The Feeling and Perception of Using Analog and Digital Task Management Tools within Agile Development

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Abstract
The field of software development has rapidly been changing due to changes in work requirements and expectations of stakeholders. As a result, there has been a widespread adoption of agile methodology within the software industry, as it allows for a constant stream of deliveries and project adjustments. Agile methodology allows project teams to pick and adjust appropriate agile practices as they see fit, meaning that situations differ in various ways. With respect to the young age of agile methodology and the various approaches has created gaps that could affect project efficiency and quality. Specifically, one of these unperfected areas is the task management tools, that has had a hard time being established in the digital space. This can be illustrated by the popular use analog tools such as post-it notes and whiteboards. Likewise, analog and digital task management tools have varying advantages and disadvantages that forces project teams to work in certain ways. For example, analog tools are easily adjusted and digital tool are instead more structured. Typically, this creates restrictions to the physical work space for employees and obstacles of project progression communication to external parties. Towards addressing the issue, a set of seven task board requirements are established as the foundation for the solution, which are based on the theoretical and practical findings. The solution is a digitalized whiteboard with syncing and cross platform abilities.

Keywords
Agile methodology, Feeling, Analog, Digital, Task board, Hybrid solution
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Chapter 1: Introduction

As the agile methodology field has only existed a couple of decades, the methodology is not fully developed (Špundak, 2014; Rasnacis & Berzisa, 2017). Therefore, there does not exist any absolute solution or practice within agile methodology. Simultaneously, agile methodology is commonly adjusted to the situations and projects it appears in. For example, it is common that not all practices within agile methodology get selected for the development process. Moreover, the most popular agile method is currently Scrum (Grapenthin, Poggel, Book & Gruhn, 2015), and therefore the study will have the primary focus on Scrum practices and often relate to the popular Scrum Backlog method, since it correlates well with task management. However, connections to agile methodology as a whole will still be included.

The observed benefits of agile project management in relation to Scrum has been linked to multiple improvements, such as improved quality of products, manageable expectations, increased team performance and higher satisfaction with customers. Also, higher predictability, transparency and confidence of the overall process was mentioned (Noguera, Guerrero-Roldan, & Masó, 2018). Noguera, Guerrero-Roldan and Masó (2018) included that the study used the digital task management tool, Trello. Furthermore, Hoda and Murugesan (2016) argue that teams will benefit from digital agile task management tools such as: JIRA, Trello, Scrumwise and Acunote; if the team has had training with these tools. On the contrary, a few other researchers observed that if the physical space is right, whiteboards and post-it notes are heavily preferred over digital task management tools with the statement that it is more pleasant, enjoyable and easier to update the whiteboard each day; the digital tool in this case was JiRa (Rola, Kuchta, & Kopczyk, 2016). While Roal, Kuchta and Kopczyk touch upon that it was more pleasant and enjoyable to physically update the whiteboard each day, the researchers did not put much emphasis on this statement, nor did they delve any deeper to how this could affect the choice between analog and digital. Similarly, majority of the research literature found and discussed in this thesis seem to follow the same path as to not question why these media forms were used in terms of perception and feeling of usage, rather they dig into other problematics within the agile methodology. Collectively and generalized, it is argued that digital tools are more accessible and practical outside the office space, but are more forgettable and cumbersome compared to the analog tools (Hajratwala, 2012; Perry, 2008).

It seems that the digital tools fail to simulate the easy and natural feeling that comes with using analog tools, such as a whiteboard. Exploring how the feeling and perception of using task management tool is important, due to the possible effect it could have on decision-making and communication within agile task management. A concrete example, in a paper by Perry (2008), it is indicated that digital task management tools decrease the communication. Therefore, has the possibility of affecting the decision-making process. Also, lack of communication between members could create poorly defined tasks, which in turn leads to other problems (Grapenthin,
Poggel, Book & Gruhn, 2015). To end this, the effects our human biases have within agile task management is crucial to explore. Therefore, an exploratory approach is taken, due to the observed lack of research within this approach of understanding the feelings and perception of using agile task management tools.

The research surrounding the agile methodology; commonly lays focus on time, efficiency or similar terms. A few examples are as follows: firstly, a solution to the problem of undefined tasks occurring in the agile process has been suggested (Grapenthin, Poggel, Book & Gruhn, 2015). Secondly, another study surveyed respondents who emphasized the importance of internal communication of project leadership (Marcella & Rowley, 2015). Thirdly, to minimize the time to finalize a project, the members should work on parallel subtasks when possible (Andersen, 2016). Lastly, researchers explain that there are many variables to consider when reducing time is a priority (Marcella & Rowley, 2015). As these are only a few, there does indeed exist multiple studies within similar or partially connected topics, yet they differ from this studies aspect: the perception and feeling of using analog and digital agile task management tools.

1.1 Problematization

Agile methodology has had a wide-spread adoption within the software development sector and with an increasing rate. Specifically, the primary contesters Scrum and Kanban are controlling the agile sector with their high adoption rate (Špundak, 2014; Rasnacis & Berzisa, 2017). As these agile methodologies are relatively new, they haven’t had time to get fully tested. Meaning, multiple unexplored research areas exists within the practices of the methodology. In particular, the task management tools which has had a hard time being established in the digital space. Illustrated by the popular use of post-It notes, whiteboards and other physical objects that require physical engagement and movement (Perry, 2008; Hoda & Murugesan, 2016). Task management tools, such as Trello and Taskworld etc, do exist within the digital space, but analog tools are still very relevant. In theory, digitalization thrives by solving the analog problematics and other physical limitations. For example, the internet heavily increased knowledge sharing to such a global scale that would not be physically feasible by any conventional means, especially true when you consider the time of year the internet gained popularity.

Most industries strive to be as efficient as possibly, where some do more than others (Mierzejewska & Shaver 2014), yet the common goal of agile development is to maximize value from the least amount of effort or input. Crudely speaking, the most industries wants their workers to output the maximum amount of value from their individual work for the least amount of overall cost, which is not necessarily their payroll but the cost of equipment, electricity, traveling, meetings and so forth (Mierzejewska & Shaver 2014). As you would think, maximizing the output of a human-being gets rather complex when you consider that we can’t always be at our top performance. Beyond, we as humans are subjugated to constant bias and emotions which we can not fully control, but we can try to minimize subjectivity by exploring
and understanding how it affect our lives (Haraway, 1988). Therefore, it seems rather important to explore how biases affect the work we do, so that we can later understand these biases and either work better with them or try to reduce them.

In agile software development, there seems to be a lack of research within the exploration of understanding how subjectivity effects decision-making processes. Specifically, how the feeling and perception of a tool could motivate its use; as how Hajratwala (2012) and Perry (2008) indicates that a poorly made task management tools has the possibly effect of turning into a annoyance, which in turn leads to decrease or improper use. In relation to the using of analog and digital agile task management tools, the problem of decrease in use would lead to a unclear environment for the whole team of how far along the project process is and also create confusion with what each team member is currently working with (Engum, Racheva & Daneva, 2009). As you would imagine leads to a few complexities and probable annoyance, due to the lack of communication and coordination. Therefore, attention needs to be brought up to the apparent problem within agile development, however could most likely also be an inspiration to understanding how subjectivity affects the usage of any tool and other practices.

1.2 Research Aim and Goal

The mixed use of analog and digital agile task management tools suggests that digital tools are not seen as a solution in all or most regards. Therefore, the aim of the study is to explore the reasons behind the mixed use of analog and digital agile task management tools, with a close look upon the feeling and perception of using these medium. The goal of the study is to provide a possible solution to perceived problematics with agile task management tools, with regards to the feeling of usage; and the advantages and disadvantages. The scientific contribution will consist of an exploration within the gap of the feeling of using analog and digital tools, specifically agile development task management tools. A design science approach is taken to develop and propose a solution. In addition, semi-structured interviews with multiple different agile development teams will be conducted. When possible, an observation of the agile workspace will be taken place after the interviews.

1.3 Research Questions

Towards addressing both the aim and the goal of the study, two correlating research questions have been formed. Both are closely related to one another, whereas answering the first research question (RQ1) will address what the perceived issues are in the second research question (RQ2).

RQ1: What are the perceived advantages and disadvantages between analog and digital task management tools?
**RQ2: How can the perceived issues surrounding the analog and digital medium of task management tools be resolved?**

Towards fulfilling these research questions, an exploration of literature about advantages and disadvantages surrounding the task management tools will be conducted, and to grasp the practice of these tools interview and observations will also be included. The study will also involve and try to understand how biases affect the task management area. The first research question, RQ1, will be indirectly addressed throughout Chapter 2, 4, 5; and concluded in 6. Simultaneously, RQ1 will be directly addressed in heading 2.4 and 4.2. The second research question, RQ2, depends on the findings from RQ1 and therefore will be heavily connected to the first heading in Chapter 5, 5.1 Examining the Findings, where findings from the theoretical background and practical results are analysed to create a set of requirements. RQ2 will be addressed throughout Chapter 5 and is heavily connected to a prototype solution. Again, will also be concluded in Chapter 6.

### 1.4 Limitations

A widespread of adoption of agile methodology has occurred within the software development sector, due to its emphasis on flexibility, adjustable, iterative process and focus on shared responsibility between each team member in the development process. A multitude of areas within agile development has been problematized and many areas has the potential to be further discussed. But, taking this studies resources into account, there will be a primary focus on the Scrum methodology and the software industry. However, due to the close connections to- and unclarieties of project management and agile development, there will be a brief description of understandings and defining of these topics. Importantly, the provided discussion, results and prototype solution will target the agile methodology, Scrum. In addition, the primary focus will be on the perception and feeling of using analog and digital task management tools. Further unexplored areas within the topic will occur, which will be described in 6.3 Future work.

### 1.5 Overview of Document

The document is divided into seven chapters with a layout inspired by the taken research methodology, Design Science. In similar words, a Design Science flow. First chapter, as previously seen, the introductory consists of a grounding explanation to why the research is relevant and important. Second chapter, the theoretical background is related to the Design Science rigor cycle, which means researching and establishing a theoretical framework to the problem is at hand. Assuring that the topic has not already been researched and is also relevant in the academic world. Third chapter, Design Science is explained and data gathering related areas are discussed. Fourth chapter, related to the relevance cycle in Design Science, here the practical results from the interviews and observation is examined and compared. Fifth chapter, related to the design cycle, here the theoretical framework and the established practical results are
analysed. In addition, the construction and decision-making behind the proposed prototype solution is explained. Sixth chapter, a discussion and conclusion surrounding all the elements brought that were to attention throughout the whole study.
Chapter 2: Theoretical Background

Project managers are in a constant battle of keeping the co-workers happy and efficient; and also keeping the stakeholder(s) calm and satisfied during the project progress. As previously mentioned, project management and agile methodology has become increasingly more important within the agile software development sector. A vast array of descriptions and rules exist within project management and agile methodology. However, multiple contradictions, disagreement and lack of exploration do exist within these fields.

This chapter, which is connected to the rigor cycle of design science, explores and describes the vast array of perspectives and definitions of project management and why agile development has gained a lot of traction, specifically the Scrum methodology. Similarly, agile task management is described, historic evolution is brought to attention and problematics within responsibility of task selection is discussed. Furthermore, the difference between agile task management tools is looked upon in order to understand the spread adoption between analog and digital tool. Importantly, the lack of exploration within the feeling and preference of using analog and digital tools is problematized.

2.1 Project Management

A vast number of different project managers and researchers have defined what project management is, but it has been shown that perspectives change over time, as we are influenced by new published works in the field (Andersen, 2016) and as project management practical experience develops. Therefore, the different definitions in published works needs to be investigated in order to understand how project management could be seen and it is imperative to clarify how this study will define project management.

A few definitions of project management are: (1) project management is a tailored set of guidelines and principles that can be applied in a situation or approach, (2) project management is a knowledge set about tasks, roles, tools and techniques that can be adjusted to a specific project, (3) project management could be any principle the project management teams rely on in order to deliver a project (Špundak, 2014). Luckily however, most of these definition fall under the same set of principles that Špundak (2014) boils down to “as a set of methods, techniques, procedures, rules, templates, and best practices used on a project“, as inspired by the Project Management Institute. On the contrary, project management is also defined as a agile process of planning, controlling, coordinating and leading a varying and complicated set of process and people who are trying to achieve a specific objectives in a project (Liikamaa, 2015). These principles do not necessarily differ from the previous set of principles, rather they have been adjusted to specifically involve the agile project management methodology.
To contain the vast number of definitions Andersen (2016) proposes a task perspective and a organizational perspective, also including a set of principles. The task perspective means that the project managers should focus on a single timed delivery, define all objectives and break down all objectives to small subtasks at the beginning of the project, and lastly stay within budget and to the quality discussed with the stakeholders. On the other hand, the organizational perspective means that the project manager should instead focus on adequate deliveries during the process, objectives are defined as the process passes, every member works closely together and lastly, time and cost are seen as expendable factors (Andersen, 2016).

Due to the different definitions and principles, the task and organization perspectives on project management will be how agile and traditional project management methodologies are defined and what their principles stand for. Importantly, the task perspective will be referred to as the agile project management methodology and the organizational perspective will be referred to as the traditional project management methodology. To clarify, these perspectives are not completely opposite of how agile and traditional project management is defined in general, but rather now has some more specific and clear principles to wrap around. In addition, the two methodologies will be focused around software development.

2.2 Agile and Traditional Project Approach

Traditional and agile project management differ in their ways of approaching a project, and one method is not necessarily better than the other. Rather, the project in question needs to consider which methods’ approach most beneficial for its case. Typically, some fields tend to lean more towards a specific methodology, as will be discussed.

The traditional method, being the older and historically long used method, is appropriate when the project has clear initial user requirements and project goals from the start of the project, due to there being a minimal uncertainty (Špundak, 2014). The traditional project manager is responsible for most of the decision-making (Moe, Aurum & Dybå, 2012), hence also tends to oversee which tasks are being worked on. And, at times the project manager just oversees, as the decision-making might be done higher in the hieratical structure (Saynisch, 2010). Furthermore, the traditional method tends to follow a strict approach, that in theory could be applied to across industries without considering adaptation (Marcella & Rowley, 2014). A concrete example, Waterfall is one the popular frameworks used when working within traditional project management. The framework focuses on one specific phase at a time; such as planning the project requirements, developing or testing. The idea being that the phases go down as a waterfall until project completion. Importantly, after one specific phase is completed, it is written in stone and should not be altered e.i. it’s quite hard swimming up a waterfall. Overall, traditional project management is closely related to hierarchical nature, where a few lead the many, and once something is marked as done, it’s done, period (Saynisch, 2010).
The agile method has gained high and wide amount of public attention, as it is seen as the go-to method in recent years (Špundak, 2014). It has also been widely implemented and used around the world with over 20 different variants (Rasnacis & Berzisa, 2017), where the Scrum framework is the most popular in the software development field (Grapenthin, Poggel, Book & Gruhn, 2015). In fact, a survey showed that 50% of companies of who answered said they were adopting Scrum (Rodriguez, Soria & Campo, 2013). The major attention is due to its solution of dealing with the two weaknesses of the traditional methodology, which is the intolerance for change and the lengthy development cycles (Engum, Racheva & Daneva, 2009). It is unclear which agile practice solves those specific problems, but there’s a magnitude of improvements that has come along with agile methodology. The agile methodology Scrum has greater flexibility than the traditional waterfall method (Mejía et al., 2016). In addition, the implementation of the agile methodology is related to improvement in the development process, namely: faster delivery, less bugs, increased and effective communication, better quality, more precise risk analysis and reduced costs (Rasnacis & Berzisa, 2017). Further, it has also been observed to create manageable expectations, improved team performance, greater customer satisfaction, improved visibility of the progress, also including, transparency, confidence and predictability (Noguera, Guerrero-Roldán & Masó, 2018) Importantly, agile methodology works in iterations and therefore has the ability to adjust to new objectives and goals. This is done by doings timed sprints with defined tasks and a end goal. After each sprint new tasks and goal are set. Overall, agile project management is more related to a heterarchy, although debatable if true, everyone involved should have the same amount of responsibility.

The agile methodology compared to traditional, has drastically changed the nature of collaboration, coordination and communication (Moe, Aurum & Dybå, 2012). Namely, agile methodology focuses on a shared leadership, also known as self-organization (Hoda & Murugesan, 2016) and important decisions are made through an interactive process, involving the people whose work closely relate or influence each other (Moe, Aurum & Dybå, 2012). As a result, the responsibility of a project manager has changed to, parallelly being the leader, the manager, the facilitator and mentor (Liikamaa, 2015). Similarly, it is argued that implementation of agile project management would be a challenge without self-organizing teams (Rasnacis & Berzisa, 2017). On the contrary, it is argued that self-organization has made communication with stakeholders more complicated, compared to the traditional approach where the project manager is responsible for most of the decisions (Moe, Aurum & Dybå, 2012). Equally, members in self-organized teams are closely involved with daily project management activities such as planning and establishing tasks, which has lead to a set of new challenges. (Hoda & Murugesan, 2016). Therefore, it has become increasing important that group commitment and clearly defined member responsibility is understood throughout the whole team (Noguera, Guerrero-Roldán & Masó, 2018), including the importance that all project participants should share similar views on the methodology and framework used (Andersen, 2016). More importantly, self-organization has
led to a shared responsibility within aspects of project management, including decision-making on establishing which tasks should be prioritized and which to throw aside.

As established, as Scrum is the popular and widespread agile framework it is important that problematics within the framework is brought to attention and possibly solved. A brief description, Scrum proposes a rotation of roles, small packets of deliverable works and these are turned into to workflow components such as: Sprints, regulatory meetings, shared responsibility and persistent task evaluation through the use of a backlog; could also be referred to as a task management tool (Noguerà, Guerrero-Roldán & Masó, 2018). These workflow components are entangled with one another through the human interaction between them, and while it is possible to change what components to use and how to use it, it could affect the other components. For example, Having a single short meeting a week could affect the outcome of the task evaluation, due to the lack of coordination and thought gathering. Simultaneously, to emphasize the agile of the Scrum framework, a single short meeting a week has the possibly for being advantageous in a certain situation, if the whole agile team agrees upon it and the reason behind the decision of doing so are valid. Importantly, the use of a Scrum backlog e.i. A task board, is highly important to keep the team coordinated, by gathering all the necessary and sufficient tasks in a clearly defined space, either digitally or in analog (Grapenthin, Poggel, Book & Gruhn, 2015; Jyothi & Parkavi, 2016).

2.3 Agile Task Management

Agile task management will be defined as managing the projects or products tasks in a defined space, e.i. task board; which is heavily connected to communication, decision-making and prioritization in relation to tasks. Namely, task board is a generalization of a backlog and a to-do list, who all have similar if not the same definitions. In theory, agile task management is about having collective understand and responsibility of tasks, yet observed practice has shown different outcomes.

Agile task management has become a major task, in itself (Engum, Racheva & Daneva, 2009). As the practice heavily relies on self-organization, which includes taking responsibility of identifying, describing and selection your own task for the up and coming sprint. Multiple project participants such as the client, project manager, developers, marketing, sales, management and support; should preferably be involved in the planning phase to identify the necessary task for the task board (Moe, Aurum & Dybå, 2012). To clarify, self-organization has made it increasingly important that everyone involved in the project to collectively be apart of choosing the projects direction and goal. In the traditional view, this was normally discussed between the stakeholders, project owner and project manager. But as the refined roles of the agile methodology has changed to involve self-organized teams, these normally traditional project management activities have become part of every project participants daily routine (Hoda & Murugesan, 2016). This is due to the heterarchical view of agile development, as previously...
mentioned. Furthermore, Scrum changes requirements of a organization as a whole: from resource allocation to how tasks are adjusted to strategic decisions and how the organization supports the teams to shifting the power between all project participants as self-organized team members (Moe, Aurum & Dybå, 2012). In conclusion, the agile theory is to have a heterarchical organization, where the teams are self-organized, meaning each project participants has to take their own responsibility in ways of project contribution.

In practice, it has been found that self-organization can be a self-restraint for members new to the agile methodology. These members struggle to take their own initiative of task selection and frequently asked managers for guidance for a period of time before fully grasping the freedom that comes with being agile (Hoda & Murugesan, 2016). Furthermore, in a student case, it was found that circumstances and workloads made the students forget the agile principles and only laid effort on the completing tasks, in addition it was mentioned that teams tended to begin working on tasks without fully understanding nor considering what those tasks required in the first place (Noguera, Guerrero-Roldán & Masó, 2018). Grapenthin, Poggel, Book & Gruhn (2015) recommend that all the tasks in a task board should be refined and understood to such a degree that it couldn’t be considered a black box. As this recommendation is only beneficial if members puts effort into understand the task before the work begins, its important that the task board has emphasizes on the details of each task and not only a generalized task name e.g. create dropdown menu or change home page.

The material the task board is made of needs to be considered in agile task management, whereas if it should be digital or analog. It is argued that using a digital task board could be good when the context is appropriate: (1) when team members have different levels of knowledge about the project and communication is difficult or hindered and (2) when the project owner and the project developers have different expectations or possible end goals (Engum, Racheva & Daneva, 2009). In other words, when physical communication is not possible or when there is a conflict of ideas what the end goal is, a digital task board could improve the situation. However, these suggestions were a result of testing a tailored digital task board that Engum, Racheva and Daneva (2009) developed; namely RedMine. Therefore, might not be applicable to all digital task boards. In addition, there was no mention to analog task boards, so there might be some biases in their conclusion.

### 2.4 Analog and Digital Task Boards

Before the use of task boards, traditional task management was practiced by using papers with assignments which were handed out in folders or similarly. Later there was more of a transition to using other analog materials, like post-it notes and whiteboard; which arguably made the task board approach more prevalent. Likewise, digitalization became a common practice and task boards started to get digitalized, yet the analog task boards to still be widely used. Despite this, it is agreed upon that a task board is a powerful tool that creates a shared understanding between
the team members, since the task board is a clearly defined space where it possible to visually see the project progression such as: work in progress, pending review, done tasks (Rodriguez, Soria & Campo, 2013).

Other than analog task boards, there is wide existence of different and similar digital task boards, who focuses on different aspects of task management, these tools are namely: todoist, Todo Cloud, Taskworld, Pintask, Producteev, Trello, Wrike, Bambam, hiTask, MeisterTask (Jyothi & Parkavi, 2016), Redmine (Engum, Racheva & Daneva, 2009), Virtual Scrum using virtual reality (Rodriguez, Soria & Campo, 2013) and a unnamed hybrid tool trying to combine analog and digital through the use of a smartphone (Nakazawa, Komatsu, Tanaka & Matsumoto, 2017). Indeed, there is by no means any lack of digitalization of task boards, yet seemingly not widely mentioned. It is possible that the decisions lean towards analogs tools instead of digital.

As you would expect, analog and digital both have their advantages and disadvantages that could affect the decision on whichever to choose between. Perry (2008) lists a few key points to both analog and digital, starting with the analog key points: (1) cheap, it is cheap to create and maintain where the minimum requirements are just tape and sticky notes; (2) minimal training, only requires minimal training as the functions are fairly obvious, due to there not being any complex functions or charts to explain; (3) centralized interaction, it is a centralized location where the progress of the team can be tracked, and also a useful place for holding meetings and informal discussions, therefore increased communication; (4) physical interactions enhances learning, research indicates that the tactile interaction creates additional stimulus that helps the mind to absorb information more efficiently. Hajratwala (2012) also has a few key points to add to the list: (5) easy to modify, its rather easy to adjust a analog task board, specially in unexpected ways; (6) visible reminder, a analog task board is a constant visible reminder of the project progress. On the contrary, Perry (2008) mentions: (A) Limited to line of sight, it can only be viewed from a specific physical location, which can be problematic when outside that location; (B) does not reflect history well, an analog task board does not itself document the historical events of the board, unless someone actively does it. Overall, the analog advantages suggest that cognitive thinking can easily brought into the reality, through the roughness of our thoughts to the roughness of the analog tools. Similarly, analog seemingly promotes our natural process of interaction and doings with both objects and people. However, the disadvantages suggest that the roughness and physical limitations of analog creates a limitation to physical space as the tool and historical data, such as different interactions with tasks and time taken to complete a task is not documented unless extra effort is put in to do so.

Furthermore, Perry (2008) addresses the key points to the advantages of using digital: (1) decentralized access, useful when working from multiple locations and ideal for sharing information across great lengths; (2) integratable with existing digital tools, a digital task board could be integrated with other digital tools, such as bug tracking systems or project tracking
systems; (3) reflects history well: a digital task board is a handy way to save history of the project progress, which could be useful when looking for trends and patterns. And as previously mentioned, (4) centralized and summarized end goal: when the project owner and project developers have different expectations on the tasks or the projects end goal, a digital task board could by design put every member on the same page (Engum, Racheva & Daneva, 2009). By its design, digital allows for increased detail in descriptions, which decreases risk of misinterpretation. On the contrary, Perry mentions: (A) switches interaction focus, the digital tool can take focus away from interaction with people to the tool instead, needless to say that the task management tools should discourage this; (B) access restrictions, The information might unintentinally be black boxed to external project participants, and further a connected device needs to be present to view the information; (C) training, most digital task boards require some kind of basic training to use them well. Hajratwala (2012) also points out; (D) forced structure, it is common that digital tools “suggest” how to use the tool, rather than the other way around. Overall, the digital advantages suggest that multiple different location points of interaction can be connect to a digital single space, this space also has the possibility of being connected to other digital tools and most, if not all, interactions are saved automatically as data and could further analysed and correlated to create metadata. On the contrary, digital seems to try too hard and therefore suffers from being too structural and requires more in-depth thinking due to increased complexities. The increased in-depth thinking might discourage informal communication (See Table 1 for a summary of the analog and digital advantages).

<table>
<thead>
<tr>
<th>Analog</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-cost</td>
<td>Decentralized access</td>
</tr>
<tr>
<td>Minimal training</td>
<td>Integratable with other digital tools</td>
</tr>
<tr>
<td>A place for centralized interaction</td>
<td>Reflects history and backlog</td>
</tr>
<tr>
<td>Cognitive learning through physical interaction and movement</td>
<td>Centralized and summarized end goals</td>
</tr>
<tr>
<td>Easy to adjust and modify</td>
<td></td>
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<tr>
<td>A visible reminder, In office</td>
<td></td>
</tr>
</tbody>
</table>
Further, there are other factors that need to be considered like the office space, that could affect the decision between analog and digital agile task boards (Rola, Kuchta, & Kopczyk, 2016). For example, a lack of space could make choosing digital more suitable. The consequence being that the digital choice cannot be expected to promote collaboration and communication (Nakazawa, Komatsu, Tanaka & Matsumoto, 2017). Similarly, having conversations in person is seen as the best form of communication (Beck et al., 2001), and having a digital tool does not promote the same centralized interaction as the analog tools bring. Importantly, the different advantages, disadvantages and more specific factors suggest that an agile task board should be agile, flexible, documented and possibly accessed from any location. However, the agile team has to choose between having a agile and flexible analog task board or a well documented and easy access from any location: a digital task board. To conclude this, analyzing the difference of what the researchers describe, suggests that agile task boards should have be rough and inherently begin unstructured and adjusted to the team's needs.

2.5 Situated Knowledge

As we have established the definition of project management, agile task management and discussed the advantages and disadvantages of the two different media of task management tools, it’s time to expand upon the possible problematics with these tools by involving biases to the equation. Specifically, involving our own human biases that are actively influencing, either consciously or subconsciously, our way understanding the world we live in and what it means. For instance, Van Dijck (2014) mentions how algorithms are influenced by biases in human behavior, specifically stressing that data is collected and filtered by human-beings, who all have different ways of interpreting what is relevant and what is not. Similarly, our embodiment of different subjective senses and understanding, changes our development as beings (Pink, 2009). For example, senses such as the smell of coffee and listening to heavy metal music in morning will affect each being differently. Some might think a childhood memory, some might feel weird, others might love the combination and other might not. On a side note, this and the next heading should be seen as introductory to the practical field work, whereas understanding human perception and feelings through research literature is rather impractical.

Due to the existence and the ramification of these biases, the term situated knowledge was coined, which could be defined as viewing from a new perspective in order to diminish our existing understanding, which could be heavily influenced by biases (Harway, 1988). Meaning, situated knowledge is about understanding our inherent biases and trying to minimize or remove these subjective influences of our world view, by involving new perspective(s) of understanding. The emphasis is on try to minimize subjectivity, due to the argued belief that we can not fully escape our biases only make ourselves more aware of them and adjust our knowledge and
decisions accordingly (Harway, 1988). Including new perspectives to the previous example could be done by adding a cat’s and the air’s perspective: a cat's perspective might be it is time for food and from the air’s perspective not much would change, unless bass is involved that would create ripples in the air which might later change the coming weather, in extreme circumstances. To summarize, situated knowledge is a way of understanding and minimizing inherited biases by considering one or more new perspective(s) to the topic in question.

2.6 Feeling and Perception of Use

The chosen task boards might be through objective conclusions based on what the companies or teams goal is and how the team will be developing. However as mentioned, some of the advantages, especially with the analog tools, include the human involvement and therefore subjugated to biases. In addition, research within this aspect is lacking: how does our feelings and preferences of agile task boards affect the decision-making process? To explore further how a task board is possibly chosen, we need consider that there might subjective entities in play that affect the decision-making process through the use of situation knowledge e.g. tackling this apparent decision-making problematics in a new perspective (Haraway, 1988). Side note, as previously stated, this and the previous heading should be seen as introductory to the practical field work.

For an information system, a digital task board, to be fully adopted user acceptance is critical (Wamba, Bhattacharya, Trinchera & Ngai, 2017). Importantly, by fully adopted means that the users sees the potential usefulness and it feels as a natural part of the situation, meaning accepting to use something is not the same as fully adopting it. For example, the user might be required to use the system because its heavily connected to the company's system of working. DeLone and McLean (2003) argue that when use is required, it is likely that the system has a significant beneficial impact and also points out that no system is totally mandatory as some employee in the organization has made the decision to adopt the system. However, totally mandatory is referring to the business as a whole, but that does not discard that the employees who are required to use the system might feel as if it is mandatory. The technology acceptance model presupposes that motive of using technology is influenced by two ingredients: perceived usefulness and perceived ease of use (Hwang, Al-Arabiat & Shin, 2016). The first ingredient, perceived usefulness, refers to that the user’s perception of the technology is swayed towards it increasing the user’s performance. The second ingredient, perceived ease of use, refers to the technology seeming easy to use. If the model is used right, the feeling of being mandatory might not appear, as the benefits of the system is clear and the system is not a hassle to use. In terms of task boards, both ingredients need to be discussed. Perceived usefulness is very much connected to the advantages and disadvantages of each task board medium. However, this study emphasizes on exploring the perceived ease of use, the feeling of using digital and analog task boards, as the human aspects seem to be forgotten within this topic. In similar words, the ingredients in this case are heavily connected, but researching is lacking within perceived ease of use, in terms of
how the feeling influences the use of each medium. In addition, using situated knowledge to get an objective approach to the apparent problem.

As previously indicated, most of the research discussions seemingly evolves around discussing the advantages and disadvantages of the differently named task boards or simply points out which tool they used and sometimes explain why. The why is commonly in the terms as: why the tool is good for them, yet do not mention any kind of comparison to any other tool. However, that is not to say a agile team should try every agile task board out there, due to the limited resources normally at hand. In addition, since agile development is self-organized by each team member (Hoda & Murugesan, 2016), suggests that each team member needs to try the tool and agree upon its usage as the task board. Hajratwala (2012) discussion of task management tool usage explains that a client team and their team were using two different task board, which led to communication problems between the two teams. This indicates that that every team and team members needs to agree upon the same task board, including all the project participants who could possibly be interested in the task management area of the project such as: the project owner, project manager, developers, stakeholder and possibly even the financial team.

Conventionally, these adoption decisions are commonly made the by senior management who later expects the employees to use the chosen tool (Hwang, Al-Arabiat & Shin, 2016). Even though, senior management might be the most experienced staff for effectively making this decision, as a agile company everyone to some extent should be included or atleast the employees whose purpose is to use the tool. Notably, some employees might not have as a big of a vote as others and further the importance of each project participant will vary from project to project. Similarly, the situations will vary with each project and a absolute path does not exist. Especially within agile development where the methodology and framework should be tailored to the project and not vice versa (Špundak, 2014; Rasnacis & Berzisa, 2017)

A few papers have taken a new approach to agile task boards and task management, briefly mentioned in previously. Firstly, Rodriguez, Soria and Campo (2013) uses virtual reality to combine analog and digital agile task management principles, with the purpose of learning the Scrum framework. In the virtual reality world, you were playing as your own avatar in a large playing field where you could also communicate with other connected people’s avatars. The main objective was to solve tasks by using the Scrum practices and principles together with the other connected people as a agile team (Rodriguez, Soria & Campo, 2013). The concept as a whole could perhaps create a new type of agile task boards: virtual agile task boards, the name will most likely need some adjustments. The concept in itself is quite peculiar, especially if a business would adopt this technology for their agile teams to use. It could be a good fit for virtual reality development oriented businesses. Secondly; Nakazawa, Komatsu, Tanaka and Matsumoto (2017) also created an alternative approach through combining analog and digital agile task boards by introducing a smartphone, a short-focus projector and a tailored digital task board to the equation; with the primary goal of promoting communication that digital task boards
lack. Basically, it worked by the projector projecting a digital task board onto a plain surface, where the task board was controlled through the use of the smartphones gyro sensor. For example, moving the smartphone to the right would move the selector to the right and tilting the upper part of the smartphone towards you would move the selector upwards. Removing the individual screen looking commonly associated with digital task boards and moving it to a shared space increased the communication between the agile team, and also was operated at similar speeds as analog and digital usage (Nakazawa, Komatsu, Tanaka & Matsumoto, 2017).

Importantly, they could later use the analog digital hybrid task board as any other digital task board, which favors off-location participants. This concept is more appropriate for the business sector than the previously mentioned, due to the apparent practicalitical and communication benefits. However, the paper does not address the fact that only one smartphone can be actively used at a time when projecting, which in turn could present problems such as: one member getting more control over the situation. Concurrently, there was no mention to how it actually feels to use it, just how effectively the participants could use it.

In conclusion, these two prototypes try to situate agile task boards in new a environment, that has been relatively successful in solving their mentioned problematics. The researcher also used situated knowledge in order to find new approach to the problematics, rather solely using similar technologies and platforms. In addition, these concepts also suggest that it is possible to combine analog and digital benefits, which normally go against each other, into a single solution. But rather than just exploring the more objective benefits, exploring the human aspects of feelings and perception could help to understand the problematics better. Pink (2009) proposes and uses sensory ethnography to understand how senses affect our perception of reality which commonly is through interaction with people. This is not an ethnographic study, however the mentions and practices that Sarah purposes could still be applied to semi-structured interviews and observations. Importantly, in order to understand the other people's perception of reality, you need to observe and question why they think about something like they do (Pink, 2009). For example, asking how do you know something is clean? The intent being exploring the senses related to cleanliness. Furthermore, Pink (2009) argues that sensory oriented observations helps finding the non-verbal. More importantly, to further explore feelings and perception it is necessary to involve and communicate with agile teams with a sensory inspired approach.

The use of Design Science does not explicitly correlate with the same principles as Haraway or Pink. However, to develop and achieve a stronger theoretical standing with regards towards addressing the research questions, Harway and Pink are implemented as a means to expand Design Science. Pink (2009) introduces how nonverbal communication affects the way are perceived and interpreted by individual. Haraway (1988) expresses how inherent biases affects the way things are perceived by individuals and how these biases can be personal or cultural etc. Together, these theoretical discussions add value to how to interpret participants expression in the relevance cycle, and how articles describe agile methodology and agile task management in
the rigor cycle. In addition, Haraway argues the importances of taking a new approach to an issue to try to minimize bias and hence the research of the study will follow the same principle. In other words, Haraway and Pink works expand Design Science by involving useful and relevant factors. Being useful as the research questions heavily involve agile methodology, which is adapted to the perceived situations a group of individual are in; and the individual preference of task management tools, which is also discussed through the Technology Acceptance Model.
Chapter 3: Research Methodology

The school of thought the study consists of is a hermeneutic perspective, as a result of my personal and academic background. Meaning, the research will be focused on qualitative and human-centric point of view. Interpretation of subjective feelings and perception of tool usage will be included, due the reasons previously addressed in Chapter 1 and Chapter 2. Therefore, it seemed reasonable to use a design science approach, which focuses on problem(s) entangled within human aspects, technology and management; and further tries to solve these problem(s) by introducing a new prototype or full fledged solution (Peffers, Tuunanen, Rothenberger & Chatterjee, 2007; Hevner, March, Park & Ram, 2004). Specifically in this study, being a demonstrative low-fidelity prototype solution aiming to solve the problematics with the current task board medium.

The current chapter explains the chosen research methodological approach and its connection to the research topic. In addition, it is clarified how the paper is associated with the different cycles in the research methodology, in terms of its layout and contents. Secondly, data gathering techniques and inspirations are provided, including a detailed summary of the semi-structured interviews and observations location and environment. Further, all the participants are listed in a table, whereas their true personal and company identity will remain disguised. The information that has a higher chance of effecting the study is provided such as: amount of agile experience and the title of the employee. Lastly, the ethical considerations and the ethic code used are justified.

3.1 Design Science

Design Science is the chosen methodology for the study, due to its practical and academic combination but also due to the construction and evaluation cycle of a prototype. The methodology is divided into three cycles with the ability to iterate, which are namely: relevance cycle, rigor cycle and design cycle (Hevner, 2007). Importantly the design cycle depends upon the discussion and results from both the rigor cycle, the theoretical; and the relevance cycle, the practical. Notably, if resources agree, multiple iterations of all three cycles is possible, which would possibly lead to more reinforced study. Further, Design Science has a increased possibility of coming across wicked problems that can’t necessarily be solved by a single absolute solution, however a prototype conceptual solution to could address the problem (Schmitt, 2016). The occurrence of these wicked problems could be due to the subjective nature of human involved in the study for instance: how this study relies on the perception and feeling of a task board which is subjective and changes from individual to individual and culture to culture. Furthermore, addressing the specific problem could reduce the risk of its influence over the larger problem at hand.
The rigor cycle, Chapter 2: Theoretical Background, will ensure that the research project is a research contribution and not already well-documented and discussed in the world of research, by looking and grounding the study with scientific theories and experience. The rigor cycle will allow the study to develop and discuss upon similar research topics and further define or generalize different keywords; in this case being project management, task board and task management. There will be a major importance of understanding how the different literature defines these three keywords as it differs, indicated in the previous chapter, Chapter 2. Further, for this study it was important to give attention to the indications that the other studies consisted off such as, exploring the common trends in the choice between digital and analog agile task boards.

The relevance cycle, Chapter 4: Establishing the Practical Results, consists of looking at the more practical aspects by for example conducting interview(s), observation(s) or both. In this study, semi-structured interviews with individuals in multiple agile development teams will be conducted and provide valuable insight into how the agile teams explain their practices and what their thoughts are. Furthermore, semi-structured interviews will encourage the interviewee to explain his or her thoughts by asking open-ended questions, which in the end might produce new and interesting ideas or topics to the study. At the same time, an observation will provide a more informal overview of how the agile team actually work and their agile workspace. Clues might be found in the environment and including an informal discussion with a team member, preferably with the project manager or scrum master, could provoke unexpected discussions and results that might have been considered not worthy or not considered at all. Further, a case with two groups of students in a Java course, if time did permit, would be conducted. Each group of students, around 7 to 8 people, would either get analog or digital as their chosen task management tool to work with during the whole course. The case would have provided a firsthand insight to analog and digital tools could affect development performance. A short
survey would be handed out after each session, which would question the progress of the group project and the practicality and feeling of the task management tool used.

The design cycle, Chapter 5: Construction a Solution, analyses the findings from the theoretical background and the established results, which in turn produces requirements for a well-established task board. Likewise, the notion of the solution is addressed and is followed by the prototype solution proposition and prototype conceptualization. The latter discusses how the prototype came to be and how it connects to the established requirements from the analysis. Although no evaluation took place, a short evaluation process description is expressed, as it is part of Design Science. The evaluation heading will express how it would have been evaluated, with regards to the current knowledge. It is also important to emphasize that the solution went through multiple ideas before being locked into one single idea, due to how the design cycle is dependent on the two previous cycles.

3.2 Data Gathering

All the different names for a task board seem to be rather large. Therefore, it felt necessary to provide my searched queries and what my generalization consists of. Agile task management could be seen as a agile-, kanban- or scrum backlog; also came across card based planning. An agile task management tool, a task board had the span of: task-, agile-, Kanban- or Scrum board, backlog or to-do list. To fully understand select one word in each bracket to get one combination: [Task / Agile / Kanban / Scrum] [Board / Backlog / To-do list]. A search query ended up being: ("analogue" OR "analog" OR "physical" AND "digital") AND ("preference" OR "feeling" OR “perception”) AND ("agile project management" OR “agile”). The terms card wall and progress board were also found. The point being to present the alternative keywords for seemingly the same words. As these might only be a few, I find it necessary to report the ones I considered and used while researching this studies subject.

A qualitative data gathering approach is taken to understand individuals feelings and perception of agile methodology, in relations to agile project management and task management. Pink (2009) notes in the book “Situating Sensory Ethnography: From Academia to Intervention” that “it would be erroneous to see sensory ethnography as a method for data collection at all”. However, I argue that it is possible to use sensory ethnographic ideas to be inspired by and refer to, when conducting and later discussing the semi-structured interviews and observations. Pink argues sensory ethnography does not have an objective or truthful output and therefore cannot be scientific. Yet, as previously argued, pretending that humans bias does not influence the reach for true objectivity seems slightly ridiculous (Haraway, 1988; Pink, 2009). In addition, Design Science commonly crosses subjective elements, due to its involvement with human-beings (Peffers, Tuunanen, Rothenberger & Chatterjee, 2007; Hevner, March, Park & Ram, 2004). Understanding the reasoning behind the feelings of a thing in question gives insight to why it might be used or not be used. Understanding the reasoning behind multiple individuals feelings
of a thing in question could provide value insight that is comparable, which creates a more indepth picture of the advantages and disadvantages of the thing in question. The thing in this case is, ofcourse, a task board.

A purposive sampling technique was used to gather participants, meaning that the participants was chosen based their characteristics and the object of the study. Similarly, traces of snowball sampling do occur, as I contacted one member in a team who later connected the rest their team members. Moving on, the participants were reached out to through multiple media, commonly through the help of Malmö University staff who had contact with external relations with probable fit companies for this studies topic. However, out of the nine different possible companies who seemed to fit; four ended up not responding to the request, two were not a fit as they did not use agile methodology and two responded with saying that they don't have time to participate. Which leads us to the final company (D), who accepted the request and one participant within the company had time to partake in a interview, which was the project manager (See Appendix III for the participation request and Appendix IV for the pitch, that was provided as additional information after acceptance).

Simultaneously as these requests were sent out, I took the opportunity through the help of a family member to post an article on LinkedIn, that briefly explained my studies in a more captivating manner, in the hope that someone would get hooked, so to speak. The aspiration was not only to find participants, but also find participants completely outside my social realm, to a certain extent, compared to the other methods used. The article got more than 600 views and ~60 clicks, but unfortunately no responses related to acceptance of the request were received. Nevertheless, as a precaution, I also reached out to friends who worked within software development and used agile methodology, and asked them if they could contact their companies and forward my participation request. This turned out to have a great response rate where three out of the four companies asked, accepted the request. These companies (A, B and C) were in unison able to lend me ten participants (see Table 2 below for all the participants). I wanted to assure that they were willing to participate because they wanted to, and not told to, where they commonly responded with that they knew the struggles of finding willing participants and therefore were happily willing to help out.

3.2.1 Semi-structured Interviews

As previously stated, the idea behind semi-structured interviews is to encourage the interviewee to further shape their thoughts and descriptions of why they are thinking in a curtain way. It doesn’t only shape the description, but also helps the interviewer to more precisely understand their point of view, possibly leading to decrease in misinterpretation. In addition, the open-ended questions could produce new and interesting ideas or topics on which the researcher would not have otherwise considered to be in the study (see Appendix I for the interview questions). Pink (2009) emphasizes that researchers do not always necessarily know what they are expecting to
find, and also mentions that in order to understand others perception of reality, you need to observe and question why they think about something as they do. In similar words, the interviews took to consideration that the researcher might not know all the possible angles. In order to closely understand the angles and perspectives, it was important to ask follow-up question commonly associated with why: could be as simply as just asking “why?” to “why do you feel as if this is more advantageous than the other?”.

As more than talking is happening during an interview, it was partially important to consider the interview environment. The environment should be understood as a shared placed, whereas understanding the situation includes the non-verbal communications (Pink, 2009). Body language, sound pollution, the drinks on the table, open or closed door, weather outside and more; is all included in the non-verbal communication and therefore has some effect on the study. A extreme scenario as an example, the coffee machine messed up and made some horrendously bad coffee, that after drinking the coffee it leaves a unimaginable aftertaste and the sensory nervous system is sending a constant stream of “please remove this awful thing”. The point being, it could be a distraction from the more important issues at hand, unless you consider coffee to be quintessential.

The companies participating were located in southern Sweden namely: Karlskrona, Blekinge (A); Växjö, Småland (B) and Malmö, Skåne (C, D). All the interviews were conducted within the companies respective office space, which all had proper interview conditions. The noise pollution was fairly low, was behind closed doors in rooms fit for multiple people, had comfortable seating, a table and more. Furthermore, the average length of each interview were 15 minutes; where company A had the average of 17 min, B of 11 min, C of 16 min and D of 17 min. As previously stated, three out the four were reached through friends and the last one was reached through Malmö Universitet staff suggestions and personally emailed by the researcher. Moreover, the interviews were recorded on a mobile phone and later transcribed for analytic purposes. Finally, the interviews were conducted within the timeframe of four weeks and separated into five different occasions, as company A had been split into two segments: the reason being due to time and workload. These occasions being: A on the 2 Mar and 23 Mar, B on 9 Mar, C on 12 Mar, and D on 16 Mar; during anno 2018.

3.2.2 Observation of Workspace

The observation of the workspace were quite informal and were preferably conducted before the interviews, as it relaxed both the interviewer and the interviewees. In the case that the observation was not conducted or was after the interview, the interview normally started with some kind of informal talk just to get to know each other and ease the relation. The purpose behind the observations was to gather a complete understanding on the working conditions, which would establish a better connection to their thoughts and perspectives (Pink, 2009). For example, limited office space could mean higher preference to a digital tool, instead of a analog
tool that uses the limited space. Furthermore, as with the interviews as well, the observations could also provide interesting thoughts and discoveries, that would not have otherwise been treated. Important side note, company B will not be discussed in this matter, as their policies seemed to be very strict to external parties, indicated multiple times throughout association with them. However, it is safe to say, that the team commonly worked with internal software development. From now on, as I did not talk to the entire company, companies are going to be referred to as teams e.g. team A, team B etc, unless the issue at hand is with the company as a whole.

As the interviews in the first occasion with team A were in the morning, I was invited to take part of the morning standup meeting. They had these meetings every morning at a set time and the matters during the day were discussed and this time I was also introduced and situated to the team and the office. The team is considered to be software development consultants to an external party. To briefly explain the observation: the whole office consisted of an open environment, where multiple teams had their specific locations; the duration of the observation and standup meeting were about 30 minutes. Further, observation with team C were both before and after the interview, as to clarify discussions and questions. They were divided into two rooms: one for development and other for management; whereas the task board used was with management. In total, the observation duration was around 20 minutes. Also, team C were developing their own web application, where they personalized subsections of the application to clients. Importantly, further details surrounding the observations will be discussed in the coming chapters, where the possible effect of how their environment could influence the chosen tool.
3.3 Participants

The study consisted of a total of eleven participants, whereas average experience in agile methodology was 47 months. The participants will be referred to by their ID as the table below shows, Table 2. The table also shows all the participants that have partaken in the study and include their age, agile experience, role, and when they partook in the initial interview.

<table>
<thead>
<tr>
<th>ID</th>
<th>Company (Team)</th>
<th>Age (years)</th>
<th>Agile Experience (months)</th>
<th>Role</th>
<th>Interview Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1_A_PM</td>
<td>A</td>
<td>38</td>
<td>168</td>
<td>Project Manager (Team Lead)</td>
<td>2 Mar</td>
</tr>
<tr>
<td>P2_A_Dev</td>
<td>A</td>
<td>30</td>
<td>18</td>
<td>Developer</td>
<td>2 Mar</td>
</tr>
<tr>
<td>P3_A_Dev</td>
<td>A</td>
<td>26</td>
<td>12</td>
<td>Developer</td>
<td>23 Mar</td>
</tr>
<tr>
<td>P4_B_PM</td>
<td>B</td>
<td>28</td>
<td>18</td>
<td>Project Manager (Scrum Master)</td>
<td>9 Mar</td>
</tr>
<tr>
<td>P5_B_Dev</td>
<td>B</td>
<td>38</td>
<td>6</td>
<td>Developer</td>
<td>9 Mar</td>
</tr>
<tr>
<td>P6_B_Dev</td>
<td>B</td>
<td>23</td>
<td>24</td>
<td>Developer</td>
<td>9 Mar</td>
</tr>
<tr>
<td>P7_C_PM</td>
<td>C</td>
<td>61</td>
<td>48</td>
<td>Project Manager</td>
<td>12 Mar</td>
</tr>
<tr>
<td>P8_C_Dev</td>
<td>C</td>
<td>29</td>
<td>6</td>
<td>Developer</td>
<td>12 Mar</td>
</tr>
<tr>
<td>P9_C_Dev</td>
<td>C</td>
<td>23</td>
<td>10</td>
<td>Developer</td>
<td>12 Mar</td>
</tr>
<tr>
<td>P10_C_Des</td>
<td>C</td>
<td>24</td>
<td>24</td>
<td>Designer</td>
<td>12 Mar</td>
</tr>
<tr>
<td>P11_D_PM</td>
<td>D</td>
<td>51</td>
<td>180</td>
<td>Project Manager</td>
<td>16 Mar</td>
</tr>
<tr>
<td>11</td>
<td>4 (Teams)</td>
<td>~34 (Years)</td>
<td>~47 (Months)</td>
<td>4 Project Managers, 7 Developers, 1 Designer</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: All the interviewed participants. A description of table column meanings: (1) ID: First keys stands for participant number; the second keys, after the underscore, stands for their team; and the keys after the last underscore stands for their role. (2) Company: describes the company they were in. During the study, they will commonly referred to as team, not company. (3) Age: Age of participant in years. (4) Agile experience: months of experience within the agile methodology. (5) Role: the generalized role, for the sake of simplicity, of the participant within the company. The parenthese is the stated role. (5) Interview date: shows the date they participated in the interview.
3.4 Ethical Considerations

There are a few ethical considerations that need to be brought up for transparency reasons. First, the participants' identity will be disguised to avoid potential harm to their social life, work life or similar; due to them partaking in the study. Secondly, all participant will be informed and aware of their rights and informed consent will be asked for before participation. They will be asked before participation as so they can participate in the study and also be informed that they can opt-out at any point in time, for any reason. However, the number of unsatisfied participants after participation will be mention for transparency reasons. Which ended up being zero unsatisfied participants. Beyond this, it is important to consider that it is possible that the participants and the researcher might not be fully aware of the possible consequences of partaking in the study. However, it is mostly a side note, as being fully aware of everything is rather impossible. Importantly, this study will be inspired by the principles of APA’s ethics code, which includes a more in-depth description of the ethical considerations explained above (Smith, 2003). Also, the images used in the study have been approved by the appropriate and respective owner(s).
Chapter 4: Establishing the Practical Results

The theoretical background introduces a wide array of information, which is commonly not as current as today. Meaning, there is an importance in exploring and analysing how the agile software development field has possibly changed from what is documented in science to practical field work, in order to gather assurance if the business problems are still relevant. Further, the applied ways of agile methodology in practice does not only differ due to time, but also as the fundamentals of agile methodology means adapting to the explicit situation the people co-exist with (Grapenthin, Poggel, Book & Gruhn, 2015). Accordingly, it is influential to consider the teams scenarios to develop a dynamic solution that could be applied in multiple circumstances.

Design science research has the desire to improve the important and relevant business problems by introducing a solution, often technology-based, and discussing the process of building these solutions (Hevner, 2008; Hevner, March, Park & Ram, 2004). This chapter is part of the relevance cycle and it analyzes the practical results from the semi-structured interviews and observations which were conducted with four distinct companies, who referred themselves or the team as using agile methodology. Firstly, the results surrounding agile methodology and practices is established. Secondly, the results are analyzed through within individual team members to the individual agile teams and later compared to the other agile teams, in order to examine if any conflicts exist within a agile team and later the conflicts between agile teams. These results will provide a clarification of how various agile approaches differs from company to company or team to team.

4.1 Agile Methodology in Practice

Using agile methodology consists of adapting to the project requirements, while at the same time trying to keep some kind of standardizing for ease of communication between both teams and companies, as the constant stream of deadlines keeps the teams occupied; shown by the responses from interviews, observations and the participation requests. Yet, as indicated by the participating teams, agile methodology has plenty of common grounds, their approaches to these grounds may differ in various ways. Subsequently, looking towards each teams approach adds interesting and noteworthy thoughts to their situation and their use of tool. Establishing the similarities and differences between each team adds an a more comprehensive understanding of their thoughts on agile methodology as a whole and the usage of task boards.

4.1.1 Selected Framework

Indeed, agile methodology stands true to its name. Each team had their own variant of approaching agile methodology and chosen agile practices, commonly using Scrum. Some teams emphasized on different practices within the chosen framework, but they all noted that the
backlog e.i the task board, and shared-responsibility were a few of the major points of agile development. In similar words, the teams have adapted to the project(s) requirements and used seemingly appropriate methods and practices. Although, they might not have full control over the decision making process of these methods, practices and tools; due to the hierarchy that still exists within the company, to some extend. Insignificant data makes it hard to establish if the lack of full agile adoption within the companies affected the process of development. Nonetheless, the different approaches all seem to work by their own standards, of course there will always be ways to improve, which all the teams strive for.

The agile framework used were commonly related to the Scrum practices. Both team A and team B had established that they were using Scrum practices in their projects, whereas they had chosen particular practices that fit theirs needs, which is commonly done within the agile world. Further, team D switched between Kanban and Scrum depending on various factors such as: who is the client and what is the apparent workload, in terms of delivery frequency and task complexity. Expressing that Kanban being better for projects with very frequent deliveries and a two or three sprint that normally associated with Scrum would not hold, in these cases. On the other hand, team C had not truly established which framework was currently being used, and instead most members had a broad sense of that it was a agile way of working. The answers gathered concluded that they were clearly inspired by both Kanban and Scrum practices and had mixed the two. P7_C_PM expressed that this might be due to that it’s a relatively new company, whom might not have the need for complete structure, as the redundancy that comes with might not outway the apparent benefits yet.

Concluding, all the participating teams had a connection to the Scrum practices, whereas two were continuously using it, one switched between Scrum and Kanban depending on the project requirements. And, lastly the smaller company, team B, do not yet see a need for a fully fletched establishment. Simultaneously, it is possible to question when agile becomes agile and when its not. As established, agile methodology consists of adapting to the situation and using the agile practices that seem to fit to that situation. Basically, evaluating if the agile practices are used right, you may need to go case specific as all projects and situations differ.

4.1.2 Situation and Approach
It is important to consider that each team had their own situation that affected how they approached agile methodology. Team A and team B both had a more permanent and similar projects that reduced the need for constant change and adaptation, in terms of how to use agile methodology. In contrast, team D was seemingly working with multiple clients and projects and therefore had a need to adapt to the new projects and their requirements. Similarly, team C had multiple clients, but are working on the same webb platform and adjusting the different subsections of the platform to the clients requirements. Importantly, even though agile methodology tries to remove hierarchy, team A, B and C (Not enough information if also related
to D) had signs of hierarchy, as it was frequently mentioned that some decisions were made from people in higher positions. For example, these team either had the decision of the select task board be taken by higher ups, external parties or it already was there when they entered. However, they all collectively agree that the current task board is place feels appropriate and if the team members would want to change: that change would be possible, if there is a valid reason for it. Highlighting that there is some kind of acceptance towards the idea of self-organization, as the team and team members can switch a few things around.

The agile methodology consists of self-organization that heavily depends on member participation or also described as “to mention effective project methods, everyone has to be accountable for the process” by P6_B_Dev when questioned about shared-responsibility within agile development. P1_A_PM and P2_A_Dev both agree that agile development consists of a combined effort with shared responsibilities, even though the individual tasks may differ from member to member. Meaning, as P2_A_Dev points out, the project manager will not have as much time of implementing code in the program as a developer, due to the project manager having to coordinate, communicate with external parties and refine tasks etc. Equally, even if each participate may work with different assignments, they are still very likely influence one another. It’s going to be rather hard to code for external parties when communication to that party stops and it’s going to take high level of convincing to keep communication with a external party when the developers stop developing. Possibly also a problem, or atleast temporary one, if one single developer stops engaging with the project. Therefore, agile development depends on shared-responsibilities from programmers to possibly the accountants. In addition, shared-responsibility indicates that communications need to be a constant flow throughout the whole project.

4.1.3 Meetings
The teams all collectively had morning meetings everyday, where they discussed the plans for the day, with exceptions here and there depending on which team and the current circumstances. During the short observation with team B, I found that they used a TV to visually remind the members of the digital task board, and during interview with P11_D_PM it was expressed that they also used a TV to visually remind the members. And, while its insignificant to say if the teams using digital task board had the meeting around the TV, it is fairly certain that they do as much of these morning meetings revolve around the task board. Further, the other teams A and C used a analog task board and their morning meetings consisted of them standing near the task board and discussing the relevant topics such as: who will do which task, is anyone stuck etc. Overall, the morning meetings were aimed to be at around 20-30 minutes and no more. The teams all had their variants of evaluation meetings after a certain goal has been reached, with the focus on constant self-improvement and the quality of the produced good. Self-improvement referring to both improving as a team effort and individual performance. Similarly, the meetings seem to be prefered to take place next to the task board, as the task drives most of the
conversation. The analog using teams, standing in front of the their physical board with each member engaging with the task board, and the digital using teams, having a screen to show the task board. Another note, Team B automatically engages with the digital task board through connections between the developing program and the digital task board, throughout the day.

Figure 2: Team A, analog task board (blurred parts due to sensitive information). The post-it notes on the whiteboard represents a task and the circle magnet with a image on top represents the member in charge of the task. Interestingly, during the morning stand-up meeting around the task board, the individual who hold the team mascot talks and the others listen.

4.1.4 Task Selection Responsibility

Task selection responsibility was touched upon to see who is actively using the task board in question. The results, especially between the project managers and the developers including designer, seem to at times have a slight conflict between the statements. In team A, the project manager P1_A_PM explained that the strive was to make each member know a little bit of everything, so that they know all the parts of the process within the development of the application. P2_A_Dev expressed that the responsibility lies on the team members, while P3_A_Dev said it was mixed depending on how important the tasks are: the most important ones are handed out, while the minor tasks are freely picked. Further, P4_B_PM stated a similar approach as P1_A_PM, and explicitly said (the quote is translated from swedish):

What I strive for is that all shall be able to do everything and therefore I don’t want them to pick something they already can do, rather pick what's on top [highest priority]: this has to be done, do it. If you can’t, ask someone for help.
Otherwise everyone becomes attached to their own domains and if he is sick, no one can do it. (Interview, P4_B_PM, 9 Mar)

The idea from these two project managers being to create a collectively knowledge base for each member in the group, by learning and teaching each other to reduce the responsibility a single developer might have. Meaning, if someone is not be able to work, the whole team will not suffer as they might have if that members role was critical for project progression. Concurrently, P5_B_Dev said in the beginning that the scrum master recommends which tasks to pick and P6_B_Dev said that task selection depends on time, but mostly get to choose for himself. The few conflict in results, between project manager and developers, could be due to the knowledge base or experience the developers have and therefore have varying amounts of freedom within task selection.

Team C concluded with similar statements as Team A and B, where the developers had varying amounts of freedom. The situation in Team C however differs in the way that they are working with different clients within the development of subsection in a single web application. For example, P9_C_Dev has been working towards a client’s subsection by himself, and therefore has been rather free to choose which tasks to do, of course while also considering the priority of the listed tasks. While, P8_C_Dev and P10_C_Dev had mixed task selection responsibilities, where at times they could get handed a task and other times they could select a task. Likewise with team D, P11_D_PM forwarded that they mostly have self-selection of tasks within the team, depending on experience and members of team.

The project managers seem to have a common strive to create a base knowledge between each member within the team, with exceptions to current experience etc. The idea being not to put too much pressure on a single member and a common strive to develop the team as one. At the same time, the developers do not seem to mind being handed tasks at times, as they still have freedom to freely choose other tasks and also object to the handed task, if need be. Although the task selection responsibility was commonly by the project managers, the individual team members were engaged with the task board in various ways. However, the digital task board seem to reduce the active use as the digital systems automatically updates the changes made. Compared to analog where multiple developers mentioned that they at times took the post-it note, with a task, and placed it on their computer to serve as a reminder and perhaps visually show which task they have at hand when someone walks by.

4.1.5 Noteworthy Mentions

The preferred space to work in for all teams was in-office, even those who used a digital task board mentioned this. The reason being that it's much easier to help others with problem solving in person. Although not specifically mention, it is likely due the practicality of being able to respond fast, easily walk over and look at the problem, and the helper being able to actively
engage with the problem. Whereas, over distance you would need to use some program that allows for remote control or screen-sharing. As a result, the working inside the office brings practical and easy of communication within the team and possibly better connection to the other teams who might work with the same client.

Team A used a physical task board for dividing the task between the team members, internally. While at the same time, the client they worked towards used a digital task board, which needed to be updated. Having an internal task board made it easier to divide the tasks individually and added the possibility to further divide the tasks they received from the external task board, if needed. Also, P2_A_Dev expresses when “talking about this specific tool [Jira]: it is so slow and cumbersome, that everybody hates it and it is not used actually that much or that well”. Later it was observed that the sheersize of the system made it hard to grasp and the bad response rate between each button click could be several seconds. Therefore, the team lead, also referred to as the project manager, was the person who commonly updated the digital tool in order to present the developed features to the client and achieving the deadlines. Team C, who also used a physical task board internally, also used a digital system where client could send issue. Team B, who used a digital task board, also had a similar complaint system. Point being, the teams or companies have an internal task board as it makes it easier to further divide the tasks and adjusts the tasks in their own way. In addition, having an internal task board makes it easier to include multiple clients and systems into one single place. For example, P11_D_PM mentioned that they at times get the project requirements in an excel or word document that needs to be converted into the internal task board. The client might not either understand the full scale of some tasks, as changing the navigation directions and colors is rather simple and making a “simple” search engine is not so simple. Therefore, the requirements not converted in a 1:1 ratio, as they need to be their summarized into a single task or divided into multiple tasks, or both. And again, the digital systems, beyond the internal task boards, are commonly in place and used for external communication and presenting the task management to outside office parties.

4.2 Understanding the Task Board Medium

It is time to address what each participating team and members brought up during the interviews and observations with the focus around the task board medium. Their thoughts surrounding analog and digital advantages and disadvantages will be presented. However, before blatantly reviewing what each participant said, the teams situation will be addressed as it will influence their perspectives (Haraway, 1988). Furthermore, a collective understanding of the reviewed advantages and disadvantages of each task board medium will be provided, where a few generalization will occur to provide something easier to grasp and something to compare with. Importantly, as each participants thoughts and situation is previously addressed, the transparency could provoke readers to gather their own conclusion as weight on different statements could be made. Assuring a better reach for objectivity.
4.2.1 Team Stances

Each team's situation and the team members' opinions will be reviewed. The team's situation might influence their opinion, and therefore it's necessary to review the situation and then point out what each member expressed. As a result, there will be a clearer understanding of why some participants address the advantages and disadvantages in certain ways. In addition, readers might come to other conclusions as they might emphasize the importance of different factors. For example, maybe the agile experience of a member reduces or adds weight to statements, however this will not be taken into account in this study, as the experience is too diverse.

Team A used an analog task board to internally divide the task between each member, where the analog board was post-it notes with tasks, a whiteboard with the layout and magnets representing each member, as previously seen in Figure 2. In addition, required and controlled by the client, the team also used a digital task board for external communication of the tasks and project progression. To note, clients project is large scale and consist of more than a dozen teams between different companies. In other words, the digital task board is entangled with multiple teams and therefore heavily connected to the project as a whole, meaning it has a low probability of being switched out by request. However, the internal task board could be switched out with valid argumentation to why. Further, the participating team members outlined a few advantages and disadvantages with analog and digital task boards:

- **P1_A_PM** preferred analog task boards, due to it being practical and creates a feeling of engagement that doesn’t really come with digital. For example, the morning stand-up meetings are more engaging as everyone can actively interact with the task board.
- **P2_A_Dev** also prefers the analog task board, and with similar points stated that it’s practical and effortless to use. Compared to digital, that has some advantages such as being detailed and stores more information, yet it doesn't come with the same practicality. In particular, the digital task board used they used had bad responsivity, which could be up to several seconds per button click and pointed out that even the client used an analog task board internally.
- **P3_A_Dev**, again, preferred the analog task board and emphasized the liking of the layout. The disadvantages with digital was “the hassle of logging in and I have to add so much information to the digital ones: id, name, due date. Sometimes, I just want a easy post-it with a name”. Generalizing analog to being easy to use, and digital being time consuming. Although, it was further stated that if logging in could be integrated with another log-in system that point could be removed. Furthermore, It was also said that it was easier to notice when people changed the analog task board, as you notice when people interact with it. Nevertheless, digital was good for projects with multiple teams and over long physical distances, as it is decentralized and has detailed descriptions, and you have the ability to backup.
Moving on, Team B was not truly observed so details might be lacking, however it was discovered that they internally used the digital task board Jira which was integrated into other development systems. For example, when a developer would push code into the project, the task board gets automatically updated accordingly. The team had their own room, where they also had a large TV with the digital task board connect to a mouse and keyboard so you could go up and change things around. Further, the team mostly worked with the internal systems and therefore did not have the significant need to update any parties beyond the company itself. Again as the previous team, the digital tool seemed to be heavily connected to the company as a whole, and therefore lowering the chances of change unless a multiple people with valid reasons argue for change. The team members individually present some thoughts surrounding the task board medium:

- P4_B_PM adds that the advantage with analog is that you get the physical feeling of progression when moving the task. The digital tool, Jira, does not provide that same feeling. It was also noted that at times you forget to move the move task in an analog board, but later corrects and says that happens with digital too.
- P5_B_Dev preferred the digital and brings to attention that digital task boards saves history, which is good when you want to make plans and get an overall overview of the project. Also adds that the detailed task reduces the need for clarification.
- P6_B_Dev feels more attached physical task board, but the physical task board feels less attached to the project, and vice versa with digital. Also, expresses that digital task creation is more time consuming due the structure and the the required data fields. In contrast, similarly as expressed by P3_A_Dev, the detailed task makes it easier to people to get a feeling of what the task is about, without having to ask.

Next team, Team C, used an analog task board, which consisted of a large paper taped onto a wall which worked as the layout and it had different colored post-it notes with task names, the colors referring to which client the task was for. The task board itself could easily be switched out to something else, without much of an issue. Being a smaller company, they had a slightly different situation where the management and development were divided into two different rooms, whereas management had the task board. When asked if this was a problem, the developers and designer responded with that they did not think it was a big issue, since they look at it every morning during the meetings. Moving on, beyond the internal analog task board, they had a digital dashboard where clients could report issue and similar. If the issue was big enough it would be added to the task board. Furthermore, the different participants within the team expressed some thoughts:

- P7_C_PM emphasized that the analog task board was fast, cheap, easy to set-up, easy to change and it works well as it gives a better overview, compared to digital, where the
screen size and possibly the layout design is a limitation. From experience it was underlined that using digital tools, such as Excel, is questionable at best.

- P8_C_Dev is torn between which medium is preferred. In one hand, the digital always accessible and the tasks are more detailed. In the other hand, the analog task board works as a visible reminder everytime you walk by it and the possibility of taking a post-it note, and having it on the screen as a reminder is also nice. Further, when asked if digital web based tools can fall victim to being just one out of several tabs, it was agreed upon. The question pointing towards that having multiple tabs open, makes the task board tab just sink in and get lost in plain sight.

- P9_C_Dev likes both digital and analog, but prefers analog because “when you are standing in a room with your development colleagues right, and you are talking and using the board it kinda adds to, well not the experience, but the communication part because you actually physically interact with the stickers or notes [...] which creates a habit”. In similar words, the analog task boards increases engagement and creates a habit of using it. Later also adds that you don’t forget to update the status, most likely due the morning meetings and the habit that is created. Digital on the other hand, tends to be forgettable as it doesn’t create the same habit. However, adds that digital is great when distance is an important factor to consider.

- P10_C_Des similarly notes that digital is forgettable and you have to remember to check it everyday, while you always see the analog one. Also, the physical interaction is much nicer with the analog task board.

Lastly, Team D used Jira as their task board. The Jira they used was adjusted to fit the teams need and it had a focus around different charts, that commonly associated with agile methodology. For example, their working method was very focused around burndown charts, which is a graphical representation of the how many tasks are left and how much time is left e.g. y-axis is tasks and x-axis is time, and it should slowly go down from top left to bottom right. Like Team B, this team also had a TV in the room constantly displaying the digital task board, and also had a mouse and keyboard so you could walk up and interact with it. P11_D_PM mentioned that the bigger screen the better it would be and that it should preferably be touch to bring out a stronger feeling of physical engagement. Other points mentioned were:

- P11_D_PM expressed that digital task boards, Jira in this case, makes burndown charts easier to make as it is done automatically, compared to analog where you have to gather all the information and create a chart through that, which ends up being a burden. However, analog brings out engagement as you have to physically interact which is not quite the same as dragging it, maybe. Therefore, would prefer a big touch screen in the project room.
4.2.2 Task Board Establishment

Each participant introduced multiple thoughts related to the task board medium, being both analog and digital, and commonly used their own descriptions of what the advantages and disadvantages are. Meaning, a fully comprehensive list considering all the different elements could be summarized into a table, but would be rather hard to grasp as a whole. In order to get a overview and comparable data of what the major key points are, a list with a few generalizations will be introduced and discussed. It is also important to highlight, the table introduced will be based on the the previous section, 4.2.1 Team Stance. In addition, Appendix V outlining how the data was generalised, and which participant expressed what key point and contains a brief explain of the generalization. To conclude this, the produced and generalized analog and digital advantages and disadvantages are as seen in Table 3 below. The terms gathered and their meanings have been combined and the number presented in parentheses represent the amount of participants expressing the related throughs.

<table>
<thead>
<tr>
<th></th>
<th>Analog</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pros</td>
<td>Cons</td>
</tr>
<tr>
<td>Engaging</td>
<td>(5)</td>
<td>Forgettable to move tasks (1)</td>
</tr>
<tr>
<td>Habitual</td>
<td>(4)</td>
<td>Manuel data gathering and usage (1)</td>
</tr>
<tr>
<td>Practical</td>
<td>(3)</td>
<td></td>
</tr>
<tr>
<td>Easy to use</td>
<td>(3)</td>
<td>Generates charts (1)</td>
</tr>
<tr>
<td>Feeling of progression</td>
<td>(1)</td>
<td>Integratable with other digital tools (B)</td>
</tr>
<tr>
<td>Low-cost and easy setup</td>
<td>(1)</td>
<td></td>
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</tbody>
</table>

Table 3: Practical advantages and disadvantages of analog and digital. Note, the number in parentheses represent the amount of participants mentioning the key point, and the letter represents the team where the key point was observed. For example, “(2, A)” means two participants mentioned it and it was also observed in team A. Importantly, the length of the columns does not directly correlate with greatness or terribleness. Again, See Appendix V for which participant expressed what and the generalization, and go to previous section, 4.2.1 Team Stances, for how they expressed it.
The data presented shows for example that five participants mentioned that analog task boards are engaging and four mentioned that they are habitual. In comparison, it was also mentioned that the digital task boards were detailed by five participants and three mentioned it was decentralized. As these key points were commonly mentioned considering the amount and abstract questioning approach shows that the key points with multiple mentions has higher relatability to the specific medium, analog or digital. For example, easy to forget was mentioned by four participants and therefore has a higher relatability than the key point no feeling of progress, which only had one mentioning. In addition, the key points with one single mentioning can not truly be established as a new factor, unless also mentioned in the theoretical background, due to the lack of significant data of being an issue and being relevant. Therefore, will not be weighed into the study any further, just mentioned as a possible factor to consider for future research. However, although generates charts was only mentioned by one participant it will not be disregarded, as it is common knowledge that many large business are highly involved with charts and agile methodology can have charts involved to gather more precise estimates and a better overview.

As you might have expected, the table is far from perfect when considering the the different elements behind the key points. For example, digital being detailed reduces the need the for clarification and therefore reduced time spent explaining task, however it is also time consuming to add the extra detail. Considering the true effects of these and similar conflicts will need more and precise data, which will not be included in this study. Furthermore, its important to consider that the practical key point was merged with the clear and understandable key point; and habitual was created through combining changes are noticed, being a constant reminder and creates a habit. Nevertheless, it is clear that digital has significant advantages related to data and storage. Meaning, the vast amount of data easily available leads to a historical overview of the project, the detailed tasks are by themselves comprehensible, the data can easily be converted into usable statics and charts, and a digital tool could possibly be integrated with other digital tools. In contrast, analog produces another array of valuable points: members feel more engaged, a habit of usage is unconsciously created, comes with a feeling of progression as you physically move the tasks, the cost and setup requirements are bordering on being irrelevant, and it is easy to use. Lastly, even though being broad, its practical in terms of being effortless to use and overall easy. It is effortless for next to everyone to use, as the everyone knows how to interact with these analog tools, as if it was (or is) part of human nature.

Beyond the greatness of each medium, they both have mentioned disadvantages, besides comparing the analog or digital to one another in terms of what advantages they do or do not have. The explicitly mentioned analog disadvantages were rather low and with low amounts of participants expressing those key points. I do believe more exist and that more participants would add more key points to that area. First point, forgettable to move tasks does slightly contradict with being habitual, but the situation could differ from what was thought when
expressing this key point, as perhaps the analog task board was not in a remote and accessible location or not fully integrated into the project itself. Next point, manual data gathering and usage is referring to that when charts and statistical data is necessary, it is going to be a rather enduring and painstaking task to complete as working with statistical data without the use of a digital tool takes a lot of time. In contrast, the digital medium got more than the double amount of expressed disadvantages starting off with: it easy to forget the digital tool, as it might not be always be visible or get lost in a stream of other digital tools; as the tasks need to be more detailed, it is more time consuming to create each task, which is seemingly a big disadvantage with digital as it reduces simplicity and practicality; as it is easy to forget, it also adds that it is hard to notice changes and therefore also reduces the feeling of progress. Lastly, digital tools have a chance of becoming slow as the system gets bigger. The size does not precisely mean slower, rather poor implementation of new features or a weak algorithm could heavily affect the system performance.

Further key points could have been added such as: digital tools have a tendency to be deeply rooted into the project and company as a whole and therefore being an additional disadvantage in digital. However, although it is possible to investigate further key points, it might not add more value or relevancy beyond the existing points. Chapter 6 will discuss future work, where similar topics will be brought to attention for those who might want to delve deeper into the subject at hand. Again, it is important to consider the full explanation behind the key points that the participants brought to attention.
Chapter 5: Constructing a Solution

The perceived issues will be approached through the construction of a prototype with the aim to solve these issues. Also, through the aim of design science, the idea also to inspire other researchers and designer to create their own innovative solutions aimed at addressing the perceived phenomena (Hevner, March, Park & Ram, 2004; Hevner, 2007). In addition, the theoretical background and the practical results will be compared to strengthen the relevance of the perceived phenomena and to better understand it as a whole. It is also important to highlight, it is understandable that a few issues might differ due to limitations of the examined literature and also the practical limitations to the southern part of Sweden. However, there will not be an overemphasis on the rigor cycle as it can lessen relevance, meaning a fair balance between the two needs to be had (Hevner, March, Park & Ram, 2004). Concluding, the chapter will be aimed towards analysing the findings and directly relating them to the research questions to solve the issues at hand.

First off, the findings will be analysed and hence a requirements for the task board will be established. Secondly, the notion on how to approach the problem is presented. Followed by the prototype solution proposition, it will be discussed how the prototype connects to the newly established requirements. Next heading, the conceptualization process of the prototype is documented, where the you can find the different stages the prototype went through and why it formed as it did. Lastly, although the prototype was not evaluated, ideas of how to evaluate will briefly be expressed.

5.1 Examining the Findings

It is clear that digital does not lack usefulness as it is closely related to key points related to saving and using data such as generating charts, archiving and well-detailed tasks. However, the perceived ease of use is seemingly lacking, indicated by how it was mentioned being easy to forget and never related to any of the advantages of analog usage. Yet, digital and analog task board usage is split, indicated in the theoretical background and further shown in the practical results. The technology acceptance model expresses that digital adoption and continuous usage depends on the digital tool being perceived inheriting usefulness and ease of use (Hwang, Al-Arabiat & Shin, 2016; Wamba, Bhattacharya, Trincher & Ngai, 2017). Meaning, either that it is possible that the perceived usefulness of a few digital task boards outweigh the lack of ease of use or the lack of ease of use has been solved through addressing and using the digital task boards as an analog one. The practical results show that the two teams who mainly used a digital task board, also preferred to have it visually on a TV in the project rooms and showed interest for having a touch screen for interaction at the TV or screen. In other words, instead of opening the digital tool on a computer, which developers normally are next to, it was preferred to actively engage with it by involving more physical interaction with the tool. In addition, the large screen adds a better overview of the tool. As mentioned in the theoretical background, analog had the
advantages of creating a place for centralized interaction, which without a doubt all the interviewed teams aimed for, both analog and digital. The morning meetings are a place where one of the main points is to understand what task each member will work with throughout the day, emphasizing the crucial importances of having an overview of all the tasks and project progression e.g. the task board. Rola, Kuchta, & Kopczyk (2016) even presented an optional office space design for agile development teams, with the purpose of increasing communication and decision-making processes. Concluding, task boards are essential for project related interaction, as it serves as a place for communication and coordination of the team and possibly the external parties involved, and physical interaction is highly preferred as it helps to show changes made and natural physical interaction makes it easier to use.

Multiple connection between the theoretical and the practical within the analog medium has been found, showing the relevance of these issues in the phenomena. Again, the theoretical analog advantages expressed that it was a place for centralized interaction, which is highly connected with the practical key point engaging that was mentioned by five participants. Similarly, minimal training, and easy to adjust and modify are connected to being easy to use and being practical. The same goes with low-cost and easy setup correlates with low-cost, although the theoretical did not explicitly express it being an easy setup, just easy to modify. However, both key points are highly similar and therefore will be considered to correlate. Similarly, cost for the task board does not seem to be a deciding factor and P7_C_PM mentioned that they did not choose analog because it was cheap, rather the easy adoption of the analog task board was the deciding factor and it just happen to be very cheap to buy paper and post-it notes. Furthermore, it is also important to highlight, the theoretical did not mention analog being habitual, but expressed by four participants, showing new findings. On the contrary, the practical result did not find any direct correlation to that analog has cognitive learning through physical interaction and movement, although indicated through how physical interaction seemingly improves communication and coordination.

Similarly, the digital medium has multiple connections too. The theoretical key point centralized and summarized end goals connects to detailed, as they both depend on well descriptive information in a specific place. Although, you can argue that it is not connected to being centralized, I would argue that it does not need to be expressed through words, rather is a common understanding that digital tools aim to centralize information to a specific place, related to the overall topic of the digital platform. Similarly to how educated swedish people have a common understand that you find mostly accurate information on wikipedia. Further; reflects history and backlog, decentralized access and integratable with other digital tools all have a one to one connection between the theoretical and the practical results, showing their relevance but not establishing anything new. However, the theoretical was missing that digital tools have the possibly to generate charts, which was only mentioned by one participant in the study, but could be highly informative in certain business situations. But, the seeming lack of relevance means
that this point will not be in high priority to involve in the solution. Similarly, The Kanban method emphasises on graphical representation of work, deliveries and prioritisation of tasks; however in Scrum this is not as important (Noguera, Guerrero-Roldán & Masó, 2018).

Moving on, the summarized task board requirements found through examining the theoretical background and the practical results are as follows:

- **A task board is an essential part for team coordination and communication**, commonly a center point in morning meetings where each member discusses their project related topics, such as which task they are working on and the progress made.
- **The task board should be physically interactive and large**, as the interaction gets every member engaged and the large size means a clearer overview of the project. Strengthened by the practical results that shows that all team members are engaged with the task board, and not only the project managers, which further connects to how the theoretical background emphasizes how agile development involves self-organization and self-responsibility.
- **The task board should be practical and easy to use**, which the analog tools are firmly holding compared to the digital who seems to lack perceived ease of use, but instead has the upper hand on perceived usefulness.
- **Should not be lacking in detail**, less descriptive tasks are harder for other member to fully comprehend its meaning and relation to the intended output of the task. The point commonly associated with the digital medium and is one out of multiple points connecting to perceived usefulness.
- **The task board should constantly be visible in the office space**, which is also the place where the team members are recommended to be at when possible, for multiple reasons. In general being that it is easier to work as a team when distance and delay is not a influencing factor. In addition, the task board being visible reminds the members of their tasks and goal.
- **Decentralized access is essential when external parties are involved**, meaning that the physical space of a task board should not be a limitation when external parties are involved, whom might not be close to the office space.
- **A task board should be habitual**, which can interpreted and solved in multiple ways. But, the essence is that the task board should be part of a routine that does not feel forced or useless, which can be related to the technology acceptance model: for true adoption and use, the digital tool should both useful and easy to use.

In conclusion, there are multiple requirements that are essential part of task boards, which can influence both the team and the project as a whole. Importantly, the requirements do differ from team to team and project to project, and therefore needs to be adjusted accordingly. This is especially important in agile development, as the team adjusts to the project requirements and
goal. In addition, more requirements could certainly be established with more research and participation involvement. Nonetheless, these stated requirements are built through analysing upon the findings throughout the research, and importantly they do not only summarize what has already been said, but also adds a few key points and attempts to describe the reasoning behind them.

5.2 The Hybrid Notion

Reflecting upon the newly established task board requirements, it is clear that the current task board medium are not a clear fit for these requirements, meaning a drastic change is needed to solve the issues within these two mentioned medium, analog and digital. Through the use of the technology acceptance model, the perceived usefulness of digital tools is very much in place. But, the perceived ease of use is without a doubt lacking, as the increased detail and complicity that comes with digital tools makes them harder to use, at least for new adopters. Therefore, I argue that through the idea of situated knowledge, a new approach needs to be applied to the perceived issue at hand, to fulfill the close to contradictory requirements by the standards in the current medium, by introducing a analog and digital hybrid solution.

The idea is to introduce a hybrid solution that addresses the newly established requirements mentioned in the previous section, 5.1 Examining the Findings, while also further introducing another medium to meet these requirements. Similarly, the hybrid solution could be seen as a Internet of Things (IoT) device that tries to combine the physical and digital worlds, where digital access is not noticed anymore, rather entangled in society. Some might not agree, as IoT is relatively new at this stage and the search for optimal use of IoT devices is ongoing, especially in the academic world (observed by the constant connection and discussion surrounding IoT devices in the IoT related fields of study). Moreover, this is not the first hybrid approach to the task board medium, as mentioned in the theoretical background namely: Virtual Scrum using virtual reality (Rodriguez, Soria & Campo, 2013) and a unnamed hybrid tool trying to combine analog and digital through the use of a smartphone (Nakazawa, Komatsu, Tanaka & Matsumoto, 2017). Both are trying to involve a new medium, but the latter is arguably more relevant to the business sector, as previously discussed. Unfortunately, the latter hybrid solution seems to suffer from engagement with the tool, as it was controlled through a single phone, and similarly having a single remote control is a well understood problem in the western world. In addition, it was centralized around being visible on the web after the meetings. However, these two hybrid solution goes to show that hybrid solutions are possible, including the opportunity to take advantages from both the analog and digital medium. Also, the hybrid solutions mentioned got positive feedback from the testers, which is great since that means that the users are not afraid of considering a new way of working with task boards.
5.3 Prototype Proposition

To match and build upon the advantages of analog and digital, a new medium will be introduced to solve the perceived problems with the current task boards. The new medium being in the hybrid medium means that it can be discussed and related to the ever-popular IoT concept, and Web of Things (WoT), in today’s world. Importantly, the solution will be presented as a low-fidelity demonstrative prototype that aims to generate ideas surrounding the area and to be a new approach tackling the perceived problem. The prototype will consist of multiple components demonstrating an idea of a possible solution, these components namely being: storyboards, crazy eights, sketches and similar analog methods.

A point to consider, a prototype is not meant to be self-representative, rather be explained by an external part (Lim, Stolterman & Tenenberg, 2008). However; Lim, Stolterman and Tenenberg do not mean the prototype itself should lack description of any kind, as it strives to present a idea. It is also important to consider, a sketch can provoke different ideas between individuals and therefore the amount of details should be adjusted accordingly. In other words, the more abstract something is, the more varying the perspectives can be between individuals. For example, abstract art paintings create different ways individual to interpret them. The prototype expressed here will need to strike a balance between creating new ideas through abstractness and being detailed enough to understand the possible use of a hybrid medium. Similarly, a prototype that involves all the identified requirements does not mean it will be the almighty solution, since another prototypes and solutions can meet and emphasize the requirements in various ways (Lim, Stolterman & Tenenberg, 2008). Again, emphasizing that the idea of this prototype is to present a possible solution, yet also provoke new design ideas of other possible solutions that addresses the same issue.

The prototype will be a digitalized whiteboard, meaning the contents will exist and be saved in the digital realm. A visual design overview of the prototype is seen below, Figure 3.
The prototype solution consists of multiple points that aims to address the established requirements. First point; It will be possible to draw, write and move items with a pen, either through typing on a virtual keyboard or plain handwriting. However, consistency with using one type of style is highly recommended. This point aims address the requirements commonly associated with the analog advantages, namely being: (1) the task board should be physically interactive and large, (2) the task board should constantly be visible in the office space, (3) the task board should be practical and easy to use, and (4) a task board should be habitual. Second point, whenever the digital whiteboard is changed in anyway, the changes will be uploaded to a cloud where all the data will be saved. The cloud will hold all the data so multiple devices can connect to the same task board from different locations. Allowing for better team coordination and communication especially when members are outside the office, in other words addressing: (5) task board is a essential part for team coordination and communication. Third point, the task board will not be limited to digital whiteboards, rather all appropicate devices with internet access will be able to use the task board, if permission is given. The point has similar aims as the previous point, yet also tries to address to the external parties devices whom might not be so willing to invest in new technologies, at least in the early adoption stages when the tool is not widely used. Namely the point addresses: (6) decentralized access is essential when external parties are involved. Furthermore, unfortunately the prototype does not by itself try to address that a task board (7) should not be lacking in detail. Rather relies on that the teams themselves approach this requirement, while at the same time not affecting the task board being easy and practical to use. However, not emphasizing this requirement with the prototype is not only due to the poor connect with physical usage and detail, but also as younger companies might not be
truly ready for added complexities, as expressed by P7_C_PM. Therefore, the lack of direct involvement through the prototype does not mean the requirement cannot be approached through the users adjusting according to their own standards or preference.

5.4 Prototype Conceptualization

Conceptualizing a prototype has without a doubt been part of the whole thesis project, including writing the thesis paper, and therefore indirectly gone through multiple iterations before settling on a valid approach to the perceived problem. Personally, I find it interesting to gently upon the some parts of the process that might have been involved in the final approach, as those might also be valid in similar situations surrounding the discussed topic and therefore will be briefly brought to attention. Further, the brainstorming process considering the established requirements will be explored, where it will also be possible to see the three major ideas that came up. Later, refined crazy eight sketches will express how the solution can be used in the agile work environment. Finally, other sketches of the idea will be presented to allow for a more comprehensive understanding of the presented solution.

In the beginning, before the compared requirements were established, the gist was to create a set of guidelines that would express when a medium should be used. For example, when the team is more than ten people and a heavily project connect external party is involved, a digital tool would be recommended. A specific tool could also have been suggested. These guidelines would serve as recommendations that acknowledges different type of situations. The idea being that the user would go through a some kind of checklist, and accordingly be recommended a tool or medium. Nevertheless, this idea was later changed to something else, as it did not take into account that the current tools are lacking in various ways. However, I am not saying the approach is not viable at all, rather more appropriate approaches were found in relation to the study.

Through a set of discussions with my supervisor and friends, a fitting approach was found being a hybrid medium that tries to combine both analog and digital to one thing. After a few brainstorming sessions with my supervisor and a few friends, who also have background in Media Technology, three major ideas that tries to meet the requirements were found. The ideas are all in the hybrid medium and similar in various ways, however they do differ. These are ideas are:

A. Capture what is written on the whiteboard and upload a image of it to the web for digital distribution. In other words, a camera taking a picture of the whiteboard when changed are made and uploads it.

B. Digitize a whiteboard; where you can draw, write and move items with a pen or hand to update. The whiteboard syncs to the cloud after changes have been noticed, where it later
can be changed by another connected device such as: another digital whiteboard or browser. And, the process repeats.

C. A digital tool viewed through a TV and controlled with physical movement such as swiping in the air with your hand will move or change the digital tool in a certain way. For example, moving your arm to the right, moves a task one column to the right.

As it was previously discussed you might have figured that B was chosen, as it seemed most appropriate and interesting one out of the three. Idea A makes it easy for analog users to digitalise their information by simply having a camera that takes pictures of the board when it notices changes and uploads it to the web. It does also make it easier for external parties to view the process, however not much more is solved. In addition, the digital users are not involved in the solution, as taking a picture of a digital board and uploading it to the web is rather unnecessary. On the other hand, idea C is very similar to Idea B, but engagement with the board is through whole body movements in the air, that a camera picks up. However, it might be impractical to use, due to the new extreme way of working with a task board. In addition, beyond needing free and explicitly defined space for usage, franticly flailing your arms around in a project room might be distracting for the other members. Also, during meetings multiple people might be trying to express thoughts through body movement, which might get picked up by the camera. Obviously, it would be possible to solve these problems, but it more seems like a additional feature to Idea B. Therefore, if idea B is developed and working, idea C could be the second generation that introduces new features.

Figure 4: Visual expression of the major ideas. Note, the image is adjusted to the previously stated, where idea C is seen as a possible addition to idea B. Also, The TV in idea B only receives data, as the TV is just seen as a way to visualize the task board and not interact with it, in this case.
Crazy eights were made to show the process of how the solution interacts with the agile environment; involving the team who is using it in the office, a member working from home and an external party who wants to see the project progress. To make the crazy eights easily understandable, a refined version was made where the details are a bit clearer. Similarly, it could at this point after refinement, also be referred to as a storyboard as they both represent a certain scenario.

![Refined Crazy Eights](image)

Figure 5: Refined Crazy Eights. To clarify, step 1 to 5 is the team being in the office; step 6 is an external party viewing the teams task board from another location; step 7 is a team member moving a task in the task board from home; and lastly in step 8 the project manager sees the changes on the digital whiteboard, made in the previous step.

The figure above, Figure 5, shows the refined crazy eights in a scenario, where a consultant team is working towards a larger company, who hired them to help develop an application. Meaning, beyond the internal members in the team, a distant external party also is interested in overviewing the project progression. I heavily suggest to also read the figure description as it points out specific details.

As the task board is commonly used during meetings, it seemed fitting to present how it would be used in that scenario. Moreover, individuals using the task board during the day does not add any new information beyond Figure 5 to understanding the concept. Individual usage would just be one member moving a task from point A to B and someone might notice it later during the day, but most likely it would be noticed in next meeting, as mentioned in previous discussions surrounding usage of task boards.

An additional feature will also be included to make this task boards usability clearer for potential users, who might not be satisfied with the presented usage scenario and descriptions. As larger
companies might be involved with multiple projects or divided large projects into smaller projects, the task board will allow for users to easily switch to another project overview. Meaning, you will be able to view another projects task board within the same digital whiteboard. However, this presents a potential problem that members who did not see the switch might get confused to the new project task board. To combat this and similar problems, a default task board has to be set, where after certain amount of time in another task board, it will automatically switch back to the default one. In addition, it will be clearly visible when viewing the other task board that it is not the default one.

Figure 6: Digital whiteboard semi-technical representation. The figure shows how devices can interact with an app (cloud), and importantly, how the digital whiteboard can be connected to multiple clouds as the dotted lines show. In this case, the clouds represent a project.

To clarify, the primary objective is to present a new device that solves the perceived problems with the current task board mediums. The secondary object is to develop the technical side of the solution e.g. the app. The preferred scenario is that existing task board apps could integrate the digital whiteboard to their app, and hence make them co-exist without direct competition. This is due to the interviewed teams using JiRa which was entangled with other systems, and switching to another task board tool or creating a app with similar complicities is a extreme task. Both sides of the coin, between creating a new technical solution or implementing a existing one, have their own different effects on the digital whiteboard. A new technical solution means greater controlled usability from the beginning, while the other means greater connection to existing tools and reduces the need for changing from the current digital tools. Accordingly, if the prototype was constructed, I would heavily suggest creating a technical solution to grab a hold of early adopters and later implement existing tools to catch more hesitant adopters. Simultaneously, the workload will be divided as implementation of new tools is not necessary.
from the start and adds the possibility that the developers of the current task board tools start to adjust to the whiteboard, and not the other way around.

5.5 Evaluation

If done, towards evaluating the prototype interviews with the participant partaking in the study will be had, where the discussion will revolve around their thoughts about the prototype solution. Importantly, it will be questioned if they would be willing to adopt the solution, if it was fully fledged. Question why to either yes and no is crucial to understand what is either good or bad with the prototype. A collection of pictures and descriptions will be provided for the interviews to easily show the participant what the current solution is and how it could be used in a real scenario. The evaluation interview questions can be found in Appendix II, however the interview will most be off-script as ideas and concepts get tossed around. The general idea being to see how they would apply and interact with the solution and later compare the results to see if the prototype has potential in the business sector.
Chapter 6: Discussion and Conclusion

An exploratory approach was conducted to grasp the difference between the two task board medium and analysis the issues by involving human biases, perceived usefulness and perceived ease of use. As a result, a set of requirements were established for the optimal task board. These requirements were established through the theoretical background and the practical results, both based on exploring agile development practices and later involving the task board medium to these practices, for a fully fledged integration between the two. Finally, using the established requirements to develop a demonstrative low-fidelity prototype not only as a solution, but also inspire other researchers to dive deeper into the topic.

The objective was to address the following research questions:

- (RQ1) What are the perceived advantages and disadvantages between analog and digital task management tools?
- (RQ2) How can the perceived issues surrounding the analog and digital medium of task management tools be resolved?

Through Design Science cycles these research questions have been addressed, analysed and a possible solution has been demonstrated. The major findings being that agile holds true to its name, where every situation has its own adaptation of the methodology, which means the task board needs to be dynamic and adjustable to both the team and the project requirements. As a result, towards addressing RQ1 and RQ2, the context is extremely important to consider and findings have a high chance of being case specific. Generalized findings for RQ1 show that analog lacks perceived usefulness, while digital lacks perceived ease of use. More specifically, table 1 and table 3 both express the advantages of the analog and digital task board board, whereas ones advantages is commonly the other ones disadvantages, even if left unmentioned by the tables themselves. Importantly, through inspiration by Pinks sensory ethnography, table 3 was created through an high level of understanding towards the circumstances of individuals and the teams and how these circumstances influenced the participants expressions and results. Towards addressing RQ2, seven requirements for a task board were established with explanations, so the requirements can be weighted accordingly. As inherent biases discussed by Haraway might influence the results both from the researchers point of view and the participants point of view this was important to present for transparency reasons and to achieve a high level of clarity Furthermore, a prototype solution addresses the established requirements, and is not only a means to address the issues with current task boards, but also has a means to inspire future work. Through Haraways discussion surrounding the need for thinking through a new lens to minimize biases, the prototype solution was established in a hybrid medium where the aim is to combine the advantages of both the analog and digital medium. Importantly, previous works addressed that an issue did exist and possible ways to solve it, however the discovered litterature did not explicitly express the task board medium with deeper reflection. Therefore, a deeper
exploration of the medium established a set of requirements and a solution, with regards to the participating teams situation and expression. Nonetheless, future works needs to consider the circumstances of the teams and how it could affect the results, as agile methodology is adjusted to the perspective project. In addition, the next step of the represented solution is evaluation and continued development from low-fidelity to high-fidelity. Likewise, the established requirements are not absolute, rather are relative to the situation.

6.1 Results

The findings are heavily connected to the practical results as they revolved around how agile development and how the task board was used in practice, leadings to a more comprehensive understanding of the relation between the two. However, the theoretical established important terminology and introduced a way to understand and relate data to different models. For example, the technology acceptance model connected how tools are perceived affects adoption (Hwang, Al-Arabiat & Shin, 2016). And, situated knowledge emphasizes that approach a single issue requires different perspective(s) to reduce inherent bias the researcher might have (Haraway, 1988). In other words, the theoretical background established how to approach the issue and the pre-existing findings within the area of study. Furthermore, understanding the connection between perceived usefulness and perceived ease of use, guided the advantages and disadvantages to be established as a single set of requirements. Which would later the basis for a task board prototype solution, that was approached in a new hybrid medium.

Reflecting upon the practical findings, another method for extracting comments surrounding the task board medium needs to be set. Currently, the comments were commonly unsurely expressed, meaning that confident comments need to be gather for further insights. Likewise, the findings from the theoretical background are bordering of being a reasonable amount of data that could be used for comparison, as many articles did not express appropicate or similar comments, with regards to the task board medium. As a result, involving practical experience was more than necessary. Concurrently, it seems as if the task board medium is not seen as being a major part of the agile methodology. Yet, the practical findings argue otherwise, showing how important and involved the task board is with the agile teams. At times as projects get larger, the task board will be used glue that keeps development from falling apart and becoming redundant.

Towards establishing an absolute set of requirements for an agile task board seems to be exposing a wicked problem. Design Science has a increased possibility of coming across wicked problems that can not necessarily be solved by a single absolute solution (Schmitt, 2016), which seems to be applicable to the established requirements for an agile task board. Without a doubt, as research continuous within the same topic, adjusted or new requirements will be developed. Accordingly, I want to again emphasize this is the underlying reason towards developing the prototype as being an inspiration, to provoke new research developments and ideas. As the
digital whiteboard solves most but not all the established requirements, due to contradictories between how tools are engaged with and the technical limitations that comes with it.

6.2 Validity

Issues concerning the validity of this research must be recognized. It’s necessary to note that only four different company perspectives were interviewed, whereas a total of eleven participants partook in the study and therefore might be considered lacking. In addition, these software development companies worked within consulting, internal development and single platform development. And accordingly does not represent the software development field as a whole, rather just a small portion.

It is also important to note that research within this study's regard was rather lacking and relied a fair bit on similar research literature indications, rather than being specifically stated. In other words, the research literature was investigated for clues on what could possibly be factored in, but not always specifically mentioned. The clues primarily helped to understand how and why they used a specific task board in some detail, which later had to be correlated with other articles to build a fairly reasonable image.

Further, it must to be recognized that discussing the feeling and perception of using a specific tool does have a subjective impact on the study. For example, the feel and perception might be different from individual to individual, business to business and culture to culture. Nevertheless, the ambition of the study was to provide value insight to a rather new approach of understanding advantages and disadvantages from more than a strive total objectivity, to also considering the human aspects and biases involved in the using of specific tools. As an example, how we all have our preferred digital tool to write with, preferred pdf reader and so forth.

6.3 Future Work

As you might expect, an exploratory study and crossing a wicked problem means there is potential to further research to create a comprehensive understand of agile task management. For instance, consider agile experience or the age of participants has a high chance of discovering something such as that age might relate to the amount of authority. Likewise, the size of the team or company might influence the chosen type of task board medium, and involving a more diverse selection of business would likely also help to understand similar decisions-making processes. In similar words, considering more factors could heavily impact the findings within the area of study.

Towards constructing a solution in the long term, a high-fidelity working prototype is recommended to be created, as to generate interest from people and companies to the problem. The reason being that less interested people want to see a working solution parallerly as the
problem is presented, as it is fairly easy to complain and harder to do deal with the complaint. In the short term, constructing and evaluating a prototype would be the first logical step to understand if the approach is in the right direction. Similarly, during construction, bodystorming different usage occasions could provide multiple expected results, as we create a new path of viewing a problem through physical interaction (Schleicher, Jones & Kachur, 2010).
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Appendices

Appendix I: Initial Interview Questions

1. How long have you been working with agile development?
2. Which agile framework are you using right now?
3. How would you describe agile development and what are your thoughts on it?
4. How would you describe what a task board is and its role in agile projects?
5. On whom does the majority of the task selection responsibility lay on?
6. Which is the preferred task board and why?
   a. Follow up on digital/analog reasoning
7. Do you feel as if the use between analog and digital task boards could affect the team or project differently?
8. Which task board(s) are currently being used?
   a. Do you have internal or external task boards, or both?
9. When the [insert name of tool(s) the participant used] was chosen, who was partaking in the decision?
   a. Does the decision include the developers, project manager (Scrum master) and/or stakeholder?
   b. Did the people involved in the decision also use the tool?
10. Is there anything else you would like to add?
Appendix II: Evaluation Interview Questions

1. Does this seem like a logical approach to task management?
   a. Do you think anything could possibly go wrong?
2. Do you see any benefits or obstruction with using the prototype?
   a. If so, Why?
   b. If not, Why?
3. Would you consider using the prototype if the chance came up?
4. How would you implement the solution to your current situation?
Appendix III: Participation Request

The research explores how feelings and perception affects the use of analog and digital task boards within agile software development. An example, using post-it notes and whiteboards has a special feeling to it due to its roughness and higher physical engagement, compared to digital tools. The theoretical effects between the use analog and digital task boards is on internal and external communication, and the teams shared project understanding.

I am looking to conduct interviews with 3–5 members from the same agile team, whereas one is the project manager (or Scrum master). Also, A brief observation of the agile workspace would be appreciated. The expected duration per interview is ≈15 minutes, in a suitable space with the time and date set by you.

The interviews will touch upon your experience with agile methodology and primarily focus the use of analog and digital task boards. The interviews and observation will be voice recorded and transcribed. You can at any point in time opt-out from partaking in the study.

The information you provide will be cared for and kept away from unauthorized entities. In addition, each participant and company will be anonymized. Further, the results will be presented in an oral presentation and in the thesis. When the study is complete and passed, it will be published online and the voice recordings will be deleted.

Hereby, I am asking for your participation in the study. If you have any questions or want to partake in the study, just send an email to the address below and I will respond as fast as possible.

Liam Wolter
[Redacted email to researcher]
Valid through: 26 Feb to 11 Apr 2018
Malmö University, Media Technology: Master's (One Year) Thesis

Supervisor:
Bahtijar “Bato” Vogel
[Redacted email to supervisor]
Appendix IV: Pitch - Additional Information

Note, the original size of the pitch was no more than one page, but has now been fitted to the standards of the current paper. Previously, the font size was 11, and now, the size is 12.

"The Feeling and Perception of Using Analog and Digital Task Management Tools Within Agile Development"

Introductory
Agile methodology has had a wide-spread adoption within the software development sector, with an increasing rate. Specifically, the primary contesters Scrum and Kanban are controlling the agile sector with their high adoption rate. As these agile methodologies are relatively new, they haven’t had time to get fully tested. Meaning, multiple unexplored research areas exists within the practices of the methodology. In particular, the task management tools which have had a hard time being established in the digital space. Task management tools such as Trello and JIRA, do exist within the digital space, but analog tools are still very relevant. Illustrated by the popular use of post-it notes, whiteboards and other physical objects that require physical engagement and movement. In theory, digitalization thrives by solving the analog problematics and other physical limitations.

Research Aim and Goal
The mixed use of analog and digital agile task management tools suggests that digital tools are not seen as a solution in all or most regards. Therefore, the aim of this study is to explore the reason(s) behind the mixed use of analog and digital agile task management tools, with a close look upon the feeling and perception of usage between these different media forms. The goal of the study is to provide a guideline on when and how to use analog or digital agile task management tools, with regards to the feeling of usage and the advantages and disadvantages. The scientific contribution will consist of an exploration within the gap of the feeling when using analog and digital tools, specifically agile development task management tools.

Research Questions
RQ1: What are the apparent advantages and disadvantages between analog and digital task management tools?

RQ2: How does the feeling and perception of analog and digital usage affect the choice between analog and digital agile task management tools?

Requirements
The ideal situation would be to interview the project manager (or Scrum master) and two or three developers in the agile team. Each interview should be conducted individually with an estimated time of 15 minutes. Further, if possible, observing the agile workspace will be well appreciated. Preferably, the interviews will be spoken in English. Notably, I am adjustable to changes if needed.
Appendix V: Generalized Participants Task Board Expressions

The key point is on the left side, whereas the participant expression the key point is on the right side. It is also important to highlight, the participants expressing the key points are discussed in 4.2.1 Team Stances, where you can find what each participant expressed and reasoning behind it. In addition, the participants team situation is presented to further understand their perspective. Removed means it was considered to be redundant to include, as for example: “not as engaging” in digital disadvantages was expressed simultaneously as being “engaging” in analog advantage, and since “engaging” is highly correlated with analog it basically means the same does not apply to digital. However, “no feeling of progress” and “feeling of progression” was included, due to one does not reasonably outweigh the other. Therefore, both nor neither has to be removed. Moving on, the key points that are summarized and generalized are as follows:

<table>
<thead>
<tr>
<th>Analog Pros</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Point</strong></td>
</tr>
<tr>
<td>Cheap and easy setup</td>
</tr>
<tr>
<td>Easy to use</td>
</tr>
<tr>
<td>Engaging</td>
</tr>
<tr>
<td>Feeling of progression</td>
</tr>
<tr>
<td>Practical (Generalized Point):</td>
</tr>
<tr>
<td>→ Clear and understandable overview</td>
</tr>
<tr>
<td>→ Practical</td>
</tr>
<tr>
<td>Habitual (Generalized Point):</td>
</tr>
<tr>
<td>→ Changes are noticed</td>
</tr>
<tr>
<td>→ Constant reminder</td>
</tr>
<tr>
<td>→ Creates a habit(or routine)</td>
</tr>
</tbody>
</table>

Table 4: Analog advantages from the practical results.
### Analog Cons

<table>
<thead>
<tr>
<th>Key Point</th>
<th>Participant Expressing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forgettable to move note</td>
<td>P4_B_PM</td>
</tr>
<tr>
<td>Manually gather data and usage</td>
<td>P11_D_PM</td>
</tr>
</tbody>
</table>

Table 5: *Analog disadvantages from the practical results.*

### Digital Pros

<table>
<thead>
<tr>
<th>Key Point</th>
<th>Participant Expressing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detailed tasks</td>
<td>P2_A_Dev, P5_B_dev, P6_B_Dev, P3_A_Dev, P8_C_Dev</td>
</tr>
<tr>
<td>Decentralized</td>
<td>P3_A_Dev, P9_C_Dev, P8_C_Dev</td>
</tr>
<tr>
<td>Generates charts</td>
<td>P11_D_PM</td>
</tr>
<tr>
<td>Integratable with other digital tools</td>
<td>Team B <em>(Observed)</em></td>
</tr>
<tr>
<td>Reflects history and backlog (Generalized Point):</td>
<td></td>
</tr>
<tr>
<td>→ Backup</td>
<td>P3_A_Dev</td>
</tr>
<tr>
<td>→ History</td>
<td>P5_B_Dev</td>
</tr>
<tr>
<td>→ Image over the whole project process</td>
<td>P5_B_Dev, P11_D_PM</td>
</tr>
<tr>
<td>Habitual (Generalized Point):</td>
<td></td>
</tr>
<tr>
<td>→ Changes are noticed</td>
<td>P3_A_Dev</td>
</tr>
<tr>
<td>→ Constant reminder</td>
<td>P8_C_Dev</td>
</tr>
<tr>
<td>→ Creates a habit(or routine)</td>
<td>P9_C_Dev, P10_C_Des</td>
</tr>
</tbody>
</table>

Table 6: *Digital advantages from the practical results.*
Table 7: Analog disadvantages from the practical results.

The representation below is another form of what was seen in the tables above, which might or might not be easier to understand, depending on person to person.

<table>
<thead>
<tr>
<th>Digital Cons</th>
<th>Key Point</th>
<th>Participant Expressing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy to forget</td>
<td>P8_C_De, P9_C_De, P4_B_PM, P10_C_Des</td>
</tr>
<tr>
<td></td>
<td>Time consuming to add tasks</td>
<td>P3_A_De, P6_B_De</td>
</tr>
<tr>
<td></td>
<td>Chance for a bad response rate</td>
<td>P2_A_De, Team A (Observed)</td>
</tr>
<tr>
<td></td>
<td>Hard to notice changes made</td>
<td>P3_A_De</td>
</tr>
<tr>
<td></td>
<td>No feeling of progress</td>
<td>P4_B_PM</td>
</tr>
</tbody>
</table>

Analog:

Pros:
Cheap and easy setup: P7_C_PM.
Easy to use: P2_A_De, P3_A_De, P7_C_PM.
Engaging: P1_A_PM, P6_B_De, P10_C_Des, P11_D_PM, P9_C_De.
Feeling of progression: P4_B_PM.

Practical (Generalization):
- Clear and understandable overview: P7_C_PM.
- Practical: P1_A_PM, P2_A_De.

Habitual (Generalization):
- Changes are noticed: P3_A_De.
- Constant reminder: P8_C_De.
- Creates a habit (or routine): P9_C_De, P10_C_Des.

Cons:
Forgettable to move note: P4_B_PM.
Manually gather data and usage: P11_D_PM.

Digital:

Pros:
Detailed tasks: P2_A_De, P5_B_de, P6_B_De, P3_A_De, P8_C_De.
Decentralized: P3_A_De, P9_C_De, P8_C_De.
Generates charts: P11_D_PM.
Integratable with other digital tools: Team B (Observed).

Reflects history and backlog (Generalization):
- Backup: P3_A_De
- History: P5_B_De
- Image over the whole project process: P5_B_De, P11_D_PM
**Cons:**

<table>
<thead>
<tr>
<th>Cons</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chance for a bad response rate:</td>
<td>P2_A_Dev, Team A (Observed).</td>
</tr>
<tr>
<td>Time consuming to add tasks:</td>
<td>P3_A_Dev, P6_B_Dev</td>
</tr>
<tr>
<td>Hard to notice changes made:</td>
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<td>No feeling of progress:</td>
<td>P4_B_PM</td>
</tr>
<tr>
<td>Easy to forget:</td>
<td>P8_C_Dev, P9_C_Dev, P4_B_PM, P10_C_Dev</td>
</tr>
<tr>
<td>(Removed) Not as engaging:</td>
<td>P1_A_PM</td>
</tr>
</tbody>
</table>