-collected data. In the initial analysis, all the various characteristics are examined. Descriptive analysis is used to create various diagrams that illustrate these multiple traits. In paragraph 5.1, the data collection and the number of responses will be described. In paragraph 5.2, the data will be displayed, and in paragraph 5.3, a qualitative description of the job descriptions and agile usage reasoning per domain will be given.

### 5.1. Data and sample size

The collection of the data took place from June to October. There was a small challenge in collecting the required responses because the survey was meant for people working with agile outside IT. This is still a relatively new phenomenon, thus making it hard to find these people. Many of the people contacted were still using agile more in an IT environment than non-IT, thus making them not valid for the study. Another challenge was the month of August. In this month, almost no one responded to any message. This probably had to do with the holiday season, making August a month with a low output.

With the help of my channels, I contacted participants to fill in the survey and asked participants to spread the survey among their connections. Besides these channels, other external channels like LinkedIn and other forums have been used to distribute the survey. Since each response was anonymous, it was impossible to tell where it came from. From all the methods, 129 participants started the survey. From these 129 responses, 82 were filled in completely, giving the study a 64% completion rate. However, from these 82 responses, 11 participants were removed for analysis based on their answer on Q6 – I am part of a team: *“That is working in a software domain with agile”*. Bringing the total number of valid responses to 71.

From the Qualtrics environment, the data was exported into Excel, in which the data was prepared for analysis. From Excel, the data was imported into JASP, a statistical analysis tool. With this tool, the data is analysed and displayed for this study. Since no data on non-participants is available due to the nature of this survey, non-response bias cannot be assessed in this situation.

## 5.2. General characteristics

### 5.2.1. Industry domains

The participants are primarily from three distinct domains. These industries are financial services (22,54%), education (21,13%) and marketing (19,72%). The rest of the sample is divided into small numbers coming from the following domains: consulting (9,86%), public domain (5,63%), healthcare (5,63%), and manufacturing (4,23%). Other domains are shown in Table 6.

<i>Domain</i>	<b>Participants</b>	<b>Percentage</b>
<i>Financial Services</i>	16	22,54%
<i>Education</i>	15	21,13%
<i>Marketing</i>	14	19,72%
<i>Consulting</i>	7	9,86%
<i>Public domain</i>	4	5,63%
<i>Healthcare</i>	4	5,63%
<i>Manufacturing</i>	3	4,23%
<i>Engineering</i>	2	2,82%
<i>Entertainment</i>	2	2,82%
<i>Energy</i>	1	1,41%
<i>Media / Publishing</i>	1	1,41%
<i>Human Resource Management</i>	1	1,41%
<i>Communication</i>	1	1,41%

Table 6: Responses divided per industry.

### 5.2.2. Organisational size

The participants could choose out of six options to indicate the size of their organisation, but the sixth option (50.000+) was not picked, so this is not shown in Table 7. Most of the participants work in small organisations with only 10 to 250 employees, with a percentage of 46%. Followed up by organisations with 251 to 1000 employees with a percentage of 24% and 1000 to 5000 employees with a percentage of 16%. The other two categories can be seen in Table 7.

<i>Organisation size</i>	<b>Participants</b>	<b>Percentage</b>
<i>10 – 250 employees</i>	33	46%
<i>251 – 1000 employees</i>	17	24%
<i>1001 – 5000 employees</i>	12	17%
<i>5001 – 20.000 employees</i>	7	10%
<i>20.001 – 50.000 employees</i>	2	3%

Table 7: Organisation size

### 5.2.3. Years of working experience

The participants were asked to indicate how many years of general working experience they have and how many of these years they are experienced with agile methods. There is a more balanced split of the participants in the first three categories, with a slight increase in participants from categories one to three. Sixteen participants stated they have 1 to 5 years of experience (23%), 20 participants said 6 to

10 years of experience (28%), and 22 participants stated 11 to 15 years (31%). After this, a decline can be seen in participants, with only 8 participants saying they have 16 to 25 years of experience (11%) and 5 with more than 25 years of experience (7%). The complete comparison is shown in Figure 11.

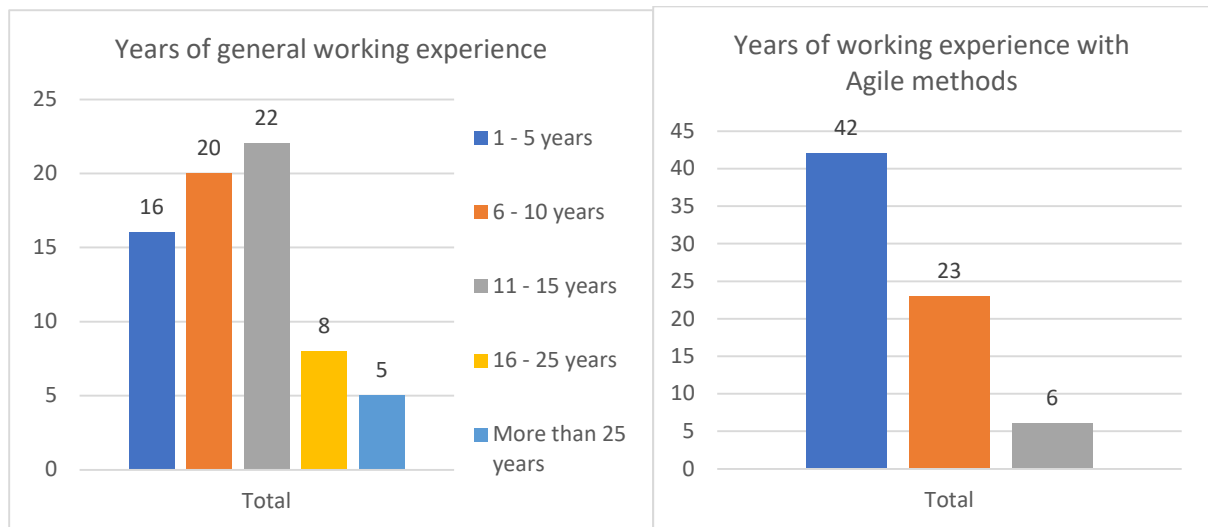


Figure 11: General working experience and years of working with agile methods

Figure 11 also displays the participant's years of experience with agile methods on the right side. The participants' divide leans towards the first two categories of 1 to 5 years and 6 to 10 years. The first category has 42 participants (59%), and the second has 23 participants (32%). These two categories have more than 92% of the participants. The third and final category is 11 to 15 years, with 6 participants (8 %). The remaining two categories of 16 to 25 years and 25 years or more were not picked.

#### 5.2.4. Team characteristics

For this question, all 82 participants are shown to indicate the difference between the participants, as described in paragraph 5.1. This question was used to filter out software-related agile users. Most participants said they are actively working with agile methods outside of IT, with 49 participants (60%). The other 22 participants (27%) indicated that they have worked with agile outside IT. And as displayed in Figure 12, only 11 participants (13%) indicated that they are working with agile methods but in a software-related domain, excluding their responses from further analysis.

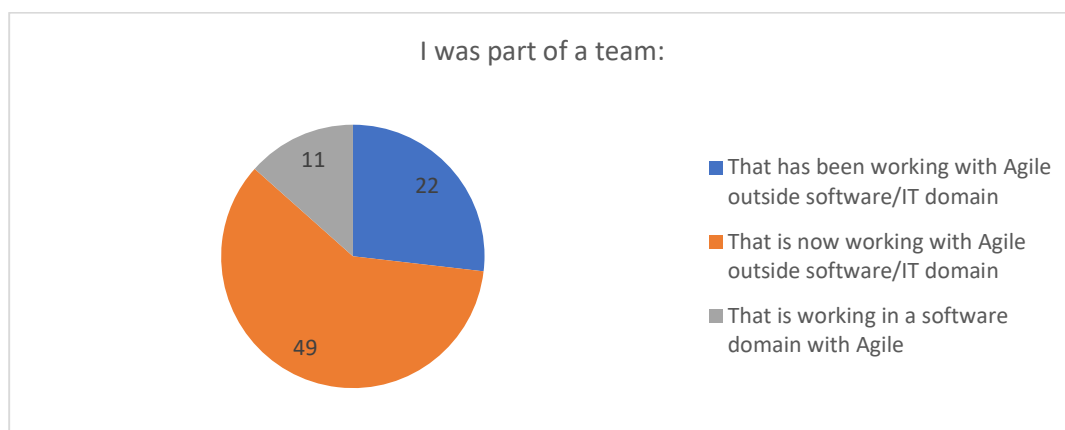


Figure 12: Division on working agile outside IT or not

The participants were asked to categorize their work as a service, like consulting, a product, like a marketing campaign or a combination of the two options, like weather forecasts. The examples are based on answers given by the participants. Service was the most significant category with over 56% of the participants, the combination being second with 26% and product at 18 %. The values per category are displayed in Figure 13.

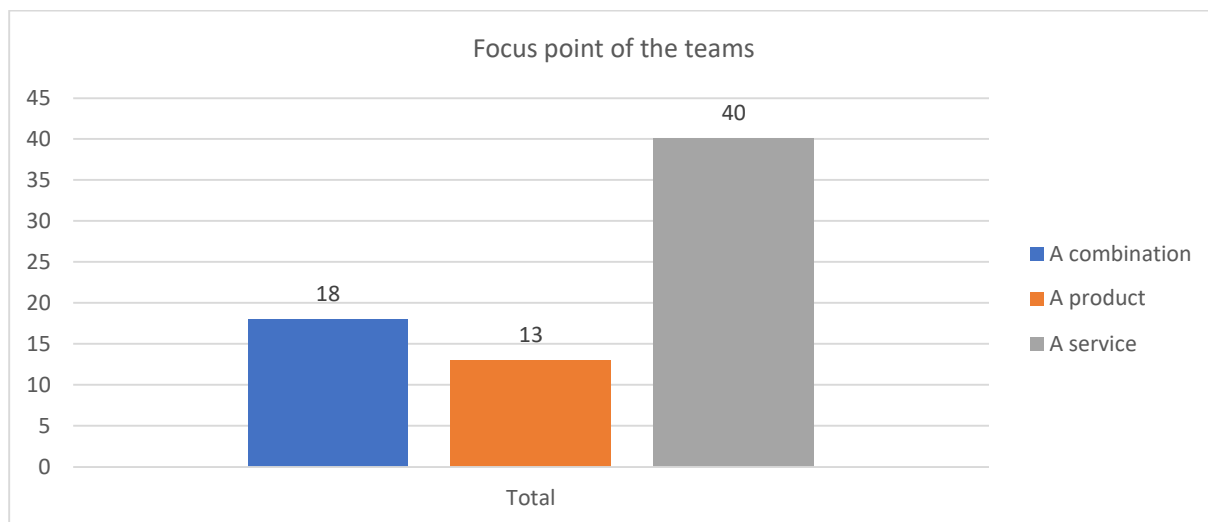


Figure 13: Focus point of the team

The participants could indicate their team size between 3 and 20+. The three categories that got the most participants are team sizes of 6 with 9 participants (13%), a team size of 12 with 8 participants (11%) and a team size of 20+ with 8 participants (11%). These three categories represent over a third of the participants. The rest of the categories are displayed in Figure 14.

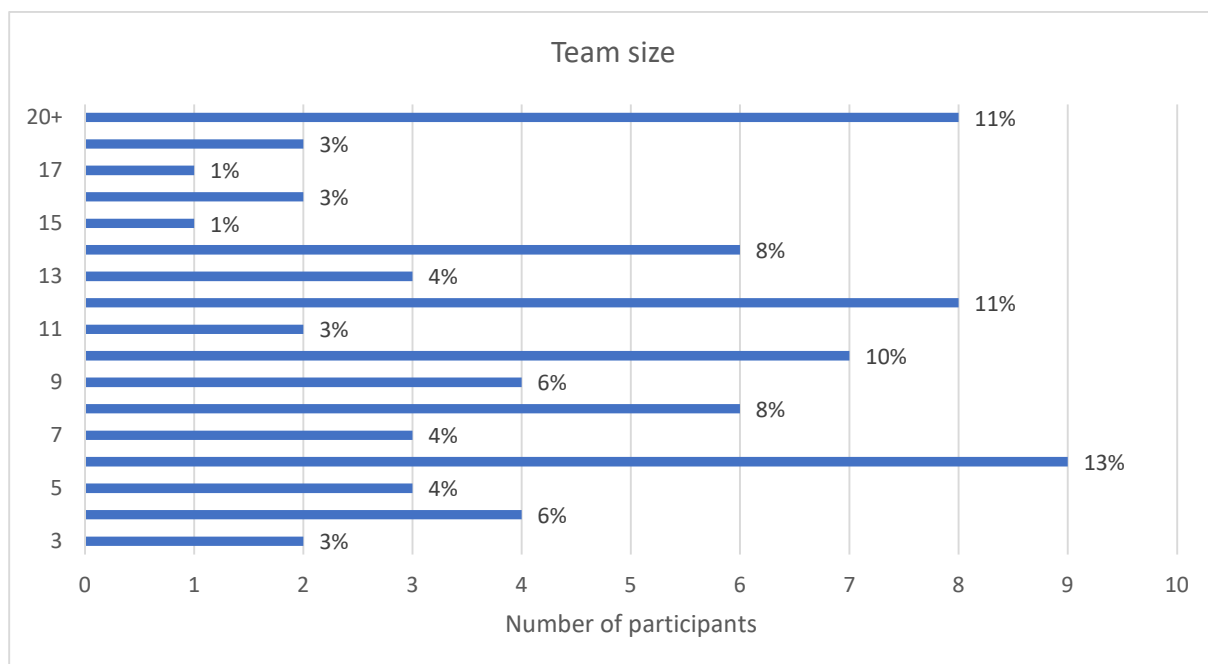


Figure 14: Team sizes

### 5.2.5. Application of agile methods and practices

The participants could select multiple answers for this question because multiple agile methods can be used. Because of this, the values are higher than there are participants. There were eleven choices to pick from that were based on the literature review from this study, but only nine were selected. The Scrum method has been chosen most often, with a score of 57 (45%), followed by the Kanban method with 27(21%). The third largest category is the internal created-based methods, with 15(12%). After this category, the method picks are more evenly matched, going with SAFe (6%), Lean Management (5%), Scrumban (5%), Scrum of Scrums (3%), Large scale scrum (2%) and The Spotify Model (1%). In Figure 15, all the figures are shown again.

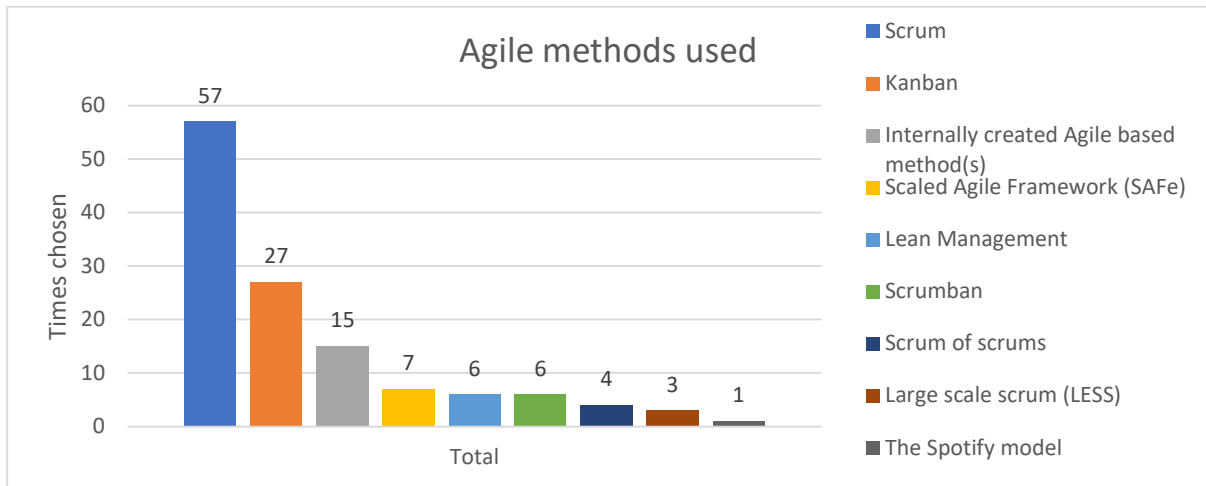


Figure 15: Agile methods being used

In Figure 16, the agile methods are displayed for each domain on a percentual basis, following the same colour scheme as in Figure 15.

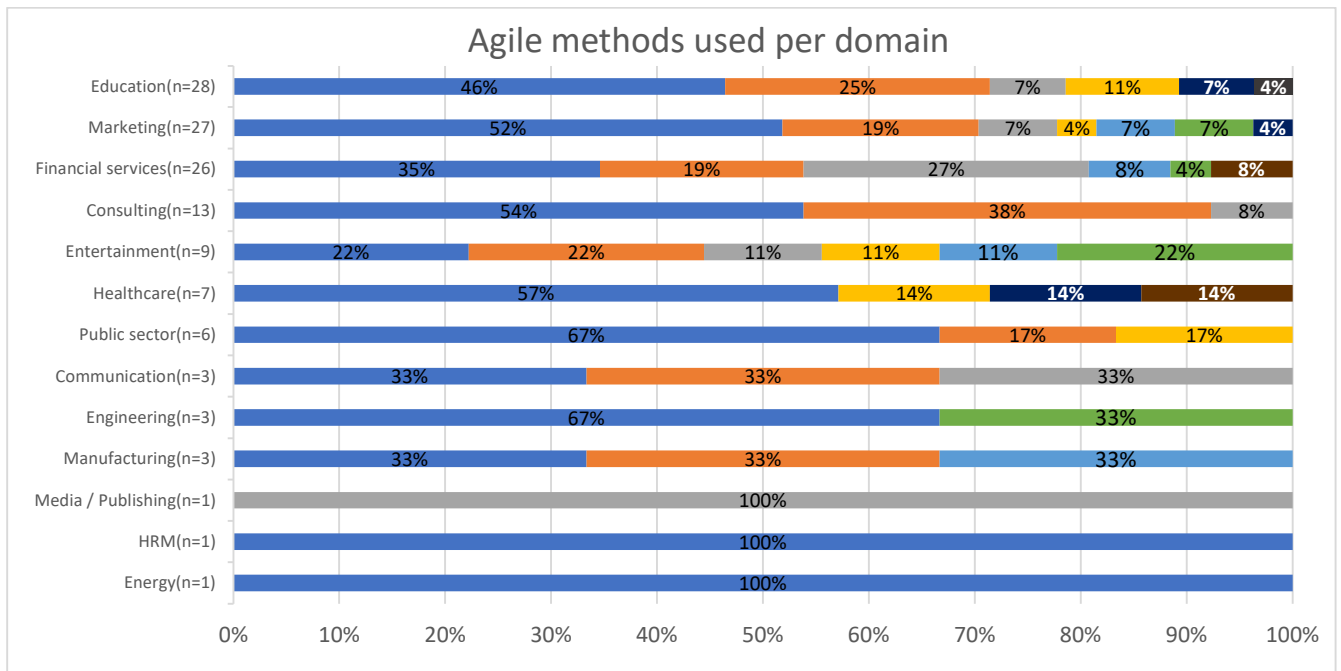


Figure 16: Agile methods percentual usage per domain (n= total amount of chosen agile methods)

For the agile practices, the participants could pick out eight practices. They could pick more than one. Figure 17 shows a display of the amount each practice is picked. This figure shows that iteration planning and stand-up meetings are picked the most, with 60 out of 71 participants and 85% of the participants. They are followed by the retrospective with 37 (52%) and customer access with 31 (44%). The co-location and iterative development practices follow closely with 24 (34%) and 23 (32%). The last two are continuous integration & testing, with 18 (25%) and customer acceptance tests, with 13 (18%).

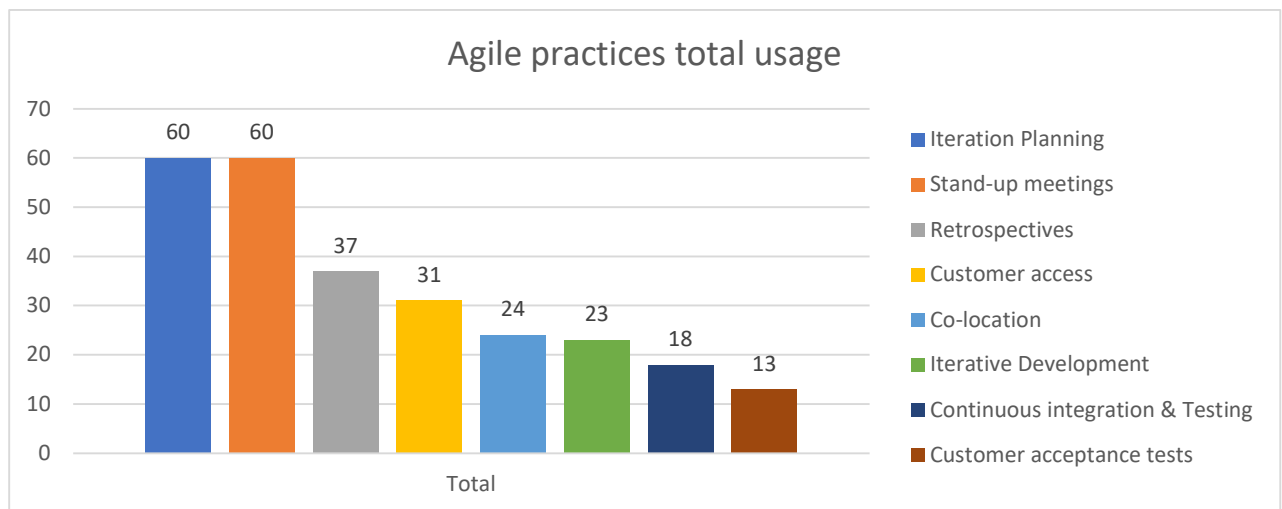


Figure 17: Agile practices total usage

In Figure 18, the agile practices are displayed for each domain on a percentual basis, following the same colours as in Figure 17. This figure shows that the practices are seemingly evenly picked throughout the different domains.

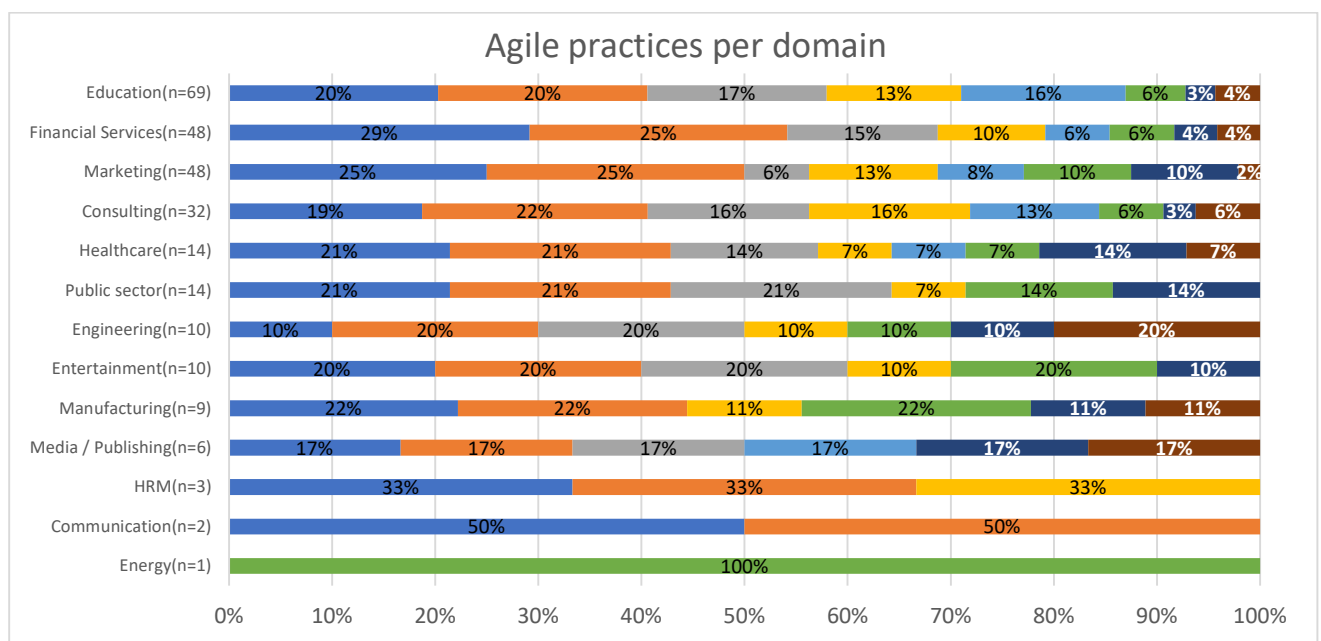


Figure 18: Agile practices percentual usage per domain (n = total amount of chosen agile practices)

### 5.2.6. Agile maturity and agile mindset level

The survey measured the maturity level of the participants regarding agile usage within their team. The Laanti model (2017), shown in Figure 9 on page 42, has been used for this testing. From this model, only the team-level layer is used. The biggest group of participants estimated their team on the beginner level with 28 (40%). The following two groups are closer, with 19 on the novice level (27%) and 18 on the fluent level (25%). Few participants chose advanced, with 5 (7%) and only one on world-class (1%).

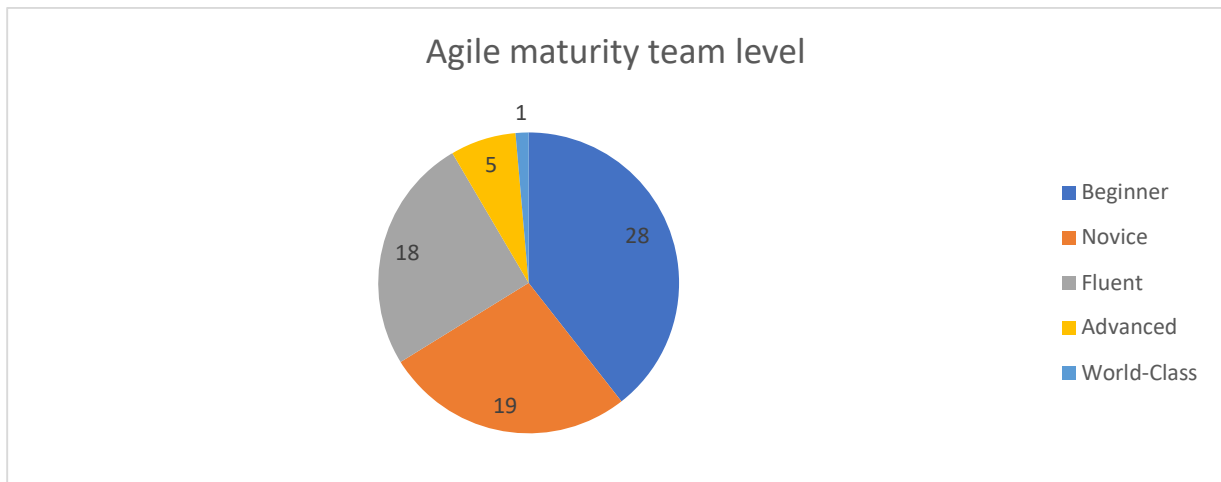


Figure 19: Agile maturity team level

Figure 20 displays the level of agile maturity and the average agile mindset score corresponding to the chosen category. This figure shows that the agile mindset score falls around value four between the maturity levels. This indicates that the participants give themselves a high agile mindset score, apart from what agile maturity level they pick. In appendix D, the corresponding statistic measure to this plot can be found. On the next page, Figure 21, it can be seen this figure shows the agile mindset level on the vertical axis and the components of which the mindset is made up across the domains on the horizontal.

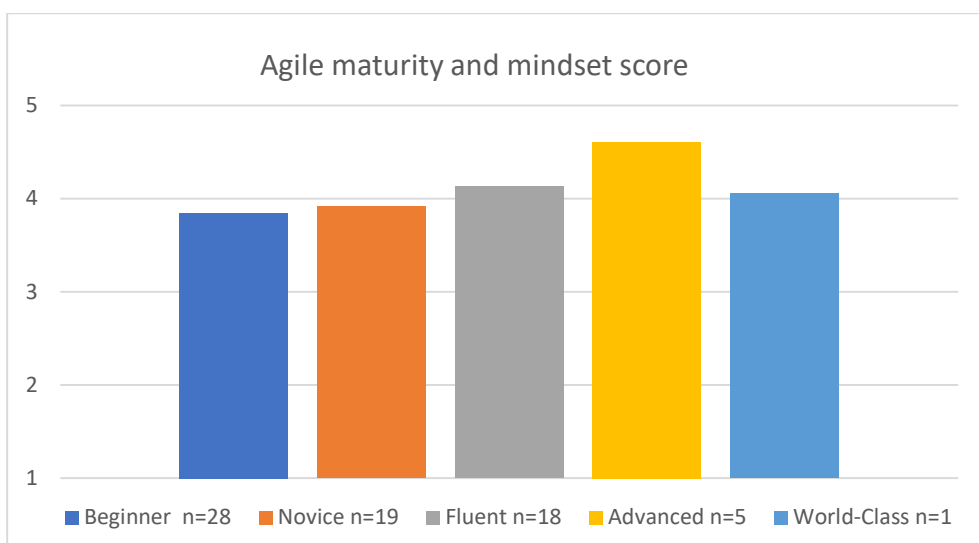


Figure 20: Agile maturity level and Agile mindset score



As described in paragraph 3.1.1, the agile mindset consists of four parts, self-guidance, customer co-creation, learning spirit and collaborative exchange. In Figure 21, the score of these four individual parts and the total mindset score can be seen across the domains. The figure shows that across all domains, the score for the agile mindset is on the same level, with an exception for HRM.

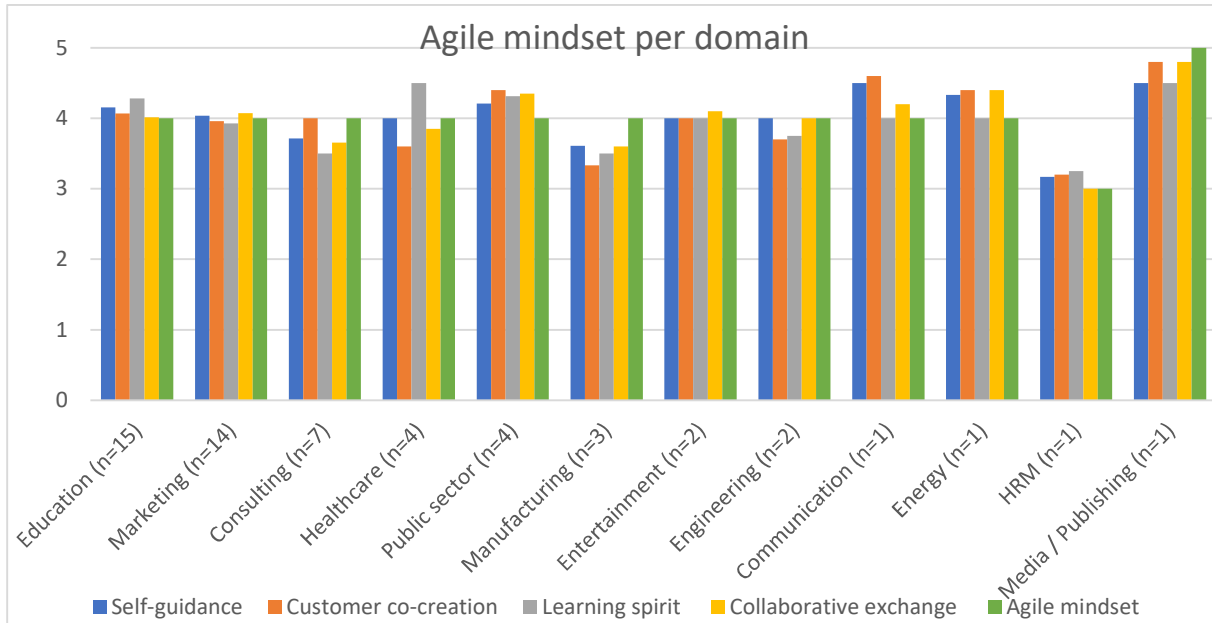


Figure 21: The Agile mindset score and the four parts of the mindset

### 5.2.7. Product life cycle

To attain more insight regarding using agile methods outside of an IT environment, participants were asked in which area of the product life cycle their team operates. The four options are displayed in Figure 22. The two most significant categories are marketing/consulting/sales, with 28 participants (39%), and design/development, with 24 participants (34%). These two categories represent 73% of the participants. The other two categories are production/assembly 14% and product planning 13% filling out the remaining.

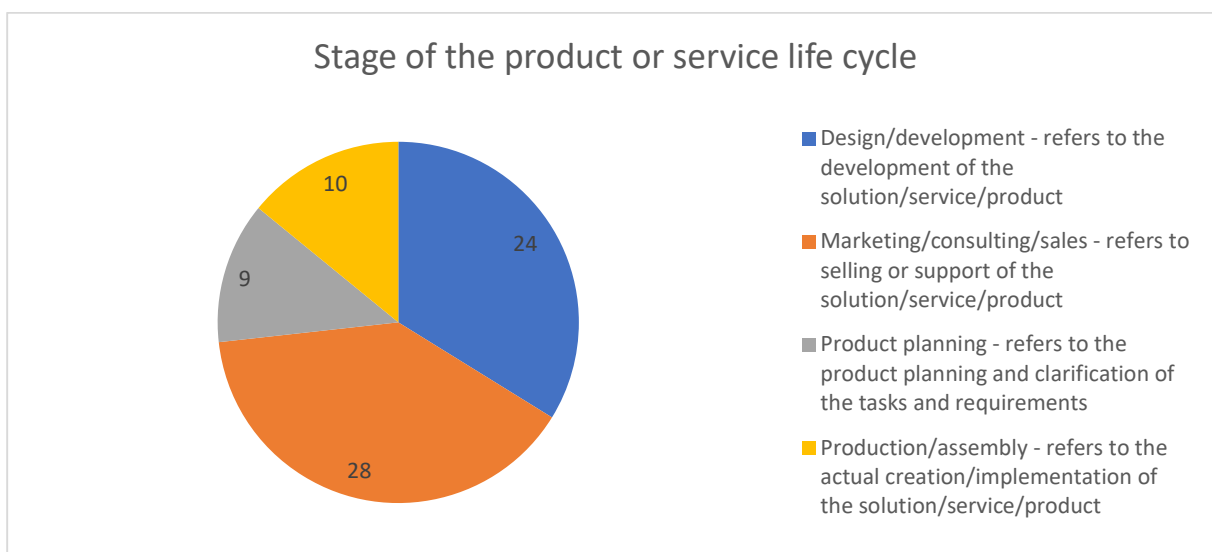


Figure 22: Product life cycle

### 5.3. Reasons for application for agile methods and job descriptions per domain

For the job description questions and the reasoning for agile usage, each participant could give their answer in an open question with a word limit of five hundred. Because of this, quantitative analysis cannot be performed on these questions. For this reason, a qualitative analysis has been performed on these three questions. The top six domains are picked because all other domains have a small number of samples and are deemed less relevant.

#### *Financial Services*

With 16 participants, the financial services domain has the largest sample share. The participants' job titles can be divided into three groups: *accountants*, *analysts*, and *collection/credit agents*. The type of their service or product is also grouped based on the similarities among the descriptions. The two most common descriptions are collecting outstanding accounts and providing financial analysis for their customers. The main reason for this is the clarification of tasks and improvement of the communication between team members. Table 8 shows individual answers and their reasoning for using agile methods.

Job title	Task description	Reasoning	Method	Service/ product	Practice
<b>Medior Credit management</b>	Debt Collection for our client	Improving our work method	Scrum	Combination	Iteration Planning
<b>Incasso agent</b>	Collect outstanding accounts	To ensure a steady flow of communication and collection of the accounts in the team	Scrum	Service	Iteration Planning, Stand-up meetings
<b>Senior Accountant</b>	Provide attestation of financial statements for publicly traded companies	Tight timelines and team structure	Scrum	Service	Iteration Planning
<b>Business insight analyst</b>	Banking services	Structure of planning and work	Scrum, Kanban, internal	Combination	Iteration Planning, Stand-up meetings Customer acceptance tests, Customer access, Retrospectives
<b>Data scientist</b>	Providing analysis	Seeing an open flow of tasks within the team	Kanban, internal	Service	Iteration Planning, Stand-up meetings
<b>Team manager</b>	Overseeing the billing process of customers	Swift and autonomous decision making	Scrum, Kanban	Service	Iteration Planning, Stand-up meetings
<b>Financial Analyst</b>	Stock analysis	Allocation of activities	Scrum	Service	Stand-up meetings, Co-location

Table 8: Finance domain examples

#### *Education*

With 15 participants, the education domain comes second in the sample. The participants' job titles can be divided into three groups: *students*, *teachers*, and *managers*. The task descriptions can be grouped into two: students managing their projects and schoolwork with agile methods. The second is the way of teaching that the school and teachers practice, like how they want the project processes to be done or how they want to teach the students specific skills. The reasoning for using agile methods can be divided into three subjects. First, schools and teachers want to give their students more autonomy in planning and completing tasks. The second is that they want to use agile methods to promote working together as a student team because teamwork can bring forth the best in students.

The third and last one is allowing students to provide feedback to each other on a routine basis. Table 9 shows some of the individual answers and the participants' reasoning.

Job title	Task description	Reasoning	Method	Service/ product	Practice
<b>Student Business Studies</b>	School projects to be completed in sprints	To ensure a steady form of planning in the required tasks and to be open to feedback	Scrum	Combination	Iteration Planning, Stand-up meetings
<b>Lecturer</b>	Education	Giving the students more decision power	Scrum, Kanban	Service	Iteration Planning, Stand-up meetings, Customer access, Co-location, Retrospectives
<b>Teacher</b>	Teaching students to do schoolwork scrum	A new way of teaching is applied within the school	Scrum	Service	Iteration Planning, Stand-up meetings, Customer access, Co-location, Retrospectives
<b>Teamleider</b>	Scrum in education	Following the Scrum@school theories	Scrum	Service	Iteration Planning, Stand-up meetings, Customer access, Co-location, Retrospectives
<b>Opleidings manager</b>	Education, Curriculum	Teamwork gives the best solutions and quality of education.	Internal	Combination	Iteration Planning, Stand-up meetings Retrospectives
<b>Agile coach</b>	Education	Clear goals, delivery of genuine products with value	Scrum, Kanban	Combination	Iteration Planning, Stand-up meetings, Customer access, Co-location, Retrospectives
<b>Lector</b>	Applications in educational fields	Efficient task processing	Scrum	Combination	Stand-up meetings Customer access, Co-location, Retrospectives

Table 9: Education domain examples

### Marketing

With 14 participants, the marketing domain comes third in the sample. For this domain, the job titles can be grouped into *marketing specialists*, *agile jobs (scrum master/ agile coach)* and *consultant*. The task description is straightforward: the development of marketing campaigns and consulting on marketing campaigns. The reasoning for using agile methods can be divided into two groups: the first is being able to adapt quickly based on changing trends or needs. The second is to divide big marketing projects into small sub-projects among teams. Table 10 shows individual answers and their reasoning for using agile methods.

Job title	Task description	Reasoning	Method	Service/ product	Practice
<b>Digital Marketing Specialist</b>	Theme and water park	It has increased the responsibility of individual employees and created a better workflow and overview of the work to be done.	Scrum, Lean	Service	Stand-up meetings
<b>Marketeer</b>	Development of marketing materials	Able to adapt quickly to changing trends from data	Scrum	Service	Iteration Planning, Stand-up meetings, Customer access, Co-location
<b>Marketing Manager</b>	Marketing campaigns	Short-iterated marketing campaigns and being able to make fast adjustments	Scrum	Service	Iteration Planning, Continuous integration & Testing, Stand-up meetings, Customer access
<b>Scrum master &amp; Brand strategic</b>	Developing marketing campaigns	To make smaller projects out of one big project	Scrum	Service	Iteration Planning, Stand-up meetings
<b>Agile coach</b>	Marketing campaigns	Delivery of small results in short amount cycles and ability to apply fast customer or data-based feedback	Scrum, Kanban	Service	Iteration Planning, Stand-up meetings, Customer access
<b>Marketeer</b>	Advertisement	Being able to adapt to market changes quickly	Scrum, Internal	Combination	Iteration Planning, Stand-up meetings, Customer access, Co-location
<b>Scrum Master</b>	Supports other teams in the implementation	Effective workflow	Scrum	Service	Iteration Planning, Iterative Development

Table 10: Marketing domain examples

## Consulting

With 7 participants, the consulting domain comes fourth in the sample. For this domain, the job titles can be grouped into *consultants* and *coach/trainer*. The task descriptions are mainly guide, train, and improve other people or organisations. The reasoning is also very much in line with each other. It is about open and transparent communication, receiving feedback and providing structure. Table 11 shows individual answers and their reasoning for using agile methods.

Job title	Task description	Reasoning	Method	Service/ product	Practice
<b>Consultant</b>	Guiding teams towards an agile working way	To teach other companies the way of working agile	Scrum, Kanban	Service	Iteration Planning, Iterative Development, Continuous integration & Testing, Stand-up meetings, Customer acceptance tests, Customer access, Co-location, Retrospectives
<b>Agile Program Coach</b>	Guiding organizations in their journey towards becoming agile	It makes the company more future-proof and able to adjust to quick changes	Scrum, Kanban	Service	Iteration Planning, Stand-up meetings, Customer access, Co-location, Retrospectives
<b>Consultant</b>	Improvement of business processes in different domains	Be able to communicate clearly what has to be done in a specific time frame	Scrum, Kanban	Service	Iteration Planning, Stand-up meetings, Customer access, Co-location
<b>Software trainer</b>	Giving software training to companies	Quick feedback, nice to have a structure in the lectures	Scrum	Service	Iteration Planning, Iterative Development, Stand-up meetings, Customer acceptance tests, Customer access, Retrospectives
<b>Team leader</b>	Overseeing the work of consultants	Creating an agile environment for quick responding	Scrum, Kanban	Service	Iteration Planning, Stand-up meetings, Retrospectives

Table 11: Consulting domain examples

## Public domain

With 4 participants, the public domain comes fifth in the sample. The public domain is relatively small compared to the other given domains, so for this reason, all the participants are shown in Table 12. The job titles are mostly agile-related roles like scrum master and agile coach. The tasks that they are working on are different from each other. One task description is the creation of informative guides for government subsidies. Another task description is the coaching of employees working the agile way. The reasoning for these tasks is more in line with each other with two main subjects. The first is the transparency of the work among team members, and the second is being able to act quicker and more flexibly to changes in the process or policies.

Job title	Task description	Reasoning	Method	Service/ product	Practice
<b>Scrum Master</b>	Digital tools	Transparency, quicker response, more flexibility to move	Scrum, SAFe	Product	Iteration Planning, Iterative Development, Continuous integration & Testing, Stand-up meetings, Retrospectives
<b>Consultant</b>	Public services	Not given	Scrum	Service	Stand-up meetings, Customer access
<b>Scrum Master</b>	Creating informative guides for government-related subsidies	Transparency, promptness of reaction, and increased mobility	Scrum	Product	Iteration Planning, Iterative Development, Continuous integration & Testing, Retrospectives
<b>Agile coach</b>	Coaching of government employees	Trying to make teams adjust faster to policy changes	Scrum, Kanban	Combination	Iteration Planning, Stand-up meetings, Retrospectives

Table 12: Public domain examples

## Healthcare

With 4 participants, the healthcare domain has the same number of participants as the public domain, so it shares the fifth place in the sample. As for the public domain, all the participants are displayed in Table 13. Two job titles are agile-related jobs with the scrum master and team leader. The other two jobs differ too much from each other to group them. As for the task descriptions, the same can be said with four different explanations. The subject that can group them is that the tasks are executed within a digital system. For the reasoning, it can be said that efficiency is the central pillar for using agile methods.

Job title	Task description	Reasoning	Method	Service/ product	Practice
<b>Data Specialist</b>	Database	Efficiency	Scrum	Combination	Continuous integration & Testing
<b>Scrum Master</b>	Diagnostic Instrument	To increase the team's delivery/time to market	Scrum, Scrum of scrums, large scale scrum	Combination	Iteration Planning, Stand-up meetings, Retrospectives
<b>Sales planner</b>	Partner management and sales planning	Planning with external partners	Scrum, Scaled Agile Framework (SAFe)	Combination	Iteration Planning, Continuous integration & Testing, Stand-up meetings, Customer acceptance tests, Customer access, Co-location, Retrospectives
<b>Team Leader</b>	Classification system	Efficiency	Scrum	Combination	Iteration Planning, Iterative Development, Stand-up meetings

Table 13: Healthcare domain examples

## 5.4. Tasks and related agile usage across domains

The participants described why they are working with agile methods, and based on this information, a grouping was made. This grouping is made so that the reasoning can be seen across domains. The reasons are divided into seven categories, shown in Table 14. All the individual answers were analysed and coded to develop these categories. Based on this coding, a count of the methods and practices linked to the participant's response has been made. The corresponding count tables can be found in Appendix C. Based on this count, the top two methods and the top three practices were picked for each category. This process led to the creation of Table 14: Reasoning, method, and practices across domains. Table 14 gives an overview of the main reasons agile is being used and what methods and practices are used the most. Figure 23: Reasoning for agile across domains can be found on the next page.

Global reasoning	Method	Practices
<b>Creating an overview of tasks</b>	Scrum, Kanban	Iteration Planning, Stand-up meetings, Retrospectives
<b>Improving communication</b>	Scrum, Kanban	Iteration Planning, Stand-up meetings, Retrospectives
<b>Encourage individual decision making</b>	Scrum, Internal	Iteration Planning, Stand-up meetings, Retrospectives
<b>Becoming more flexible</b>	Scrum	Iteration Planning, Stand-up meetings, Customer access
<b>Becoming more efficient</b>	Scrum, Kanban	Iteration Planning, Stand-up meetings, Retrospectives
<b>Improve time-to-market</b>	Scrum, Internal	Iteration Planning, Stand-up meetings, Customer access
<b>Allow for easier receiving and processing of feedback</b>	Scrum	Iteration Planning, Stand-up meetings, Customer access

Table 14: Reasoning, method, and practices across domains

Figure 23 shows the given subjects from Table 14 across the domains on a percentual basis. In this table, the divide of the reasoning seems evenly spread in the upper categories with a higher number of participants. In Figure 24, the reasoning subjects' total numbers and their percentage are shown. This figure shows that the most picked reason is 'Creating an overview with tasks' with 26 (21%) followed by three subjects, 'Improve time to market', 'Becoming more flexible' and 'Becoming more efficient' with the same values 21 (17%). The values of the remaining categories can be looked at in Figure 24.

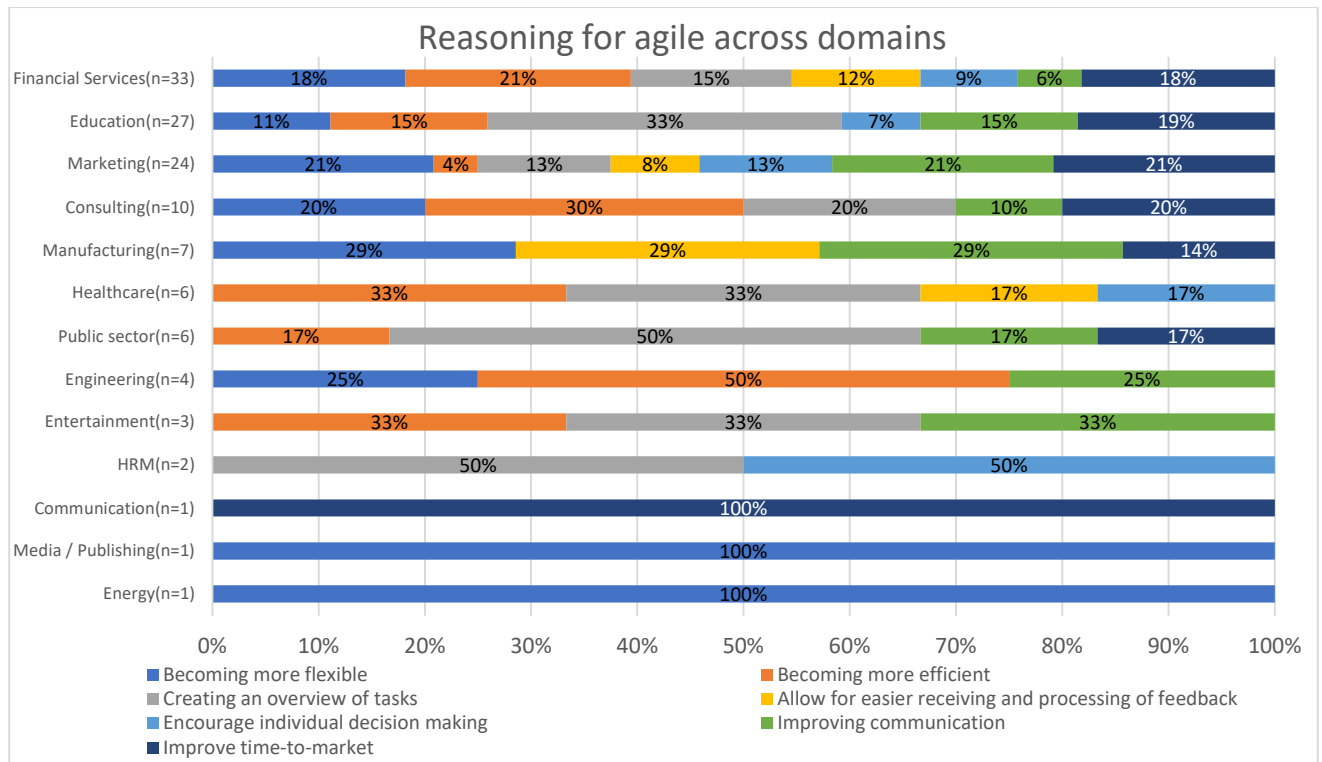


Figure 23: Reasoning for agile across domains

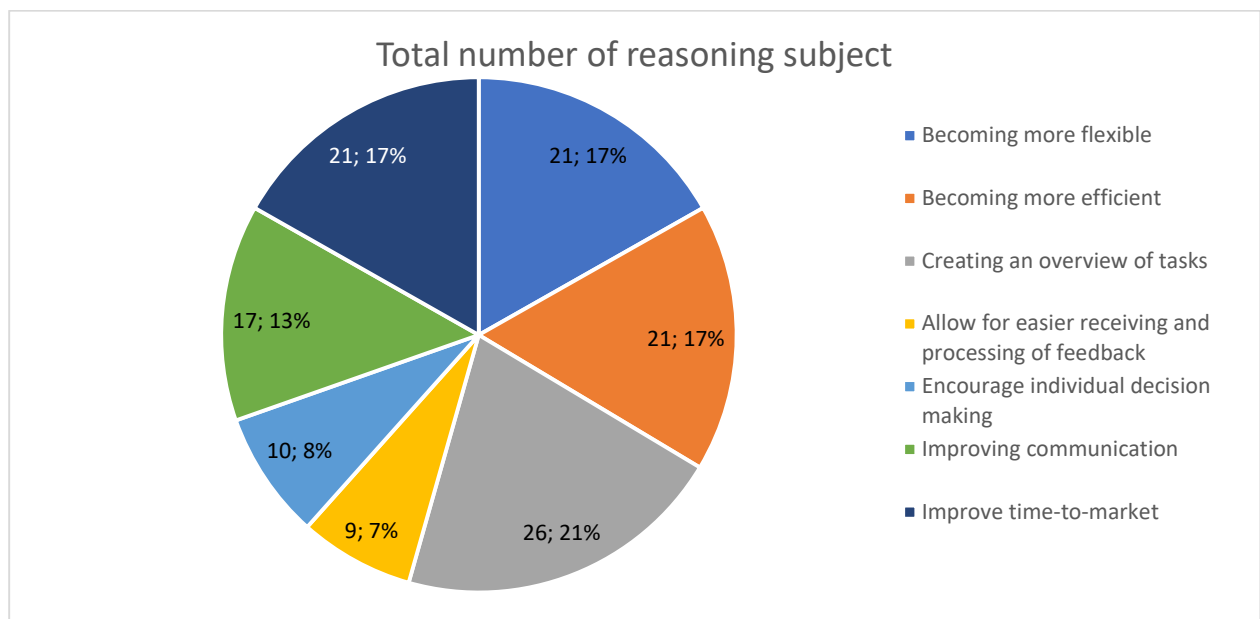


Figure 24: Total number of reasoning subjects (n-total= 125)

## 6. Hypotheses and correlation testing

The relationships between the elements of the hypotheses will be examined in this chapter. The correlations between the agile mindset and agile practices' impact on team performance have been analysed. Besides the hypotheses analysis, the data has been studied for other interesting findings not displayed in the original research model. In Table 15, the descriptions of the acronyms are shown to be used as a legend for the following correlation tables.

Variable name	Description
<b>Agile practices (AG-PR)</b>	
<b>AG-PR1</b>	Iteration Planning
<b>AG-PR2</b>	Iterative Development
<b>AG-PR3</b>	Continuous integration & Testing
<b>AG-PR4</b>	Stand-up meetings
<b>AG-PR5</b>	Customer acceptance tests
<b>AG-PR6</b>	Customer access
<b>AG-PR7</b>	Co-location
<b>AG-PR8</b>	Retrospectives
<b>Agile mindset</b>	
<b>A-Mind</b>	Total agile mindset score
<b>Teamwork quality factors</b>	
<b>TQ-C</b>	Total score communication
<b>TQ-CO</b>	Total score Coordination
<b>TQ-BMC</b>	Total score Balance of member contribution
<b>TQ-MS</b>	Total score Mutual support
<b>TQ-E</b>	Total score Effort
<b>TQ-COH</b>	Total score Cohesion
<b>TWQ</b>	Total score Teamwork quality
<b>Team performance factors</b>	
<b>TP-EFEC</b>	Total score Effectiveness
<b>TP-EFIC</b>	Total score Efficiency
<b>TEAM-PERF</b>	Total team performance score

Table 15: Correlation variable codes and description

### 6.1. Descriptive statistics

For the first part of the survey statements about the agile mindset and the teamwork quality model, a 1-5 Likert scale was used to measure the participant's satisfaction and agreement with the given statements. For each element of the model, between four to ten different statements were given in, which the participant had to answer. On the next page in Table 16, the summary of the agile mindset and teamwork quality data points are given.

	Valid	Missing	Mode <sup>a</sup>	Median	Mean	Std. Deviation	Minimum	Maximum
A-Mind	71	0	3.729	4.000	4.001	0.526	2.008	4.900
TQ-C	71	0	3.100	3.500	3.501	0.606	1.900	4.900
TQ-CO	71	0	4.250	3.500	3.563	0.677	1.500	5.000
TQ-BMC	71	0	3.667	3.333	3.399	0.719	2.000	4.667
TQ-MS	71	0	4.000	3.857	3.722	0.616	2.000	5.000
TQ-E	71	0	3.000	3.250	3.282	0.667	1.500	4.500
TQ-COH	71	0	3.300	3.400	3.513	0.564	2.500	5.000
TEAM-PERF	71	0	3.100	3.600	3.606	0.609	1.900	4.950

<sup>a</sup> More than one mode exists, only the first is reported

Table 16: Descriptive statistics for the Agile mindset and teamwork quality model

The results in Table 16 demonstrate that the mean and median are comparable, indicating a reasonable degree of symmetry in the data distribution. The mode shows the most frequent number in the sample dataset; this value could range from one to five because a Likert five scale was used. All of the research aspects had an average to a positive level of satisfaction, with TQ-CO and TQ-MS being the two highest, according to the mode. The standard deviation of the data is relatively low compared with the mean, indicating that the data is more clustered around the mean and has low variability.

	Valid	Missing	Mode	Median	Mean	Std. Deviation	Minimum	Maximum
AG-PR1	60	11	5.000	4.000	4.333	0.795	1.000	5.000
AG-PR2	23	48	5.000	4.000	4.000	1.128	1.000	5.000
AG-PR3	18	53	3.000	4.000	3.778	0.943	2.000	5.000
AG-PR4	60	11	5.000	5.000	4.500	0.792	1.000	5.000
AG-PR5	13	58	4.000	3.000	3.000	1.080	1.000	4.000
AG-PR6	31	40	5.000	4.000	3.968	1.110	1.000	5.000
AG-PR7	24	47	5.000	4.000	4.042	0.999	2.000	5.000
AG-PR8	37	34	5.000	4.000	3.946	0.998	1.000	5.000

Table 17: Descriptive statistics for the agile practises

In Table 17, the data summary of the agile practices is shown. Participants were asked to indicate which practice they used and with what frequency on a 1 to 5 Likert scale. The participants had to pick at least one practice because everyone uses a different set of practices. Because of this, the practices were not picked equally, resulting in missing values. For most practices, the mode is five, the highest possible, indicating that the frequency of usage is high except for the AG-PR3 having the lowest score of three.

The mean and median are comparable, indicating a reasonable degree of symmetry in the data distribution. The standard deviation is higher than the deviation shown in Table 16. This suggests that the data from Table 17 is more spread out from the mean, thus having a higher variability.



## 6.2. Correlation analyses

In this paragraph, correlation analyses have been conducted between the research variables. The correlation analysis has been split into two parts, the first being the variable of the agile mindset and the second being the variables of the agile practices. The first table shows in Table 10 the correlations between the agile mindset (A-Mind), the teamwork quality factors, and team performance, with a sample size of 71. Pearson's classical correlation method has been used to analyse both parts.

Variable		1	2	3	4	5	6	7	8
1. A-Mind	Pearson's r	—							
	p-value	—							
2. TQ-C	Pearson's r	0.550 ***	—						
	p-value	< .001	—						
3. TQ-CO	Pearson's r	0.361 **	0.534 ***	—					
	p-value	0.002	< .001	—					
4. TQ-BMC	Pearson's r	0.364 **	0.514 ***	0.500 ***	—				
	p-value	0.002	< .001	< .001	—				
5. TQ-MS	Pearson's r	0.460 ***	0.732 ***	0.594 ***	0.652 ***	—			
	p-value	< .001	< .001	< .001	< .001	—			
6. TQ-E	Pearson's r	0.310 **	0.624 ***	0.470 ***	0.453 ***	0.616 ***	—		
	p-value	0.009	< .001	< .001	< .001	< .001	—		
7. TQ-COH	Pearson's r	0.532 ***	0.800 ***	0.589 ***	0.438 ***	0.680 ***	0.604 ***	—	
	p-value	< .001	< .001	< .001	< .001	< .001	< .001	—	
8. TEAM-PERF	Pearson's r	0.436 ***	0.696 ***	0.381 **	0.382 **	0.443 ***	0.538 ***	0.656 ***	—
	p-value	< .001	< .001	0.001	0.001	< .001	< .001	< .001	—
* p < .05, ** p < .01, *** p < .001									

Table 18: Agile mindset and teamwork quality factors correlation table

The findings show that all variables correlate significantly (p 0.05), as seen in Table 18. It is found that the agile mindset significantly correlates (p = .001) with three out of six teamwork quality factors, with the strongest correlation being *communication (TQ-C)* [ $r(70) = 0.550$ ,  $p < .001$ ]. The other two are *mutual support (TQ-MS)* and *cohesion (TQ-COH)*. The other three factors are also correlated but less significant. The variable *coordination (TQ-CO)* and *balance of member contribution (TQ-BMC)* have a p-value of .002, and *effort (TQ-E)* with a p-value of .009. All of these are positive correlations.

The results also show that all the teamwork quality factors correlate significantly (p 0.05) with team performance (TEAM-PERF), with the strongest being communication with [ $r(70) = 0.696$ ,  $p < .001$ ]. This table shows clear correlations between the agile mindset, the teamwork quality factors, and teamwork quality factors with team performance.

On the next page, in Table 19 and Table 20, the second part of the correlation analysis is displayed. However, as mentioned during the descriptive analysis in paragraph 5.2.5, not every practice is equally picked. This resulted in somewhat lower numbers for some of the practices. Because of this, not all the practices have enough samples, making their correlations, not representative.

This report did not include a table showing the correlations between the practices. This is because the underlying correlations were not significant enough, or there were too few participants who chose them simultaneously to yield meaningful results. As a result, we chose to exclude the table to prevent any potential misinterpretation of the data and to ensure that our analysis accurately reflects the findings of our study. We still thoroughly analysed the data, and the relevant results are presented in the report.

Variable		1	2	3	4	5	6	7	8	9	10
1. AG-PR1	Pearson's r	—									
	p-value	—									
2. AG-PR2	Pearson's r	0.698 ***	—								
	p-value	< .001	—								
3. AG-PR3	Pearson's r	0.426	0.849 ***	—							
	p-value	0.113	< .001	—							
4. AG-PR4	Pearson's r	0.490 ***	0.711 ***	0.605 *	—						
	p-value	< .001	< .001	0.017	—						
5. TQ-C	Pearson's r	-0.168	0.112	0.405	-0.165	—					
	p-value	0.199	0.610	0.095	0.209	—					
6. TQ-CO	Pearson's r	-0.023	0.341	0.251	-0.122	0.534 ***	—				
	p-value	0.859	0.112	0.316	0.354	< .001	—				
7. TQ-BMC	Pearson's r	-0.142	0.088	-0.249	-0.146	0.514 ***	0.500 ***	—			
	p-value	0.279	0.689	0.318	0.266	< .001	< .001	—			
8. TQ-MS	Pearson's r	-0.224	0.034	-0.063	-0.146	0.732 ***	0.594 ***	0.652 ***	—		
	p-value	0.085	0.878	0.804	0.267	< .001	< .001	< .001	—		
9. TQ-E	Pearson's r	-0.042	0.224	0.428	-0.038	0.624 ***	0.470 ***	0.453 ***	0.616 ***	—	
	p-value	0.749	0.303	0.076	0.772	< .001	< .001	< .001	< .001	—	
10. TQ-COH	Pearson's r	-0.206	0.032	0.364	-0.224	0.800 ***	0.589 ***	0.438 ***	0.680 ***	0.604 ***	—
	p-value	0.115	0.884	0.137	0.085	< .001	< .001	< .001	< .001	< .001	—

\* p < .05, \*\* p < .01, \*\*\* p < .001

Table 19: Agile practices 1-4 and teamwork quality factors correlation table

In Table 19, the agile practices one to four are displayed (*Iteration Planning(1)*, *Iterative Development(2)*, *Continuous integration & Testing(3)* and *Stand-up meetings(4)*), and it can be seen that there are no significant correlations between the frequency in which these four practices are used and the teamwork quality factors.

In Table 20, the agile practices five to eight are displayed (*Customer acceptance tests (5,) Customer access (6), Co-location (7) and Retrospectives (8)*), and two negative correlations are significant between AG-PR6 and TQ-C with  $[r(30) = -0.416, p 0.020]$  and TQ-COH with  $[r(30) = -0.411, p 0.021]$ . But because of the low sample size for this practice, the correlation cannot be deemed representative of the entire population.

Variable		1	2	3	4	5	6	7	8	9	10
1. AG-PR5	Pearson's r	—									
	p-value	—									
2. AG-PR6	Pearson's r	0.643 *	—								
	p-value	0.033	—								
3. AG-PR7	Pearson's r	0.905 **	0.411	—							
	p-value	0.002	0.080	—							
4. AG-PR8	Pearson's r	0.484	0.565 *	0.546 *	—						
	p-value	0.131	0.012	0.023	—						
5. TQ-C	Pearson's r	0.146	<b>-0.416 *</b>	-0.043	-0.068	—					
	p-value	0.634	0.020	0.843	0.687	—					
6. TQ-CO	Pearson's r	0.145	-0.086	-0.074	-0.040	0.534 ***	—				
	p-value	0.636	0.647	0.732	0.815	< .001	—				
7. TQ-BMC	Pearson's r	4.485e-4	-0.257	-0.075	-0.082	0.514 ***	0.500 ***	—			
	p-value	0.999	0.163	0.727	0.629	< .001	< .001	—			
8. TQ-MS	Pearson's r	-0.332	-0.321	-0.127	-0.094	0.732 ***	0.594 ***	0.652 ***	—		
	p-value	0.268	0.079	0.554	0.580	< .001	< .001	< .001	—		
9. TQ-E	Pearson's r	0.035	-0.314	0.246	0.159	0.624 ***	0.470 ***	0.453 ***	0.616 ***	—	
	p-value	0.911	0.085	0.247	0.347	< .001	< .001	< .001	< .001	—	
10. TQ-COH	Pearson's r	0.082	<b>-0.411 *</b>	-0.116	-0.077	0.800 ***	0.589 ***	0.438 ***	0.680 ***	0.604 ***	—
	p-value	0.790	0.021	0.590	0.652	< .001	< .001	< .001	< .001	< .001	—

\* p < .05, \*\* p < .01, \*\*\* p < .001

Table 20: Agile practices 5-8 teamwork quality factors correlation table

### 6.3. Hypotheses testing

For this study, eighteen hypotheses were formulated following the research model. This paragraph will check which hypotheses are accepted and which are not. Besides this, it will describe how strong each accepted hypothesis is according to Pearson's  $r$  values displayed in paragraph 6.2. In Figure 25, the conceptual model is shown with changes to the hypothesis's lines indicating which hypothesis is supported and how significant this support is. The complete list of the hypotheses is displayed in paragraph 3.2. In Table 21, the interpretations of Pearson's values are given.

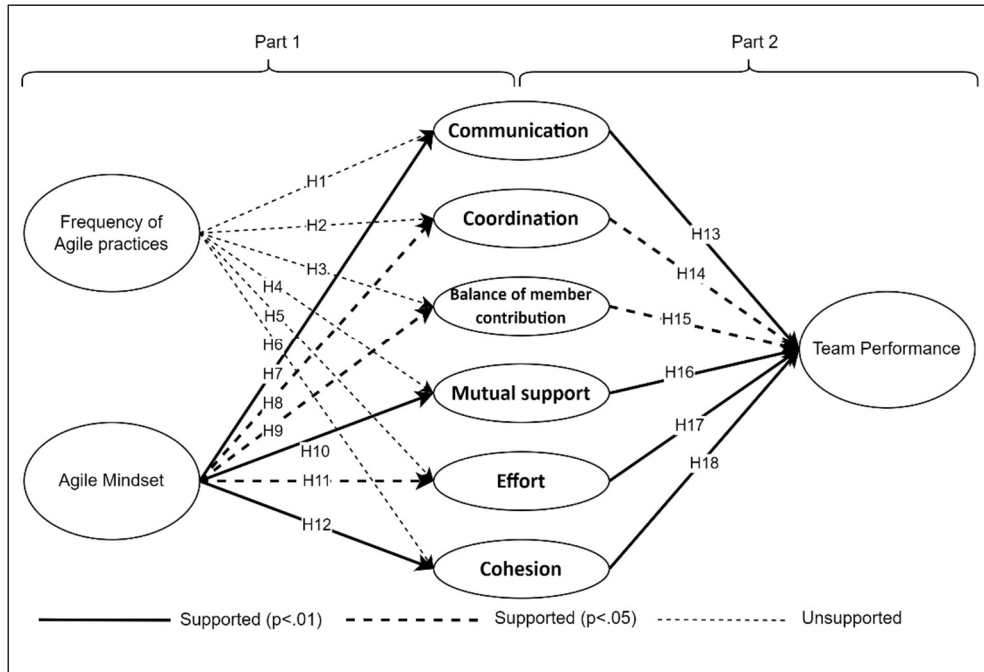


Figure 25: Resulting research model

Size of the correlation	Interpretation
.50 or bigger (-.50 or smaller)	Strong positive (negative) correlation
.30 to .50 (-.30 to -.50)	Moderate positive (negative) correlation
.00 to .30 (-.00 to -.30)	Low positive (negative) correlation

Table 21: Correlation values interpretation table

- ❖ **Communication**
  - H1 – The frequency of the use of agile practices has a positive impact on the quality of communication.
  - H7 – Having an Agile mindset is positively related to the quality of communication.
- ❖ **Coordination**
  - H2 – The frequency of the use of agile practices has a positive impact on the quality of coordination.
  - H8 – Having an Agile mindset is positively related to the quality of coordination.
- ❖ **Balance of member contribution**
  - H3 – The frequency of the use of agile practices has a positive impact on the quality of the Balance of member contribution.
  - H9 – Having an Agile mindset is positively related to the quality of the Balance of member contribution.
- ❖ **Mutual support**
  - H4 – The frequency of the use of agile practices has a positive impact on the quality of Mutual support.
  - H10 – Having an Agile mindset is positively related to the quality of Mutual support.
- ❖ **Effort**
  - H5 – The frequency of the use of agile practices has a positive impact on the quality of Effort.
  - H11 – Having an Agile mindset is positively related to the quality of Effort.
- ❖ **Cohesion**
  - H6 – The frequency of the use of agile practices has a positive impact on the quality of Cohesion.
  - H12 – Having an Agile mindset is positively related to the quality of Cohesion.

### ❖ Team performance

- H13 – the quality of Communication is positively related to team performance.
- H14 – the quality of coordination is positively related to team performance.
- H15 – the quality of Balance of member contribution is positively related to team performance.
- H16 – the quality of Mutual support is positively related to team performance.
- H17 – the quality of Effort is positively related to team performance.
- H18 – the quality of Cohesion is positively related to team performance.

### Agile practices hypotheses

During the data analysis, it became clear that agile practices cannot be tested as one entity, as displayed in the research model from Figure 25. Since the practices are not chosen equally, a mean approach could not work. Because of this, hypotheses **H1** to **H6** cannot be tested. Thus, the hypotheses are neither accepted nor rejected. This is displayed in Figure 25 as untested.

It was also analysed if the agile practices could be checked at the individual level, but this resulted in zero correlations between the practices and the teamwork quality factors. The only practice with a significant correlation was customer access, but this correlation is not representative due to a lack of data. This result cannot be used to make claims about agile practices and their impact on teamwork quality factors.

For this reason, only hypotheses **H7** to **H18** will be tested in the next paragraph.

### Agile mindset hypotheses

For this section of the model, all the given hypotheses are accepted. The null hypothesis is rejected with the agile mindset having a positive relationship with the teamwork quality factors. For each hypothesis, the corresponding values are given:

- **H7** is accepted with [ $r(70) = 0.550, p < .001$ ], indicating a strong and significant positive correlation between the *agile mindset* and *communication*.
- **H8** is accepted with [ $r(70) = 0.361, p 0.002$ ], indicating a moderate and significant positive correlation between the *agile mindset* and *coordination*.
- **H9** is accepted with [ $r(70) = 0.364, p 0.002$ ], indicating a moderate and significant positive correlation between the *agile mindset* and *balance of member contribution*.
- **H10** is accepted with [ $r(70) = 0.460, p < .001$ ], indicating that there is a moderate and significant positive correlation between the *agile mindset* and *mutual support*.
- **H11** is accepted with [ $r(70) = 0.310, p 0.009$ ], indicating a moderate and significant positive correlation between the *agile mindset* and *effort*.
- **H12** is accepted with [ $r(70) = 0.532, p < .001$ ], indicating a strong and significant positive correlation between the *agile mindset* and *cohesion*.

### Teamwork quality factors and team performance hypotheses

For this model section, all the given hypotheses are accepted, and the null hypothesis is rejected, with the teamwork quality factors having a positive relationship with team performance. For each hypothesis, the corresponding values are given:

- **H13** is accepted with [ $r(70) = 0.696, p < .001$ ], indicating a strong and significant positive correlation between *communication* and *team performance*.
- **H14** is accepted with [ $r(70) = 0.381, p 0.001$ ], indicating a moderate and significant positive correlation between *communication* and *team performance*.
- **H15** is accepted with [ $r(70) = 0.382, p 0.001$ ], indicating a moderate and significant positive correlation between *communication* and *team performance*.
- **H16** is accepted with [ $r(70) = 0.443, p < .001$ ], indicating a moderate and significant positive correlation between *communication* and *team performance*.
- **H17** is accepted with [ $r(70) = 0.538, p < .001$ ], indicating a strong and significant positive correlation between *communication* and *team performance*.
- **H18** is accepted with [ $r(70) = 0.656, p < .001$ ], indicating a strong and significant positive correlation between *communication* and *team performance*.

## 6.4. Agile team-maturity and team performance

During the analysis of the hypotheses, various aspects of the survey were also examined from a statistical perspective. However, few findings were considered usable due to low respondent counts for the different answer options. For example, when filtering by type of work, each option's resulting counts were too low to be statistically relevant. The only statistically significant finding was the relationship between Agile maturity level and teamwork quality factors. This relationship is displayed in Figure 26, with each line indicating the statistical value of the relationship. The correlations are also shown in Table 22.

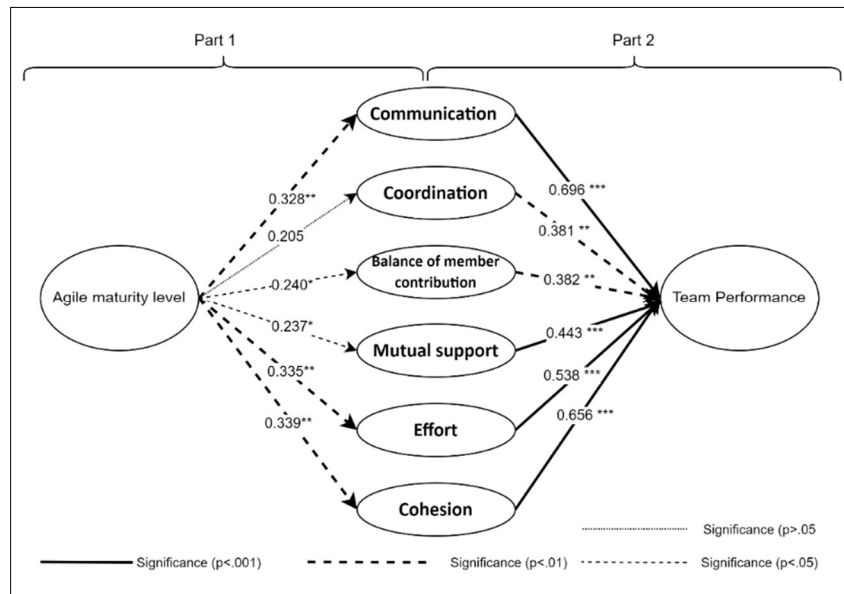


Figure 26: Agile team-maturity correlation table with the teamwork quality factors

Six positive correlations are significant, but all these are seen as low or moderate correlations. This is because none of Pearson's  $r$  values is higher than 0.339 between cohesion and agile maturity level, indicating that the highest scoring correlation is moderate.

Variable	1	2	3	4	5	6	7	8
1. AG-LVL	Pearson's r —							
	p-value —							
2. TQ-C	Pearson's r 0.328 **	—						
	p-value 0.005	—						
3. TQ-CO	Pearson's r 0.205	0.534 ***	—					
	p-value 0.086	< .001	—					
4. TQ-BMC	Pearson's r 0.240 *	0.514 ***	0.500 ***	—				
	p-value 0.044	< .001	< .001	—				
5. TQ-MS	Pearson's r 0.237 *	0.732 ***	0.594 ***	0.652 ***	—			
	p-value 0.047	< .001	< .001	< .001	—			
6. TQ-E	Pearson's r 0.335 **	0.624 ***	0.470 ***	0.453 ***	0.616 ***	—		
	p-value 0.004	< .001	< .001	< .001	< .001	—		
7. TQ-COH	Pearson's r 0.339 **	0.800 ***	0.589 ***	0.438 ***	0.680 ***	0.604 ***	—	
	p-value 0.004	< .001	< .001	< .001	< .001	< .001	—	
8. TEAM-PERF	Pearson's r 0.239 *	0.696 ***	0.381 **	0.382 **	0.443 ***	0.538 ***	0.656 ***	—
	p-value 0.045	< .001	0.001	0.001	< .001	< .001	< .001	—

Variable	1	2	3	4	5	6	7	8
* p < .05, ** p < .01, *** p < .001								

Table 22: Agile maturity level and the teamwork quality factors correlation table

## 7. Discussion

### 7.1. The impact of the agile mindset on teamwork quality factors and team performance

Agile methods have gained increasing popularity, as evidenced by reports such as the State of Agile Report by Digital.ai (2021) and the MIT Sloan Management Review (2019). However, some studies, such as (Miler & Gaida, 2019) and (Eilers, Peters, & Leimeister, 2022), suggest that simply implementing agile methods may not necessarily result in improved teamwork and project outcomes. The key to success lies in having the appropriate Agile mindset to accompany these practices, as evidenced by the findings of our research model.

According to the survey results, the presence of an Agile mindset has been found to correlate positively with a team's quality. The survey found that all six factors of teamwork quality have a moderate to a strong relationship with the Agile mindset. The strongest correlation between communication and the Agile mindset is measured by a Pearson's r value of 0.550.

This finding is consistent with previous research on the topic, which suggests that an Agile mindset, characterized by its focus on continuous improvement, collaboration, and flexibility, can positively impact the quality of a team (Miler & Gaida, 2019). This finding aligns with agile's core values and principles as outlined in the Agile manifesto, such as communication, teamwork, and flexibility (Beck, et al., 2001).

The Agile Manifesto emphasizes valuing individuals and their interactions as more important than focusing on processes and tools. It encourages team members to work closely together and continuously improve the process and product, leading to more efficient and effective use of resources and higher team performance. Furthermore, the emphasis on collaboration and open communication in an Agile mindset helps to build trust and foster a sense of shared purpose among team members, further contributing to better teamwork (Forte & Kloppenborg, 2018).

The Agile mindset also places a strong emphasis on empowerment. Giving teams the autonomy to decide how best to achieve their objectives promotes a sense of ownership among team members. This sense of ownership leads to a more committed and engaged team, as individuals take responsibility for their actions and decisions and feel invested in the project's success. A study conducted by Malik et al. (2021) further emphasizes this statement. It found that empowerment impacts team autonomy and innovative behaviour, which contributes to the project performance of the team.



Agile methodologies, such as Scrum, with their clear roles and responsibilities, facilitate this empowerment approach by allowing the team to make decisions collectively, leading to more effective and efficient work. Furthermore, this empowerment approach enables team members to focus on their specific tasks and objectives and helps communicate what is expected from each team member, thereby avoiding confusion and conflicts (Denning, 2018). This approach creates a culture where team members feel valued and trusted, and as a result, they will be more committed and engaged to the project's success.

These results suggest that implementing agile practices may not necessarily lead to improved teamwork and project outcomes on its own. Instead, focusing on cultivating an Agile mindset is just as important. For organizations looking to implement agile methods, it's not enough to adopt the framework or methodology but also to create a culture that promotes the values and principles of Agile (Ramesh, Cao, Kim, Mohan, & James, 2019). This can be done by encouraging open communication and collaboration, giving team members autonomy and ownership of their work, and fostering a focus on continuous improvement.

### 7.2. The impact of agile maturity on teamwork quality factors and team performance

Studies, such as those conducted by Peeters, Voorde, and Paauwe (2022) and Poth, Kottke, and Riel (2020), highlight the significance of Agile maturity within a team. Teams with a high level of Agile maturity possess desirable traits such as improved collaboration, better communication, and greater adaptability, which are critical for high-performing teams and effective project delivery.

Our data support the idea that agile maturity within a team is positively related to teamwork quality and performance. The correlation is low to moderate, with Person's  $r$  values ranging from 0.240 to 0.696, all being statistically significant. This suggests that increasing agile maturity at the team level is important when striving to enhance teamwork and performance.

Moreover, teams with high agile maturity possess a deeper understanding of Agile principles and values, enabling them to apply Agile methodologies more effectively and consistently (Peeters, Voorde, & Paauwe, 2022). This, in turn, can lead to better project outcomes and a greater ability to adapt to changing requirements.

In conclusion, the level of agile maturity within a team can serve as a predictor of teamwork quality and team performance. Teams with higher agile maturity will likely produce better results, work collaboratively, and adapt effectively to changing conditions (van Solingen, 2020). Additionally, these teams are better positioned to continually improve their processes and practices, leading to improved performance over time.

### 7.3. What practices are applied, and what can we expect from them?

The results showed that the participants used agile methods Scrum, Kanban, and internally created agile-based methods the most frequently. This was an expected outcome for Scrum and Kanban since these

are the most known and used methods, proven by different practitioner reports, such as The State of Agile Report. This is an annual report about Agile usage across all domains and states that just under nine in ten respondents are leveraging Scrum, and over half are leveraging Kanban (Digital.AI, 2022).

As for individual agile practices, Iteration planning and Stand-up meetings are picked the most, with 60 out of 72, followed by Retrospectives and Customer access with 37 and 31 out of 72. The reasoning for these choices could be found in the shared purpose of these practices. First, iteration planning, stand-up meetings, and retrospectives are all practices that help teams to be more collaborative and communicative. Iteration planning is used to set goals and priorities for a specific period, usually called a sprint, and to ensure everyone on the team is on the same page. Stand-up meetings are short, daily check-ins that help to keep everyone informed about what's happening on the team. Retrospectives are used at the end of a sprint to review what went well and what could be improved. These practices help to ensure that everyone on the team is aware of what's happening and can contribute to the process.

Second, customer access is a practice that helps teams to be more responsive to the needs of their customers. This practice involves giving customers direct access to the team so that they can provide feedback and input throughout the development process. This helps ensure that the final product or service will meet the customer's needs and can help reduce the risk of delivering something the customer doesn't want. Third, these practices are simple and flexible enough to be used in various contexts. They are not specific to any domain or type of project and can be tailored to fit the needs of any organization. They are also easy to implement and can be adopted with minimal effort.

What could make an impact on the usefulness of these methods and practices is the type of work that is done in domains. In this study, the most picked domains were financial services, education, marketing, and consulting. An explanation for this usage could be that non-technical work in sectors such as financial services, education, marketing, and consulting share several characteristics that align with the core principles of agility. These characteristics include constant change and uncertainty, customer-centricity, collaboration and teamwork, continuous improvement, and flexibility. These characteristics make these sectors well-suited for applying agile practices and methodologies (van Solingen, 2020)

The financial services, education, marketing, and consulting sectors are well-suited for applying agile practices and methodologies because they share several characteristics that align with the core principles of agility. These characteristics include constant change and uncertainty, customer-centricity, collaboration and teamwork, continuous improvement, and flexibility.

In the financial services sector, for example, agile practices can assist organizations in adapting to shifting regulatory environments, understanding the needs of their customers and partners, and identifying new opportunities for growth and innovation (Deloitte, 2018). Similarly, in the education sector, agile techniques can aid organizations in better understanding and addressing the needs of their

students and enhancing the quality and effectiveness of their educational programs (Pelletier, et al., 2022).

In the marketing sector, agile practices can help organizations understand and respond to rapidly changing market conditions (Gera, Gera, & Mishra, 2019), build stronger relationships with customers and partners, and improve the effectiveness of their marketing campaigns (Kihlstrom, 2022). In the consulting sector, agile practices can help organizations more quickly and effectively understand and respond to the changing needs of their clients, which can improve the quality of their consulting services (Brosseau, et al., 2019).

To sum up, the non-technical work in sectors such as financial services, education, marketing, and consulting often involves a high degree of complexity and change, a high degree of customer interaction, and a focus on innovation and improvement (Scrum Alliance, 2020). Agile practices are a fitting method to help organizations in these sectors to be more flexible and responsive to these changes, better understand and respond to the needs of their customers and partners and improve the effectiveness of their products and services (Manyika, et al., 2017).

#### 7.4. The reasoning for agile methods, and will they still be relevant in the future?

For the future of work, Agile methods can play an important role in helping organizations to manage the effects of automation and computerization. Agile practices can help organizations increase productivity, reduce costs, and create new opportunities for human workers by promoting the development of new and more complex tasks for human workers and increasing the demand for skills complementary to automation (Autor, 2015).

According to the paper "The Future of Employment: How Susceptible are Jobs to Computerisation?" by Carl Benedikt Frey and Michael Osborne (2017), jobs that involve tasks that are non-routine and difficult to automate are less likely to be impacted by computerization. These jobs typically involve tasks that require creativity, social intelligence, and decision-making skills. Examples of jobs less susceptible to computerization include creativity-based roles such as design, advertising, and marketing. Jobs that require critical thinking, problem-solving and decision-making, such as consultants and managers (Frey & Osborne, 2017). These types of jobs are well-suited to agile practices because they require a high degree of flexibility, adaptability, and continuous improvement.

Implementing Agile practices within organizations can help mitigate the negative effects of automation by optimizing the utilization of human and technological resources and creating new opportunities (Anzolin, 2021). Agile methodologies allow organizations to adapt quickly to shifting market conditions and customer demands, improving productivity and efficiency (Parker, Holesgrove, & Pathak, 2015). Furthermore, Agile practices facilitate a deeper understanding and responsiveness to customer needs, enhancing products and services and heightening customer satisfaction (Yauch & Adkins, 2004).

Moreover, Agile practices can foster the development of new and more complex tasks for human workers while also increasing the demand for skills that complement automation, such as creativity, critical thinking, and social intelligence (Frey & Osborne, 2017). This is achieved by promoting collaborative teamwork, which generates innovative ideas and novel working methods (Scrum Alliance, 2018). Additionally, Agile practices promote continuous learning and development, providing new opportunities for human workers, even in sectors heavily impacted by automation (Autor, 2015).

It is important to note that the susceptibility of a job to computerization exists on a spectrum (Frey & Osborne, 2017). Even if a job is not highly susceptible to computerization, specific tasks within the job may still be automated. Additionally, the rate of computerization is subject to the advancement of technology and the cost of automation development (Frey & Osborne, 2017).

This study aimed to investigate the reasons behind the utilization of agile methodologies among participants and if these stay relevant for the future. In order to gather this information, the participants were asked to openly describe their tasks and the reasons for their use of agile methodologies. The responses revealed a diverse range of tasks and reasons for the adoption of agile methods. Through a data analysis process, seven main themes emerged as the primary reasons for using agile methodologies. These themes included: the creation of an overview of tasks, the improvement of communication, the encouragement of individual decision-making, the attainment of greater flexibility, the enhancement of efficiency, the improvement of time-to-market, and the facilitation of easier receipt and processing of feedback.

The reasons listed are likely to remain relevant in the future as they are fundamental and general aspects of business and organizational management (Kane, Palmer, & Kiron, 2015). Creating an overview of tasks, improving communication, and encouraging individual decision-making are essential for coordinating and managing the work of a team or organization. Additionally, becoming more flexible and efficient and improving time-to-market are important for staying competitive in a rapidly changing business environment (Needle & Burns, 2010). Finally, allowing for easier receiving and processing of feedback is important for continuous improvement and customer satisfaction. However, the question of relevance in the future arises with the integration of artificial intelligence (AI) and automation.

AI and automation may not be able to replace human workers in tasks that involve complex decision-making and creativity, such as strategic planning or product development (Frey & Osborne, 2017). The reasons for the relevance of agile methods, such as creating an overview of tasks, improving communication, and encouraging individual decision making will still be relevant. Similarly, for tasks that involve human-to-human interactions, such as customer service or sales, and the management of a team or organization (Huang & Rust, 2018), such as project management or team leadership, the given reasons for the relevance of agile methods such as improving communication and allowing for easier receiving and processing of feedback will still be relevant (Smith & Anderson, 2014).

So, while the integration of artificial intelligence (AI) and automation can transform the way work is performed and organized, it may also lead to changes in the relevance of agile methodologies. In tasks where AI and automation can replace human workers and perform the task with a high level of accuracy and precision, the given reasons for the relevance of agile methods, such as creating an overview of tasks, improving communication, and encouraging individual decision-making may become less relevant (Wilson, Daugherty, & Bianzino, 2017). For example, in tasks involving data entry or simple data analysis, the use of AI and automation can make the task more efficient and accurate, reducing the need for the reasons mentioned earlier.

On the other hand, there may also be new opportunities for applying agile methodologies, as AI and automation can enhance and complement the work of human teams. For example, in the field of education, students can apply agile methods to create a clear overview of the learning objectives and break down complex topics into smaller, manageable chunks (Reehorst et al., 2019) while being supported by the use of AI-powered learning systems (Chen, Chen, & Lin, 2020). This can facilitate the reasons such as creating an overview of tasks, becoming more flexible and allowing for easier receiving and processing of feedback. In this scenario, the teacher's element can change significantly. While AI can provide new and innovative ways of teaching and learning, human teachers and instructors will still provide the personal touch, creativity, and critical thinking skills essential to a successful and fulfilling education experience. This highlights the importance of considering the human factor in education and how it can be supported by advances in AI (Paul et al., 2022).

Another example of a situation could be in a marketing environment where agile methods can be applied. The reasons, such as "becoming more efficient and improving time-to-market", can become less relevant as a reason to implement agile methods. This is because AI can automate tasks like AI-powered customer research and data analysis to provide fast new insights, increasing efficiency and time-to-market (Conick, 2017). However, AI will likely be unable to replace creative aspects or ensure ethical responsibility in marketing actions. For this type of action, agile methods and the reasons, such as improving communication and allowing for easier receiving and processing of feedback, will probably stay relevant since agile methods encourage regular check-ins and retrospectives and prioritize collaboration and communication between the different teams. This kind of practices provides an opportunity to communicate with each other, which can encourage creativity and gives the possibility to assess the ethical implications of AI and to ensure that it is used responsibly and ethically (Verma, Sharma, Deb, & Maitra, 2021).

In light of these examples, it can be expected that the given reasons for the usage of agile methods can still be relevant in the context of AI and Automation. Still, it depends on the specific task and how AI and automation are integrated into the work process. AI and Automation may replace some tasks previously done by humans and make certain reasons less relevant. Still, in many cases, AI can and will

enhance and complement the work of human teams, making the given reasons for the relevance of agile methods still important.

### 7.5. Limitations

The present study has several limitations that should be acknowledged. Firstly, the study's sample size may be considered small, as only 72 out of 82 participants were deemed suitable as non-IT agile users. This may limit the findings' generalizability to the study's target group (Thomas, 2016).

Also, sampling bias may have occurred due to how respondents were selected. This can occur if the survey or study is only distributed to certain groups or individuals with a particular attribute or characteristic relevant to the research question. This can lead to self-selection bias. To mitigate this, the survey was distributed in channels familiar with the research topic and more general topics, such as a forum for general education or finance topics. However, it should be noted that self-selection bias may still have occurred due to the online nature of the study.

Another potential bias may have occurred is non-response bias, which refers to participants who do not complete the survey but may have different characteristics than those who do respond, leading to a biased sample. However, with a response rate of 64%, the effect of this bias is expected to be limited.

Lastly, it should be noted that how agile practices were measured in this study may also be considered a limitation. Upon completing the survey, it became clear that the collected data on these practices' usage was insufficient. The participants were asked to indicate the frequency of usage of agile practices on a scale of 1 to 5. However, upon analysis, it was found that this data alone did not provide meaningful insights. Only one of the practices was chosen enough times to provide a statistically relevant answer, and the frequency interpretation could differ for each participant. As a result, agile practices were removed from the original theoretical model.

## 8. Conclusion

This study aimed to examine the relationship between the utilization of agile methods and team performance outside IT. To accomplish this, a research model was developed that evaluated the Agile mindset and practices and their influence on the quality of teamwork, which subsequently affects team performance. The model was constructed through a literature review, drawing from sources such as Eilers et al. (2022) and Hoegl and Gemeunden (2001) and a compilation of agile practices from various sources.

A quantitative survey was employed to gather data. The research question was: "In which domains outside of IT are agile methods applied, and what is the impact on team performance?" The survey was distributed to and received 82 completed responses through various online platforms, including LinkedIn, Slack, Facebook, Reddit, and MeetUp, as well as through personal outreach via email and LinkedIn messages.

The study shows that there is a continuous expansion of Agile methodologies beyond the boundaries of the IT industry and its increasing popularity. The study provided valuable insights into utilising Agile practices, their purposes, and the reasons for their adoption. The results also pointed out that having the right Agile mindset is important and positively affects various aspects of teamwork quality and team performance. Moreover, the study revealed that the level of Agile maturity within a team minimally affects the level of Agile mindset. The measurement of the frequency of the Agile practices did not result in statistically significant outcomes.

The implications of these findings suggest that when organizations aim to implement Agile methodologies outside IT, it is crucial to focus not only on the methods themselves but also on creating and fostering a supportive Agile mindset among teams and the organization as a whole. Failure to do so may hinder the full potential of Agile implementation.

### 8.1. Further research

The part of the study aimed at measuring agile practices did not produce the expected results, presenting a new opportunity to investigate the practice's impact on team performance. One suggestion for further research is to adopt the survey model Chaehan So, and Wolfgang Scholl (2019) developed on the psychological effect of agile practices combined with other performance models. The study could be extended over a longer period to increase the sample size to gather data from a more diverse range of domains. Another avenue of inquiry could be to examine the relationship between the level of agile maturity in a team or organization and the agile mindset. This would provide insights into the interplay or significance of these two factors. Finally, an alternative approach could be to employ the agile mindset model but with a different team performance model to obtain varying results, which could then be compared to the results of this study to determine if there are any substantial differences.



## 9. References

In this paragraph, there are two kinds of literature lists. The first list, 9.1, comprises all the scientific literature used. The second list, 9.2, comprises internet references like blogs, company reports, and non-scientific sources.

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## Appendix A – Agile manifesto

# Manifesto for Agile Software Development

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

**Individuals and interactions** **over** processes and tools

**Working software** **over** comprehensive documentation

**Customer collaboration** **over** contract negotiation

**Responding to change** **over** following a plan

That is, while there is value in the items on the right, we value the items on the left more.

- Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
- Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
- Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
- Business people and developers must work together daily throughout the project.
- Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
- The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
- Working software is the primary measure of progress.
- Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
- Continuous attention to technical excellence and good design enhances agility.
- Simplicity--the art of maximizing the amount of work not done--is essential.
- The best architectures, requirements, and designs emerge from self-organizing teams.
- At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

The seventeen people that first signed the Agile manifesto in 2001

Kent Beck  
Mike Beedle  
Arie van Bennekum  
Alistair Cockburn  
Ward Cunningham  
Martin Fowler

James Grenning  
Jim Highsmith  
Andrew Hunt  
Ron Jeffries  
Jon Kern  
Brian Marick

Robert C. Martin  
Steve Mellor  
Ken Schwaber  
Jeff Sutherland  
Dave Thomas

## Appendix B – Survey design



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Dear participant,

This survey identifies **the use and impact of Agile project methods outside of IT on team performance**. By completing this survey, you contribute to research that supports future implementations of Agile outside IT and will provide you with insights on how to apply Agile.

The survey will take **approximately 10 to minutes** to answer. This survey is meant for people who work with Agile project methods like Scrum, Kanban or SAFe in a **non-IT domain or in a IT domain doing non-IT related tasks**, such as healthcare, marketing and education. We are specifically interested in how usage of Agile methods could translate to domains outside of IT.

This survey is divided into four parts. The first part assesses the demography you belong to, what Agile practices you work and the experiences you have with Agile. The second part of the survey is about the Agile mindset, the third is about teamwork quality, and the fourth is about team performance.

This survey is entirely anonymous, and all data will be treated as fully confidential. There are no right or wrong answers. Therefore, we would like to encourage you to answer all questions truthfully.

If there are any questions, please contact me at [m.a.knoop@umail.leidenuniv.nl](mailto:m.a.knoop@umail.leidenuniv.nl)

Thank you very much for your participation!

Mitch Knoop

Master student ICT in Business at Leiden University

Dr Christoph Johann Stettina

Professor at Leiden University

P.S.: This survey contains credits for SurveySwap.io and Surveycircle





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What is your current job title?

Years of general working experience:

1 - 5 years

6 - 10 years

11 - 15 years

16 - 25 years

More than 25 years

Years of general working experience with Agile management methods like Scrum/ SAFe:

1 - 5 years

6 - 10 years

11 - 15 years

16 - 20 years

21 - 25 years





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Which of the following sector describes the industry you primarily work in?

Chemical	Healthcare
Communication	Human Resource Management
Consulting	Manufacturing
Education	Marketing
Energy	Media / Publishing
Engineering	Public sector
Entertainment	Sales
Financial Services	Other, please specify:

The number of employees in your organization is:

10 - 250
251 - 1000
1001 - 5000
5001 - 20000
20001 - 50000
> 50001





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If you are or have been part of a team not involved with software development, we consider this Agile outside IT.

E.g., If you are in a team working for a marketing department of a software company, and you use Agile methods to create marketing materials, this is considered Agile outside IT

Why is this important: we want to understand if the product you're working on is non-IT

I am part of a team that:

That is now working with Agile outside software/IT domain

That has been working with Agile outside software/IT domain

That is working in a software domain with Agile

I have never worked with Agile methods

What is the size of the team you work with?







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What is the focus point of your team?

A product

A service

A combination

What is the type or description of the service/product (Max 100 characters)



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What stage of the product or service life cycle corresponds best to your team's work:

Product planning - refers to the product planning and clarification of the tasks and requirements

Design/development - refers to the development of the solution/service/product

Production/assembly - refers to the actual creation/implementation of the solution/service/product

Marketing/consulting/sales - refers to selling or support of the solution/service/product





What type of Agile method is your team using?

Multiple answers are possible

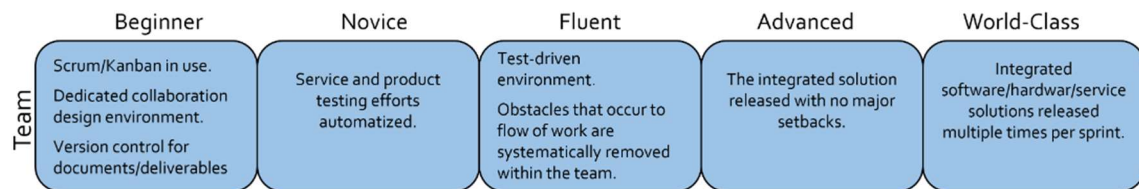
Scrum	Scaled Agile Framework (SAFe)
Kanban	Scrum of scrums
Scrumban	Large scale scrum (LESS)
Extreme Programming (XP)	Lean Management
Scrum/XP Hybrid	Internally created Agile based method(s)
Other, please specify:	The Spotify model

What is the main reason that agile methods are applied in your team?





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On what level would you put your team considering the given options in the figure

Beginner

Novice

Fluent

Advanced

World-Class





Practice	Explanation
Iteration Planning	A meeting where team members agree on the tasks to work on during the next iteration (2-4 weeks).
Iterative Development	Iterative development is when teams continuously deliver sub-results of the project in short iterations of a fixed length
Continuous integration & testing	Creating of a product or service while continuously test and adjust it through the development
Stand-up meetings	During these meetings, the team members provide each other with a status update on their tasks. As the name implies, stand-up meetings are held standing up and are generally timed between 5 to 15 minutes to emphasise their brief and intense character
Customer acceptance tests	An acceptance test is a formal explanation of a product's behaviour or outcome, often given in the form of an example of a use case. These scenarios or examples are usually established with the client.
Customer access	Customer access is all about the availability of the customer involved with the project. The goal is that the team can ask the customer for feedback and clarification on the project or product requirements in case this is needed
Co-location	This is all about the degree of physical proximity between team members
Retrospectives	The retrospective is an activity that all agile teams must do when an iteration has ended. During this activity, the entire team inspected how the iteration went to determine what went well and wrong.

Which of the following Agile practices does your team use

Multiple answers are possible

Iteration Planning

Iterative Development

Continuous integration & Testing

Stand-up meetings

Customer acceptance tests

Customer access

Co-location

Retrospectives





To what extent are the chosen practices used

Very Rarely

Rarely

Occasionally

Very Frequently

Always

1

2

3

4

5

Iteration Planning



Iterative Development



Continuous integration & Testing



Stand-up meetings



Customer acceptance tests



Customer access



Co-location



Retrospectives



This is the second part of the survey.

You will be asked to answer 20 scale questions from 1 to 5, one being strongly disagree and five strongly agree, divided into four subjects attitudes *towards empowered self-guidance, co-creation, learning spirit, and collaborative exchange*. These four subjects will measure the **Agile mindset** you are experiencing in your work.

### Attitude towards empowered self-guidance

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I can decide for myself how I achieve a work goal.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am good at organizing myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I learn new skills that help me handle changes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use mistakes as a chance for me to adjust my approach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have the courage to take on new tasks for which I do not yet know all the requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I adjust to changes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Attitude towards customer co-creation

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
Through direct conversation, I try to find out what my customer needs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I talk to my customers regularly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to find out what is most important for the customer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
While working, I frequently think about how my job helps customers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to reach my goals by satisfying customers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



### Attitude towards learning spirit

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I come up with new ideas to better complete my tasks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like exchanging views with others about the challenges of reaching our goal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is important to me to always learn something new	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoy exploring new situations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Attitude towards collaborative exchange

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I solve difficult challenges best when I work together with others in a team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like making my work transparent for others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I appreciate the different perspectives within my team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like supporting other people in my team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I regularly review my approach with others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



This is the third part of the survey.

You will be asked to answer 38 scale questions from 1 to 5, one being strongly disagree and five strongly agree, divided over six subjects: *communication*, *coordination*, *balance of member contribution*, *mutual support*, *effort*, and *cohesion*. These six subjects will measure the **teamwork quality** you are experiencing in your work.



## Communication

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
There is frequent communication within the team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team members are happy with the usefulness of the information they receive from other team members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team members communicate often in spontaneous meetings, phone conversations, etc.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team members communicate mostly directly and personally with each other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are mediators through whom much communication is conducted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relevant ideas and information relating to the teamwork is shared openly by all team members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Important information is kept away from other team members in certain situations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the team there are conflicts regarding the openness of the information flow	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team members are happy with the timeliness in which they receive information from other team members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team members are happy with the precision of the information they receive from other team members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Coordination

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
The work done on subtasks within the team is closely harmonized	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are clear and fully comprehended goals for subtasks within our team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The goals for subtasks are accepted by all team members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are conflicting interests in our team regarding subtasks/subgoals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Balance of member contribution

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
The team recognizes the specific characteristics (strengths and weaknesses) of the individual team members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team members contribute to the achievement of the team's goals in accordance with their specific potential	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Imbalance of member contributions cause conflicts in our team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



### Mutual support

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
The team members help and support each other as best they can	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If conflicts come up, they are easily and quickly resolved	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Discussions and controversies are conducted constructively	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Suggestions and contributions of team members are respected	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Suggestions and contributions of team members are discussed and further developed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team is able to reach consensus regarding important issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team cooperates well	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Effort

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
Every team member fully pushes the teamwork	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every team member makes the teamwork their highest priority	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team put(s) much effort into the teamwork	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are conflicts regarding the effort that team members put into the teamwork	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Cohesion

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
The teamwork is important to the team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is important to team members to be part of the team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team does not see anything special in this teamwork	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team members are strongly attached to the team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All team members are fully integrated in the team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There were many personal conflicts in the team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is mutual sympathy between the members of the team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team sticks together	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The members of the team feel proud to be part of the team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every team member feels responsible for maintaining and protecting the team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

This is the fourth and final part of the survey.

You will be asked to answer 15 scale questions from 1 to 5, one being strongly disagree and five strongly agree, divided into two subjects: *effectiveness* and *efficiency*. These two subjects will measure the **team performance** you are experiencing in your work.

### Effectiveness

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
Going by the results, this teamwork can be regarded as successful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All demands of the customers are satisfied	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
From the company's perspective, all team goals are achieved	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The performance of the team advances our image to the customer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The teamwork result is of high quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The customer is satisfied with the quality of the teamwork result	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team is satisfied with the teamwork result	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The product/service produced in the team requires little rework	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The product/service proves to be stable in operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The product/service proves to be robust in operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Efficiency

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
The company is satisfied with how the teamwork progresses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall, the team works in a cost-efficient way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall, the team works in a time-efficient way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team is within schedule	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The team is within budget	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



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Leiden**  
The Netherlands

Thank you for your time to complete our survey. If you have any comments on the survey, please leave them below

If you would like to receive an overview of the results of this thesis. Please leave your email below:

please go to the next page to finish the survey



## Appendix C– Count table reasoning for agile usage

Global reasoning	Iteration Planning	Iterative Development	Continuous integration & Testing	Stand-up meetings	Customer acceptance tests	Customer access	Co-location	Retrospectives
Creating an overview of tasks	18	7	5	19	4	5	5	8
Improving communication	16	4	4	15	2	6	4	9
Encourage individual decision making	11	2	1	12	2	4	4	8
Becoming more flexible	16	8	8	17	4	13	8	10
Becoming more efficient	14	-	3	11	3	9	7	10
Improve time-to-market	16	4	7	15	2	10	4	5
Allow for easier receiving and processing of feedback	9	3	5	9	4	6	4	5

Global reasoning	Scrum	Kanban	Internally created Agile based method(s)	Scaled Agile Framework (SAFe)	Lean Management	Scrumban	Scrum of scrums	Large scale scrum (LESS)	The Spotify model
Creating an overview of tasks	15	9	7	2	4	1	2	1	-
Improving communication	10	9	4	1	1	1	-	-	-
Encourage individual decision making	10	5	6	1	1	-	1	-	-
Becoming more flexible	15	4	2	1	1	-	-	1	-
Becoming more efficient	13	6	3	-	-	2	-	-	-
Improve time-to-market	14	5	5	1	2	-	-	-	-
Allow for easier receiving and processing of feedback	8	-	1	1	-	-	-	-	-

## Appendix D– Agile maturity and mindset boxplot

### Descriptive Statistics

	A-Mind				
	1	2	3	4	5
Valid	28	19	18	5	1
Missing	0	0	0	0	0
Mean	3.911	3.843	4.134	4.607	4.054
Std. Deviation	0.405	0.642	0.507	0.265	NaN
Minimum	2.729	2.008	2.983	4.208	4.054
Maximum	4.663	4.900	4.783	4.867	4.054

