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DESIGN THINKING AS A PROJECT MANAGEMENT TOOL

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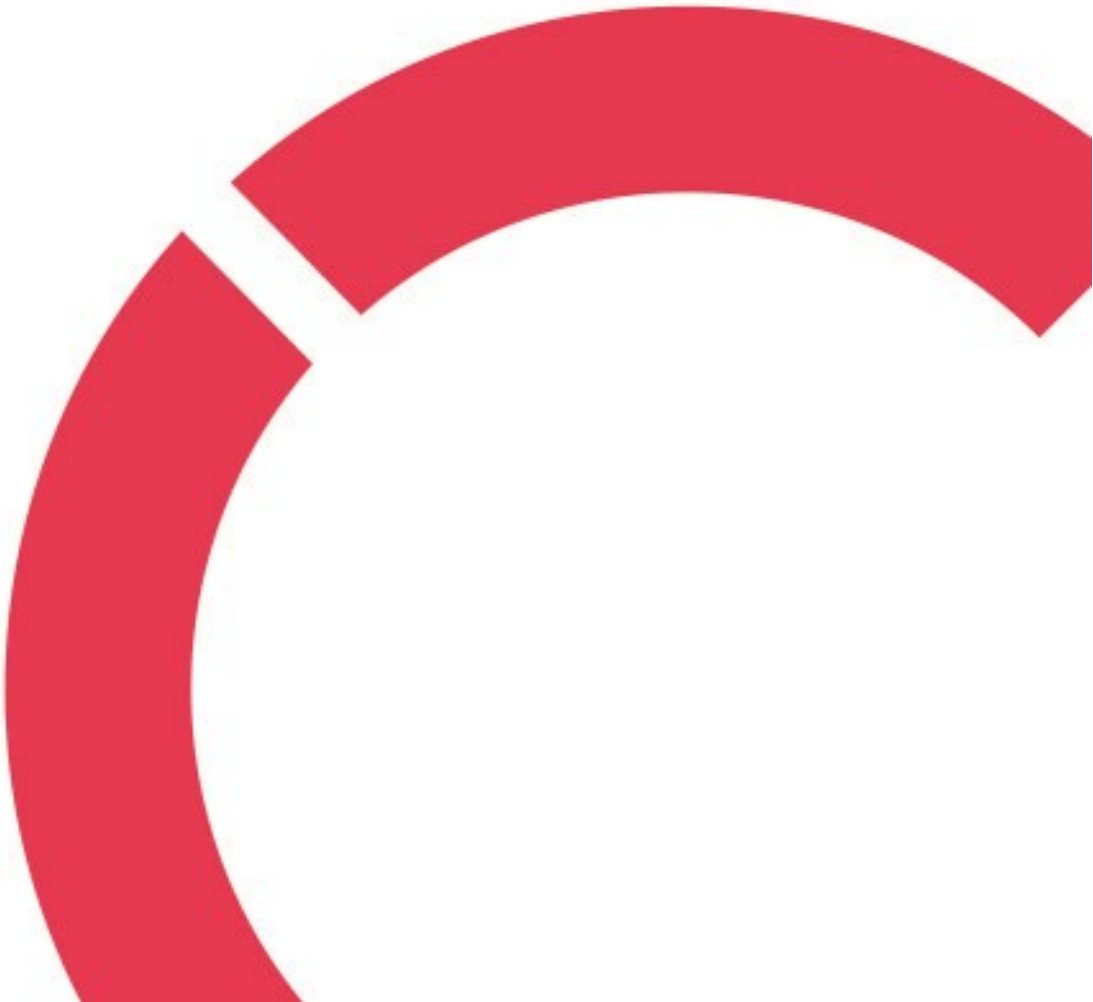

ABSTRACT

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The main idea of this thesis was to create an analytical overall picture of design thinking and different project management models. What are the elements involved and how can they be used in conjunction with each other for the best results? Essentially related to these factors is the theoretical framework of the thesis, which deals with the structure, phasing and the best application environment of the models in question.

The aim of the thesis was to go through the roles of design thinking, waterfall model, lean operating model and agile mindset as part of modern project management environment. The main priorities were the different aspects of the models and how they can best be utilized. The final focus was on applying design thinking to the other tools mentioned so that the greatest possible added value can be achieved within the current environment. The empirical section sought to find an objective perspective by comparing the ideas of two different target groups on the basis of a given topic.

The set goal was achieved and the summaries of the student groups and the professionals interviewed gave a concrete example of the importance of applying design thinking to modern project management. The concepts reviewed and the work steps involved were obtained in an easily comprehensible form. In addition, the importance of design thinking as part of general project management, and the importance of its education for future professionals was successfully highlighted.

Key words
Agile, design thinking, lean, project management, scrum, waterfall

ABSTRACT
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1 INTRODUCTION

Today, as technology advances at an ever-increasing pace, one of the key questions is how best to harness it in the various sectors of a functioning society. Rapid development also requires that practices evolve in market environments in order to maximize benefits and remain at the cutting edge of technological development. One of the areas where this is most clearly reflected is project planning and management. The key is, among other things, the ways and techniques to get the best out of the design process to serve the purpose of any given assignment.

The purpose of this study is to find answers and solutions on how to best apply different ways, techniques and perspectives of service design to project work and its outcomes. The core concept design thinking is the idea of how actual problem or issue is understood, how it affects the current situation, and how to find the best possible solution for the situation at hand. In its entirety, this is easy to understand as a pre-project step in which the decision on the purpose of a set project made.

Both project management and design thinking are very broad concepts that have been extensively researched as long as the concepts have been widely understood. Each plan that has even a little thought put into it has a clear picture of the environment at hand, the actual target of the plan, and all the resources available. Therefore, the big picture must be well-known in order to solve any given problem. Design thinking as a concept is based on a holistic understanding of the operating environment and project management is the application of this understanding to practice and the systematic implementation of the process itself.

There are very many things to take into consideration in general management. When dealing with leadership within the frameworks of specific projects, it is very important that all the goals required for the end result are achieved in the best possible way. Issues such as how to utilize all the resources and understand all of the possible variables to achieve the goals have been addressed almost throughout human civilization. An excellent example of this is one of the best-known sentences in the famous book Sun Tzu's art of war, "Know yourself and know your enemies so you won't lose in a thousand battles." (Sun). Although the work in

question is old, the things and interpretations it deals with today are still highly valued for their timelessness.

The key issues that will be addressed in this study include how to maximize the effectiveness of project management, how to make the best use of all existing resources, and how design thinking concepts and techniques can best be used as project management tools. This study begins by exploring the basic concepts of both project management and design thinking and how they are applied in today's work environment. Based on these concepts, the topic will be studied by multiple different parties with very different backgrounds. The results will be compared and studied in order to find a clear path to the general utilization of design thinking within the modern project management environment.

Since technological solutions have always been, and always will be the key guidelines for how the modern society will develop in the future, the need for better ways to handle the new opportunities will also be needed. The systematic streamlining of all these processes of course requires the correct tools to handle complex concepts. The development, design, building, and problem-solving projects all need the correct methodologies and tools to be successfully completed. However, even if the actual decision making and learning processes could be outsourced to artificial intelligence and machinery, the end users for the built solutions will be people. For this reason, the value of being able to design the solutions based on what would best serve the end user will only be increasing as time goes by.

2 DESIGN THINKING

The concept and the core idea of design thinking is, in principle, closer to ideology than to concrete action. Understanding the environment or object is at the core of a concept. Usually design thinking is equated with the purpose of creating a deep understanding of what problem needs to be solved. The general question to be answered is who is involved, what kind of people, companies, or other target groups does it affect and why. Design thinking process begins with a careful and thorough mapping of the environment and by forming an understanding of the variables. The concept itself can be crystallized into three distinct areas: understanding, experimentation, and implementation. (Julin 2018.)

The first part of understanding the concept can usually be approached by defining the problem of the object based on the research done. One of the best ways to do this is simply to do “user” research. The experimenting phase aims to find a solution (Brown 2009, 62-63). Open-minded ideas often produce surprisingly fast results, and you can move on to a lighter initial solution. The final step is to test the solution created in the so-called pilot phase on a practical level. Through this the feedback can be gathered and the evaluation of the strengths and weaknesses of the solution can be done. Finally, the results determine whether the solution developed is correct or whether to return to the experimenting phase. Once the right solution is found, it is possible to focus on working for the best results. (Dorst 2018.)

2.1 Background

The concept of design thinking is not as new innovation that a person familiarizing the subject could easily get a picture of. The concept of designing a service or product to meet the specific needs of a particular target group has been in use for a considerable amount of time. Some examples to mentioned in which areas design thinking has influenced during the passing ages are an architectural solution, a service designed specifically for a specific situation, or a concrete product that solves a specific problem. One could even argue that design thinking has always served as a tool for the further development of people and technology over the years. (Brown 2009.)

The so-called modern design thinking began to take shape, as it is understood today, as early as the late 1950s. In 1959, at Stanford University, John E. Arnold, Professor of Mechanical Engineering, wrote in his book Creative Engineering about the four areas of service thinking that formed the contemporary model of design thinking. Another excellent example of the roots of service thinking is Nobel Prize winner Herbert Simon's 1968 book, The Sciences of the Artificial, in which Simon describes the optimal design process as creative, solution-oriented, and adaptable to all human activities (Simon 1996). The core idea behind it was to adapt existing conditions to preferred ones. (Brown 2009.)

The most important of the more recent works on design thinking is Change by Design, published in 2009 by Tim Brown, who is often known as the father of modern design thinking. In his book, Brown describes how service design transforms organizations into a model that encourages innovation. One of the main ideas of his work was continuous design planning, which emphasized the development of the environment and the target organization, as well as the need for flexibility in operating methods. The solutions that come with the future are an important part of innovative business development to meet the needs of an ever-evolving environment. (Di Russo 2012.)

In today's world of digitalization, one of the most important and fastest growing cornerstones of society is technological solutions. The importance of design thinking is only emphasized with the development of technology. Due to the large number of new systems and operating models, the innovative thinking and approach of design thinking makes it possible to find the optimal solutions for optimizing the processes of organizations and, consequently, for increasing competitiveness. (Brown 2009.)

As an added point, it is important to note the prediction made in 1965 by engineer Gordon Moore about how chip-specific transistors will double every two years as technology advances. The theory that holds true so far is better known as Moore's Law. The current state of the technological environment shows that the continuous development of technology also requires the development of the way organizations operate, to meet the opportunities that come with digitalization. One of the most important and innovative solutions to this is design thinking. (Di Russo 2012.)

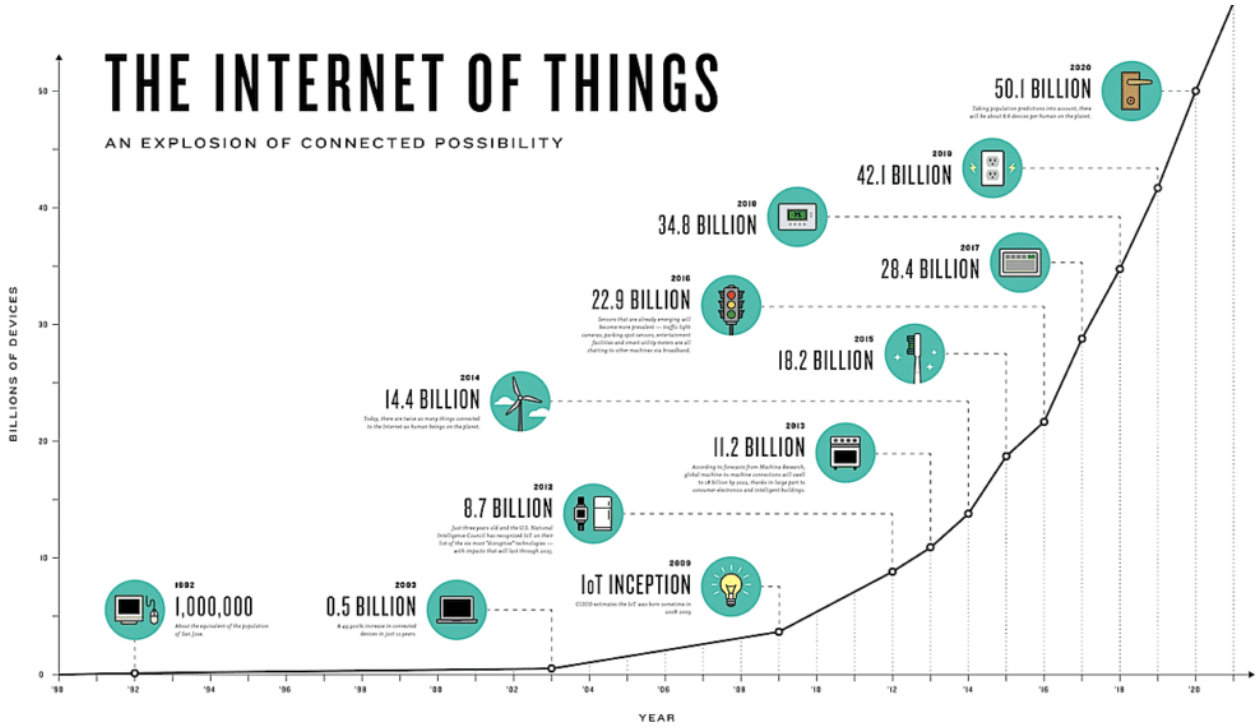

FIGURE 1. Acceleration of technological development (Halladay 2018)

2.2 Methodology

As a methodology, design thinking can be separated from other similar tools for its almost paradoxical nature, which approached sometimes even irrational concepts with logical solutions (Lalaounis 2017, 61-62). When we start to think the design thinking ideology itself, and how the design thinking-based innovative concept works in practice, we need to understand the whole process from start to finish. Generally, a process is thought to consist of six different steps: empathize, define, ideate, Prototype, test, and implement. (Gibbons 2016.)

The empathize phase, the first phase of the design thinking process, focuses on gathering information about the subject and the environment. At this point, you are imagining yourself in the state of the subject and trying to find the biggest problems and the best possible solutions. Essential questions include what they think, what they want, and how they respond. The goal is to get enough information about the situation of the object in order to really identify with it and react accordingly. (Gibbons 2016.)

The second step in the process is define. At this point, all the information collected is gathered together to find the real problem areas and points where they can be influenced as desired. The main goal at this stage is to create a realistic picture of the situation by objectively examining the collected situational information. (Gibbons 2016.)

The main focus of the Ideate phase is the innovative thought process, which seeks to find solutions to the problems identified in the earlier phase. It is important not to restrict your brain work and to give all participants the opportunity to use their imagination as much as possible. An excellent mentality is that no idea is too far-fetched or unrealistic. (Gibbons 2016.)

The fourth step is to build concrete solutions or prototypes based on the ideas found in the ideate phase. The purpose is to make the solutions light enough that they can be practically tested for the following steps with minimal effort. (Sandino, Matey & Vélez 2013.)

The testing phase focuses on the practical testing of the created prototypes. The purpose is to gather feedback in order to identify possible shortcomings that have occurred during the design phases. The end result should be a complete, well thought out and tested solution that can be deployed with the certainty that it will solve the original problem and serve its purpose perfectly. (Sandino, Matey & Vélez 2013.)

In the final, implementation phase, the ready solution is implemented. Deployment can often be a challenging and time-consuming process. Nevertheless, it is also the most important part of the entire process chain and should not be underestimated and given as much time as it needs to achieve the end result. No matter how careful and thoughtful the design phase is, if the implementation is poorly done, the significance of the previous sections will be greatly reduced. Therefore, the implementation step is the most important part of the entire process chain. (Sandino, Matey & Vélez 2013.)

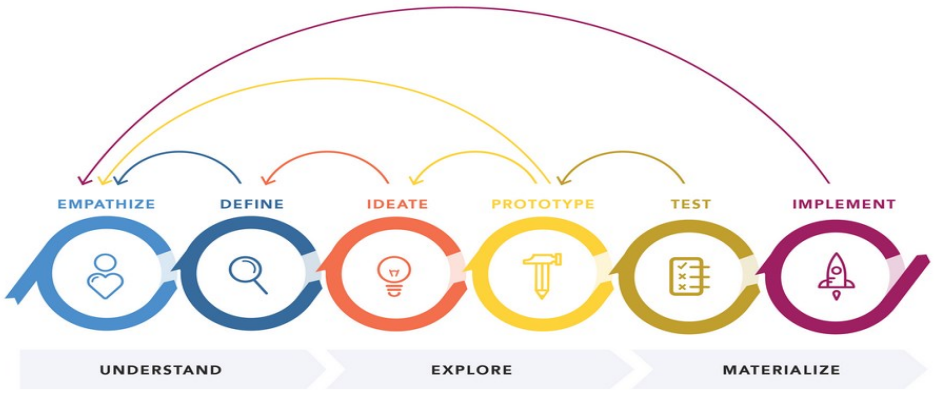

FIGURE 2. Design thinking process steps (Gibbons 2016)

2.2.1 Empathize

Defining empathy as a concept can be understood as our ability to see the world through other people, this includes a world of thought about what they see, feel, and generally experience about the world or environment around them. However, each person's perspective is their own and cannot be experienced in the same way because the feelings and experiences that each person are unique to him or her. A strong empathic approach still seeks to create the most comprehensive possible understanding of the other party's perspective. This can be achieved by leaving your own thoughts, plans, opinions, and instead focusing on internalizing the needs of others. (Dam & Siang 2021.)

As mentioned earlier, the first step in the design thinking process is empathize. The central idea of the empathy phase is to use empathy to create an understanding of the target group or organization whose problem you are trying to solve or for which you are planning a solution. The most important stages in the process are observing the environment, committing to finding a solution and approaching the people in the target group through empathy. The purpose of this is to understand what experiences they have and what motivates them. An excellent way to approach this is to become physically part of the target environment so that a deeper understanding of the environment can also be created on a personal level. (Dam & Siang 2021.)

If a comprehensive picture of the target environment needs to be created in the best way possible, one of the optimal approaches is to try to take the mindset of a beginner. In this model, there are no already existing expectations or prejudices about how the environment works, as there is no personal experience within it. A good example of this is how a student's perspective on the future operating environment may not be as detailed as expert's idea might be who already has a lot of experience. Instead, the student or a beginner doesn't have years of experience from any specific operating models, and for this reason is able to have a very broad and fresh perspective from the field. Naturally, because it is very difficult to give up your own thoughts completely, it is important to remind yourself to stay in the mind of a beginner and focus on asking simple questions like who, why, what, when, and where. Therefore, In the empathy phase, it is very important to observe the ideas that emerge in the environment, and not to judge them on the basis of one's own experiences. (Mortensen 2021.)

2.2.2 Define

The second stage of the design thinking process focuses on defining the problem. The empathy phase preceding the definition phase focuses on collecting data from the target environment. On the basis of the information gathered in that phase, a definition is created in the second phase as to what is the problem which actually needs to be solved. The information gathered is broken down into more in-depth parts of the analysis, which focus on getting concrete answers to what the problem is, why this is happening, and how the issue can be addressed at the best possible level. After this process, all the findings obtained can be aggregated into a comprehensive, detailed outcome. In simpler terms, the goal in the process's definition phase is to compile one all-encompassing statement that includes all the answers found in the information gathering phase. (Lucas 2018.)

One of the best tools for defining a problem is the problem statement map. The map works by guiding the design team toward the needs identified during the empathize phase. The basic idea is to serve as a basis from which thoughts and ideas can be aroused in the third stage of the process, the ideation. (Lucas 2018.)

A good problem statement map should be people-centered at the initial level. The reason for this is that the problem to be solved is within the target group for which the solution is going to be founded for. Another very important part of the map is the scale wide enough to allow creative and innovative mentality, and a freedom to have an open mind. There are many possible solutions, so limiting the creativity often has a negative effect on the overall outcome. On the other hand, care must be taken to ensure that the result is narrow enough to be managed as well as possible. (Lucas 2018.)

To sum up, the core idea behind the definition stage is the designer's complete understanding of what the problem is and what the ultimate goal or outcome of the project should be. This process makes the problem itself to be easier to work with and a clear definition of the desired goal can be created. After the path for the problem's solution is clear, the third stage of the design thinking process can be initiated. (Lucas 2018.)

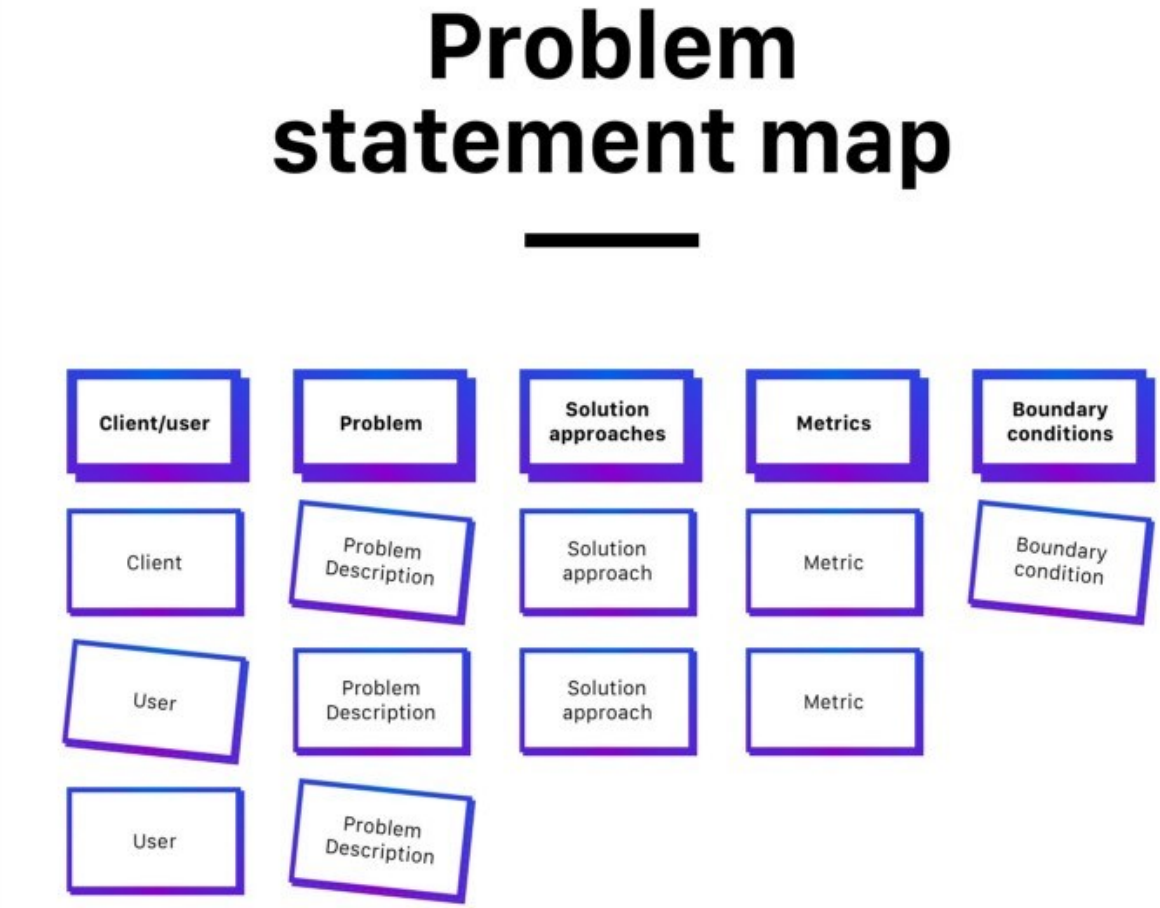

FIGURE 3. An example of problem statement map (Ristic 2019)

2.2.3 Ideate

When the problems found during the previous process steps are clear, can the search for the actual solutions begin. At the beginning of the ideate phase it is essential to come up with as many ideas as possible with the team working with the subject. This is an integral part of the process because the best outcome that can achieved will be found by experimenting and testing different alternatives to solve the problem in question. (Stevens 2021.)

As can be expected, the ideation phase is focused specifically on exploring solutions. When the ideation process is initiated, it is important not to think too much about how the ideas generated can actually be implemented, or even how high quality they are in principle. The aim is to create the most free and innovative environment possible without the limitations of the imagination. (Stevens 2021.)

The ideation phase is basically a very creative phase that gives the team a lot of freedom to go through any ideas that come up. The step focuses on thinking outside of the box, and every aspect of solving the problem is reviewed before moving to the prototype phase. (Stevens 2021.)

There are many different tools and frameworks to help implement the ideation phase. Although ideate or brainstorming is the most creative step in the design thinking process, the best possible outcome can be achieved by creating a framework for how well a free-form thought process can be controlled. An essential part is being able to bring different perspectives together in a non-judgmental environment. This allows for the creation of innovative solutions that can achieve a competitive advantage and a sense of belonging with stakeholders who are able to participate in the process. (Voltage Control 2022.)

FIGURE 4. The ideation phase divided into five steps (System Concepts 2021)

The image above is one example of managing the ideation process. The first step of the process in question is to create a lot of different ideas, which are based on the idea of solving the issues found within the define step of the process. For example, a problem statement map can be used as a basis. When all the information is available to every party involved, a clear and common understanding of needs of the target group can be achieved. (Dell Èra, Magistretti, Cautela & Zurlo 2020.)

In the second stage, the aim is to get the widest view possible on what does the entirety of the subject contain. This can be achieved by involving as many different relevant stakeholders as possible. The basic idea behind this is to get a perspective on the user experience, design, and sales possibilities of the solution. The more expertise can be associated with the ideation phase, a broader solution can be found. (Dell Èra, Magistretti, Cautela & Zurlo 2020.)

Next, it is essential to define clear and easy-to-understand rules. Free-form thinking and creativity should be encouraged, but the rules allow all parties involved to come up with their own ideas. (Dell Èra, Magistretti, Cautela & Zurlo 2020.)

In the fourth stage shown within the previous figure, it can be noticed that it is important to be able to distinguish between ideation, from going through thoughts. A clear boundary between these two sections opens up the possibility of a clear- and free-thinking environment in which

going through the ideas of other parties does not change opinion on the topic under review. (Dell Èra, Magistretti, Cautela & Zurlo 2020.)

The final step of the model is to consider how to create a detailed prototype based on the ideas reviewed. Important perspectives for this include, for example, what aspects you want to test with users, and what are the best possible tools and instruments to implement the idea. (Dell Èra, Magistretti, Cautela & Zurlo 2020.)

2.2.4 Prototype

The purpose of the define and ideate stages is to come up with an end result that can be adapted into the final solution. Once the idea is clear, a prototype can be made to test all the designed features under practical conditions. Another main purpose of a prototype is to evaluate and measure the end result, which is based on the assumptions and ideas of its designer. (Blake 2020.)

Making a prototype, or experimental version of the end result, is a key part of the design process. Prototyping is very common in the design industry as it is an excellent way to test concepts in practice. This makes it possible to find possible error estimates or shortcomings before reaching the final solution. (Blake 2020.)

The basic purpose of this is to get a clear visual representation of the end result which is being prepared as a solution to the problems found in the previous stages. It is vital in the production of a prototype to take into account the observations that emerged during the ideation phase. All and all, prototypes do not need to be complete and working solutions since the main purpose of them is to provide a concrete form for the created idea, from which the strengths and weaknesses can be found (Lalaounis 2017, 70). This also serves as an opportunity for the entire design team to see the outcome of the design phase on a practical level, and thus helps to rule out all possible errors and problem areas. (Blake 2020.)

A very important part of the prototyping phase of the design thinking process is the feedback provided by the target group and / or the customer. This helps to find possible errors and the solution can be changed and modified to the final version. At this point, however, it can also

be noted that the prototype simply does not work. As a result, we move back to the ideation or even empathy phase. (Subramanian 2019.)

All in all, a prototype phase means a simulation of a ready-made solution or a possible example version that is thoroughly tested before the final product is carried out. This makes the process stage in question very important, as it has the potential to save a huge amount of costs for the target organization. (Subramanian 2019.)

2.2.5 Test

Once the problem is formulated, a large number of ideas have been gone through, the best-found prototype has been created, we move on to the testing phase. From the feedback based on user experiences, a prototype can be created through experimentation and design that corresponds to the idea of the end result. Such a prototype can be taken to the final testing phase. (Adams & Nash 2016.)

The testing phase is part of the design thinking process where the final solution to the occurred problem is found. In other words, if the end result of the testing is found to be successful, the finished solution can be deployed in the target organization’s environment. If deficiencies are found in the testing phase, the prototype to be tested moves back to the design phase, with feedback from the testing team. (Adams & Nash 2016.)

The testing team assembled in this phase can go through, test, and experience the prototype that has progressed through the phase without interruption and gather the necessary information on how the end result works in a practical environment. (Adams & Nash 2016.)

Once the entire process chain has been reviewed and the created prototype has been thoroughly tested, a ready-made solution can be implemented in the target organization's environment. This is referred to in many sources as the final stage of the design thinking process, i.e. the implementation stage. At this stage, the solution is implemented and feedback can be collected from the target organization on the functionality of the end result. The feedback helps the design team to develop its policies for future projects and to find the most optimal solutions to the problems. (Adams & Nash 2016.)

2.3 Design Thinking in the Future

Possibly the greatest potential of design thinking is its ability to find solutions that focus on the real needs and user experiences. The intention is not to replace existing operating models, but to expand the approach towards the new challenges of the development within a modern and digital operating environment. The model itself does require a lot of skill together with an innovative and open-minded attitude. These provide crucial solutions for the situations in which customer-centric solutions are needed, even within more technologically focused environment. In the future, tools and ideologies designed purely for the technological development will retain their value as a part of the business environment. However, design thinking and service design can be an alternative approach to the same concepts, creating a comprehensive user experience in an ever-evolving environment. (Mintrom & Luetiens 2016.)

In the current time, design thinking as an ideology and operating model has become a broader and more well-known concept. However, its use and prevalence does not match the potential offered by the ideology, and there is a danger that it will be left behind by more concrete ways to operate processes (Brown 2009, 265). One of the most important things to consider is the paradoxical way in which design thinking systematically challenges the existing systems. This provides an excellent approach to perhaps the most central question in virtually any business environment, i.e., how the planning process could be integrated into the organizational decision-making process in the most efficient way possible. (Mintrom & Luetiens 2016.)

In the future, technological solutions will evolve at an ever-accelerating pace. However, these same solutions make it possible to add resources to the creation of new solutions, where design thinking is invariably an excellent approach. Through this, the answer can be found as to how the understanding of the end user of any product or service provides not only a customer experience but also an efficient and highly competitive end solution. (Elsbach & Stigliani 2018.)

3 WATERFALL

When project management is thought as a concept, it is very likely that the first thing that comes to mind is the waterfall methodology. The waterfall methodology is characterized by a clear separation and step-by-step structure of the work phases. This approach to project management helps to clarify the life cycle of a project from its initiation to the final analysis stages. (Clayton 2020.)

However, it should not be thought that this project management method would provide a ready-made and all-encompassing solution for every type of a project. The functionality of the waterfall methodology can be criticized, for example, in software development projects, where a flexible and iterative approach can provide much more leeway in testing and redesign phases. (Clayton 2020.)

However, the waterfall methodology cannot be considered as an old-fashioned way of approaching project management. Project management methodologies are tools in a same way as any other solutions that are aimed for the management and decision making. The right tool must be chosen for the right problem in order to achieve the best possible result. (Westland 2017.)

Although waterfall project management cannot be considered the best tool in software development projects, it is ideal for many other types of situations which require approach though careful planning. Examples of projects for which the waterfall model is suitable include projects focused on manufacturing or construction. The key factor in choosing a waterfall model in project management is a well-defined and fixed end result, for which the planning that is well reflected in the waterfall model provides a lot of added value to the project implementation process. (Westland 2017.)

The term waterfall has become more common in model finish-to-start style project phasing. However, when this project management methodology is applied in practice, the model can be better described as, for example, proactive or planned project management. The waterfall model is typically divided into six different steps, each of which must be completed before starting the next step. These stages are most often the requirements, definition, design,

implementation phase, testing phase, installation phase, and maintenance phase. The desired end result of these steps is a functional entity that can be applied to projects that are implemented efficiently in a linear manner with thorough planning. (Westland 2017.)

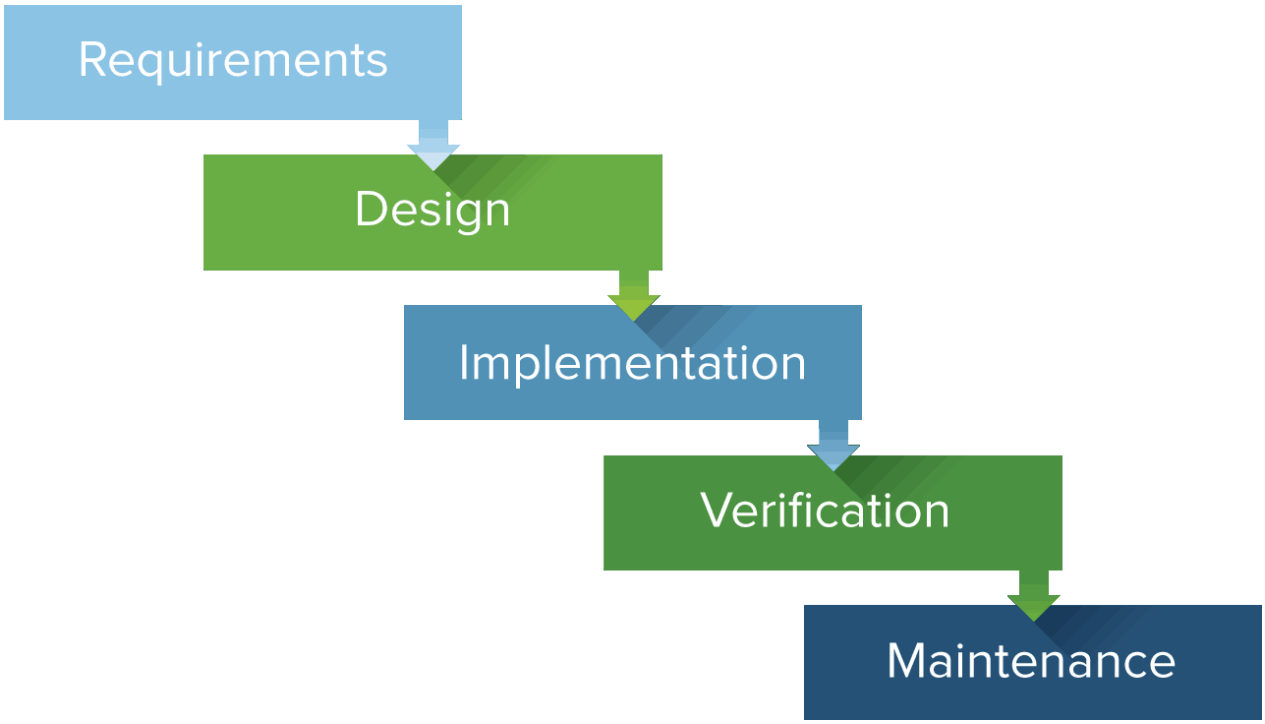

FIGURE 5. An example of the possible waterfall tasks with a finish-to-start structure (Smartsheet 2021)

3.1 Tasks of the Waterfall Methodology

Originally, the waterfall methodology came from the construction and manufacturing industries. This project management tool is a clearly phased method based on strong planning, which was developed in an environment where the project steps are too expensive to repeat over and over again from the financial perspective. Later, this widely generalized project management model was also introduced as a ready-made solution in system development projects, for which it is not the best option due to the nature of the projects. The main cause of this is the software's need for the continuous development and constant changes. (Smartsheet 2021.)

The waterfall model is often compared in software development projects alongside the much better suited agile methodology. The optimal situations for using these tools are, in principle, opposites, and it is no more sensible to compare their use in the same situations than, for example, a saw and a hammer in the same job. The waterfall model does not respond well to changes in the middle of the process, so projects where the waterfall model is worth using should be carefully selected. (Olic 2017.)

In order to make optimal use of the waterfall model, it is necessary to understand how the model is generally phased. Although small changes may occur in the tasks of the model, in principle the structure follows the same formula regardless of the situation. (Olic 2017.)

3.1.1 Requirements

Project management requires a clear understanding of what is being planned, how the outcome should work, and how this outcome will be achieved. The first step in the waterfall model will focus on finding all that is needed to complete this process chain. By identifying these requirements, a clear plan can be created for how the project can be implemented at a concrete level. It is essential to gather information from all possible sources so that as few unexpected variables as possible are encountered during the implementation phase of the project (Pelin 2009, 86). The waterfall methodology shines precisely in the environment designed to the end, and it does not respond well to the need to make rapid changes. (Murugayan & Balaji 2012.)

In order to start the process properly, it is necessary to find out what is the end result that the customer or the target of the project expects. This can be clarified together with all relevant stakeholders. These stakeholders include, for example, project sponsors, funders and all kinds of guidance and support groups. It is a good idea to involve the whole project team in this phase, so that all those involved in the implementation share the same understanding of where the project is going and how this can be accomplished. (Murugayan & Balaji 2012.)

It can be a good idea to document as much of these internal stakeholder meetings as possible so that all information can be saved for later reference or review. In most cases, these can also be the few situations in which customer feedback can be obtained before the

final result is presented. More information about what is expected of the project and its outcome, the better the response can be to the need or problem that launched the project in the first place. (Murugayan & Balaji 2012.)

3.1.2 Design

Once it is known what is expected of the project, the decision-making process can begin regarding how this outcome can be achieved. It is worthwhile to involve the project team in the design phase as well since more shared knowledge leaves less room for mistakes. (Zulqadar 2019.)

At this stage, it is important to find a clearer and more definitive solution to what is being built and through which the end result can be achieved. The design phase can be initiated, for example, by reviewing the information obtained in the first phase of the waterfall model. One of the most important questions is which kind of parts the project should be divided into and how these steps can be implemented. In carrying out this evaluation process, it is also important to ensure that the assembled project team has the necessary knowledge and skills to achieve the end result. (Zulqadar 2019.)

At this stage of the process chain, it is necessary to develop an understanding of what kind of resources are needed to implement the project. There is a need to define a clear timetable and phasing for concrete implementation, and to identify whether additional staff, either internal or external, need to be involved. The necessary tools, machines, and other logistical solutions also need to be clarified. This is also the stage during which questions and requests for clarification can still be made to the customer so that the final solution corresponds to the desired result in the best possible way. (Zulqadar 2019.)

3.1.3 Implementation

When the third stage of the model, the implementation stage is reached, the plan should be finalized and the possible variables should be mapped in as much detail as possible. The project team must be fully prepared to implement the established plan, with the phasing and

details developed in previous phases to complete the project. If the design stage has been successful, the end result will begin to emerge quickly and without unexpected challenges. (Murugayan & Balaji 2012.)

The end result of your design must allow for a smoothly progressing process. However, the possibility of encountering problems and delays is always high, as not all variables are under the control of any project team. However, similar situations must be taken into account already in the planning stage, so that situations in which there's no knowledge on how to react are not encountered during the implementation phase. The optimal situation is that the phase schedule does not slow down in the event of possible disturbances. (Murugayan & Balaji 2012.)

Even if the tasks of the project have been handled correctly, and care has been taken to ensure that any surprises do not affect the outcome too much, the monitoring of the implementation stage must be effective from start to finish. The reason for this is the level of difficulty to go back to the previous stages if critical errors does occur. Each work step should be carefully checked before moving forward without exception. This provides a strong foundation for meeting project expectations. (Murugayan & Balaji 2012.)

3.1.4 Verification

In the verification stage of the waterfall model, the project is completed with the metrics defined in the earlier stages of the process. At this stage, the end result is tested, analyzed, and finalized into a product to be delivered to the customer. Internal testing of the end result is very important to find any issues that may have been overlooked. (Alshamrani & Bahattab 2015.)

After internal testing, it is advisable to continue the testing process by taking the results to be tested by external and independent parties. This allows for the collection of impartial outside opinion, the provision of feedback, and the analysis of the information obtained. This will make it possible to identify the remaining problems that may arise for final improvements. (Alshamrani & Bahattab 2015.)

3.1.5 Maintenance

In many cases, even if the project is completed, the process itself does not end. When a customer or project client uses the outcome of the project as a long-term solution, the product or solution may need to be updated. This part of the process chain is called the maintenance stage. The need for maintenance or upgrades can be triggered by a changing market situation, or, for example, evolving environmental technology. (Alshamrani & Bahattab 2015.)

If the previous steps of the waterfall model have been carefully maintained, the necessary updates and modifications can be handled without major problems or delays. In some situations, as well as in certain industries, the organization implementing the project may provide service, upgrade, and upkeep until the end of the customer relationship. (Alshamrani & Bahattab 2015.)

3.2 Advantages of Waterfall

As with all project management tools and methodologies, the waterfall model has its own clear strengths and weaknesses. Perceiving these is an essential part of ensuring that these models can be used correctly and in the right situations. Thus, the greatest possible benefit can be obtained for organizations using these tools. (McCormick 2012.)

When reviewing the strengths of the waterfall model, the first thing to highlight is the extensive and comprehensive documentation provided by the model. Due to the rigidity of the waterfall model, all phases of the project must be handled with extreme precision and detailed documentation is required throughout the process. An additional benefit of comprehensive documentation is that the information remains within the organization. Even if staff change over time, or similar projects are launched, there is a strong documentation base in the organization that can be used to maintain, develop, and train new participants. (McCormick 2012.)

One of the great strengths is the ability of project team members to plan their schedules effectively. All parties have knowledge of what role they will play in the organization, and in

the project being worked on. As a result, it is easier to optimize human resources and possibly allocate them to other projects with certain inputs. (McCormick 2012.)

Because the waterfall-like projects are divided into clear step-like phases, the whole can be easily understood. This structure also allows for the ability of outsiders to understand what is going on in the project. The parts of the project have a clear connection to each other, so the design of the project can be implemented more comprehensively. This can be achieved by the approach based on the strong design of the waterfall model, because at this stage of the process, all occurring variables are taken into account as thoroughly as possible. (Amlani 2012.)

The strengths of a simple structure also include its ease of measurement. The project is divided into clear phases, so each part of it can be easily measured in terms of time management, budget, and use of other resources. An excellent tool here is, for example, the Gantt chart illustrated in the figure below. (Amlani 2012.)

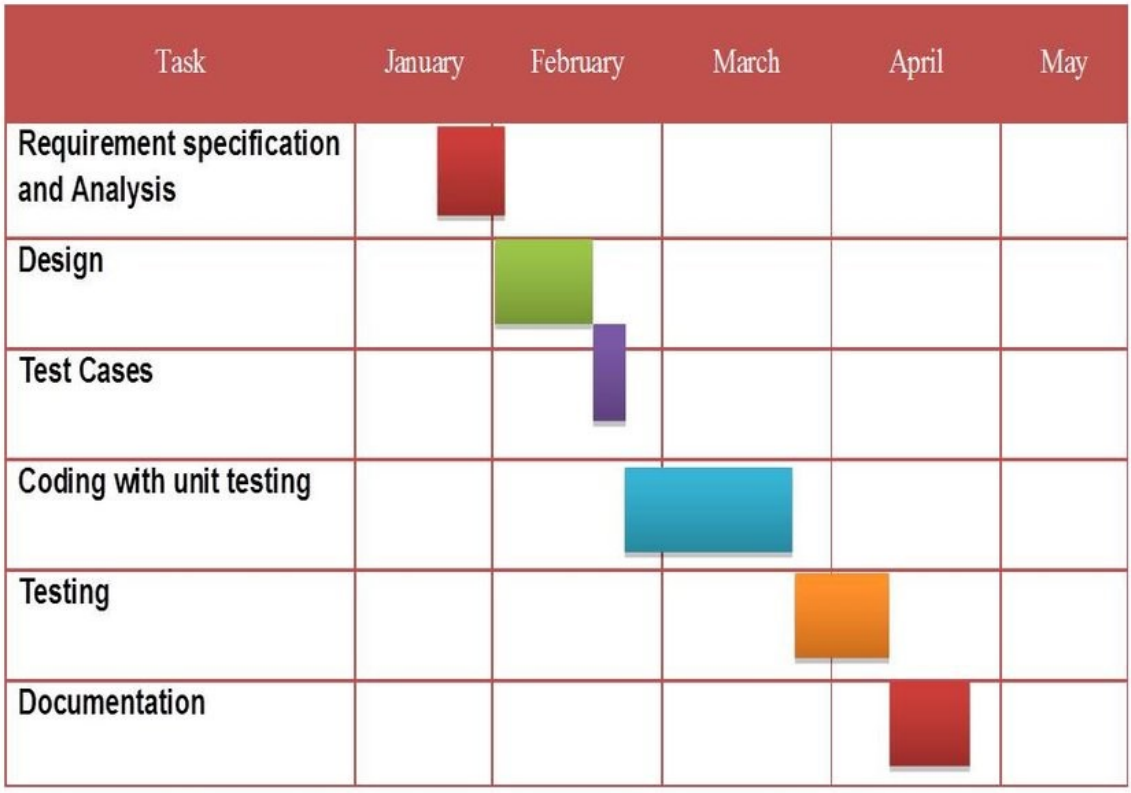

FIGURE 6. Gantt chart in which the project phases are set on a monthly schedule (Nawaz 2014)

The last strength mentioned in the waterfall model is the clear and simple part of the customer in the process. The customer knows at an early stage what kind of solution to their problem or need can be expected. Costs can be considered in a timely manner, as the entire process is carefully planned and documented from the outset. This gives more freedom to manage cash flow for each party in the project. It is also easy for the client to limit their participation to the early stages of the project, where the need for the project has been carefully identified. In addition, strong communication and reporting ensures that the customer does not have to be involved in coordinating the process itself more than is deemed necessary. (Amlani 2012.)

3.3 Disadvantages of Waterfall

In addition to many different strengths, the waterfall model also has its own clear weaknesses. Therefore, it is essential to identify the limits of the methodology in question so that it can be utilized in the right situations and environments. The waterfall model is a tool, like every other management method. It is at its best in its intended purpose and challenging to take advantage of with the wrong conditions. (Bogdan, Andrei, Sorin & Costin 2019.)

When thinking about the most typical challenges of the waterfall model, the weakness of going back may come to first in mind. Once the steps defined in the project have been taken forward, returning is often expensive and difficult. The rigidity of making changes also serves as a source of enormous pressure to be encountered in the design process, as there is basically no going back in the waterfall model once the process chain has progressed to the next steps. One of the clearest examples of this is the first stage of the process chain, the requirements mapping stage. If customer requirements are not understood, mapped, or otherwise considered, there is a high risk of project failure. (Bogdan, Andrei, Sorin & Costin 2019.)

The next weakness to be mentioned in the waterfall model is its emphasized importance of staying on schedule. If there is a delay with one project stage, the delay will follow to the next stages as well. The reason for this is the previously mentioned finish-to-start progress in the internal phases of the project. At worst, the late schedule at the beginning of the project

follows along throughout the project and eventually turns to be late from the set deadline. (Bogdan, Andrei, Sorin & Costin 2019.)

When considering the overall structure of a waterfall model, one of the weaknesses may also be the nature of the downstream stages of the process chain in relation to quality assurance. As mentioned earlier, going back in the waterfall model is very difficult and costly. An additional challenge here is the insignificance of quality assurance, as testing of the finished product takes place only at the end of the project life cycle. For this reason, feedback from quality assurance can be taken into account when the project itself is already practically completed. (Muslihat 2018.)

Performing the testing phase at the end of the process chain can also bring time management issues. If there have been problems with delays or other scheduling problems during the project, it may be reflected in the final stages being completed too quickly and urgently. Carelessness in the testing phase can be very fatal to the success of a project, as failures of projects implemented with waterfall methodology can become very costly. (Muslihat 2018.)

4 LEAN

Lean is a globally well-known and valued way of managing a company’s processes and operations. In principle, lean's methodology is not perceived as a single project management tool, but lean is more generally identified as an ideology aimed at the complete optimization of a company's or organization’s processes. The lean ideology was originally brought to the attention of the corporate world by Toyota Motor Corporation during the 1950s (Sayer & Williams 2012, 19). Since then, that ideology or model has been refined, interpreted, and utilized around the world. (Chiarini, Baccarani & Mascherpa 2018.)

FIGURE 7. Logical steps in continuous improvement in which lean drives for (Lynn 2021)

4.1 Logic of Lean

The idea behind lean is to continually strive for perfect processes and maximum performance. All factors in the environment of the company or organization are taken into account and a comprehensive explanation is created of where the waste occurs at all stages

of the process. In short, the purpose of lean ideology is to strive for perfection by optimizing practices and eliminating waste. (Reinertsen & Shaeffer 2005.)

In lean, the customer defines the value. Business is based on offering products and / or services to your customers. The needs of the customer are the basis of all operations, and in principle, all the activities of an organization are based on the idea of making a product that the customer finds valuable enough to be willing to exchange its equity for. In other words, the product offered must meet exactly the quality level required by the customer, at the right time, place, and price. (Reinertsen & Shaeffer 2005.)

When the organization's operating methods and the value determined by the customer are sought, it must be understood that any kind of waste weakens the process of creating value in the operating environment in a decisive way. The closer you get to perfection in a company's business processes, the less waste there is. Thus, it is possible to achieve the best possible value chain that creates value for the customer, with the direct result of a satisfied customer and a more successful company. (Sayer & Williams 2012.)

One of the values of lean is to create an ideal working environment for operations. All stages of the company's process chain commit human resources. Perfection can be achieved in an environment where the staff is motivated, committed, and feel that they are doing work that matters. All in all, lean ideology strives for perfection. It is an ongoing process with no clear end, but at its core is the pursuit of maximum potential through continuous development. (Sayer & Williams 2012.)

In the next section, we review what kind of waste occurs in a company’s operating environment. The purpose is to illustrate the reasons for its occurrence, and to open up possible ways to minimize it and optimize processes.

4.2 The Eight Wastes of Lean

As mentioned in the previous section, one of the core concepts of lean ideology is waste. What is meant by this is the different activities that either do not add value to the customer or directly impair the organization’s ability to provide the best possible solutions for process

optimization (Bell & Orzen 2011, 35). Minimizing the generation of waste is an integral part of lean principles, so the identification of waste and how it is generation must be thoroughly understood in order to achieve the most efficient process chain as possible. Next, eight wastes from the organization will be reviewed. (Gay 2019.)

4.2.1 Waste 1 – Transportation

One of the clearest examples of where waste occurs is transportation. This refers to the excessive or unnecessary transportation of materials, tools, personnel, and all resources in general. The transportation process takes time and resources are always attached to it which can be utilized in other functions of the organization. (Gay 2019.)

The aim of the optimization of transportation processes is to minimize the need for transport and the resources involved. Some of the best ways to eliminate transport wastage are to organize the location of the resources to be moved, to speed up the process, to optimize the batch sizes of the materials to be transported, and to plan the transport routes, as well as any intermediate storage carefully. (Gay 2019.)

4.2.2 Waste 2 – Inventory

In the earlier stages of industrial development, large inventories were often seen as a sign of success. In modern, ever-changing operating environment, excess inventory can pose great risks because of the capital tied up in materials and all others stored goods. In addition, the warehousing process itself incurs high costs for the organization. These costs include, for example, the necessary real estate, the transfer of material to be stored from one location to another, and the human resources required for inventory management, as well as inventory management systems. (Shields 2006.)

There are many contributing factors to the emergence of excess stored capital. Such as overproduction and excess procurement, which may be due to, for example, a weak business strategy. Inventory management can be initiated by developing tools such as the ABC analysis shown in the figure below, but the best way to prevent warehousing wastage is a

careful sales and operations strategy based on market forecasts, as well as proper optimization of the warehousing process. (Shields 2006.)

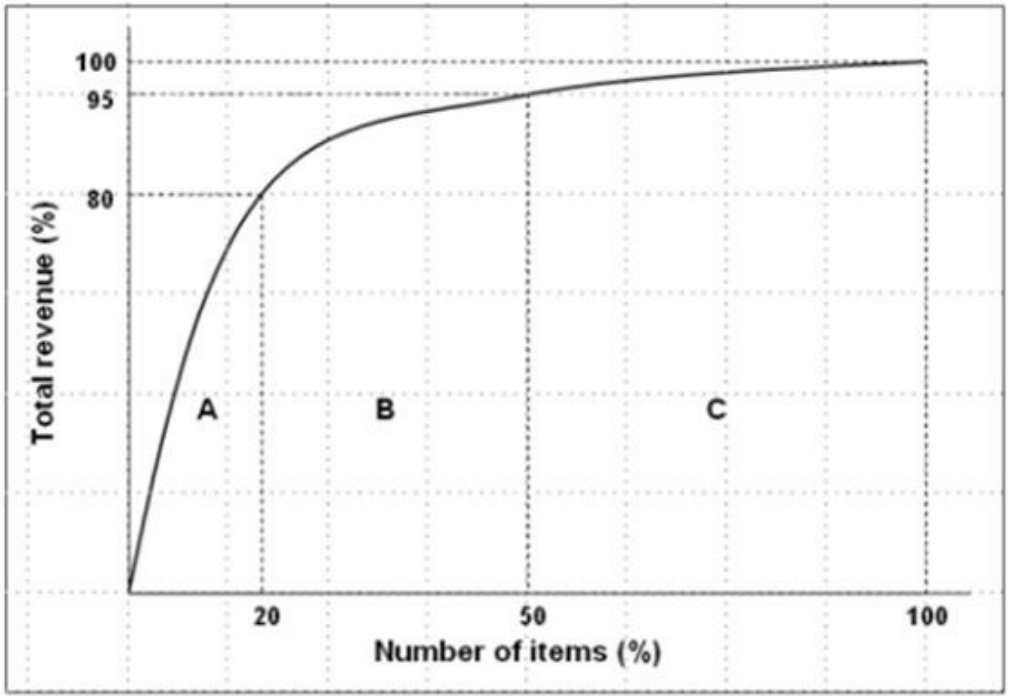

FIGURE 8. ABC-Analysis with 80/20 division (Exact Globe 2020)

4.2.3 Waste 3 – Motion

The third waste to be mentioned is the motion. This waste in question bypasses the two above so that it can be considered to be a part of both. The waste caused by the motion is manifested in principle as the unnecessary movement of resources, such as personnel or equipment from one place to another. For example, an unnecessarily long walk between the work station and the interim storage can be considered as extra movement. Smaller and more frequent movements, such as reaching for tools, can also be considered as excessive movement. The best solution would be to optimize the workstations of the organization's employees so that the overall organization of the workstations would guarantee the fastest, most efficient and safe solution to the general order of the environment. (Shields 2006.)

4.2.4 Waste 4 - Waiting

Waiting is a good example of what can come to the mind of someone familiar with the subject when the concept of wasting time is thought about. Waiting itself means stagnating the use of organizations resources, and thus halting of the productivity. The waste of waiting must be avoided by all means, because, unlike many other wastes that have a longer-term effect, waiting itself increases the risk of bottlenecks, overproduction, and overstocking. (El-Namrouty & Shaaban 2013.)

Waste of waiting can arise from any disturbance of flow in the organizational environment. Whether it is a material flow, a cash flow, or a communication flow, the probability of a wait time is high. For example, the interruption of the data flow can delay the decision-making ability of the management, and this can occur from any a minor thing such as the increased duration of processing e-mail. (El-Namrouty & Shaaban 2013.)

One of the best ways to avoid waiting waste is through careful planning at all stages of the process chain. The production plan must be carefully drawn up, as must the material and schedule plans. Monitoring and carefully analyzing the process makes it possible to avoid downtime when the possible unexpected variables can be reacted on time. (El-Namrouty & Shaaban 2013.)

4.2.5 Waste 5 – Overproduction

When an organization produces more than it currently needs, there is a waste that is identified in lean ideology as overproduction. Overproduction binds an organization’s resources to storage, which by basic assumption causes clear additional costs in warehouse. In addition to the warehousing costs generated by excess inventory, overproduction greatly increases the risk of losing the margin on the finished product. All in all, overproduction binds organization’s resources like space, staff, and capital used to manufacture and thus, creating waste. (Chahal & Narwal 2017.)

Possible reasons for this are the situations in which demand has not been thoroughly taken into account when planning the production process. Another common factor causing

overproduction is the emergence of bottlenecks that slow down the flow of the process and cause waiting in the work stations. The organizations often try to counter the excessive downtime by keeping the production process ongoing and this results as overproduction. (Chahal & Narwal 2017.)

The best ways to avoid the overproduction is to ensure that the company follows the sales and operations plan defined in the organization’s strategy. The organizations strategies are based on a carefully prepared sales forecasts, through which the demand management process provides the company with a comprehensive material requirement and production plan. (Chahal & Narwal 2017.)

4.2.6 Waste 6 – Over Processing

The sixth loss to be mentioned in lean ideology is the loss due to over processing. At its simplest, it means additional functions or work steps which are added into the product or to the manufacturing process that go beyond the required customer requirements. Another way to understand this is through the work processes which take more time to complete than its necessary. As an example of this work machines and stations that do not operate their purpose as efficiently as it would be possible. In other words, if the tools in use are not up-to-date, the processes may take longer than desired to complete. (Chahal & Narwal 2017.)

One excellent way to approach this problem is to take on the role of the customer and define what requirements are to be achieved from their perspective. If the process is implemented from the customer's point of view, the quality, implementation, and outcome will be optimized so that the product or service that creates value for the customer is implemented without additional processing. (Chahal & Narwal 2017.)

4.2.7 Waste 7 - Defects

In all its simplicity, a defect refers to a situation in which a manufactured product is unsuitable for use. When a defect occurs, the extent of any corrective action or direct loss is determined first. In both cases, there is a loss of either reprocessing or disposal. Resources are tied up in these work steps, and in the worst case, the product ordered by the customer has to be re-manufactured from the beginning. Similar situations do not add value to the customer and are therefore wasted. (El-Namrouty & Shaaban 2013.)

From the possible ways to react to defect situations at the general level, the most profitable is to look for the cause of what caused the issue. If this can be clarified, the steps in the process can be planned so that similar situations do not occur in the future. One option for this is to plan the process from the beginning so that possible problem areas and faults can be detected as early as possible and thus prevented in the future. (El-Namrouty & Shaaban 2013.)

4.2.8 Waste 8 – Skill

The skills are not a part of Toyota's original production system (TPS), but have only since become the eighth loss to be considered. Skills-related loss can take many forms in an organizational environment. One of the clearest ways to describe this waste is to think of it as a waste of human potential. This includes neglecting the skills of the employees involved in the process, untapped talent, and situations where opportunities for development are not offered. (Gay 2019.)

The most common reasons for this loss are situations where management is separated from other employees, and thus decisions can often be made without taking into account the special expertise of the employees. Similar situations often lead to suppression of employee innovation and motivational problems. Other untapped talents include inadequate training, weak incentives, and the roles of employees below their own skill levels. (Gay 2019.)

The key factor in minimizing the possibility of this waste is communication and education. Employees must know how to best complete their tasks and utilize the related tools as

required by the task in question. This can be considered mandatory in order to get the best possible benefit from the human resources for the organization. Employees have an important role to play in preventing, correcting, and optimizing processes in general. (Gay 2019.)

4.3 Value Stream Mapping

There are many different tools for implementing a lean ideology that are designed to serve the development of the organization. The main purpose of these tools is to optimize the organization's processes and eliminate waste as efficiently as possible in each area of the operations. As mentioned earlier, the lean ideology is based on the pursuit of perfection and the tools designed to be used with it, are made to fulfill that purpose. There are many different tools associated with lean, but in this work, the one to be researched is the value stream map. It serves as an example, as it summarizes the values of a lean ideology in a comprehensive way. (Abdulmalek & Rajgobal 2005.)

Value stream mapping, or VSM, is one of the most important lean tools. A Value stream is a combination of all the different processes which are needed to be completed in order to bring the product or service to the customer (Bell & Orzen 2011, 33). Value stream mapping is divided into three clear stages. In the first stage, the flow of goods passing through the organization is visualized in such a way that it gives a complete picture of what steps and processes are being implemented in the business environment. In addition to all specified processes, this mapping also includes delivery times, detailed process lead times, and downtime between processes. (Abdulmalek & Rajgobal 2005.)

In the second stage, the value stream map is analyzed in order to identify the weak points of the process chain. These can be too long delivery times, considerable downtime, and the most inefficient steps of the process. VSM analysis also allows the recognition of so-called over processing work steps. Such steps are process parts which do not add value to the customer. (Kanbanize 2021.)

The third and the last stage of the analysis focuses on the exposed weaknesses in order to enable the necessary actions to enhance the process cycle to optimal level. From the weak

points found in the process, all unnecessary work is identified and operations are streamlined according to the lean values. Once the weaknesses in the process chain have been addressed, a new value stream map can be created to highlight the effect of the changes on the flow of goods. The image below shows an example of a value stream map. (Kanbanize 2021.)

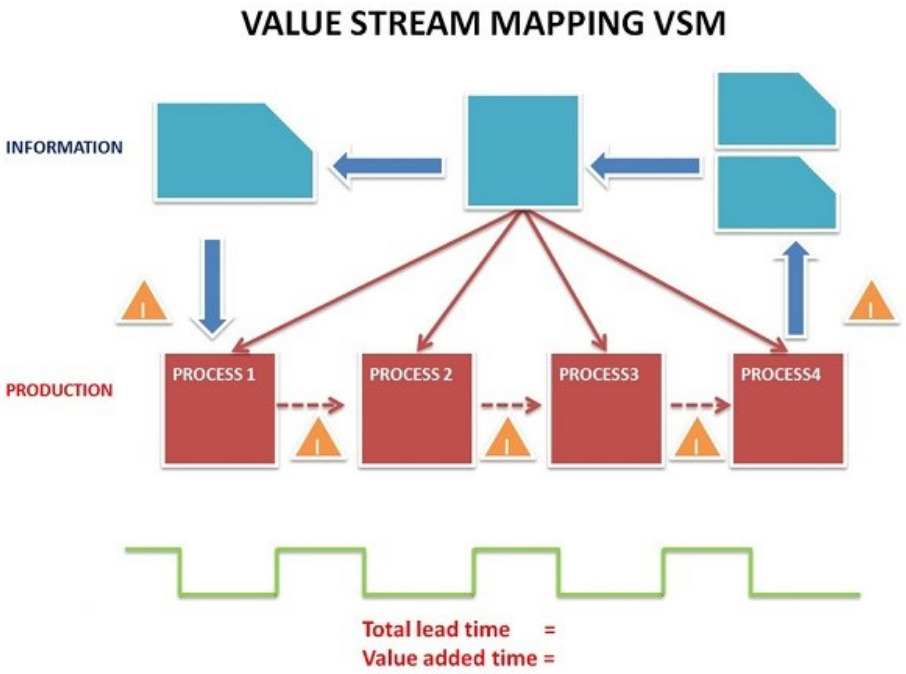

FIGURE 9. Framework for the total lead time and value-added time calculations (Arizona Commerce Authority 2018)

4.4 Strengths and Weaknesses of Lean

As with all other management methodologies and ideologies, lean has its own clear strengths as well as weaknesses. Because lean is based on optimizing processes and eliminating waste, its pros and cons are clearly highlighted in certain operating environments. For example, lean is great for environments with solid process entities as well as an easily predictable future. This makes it possible to optimize processes and strive for perfection. This also means that lean reacts very poorly to unexpected changes, and the benefits of ideology cannot be reaped in an unstable environment. (Owens & Fernandez 2014, 60.) Next, the clearest strengths and weaknesses of lean are opened.

4.4.1 Pros of Lean

Since the second core idea of this mindset is the minimization of waste, in all its forms, the outcome of this can be considered the most important and greatest strength of lean. In lean, waste means all the activities that do not add value to the customer. In other words, the organizational environment used by lean through this produces tremendous competitiveness and increases the margin of the product or service being produced. (Lindlof & Soderberg 2012.)

In order for lean to be implemented, operations must, in principle, be easily predictable and therefore on a very stable footing. This end result is most easily achieved through continuity based on strong customer relationships. In order to achieve this result, operations aim to build on strong individual customer partnerships. This enables the development of processes together with partners, which in turn improves and solidifies the relationship between organizations. (Lindlof & Soderberg 2012.)

The third clear strength is the infrastructure behind the lean ideology. This structure, and the mindset followed, allows for clarity in the business environment. When all the excess is removed, the whole thing is easier to understand. The use of resources is optimized to a level where there is nothing extra, making it easier to maintain operations and bringing the company's operating processes close to maximum efficiency. (Bhasin & Burcher 2004.)

4.4.2 Cons of Lean

When everything extra is removed from the operating environment, there is no room left for errors. Thus, faulty machines and equipment can cause clear delays in the flow of material. In lean, it is important to optimize the use of all resources so that there is no waste of waiting. As a result, tools and machines that may be damaged during the process cannot be directly replaced with new ones, as all resources are already tied up elsewhere. The best way to prevent similar situations is to make sure that maintenance work and inspections are carried out regularly. (Sayer & Williams 2012.)

Another weakness to be mentioned is also due to the vulnerability of lean in case of possible errors. In this case, challenges that may arise are the delayed deliveries, either on the behalf of supplier or in organizations own material handling arrangements. As a clear example of this, a situation can be highlighted in which the delivery of raw materials purchased by the company is delayed, this delay can then follow all the way to the customers of the organization. The reason for this is the minimization of the materials stored, and the production process cannot be initiated before the arrival of the new raw materials. (Sayer & Williams 2012.)

In lean ideology, all resources are used in the most efficient way possible. For this reason, employees in the organization may come under severe pressure during the implementation phase of the process. Especially when moving to minimizing waste, it is important to consider aspects related to change management in the work environment in order to keep employees as highly motivated as possible. Assuming that the role of employees in the environment is optimized at the best level, the staff are trained in a variety of roles to ensure that there is no loss of skill, waiting, overproduction, or over processing. For this reason, potential absences and staff changes may have a greater impact than expected in a peak-optimized lean environment. (Snee 2010.)

5 AGILE

Agile is a way of thinking that, in principle, does not mean any one particular course of action. In Agile, the focus is on the understanding that everything that is done in the environment is meant to create value for the customer. One of the concepts in agile is the idea that not everything can be planned to perfection. Variables should be taken as an essential opportunity to get the best possible result for the operations. One of the best ways to describe agile as a tool is through its flexible and iterative way of delivering results, in close collaboration with the client. (Dank & Hellström 2021.)

One of the best environments to implement the agile mindset is project management. IT-focused software projects in particular are excellent at demonstrating agile's strengths as a tool. Agile works with small and independent teams that are assembled people with many different sets of skills. The purpose of the team is to provide prototype-like solutions at fixed intervals, which are intended to provide feedback that allows for continuous improvement of the solution being provided. (Dank & Hellström 2021.)

In agile's way of thinking, it is important to start prioritizing the work that makes it possible to generate the most value for the customer. This value can be obtained by incorporating the oncoming variables into the process, and seeing them as opportunities to get the maximum potential out of the end result. In keeping with its excellent adaptability, the agile is considered to be one of the best tools in an ever-evolving technological environment. (Dank & Hellström 2021.)

5.1 Background & Agile Manifesto

Compared to waterfall and lean, which have been concepts since about the mid 1900's, agile is a relatively fresh way to manage entities. However, the concept as it is understood today dates back more than 20 years. Agile's role as part of the modern business is significant, due to its excellent suitability for the evolving technology environment. (Dank & Hellström 2021.)

Agile dates back to the turn of the millennium, when the share of failed IT projects approached up to a third of all completed projects. One of the main reasons for this is the emergence and spread of the Internet in the global marketplace. The Internet enabled the development of technology so rapidly that the project management tools in use at the time could not meet this challenge. For example, the waterfall model no longer produced results, as the model, which relied on a long design process, did not have the potential to produce final results, so that IT products would have been up-to-date when they were completed. A new, lighter approach was needed to adapt to the ever-evolving environment. (Schwaber 2004.)

In Utah in 2001, a group of the most important technology leaders of its time met, with the aim of finding a common ground for managing future technological developments. The solution found on the basis of common values was agile. Agile's goal was to provide a more adaptable and responsive software development method that does not lag behind in rapid development, but incorporates a changing environment into its operating principles. Concrete outcome for this was Agile Manifesto. This manifesto is a short document based on four different core values and twelve agile principles. However, these values and principles were not completely unheard of before, and similar ideas had been applied by many experts for years. However, the Agile Manifesto concretizes these ideas into the model that is in global use today. (Schwaber 2004.)

5.2 Agile Values

Agile mindset has been defined in the agile manifesto. Within the next part, the four different values will be introduced. The core idea behind the following values is to prioritize the right things in order to be able to deliver the best solutions to the customer with the maximum efficiency. (Fowler & Highsmith 2001.)

The first value defined in Agile Manifesto is putting individuals and interaction over processes and tools. Regardless of how good technological solutions, tools, and proven process management models are in use in your environment, the key to success is an efficient team. The underlying idea here is not to ignore different tools or model frameworks, but to emphasize that a highly motivated and communicative team is able to find solutions to future

problems regardless of tools. In a situation where teamwork and communication do not work, achieving the expected result is difficult if not impossible. In a best-case scenario, an excellent team has the best possible tools at its disposal. (Schwaber 2004).

Within the second value, working software is prioritized over comprehensive or excessive documentation. Previous project management models, such as the waterfall model, emphasize the need for very extensive documentation. Agile's second value emphasizes the importance of delivering the finished product / software to the customer in order to gather feedback and develop the end result based on the information obtained. Agile's focus is on an iterative, though feedback evolving model where excessive design and documentation can easily cause bottlenecks, eliminating the sharpest point that makes agile great. This is especially true in software development projects. However, in agile, documentation is not considered a bad thing, but in relation to the efficient delivery of new solutions, it must not be devoted too much resources. (Dank & Hellström 2021).

Communication which is one of the agile's greatest strengths, is highlighted in the third value named in the Agile Manifesto. Customer cooperation as a part of continuous product development provides an opportunity for efficient end result optimization process. Agile also differs from other project-focused models by instead of defining the final outcome to be delivered to the customer in a pre-project agreement, the best possible solution is developed with the customer from start to finish. The more communication with the customer, the less risks and ambiguities are encountered as the project progresses. (Dank & Hellström 2021.)

The last value defined in the Agile Manifesto is to prioritize responding to change over following a plan. Agile's greatest strength can be seen through in-built model to treat change as a welcome development opportunity. Its repetitive process chain model allows for timely feedback, response based on new information, and continuous development toward an optimal end solution. This final solution does not necessarily have to be clear from the beginning, but is taken step by step, following the dynamic, ever-evolving strategy developed for the project. (Schwaber 2004.)

FIGURE 10. Agile mindset summarized through the most important aspects of it (McLaughlin 2011)

5.3 Twelve Agile Principles

The ultimate purpose of Agile's twelve principles can be considered to be the creation of a framework for its flexible, changing and customer-oriented mindset. In order to be able to deliver new versions of the end result to the customer as efficiently as possible, operations must be systematized under certain operating principles. These cycles of delivery, feedback, and development can be used to their full potential when operating on the basis of the following twelve principles. (Schwaber 2004.)

1. Customer satisfaction is the top priority. Achieving this goal can be ensured by delivering functional software packages to the customer at the right time and at a constant pace.

2. Variables are opportunities for positive development. Even the variables encountered at the end of the project lifecycle are welcomed as opportunities to provide the customer with the best possible competitive advantage.

3. Workable solutions must be delivered to the customer at short intervals. The delivery of the software to the customer must take place frequently enough. This allows for more frequent feedback, and thus, provides an opportunity to develop the outcome more efficiently. From a purely logical perspective, it is easier to plan for a shorter period and possible variables can be adopted on a more flexible basis.

4. The work will be carried out in close cooperation with experts and other support groups advancing the project. All the expertise available for the project must be used as efficiently as possible. A great way to approach this is through daily and open communication.

5. A committed, reliable and highly motivated team is at the heart of the project. The project will build around a functioning team. The team must be supported and trusted. This increases the team's dedication to the project, and maximum potential can be achieved.

6. The best possible communication can be achieved through face-to-face discussion. This allows for effective interaction and allows things to be handled smoothly. In a modern environment, team collaboration can take place from anywhere in the world, so enough attention should be paid to the implementation of this principle.

7. Progress should be measured primarily through workable solutions delivered to the customer. Basically, getting to the end is at the heart of a project’s success. How much resources have been used is irrelevant to progress. The agile project is progressing with the delivered results.
8. A steady pace of work enables sustainable development. Systematic and stable work enables a continuous and forward-looking project that can be sustained for as long as needed. Optimizing work practices protects team members from being overwhelmed. In this way, the continuous delivery of solutions and the ability to react to changes are maintained.

9. Brilliant technical know-how and careful planning are essential to success. This enables the possibility of high-quality solutions to emerge. An environment that maintains high quality is also able to respond to variables and maintain agility.

10. Simplification of work is essential. When practicing agile, fast delivery of functional systems to the customer is essential. The customer buys a solution / product for a specific problem or need, so there is no need to spend extra time complicating the project.

11. Self-organizing teams produce the best results. By supporting the fifth principle, a motivated team that gets to realize its own vision can create more added value for the customer.

12. Continuous evaluation of one's own activities enables development. An essential part of developing a team’s performance is evaluating it and identifying areas for improvement. When this agile principle is implemented as part of the natural operation of a team, the best possible performance of the team can be achieved through experience. (Fowler & Highsmith 2001.)

5.4 Scrum

Scrum is possibly the most common and widespread concrete way to put agile’s principles into practice. One of the two founders of scrum framework have summarized scrum’s description excellently as the title of a book he published in 2015, SCRUM The art of doing twice the work in half of time. In terms of project management and product design, scrum provides an excellent frame of reference that allows you to leverage the best aspects of agile’s thinking in the right environment. Scrum's strengths, especially in software development projects, are reflected in the ability of teams to adapt to ever-changing requirements, the development of teamwork and the effective achievement of the end result. (Schwaber & Sutherland 2020.)

The scrum model was originally developed in 1990. In addition to the previously mentioned author Jeff Sutherland, another founding member was Ken Schwaber, both of whom were also involved in signing the Agile Manifesto (Dank & Hellström 2021 84-85). The idea behind them was to develop a value-based transparent project management tool based on exploratory process management, continuous review of operations and its customization. (Schwaber & Sutherland 2020.)

Scrum's operating model is based on the value added and feedback from certain time intervals called sprints. The results of these sprints will be carefully analyzed with the team, customers and other stakeholders. (Herranen 2020, 50-51.) The feedback from this serves as a guideline for planning the next sprint and taking the project forward in general. Scrum's operating model has a so-called 3-5-3 rule, which defines the structure and operating principle of the framework. This rule implies that scrum has three roles, five elements, and three artifacts. (Schwaber & Sutherland 2020.)

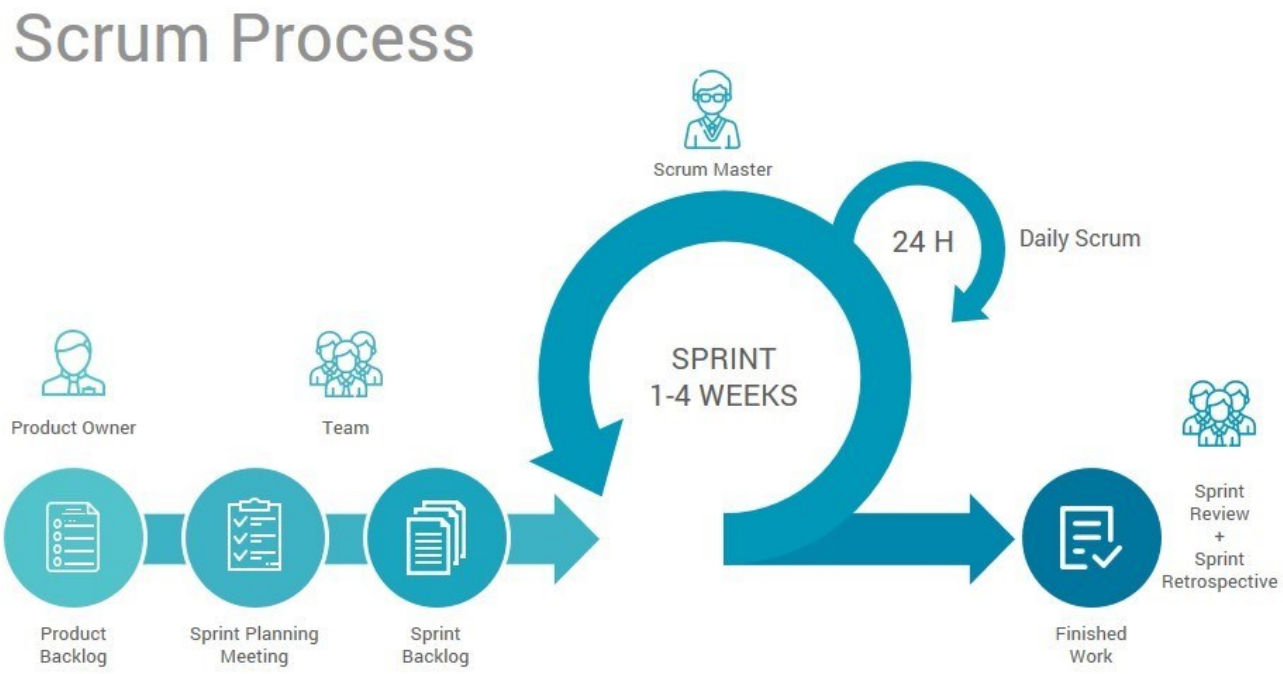

FIGURE 11. Scrum process with the elements defined in a 3-5-3 rule (Porras 2019)

5.4.1 Three Scrum Roles

The first role of scrum is the development team. This team consists of all the professionals needed to make the project to be successful with areas of expertise that complement each other, and thus having the ability to deliver as much value as possible to the end customer. The team may consist of, for example, designers, engineers of various fields, software developers, testers and other necessary experts. Most importantly, the team in question has the ability to develop its own operations as a stable and goal-conscious unit. For this reason,

it can be considered very important that all members of the team work full-time on the project. (Deemer, Benefield, Larman & Vodde 2010.)

In order to achieve the set goal, the team's tasks include organizing its own activities by deciding how the actual implementation of the work will take place, and maintaining the transparency of the implementation of work for all parties involved in the project. It is typical for the scrum team to grow and develop as the work progresses through the key values of the model, transparency and self-organization. Traditionally, more efficient operations and acceleration of pace can be expected after a few sprints have been successfully completed by the team. An inexperienced team should consider their need for additional coaching to ensure an effective and achievable organization. (Deemer, Benefield, Larman & Vodde 2010.)

Another role in scrum is the product owner (PO). The most important task of the person working in this role is to create a product backlog (one of the three artifacts) that combines the vision and the original purpose of the project. The PO is responsible for implementing the value of the product being developed, so where the development team focuses on how the work is carried out, the PO is responsible for what is being implemented in general. In this role, there is a strong focus on the commercial side and there is an ongoing discussion with all stakeholders, the end customer and the development team throughout the project. The PO is responsible for the Backlog and all the work that is added to it. The PO is also responsible for evaluating and approving the results of the development team's sprints. (Schwaber 2020.)

The third and last-mentioned role of scrum is the scrum master. The scrum master is responsible for implementing the scrum framework and uses most of its resources to assist the development team in carrying out their work. Scrum master operates in a number of important supporting roles. Tasks that include these roles include coaching, training, and resolving common external issues that interfere with operations. The primary responsibility of the scrum master can therefore be to continuously assist the development team, improve performance and remove obstacles. All of this can be summed up in a kind of a role of servant leader. (Schwaber 2020.)

It is important to understand that there is no separate team leader in the scrum model. These responsibilities are evenly distributed across all three of the previously mentioned scrum roles. (Schwaber 2020.)

5.4.2 Five Scrum Events

Another element of the 3-5-3 rule is scrum's five events. The first and possibly most important of these are sprints. These sprints are time-limited periods during which the development team strives to implement a specific pre-determined work plan. During the project, several sprints will be implemented in the scrum framework, each of which will in principle follow agile's basic idea of design and iterative implementation. (Schwaber 2004, 136-137.) The length of the sprint can vary considerably from about one to four weeks, depending on the different operating environment. The length is largely determined by the nature of the project itself. An example of this is software projects where the length of sprints can be relatively short from time to time, so as not to lag behind new technological solutions in the external operating environment during the development of the final product. At the other extreme, for example, research-based projects can be used which require clearly longer sprints to be able to test the results found during the planning phase. (Mulder, Verlinden, Maruyama 2014.)

Each sprint implemented by the development team is preceded by a work phase called sprint planning. In this phase of the work, the team intends to design and find a solution for how the product version or addition to be released by the end of the sprint will be implemented. Goals will be set for the sprint in order to guide the work by clarifying the responsibilities and tasks of all participants, and to ensure that the necessary expectations are met in an appropriate manner. In addition to this, the team prioritizes the items to be executed from the backlog which are to be executed during the sprint. (Mulder, Verlinden, Maruyama 2014.)

The third frame event is the daily scrum. It's a quick, approximately 15-minute daily meeting between the development team and the scrum master, during which current affairs and status updates are reviewed. The purpose of this is to maintain active communication and to try to bring out potential problems as quickly as possible. Daily scrum can be understood as a small-scale planning meeting in which the needs of a team can be synchronized with each

other, and any obstacles can be shared throughout the team's awareness. With its systematic nature, this operating model enables an efficient and transparent operating model in the environment of the scrum team. (Mulder, Verlinden, Maruyama 2014.)

The logical next step or event after design and implementation is sprint review step. After each sprint completed, all participants, the development team, the scrum master and the PO will meet to review the events and results of the sprint. These results are carefully reviewed to assess whether the published work has achieved the desired result. At this stage, detailed feedback will also be collected from stakeholders and end users so that the content of the backlog can be re-prioritized according to the development targets for the implementation of the next sprint. (Dank & Hellström 2021.)

The last of scrum's five events is retrospective. Whereas the sprint review focuses on improving gained results and finding a better solution, retrospective focuses on how the team can improve its performance. This phase will be carried out in principle by the scrum master and is intended to serve as a backbone for the continuous growth and improvement of the development team in scrum's operating model. These developments may be related to the team's internal chemistry through its relationships and ways of collaborating, but may also be related to the process and tools used in the work. Retrospective is an important part of team development and the constant feedback they maintain allows for the promotion of an environmental learning culture and a mentality that aims to be better tomorrow than it has been today. (Dank & Hellström 2021.)

5.4.3 Three Scrum Artefacts

Regarding its structure, scrum has three different artifacts defined in the previously mentioned 3-5-3 rule. The first of these is the product backlog, which is the responsibility of the product owner. This is a list of all the things that the development team may need to do in order to deliver the end result of the project properly. The vision at the end result serves as a basis for prioritizing the tasks recorded in the Backlog. (Dank & Hellström 2021; Schwaber 2007.)

The next scrum artifact is the sprint backlog, which represents the result the team is committed to accomplish by the end of each sprint. To follow this work, a sprint-specific tool called scrumboard is used to visualize and track the implementation of the outcome of each sprint. Once the sprint to-do list has been decided, this will not be updated during the sprint, even if it notices any grievances or prioritization of wrong things. Instead, things are reviewed during the sprint evaluation and retrospective, looking for solutions to why this happened and how things can be better done during the next sprint. (Schwaber 2007.)
The last scrum artifact is called increment. In all its simplicity, this is the result achieved during the sprint, the value of which can be added to the work and value done during previous sprints. (Dank & Hellström 2021.)

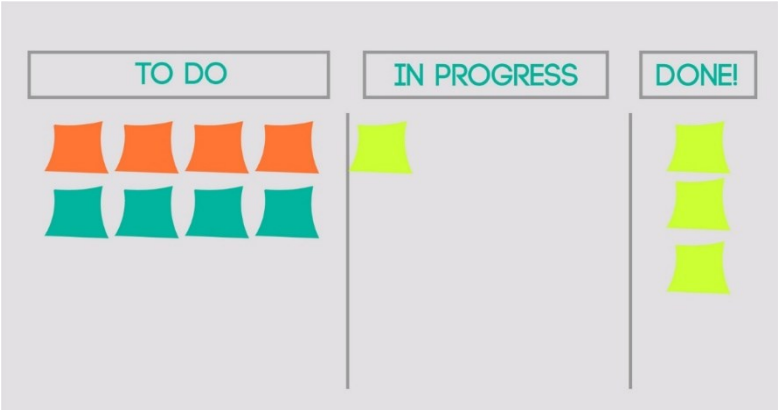

FIGURE 12. Example of scrumboard (Baranyk 2017)

5.5 Strengths and Weaknesses of Agile

As a methodology, agile serves as a very integral part of modern project management. However, this does not mean that agile is suitable for all possible environments. At its best, when its strengths have been used in an optimal way, it can achieve excellent end results. This section discusses what strengths agile has and how it can best be utilized, as well as what weaknesses should be considered when planning operations. (Thesing, Feldmann & Burchard 2020.)

The first clear strength to be highlighted is the high quality that agile models can offer. In these models, work is focused on multiple relatively short and easy-to-manage implementations. This approach allows for strong collaboration between the teams and the

resolution of emerging issues in collaboration with all the experts involved. With a comprehensive design, testing and feedback model integrated into the model, achieving high-quality results is easy to achieve. (Haines, Idemudia & Raisinghani 2017.)

The next thing to mention is perhaps agile's best-known strength, which is the flexibility and ability to respond quickly to oncoming variables. Agile was initially designed to be used for software development, which requires a rapid response capability and, in principle, an iterative way to achieve project goals. For example, models such as the scrum framework place constant change at the core of their operating principles and thus maximize operational flexibility. (Thesing, Feldmann & Burchard 2020.)

Other distinctive strengths of the method are the transparency of the project and the active involvement of stakeholders that enables it. The close co-operation between the team and the stakeholders of the project aims to ensure that the desired outcome is clear during the project and that possible changes are taken into account in good time. Therefore, the approved project is implemented in a very transparent manner, so that progress and staying within the financial framework can be accepted throughout the process chain. Transparency increases the external trust of the partners, and gives stakeholders the feeling that they have the opportunity to influence the progress of the project from start to finish. (Thesing, Feldmann & Burchard 2020.)

In order to be able to use the project management methodology correctly, it is essential to understand its weaknesses and key limitations. Agile is an excellent example of this, as it is basically designed for working on certain types of projects. Where the model is ideal for situations where the desired outcome is not entirely clear, it is also a challenge to create an accurate budget for the project. When there is no clear picture of where development work will take over time, it is challenging to estimate the cost, time, and overall need for all resources in advance. (Rao, Naidu & Chakka 2011; Lohnes 2016.)

Another potential challenge to consider in the model is that progress can be difficult to measure and evaluate until a clear final solution is found. This lack of sense of progress may drive the team away from essential goals in the search for better solutions. Poor opportunities to measure progress make stakeholder involvement particularly important to enable the project team to visualize ways to achieve the goals set for the project. Due to its nature and

operating principle, agile is easy to consider as a comprehensive solution that can be applied to all possible situations. However, it is important to remember that it is just one tool among others that needs to be applied in the right situations to achieve the best outcome. All in all, despite these weaknesses, agile offers a great tool that is at its best in today's demanding and ever-evolving environment. (Kumar, Gupta & Singh 2014.)

6 CASE STUDY

The empirical part of the text examines design thinking, from a project management perspective. The concepts were presented to two different parties who have a considerable difference in experience from these topics. The first party involved was the students of Centria University of Applied Sciences who took part in a course focused on project management. These students had no previous experience in design thinking. The other party was two experts with long experience, one approaching the topic more from the perspective of project management and the other from the perspective of design thinking. The purpose of this was both to go through the similarities between the topics and to address the applicability of design thinking as a project management model alongside other existing methods. These two groups with different perspectives were selected for the study in order to gain the widest possible perspective.

The students participating in the study approached the issue by first getting to know design thinking as a concept. This was started by learning the basic principles and the most common applications of the model. Next, the course covered the most common tools, models and ideologies of project management. The project management topics covered were the waterfall model, lean thinking, agile and scrum.

On the other side of the study, interviews were conducted with both experts on the basis of the same questionnaire prepared for this purpose. The interviews were conducted remotely, after which the questions and their answers were recorded during the interview. The responses received were then compared with each other, and then with the remarks raised about the students work.

Finally, the findings from the student work and interviews were collected in a summary that compares the ideas of those with different experiences in terms of their similarities and differences. The purpose of this was to create a framework for reflection on the applicability of design thinking to a variety of project management environments and situations. The key idea in this section was to find the weaknesses and best potentials of the design thinking model in a project management environment.

6.1 Student Cases

In the autumn of 2020, a project management course was held at Centria University of Applied Sciences, which dealt with design thinking and its application possibilities in modern project management as one of the topics. During the implementation, students became familiar with different project management models. The models reviewed were waterfall, lean and agile. A total of 23 students with no previous experience in the subject participated in the study. In the final task of the course, students were divided into five different groups, comparing design thinking to a project management tool assigned to their group with the following questions:

1. What similarities do you find between design thinking and the project management model?
2. What differences do you find between design thinking and the project management model?
3. What features of design thinking could be applied to the project management model?
4. Should design thinking be applied to your project management model? Why or why not?

6.1.1 Design Thinking with Waterfall

The first topics to be compared were design thinking and the waterfall model. The first observation of the group of students was the similarity of the phase structure of both models. In this case, strong systematicity was highlighted in both of the topics examined. Other similarities were also found between the phases of the operation, for example the testing phase. However, most of the finding's students made centered around planning. The main focus was on the similarity of the careful design phase of the waterfall model to the comprehensive mapping of the environment through empathy of the design thinking model.

When a group of students began to look for differences in models, the first important finding was also found in the structure of the planning. The finding was based on the fact that in design thinking, design is part of the entire process chain, while in a waterfall, the planning phase is carefully completed until the solutions found are implemented. The second

difference highlighted was strongly tied to the first discovery, as the observation made was the human focus and flexibility of the design thinking model throughout the process, compared to the clearly more systematic and rigid way of operating the waterfall.

The third issue to consider was the possible features of design thinking that could be applied in the project management model under consideration. The observation that emerged was that an empathic approach of design thinking could be utilized in the waterfalls planning phase, which already consumes a lot of time and resources. Team dynamics based on different perspectives could also be utilized to streamline the planning phase of the waterfall model. The student group also highlighted the possibility of an empathic approach of design to reduce the time spent in the waterfalls planning phase when the customer's need is accurately and efficiently identified.

In conclusion, between these two approaches, it was concluded that design thinking has the potential to fit perfectly into the waterfall model, as it was felt that a service-oriented approach at the planning phase could clearly reduce the risk of difficult-to-manage variables as the project progressed. The biggest challenge was the slowdown of the already slow and stiff operation of the waterfall model with the added steps. As a solution, the possibility of combining the design thinking methodology with the individual process steps of the waterfall model was highlighted, especially for large and long-term projects.

6.1.2 Design Thinking with Lean

Another topic was to compare the principles and practices of design thinking with lean ideology. As the biggest unifying factor, the group of students studying the issue found a way of working for both models that focuses on obtaining the right information to achieve the best possible outcome. Another unifying factor highlighted is the continuous analysis of activities to enable development.

When examining the differences in the models, the clearest and first point raised was the case-by-case nature of design thinking compared to the mentality of continuous development of lean regardless of the environment. The case was summed up so that although customer-

oriented design and pure process optimization may contain much the same values, the end result sought is clearly different between those models.
As students considered which features of design thinking could be used with a lean ideology, the opportunity for an empathetic approach to get to know the operating environment so well that optimal practices for eliminating waste could be found and utilized emerged.

Finally, students summarized their own conclusions about whether the models should be applied to each other. The end result was the view that the models could not be directly applied to each other because of their fundamental differences. Instead, students consider the possibility of design thinking to be applied to a variety of lean tools to achieve the best possible outcome. In the end, it was felt that design thinking could be used to find an innovative as well as customer-oriented solution, and lean ideology can be used to optimize the implementation of the solution found.

6.1.3 Design Thinking with Agile

The third methodology for student groups to compare with design thinking was the agile mindset model. The main common factor observed between the subjects was the experimental focus on development of both models. The most important aspect here was to encourage freedom of thought and initiative in an environment where the problem is thoroughly explored. A similar feature between the models was also perceived as a people-oriented and team-oriented approach in a project environment where mostly technology-based solutions can be implemented.

Although the students' observations focused largely on the similarities between design thinking and agile, there were also clear differences. The most notable of these focused on the applicable situation. The first difference was the applicability of design thinking to any environment and situation, while agile model is clearly designed for the environment of software development projects. Another clear difference, according to the research team, was a pre-existing problem that agile is trying to solve. Design thinking, on the other hand, focuses on developing a new solution in an environment which is explored through people-centered empathy.

Empathy was again highlighted as the most potential aspect to be implemented for agile model. The students considered that the emphatical nature of design thinking could enhance agile’s feedback phase and thus reduce the number of versions required thanks to a clearer outcome. The models were thought to be very similar in ideology, so the flexibility of both models would allow the elements of both to be exploited and shared freely at any stage of the process.

Initially, the whole group felt that the principles of design thinking should be used together with agile. The models are noticeably similar so they would fit well together in terms of their features. Design thinking emphasizes customer orientation, which at its best enhances agile's iterative approach.

Students comparing design thinking to agile’s mindset were also tasked with looking at the topic from the scrum frameworks perspective. Scrum is one of the most commonly used models that applies agile principles in practice, so it was also up to the students to approach it from this perspective.

Thanks to Agile's principles, there were several similarities in the topics. The most important unifying factor of which was the way in which both models put people at the heart of development projects. However, differences were also found, the most important of which is that scrum has been developed as a practical application of agile's ideology, making it a flexible and problem-solving software project framework. Thus, the greatest difference can be considered to be the fundamental difference between compared subjects, one being in principle a model of thought, and the other a practical tool to apply one.

The case was summarized so that both are based on the principles of continuous feedback and team dedication. Both test the potential outcome with a mentality of continuous improvement, so the best way to apply the principles of design thinking to scrum was to find an opportunity to combine its elements in the planning of sprints and more effective application of the gathered feedback.

6.2 Interviews

In the second phase of the study, two experts with long work experience were interviewed around the same topic as those studied by the students during the first phase. The purpose of the interviews was to create a contrast between the findings made at the beginner level and the observations gathered during the long work experience. During the interviews, seven different questions were discussed around the topic and background. This was done in an online environment through which the interviews were recorded and documented.

The interviewees were:

Mari Strang
Fast IT Architect, co-creation
Fujitsu Finland

Satu Nikula
Project Manager
Acceletic

The questions asked during the interview:

1. What is your background in this field (project management / design thinking)?
2. Are you familiar with waterfall, lean, agile project/process management tools and with design thinking?
3. Do you see similarities between design thinking and modern project management? If so, why?
4. Could the customer-centered planning process of design thinking be used in conjunction with the more traditional ways of methodologies mentioned above?
5. Have you previously applied the principles of design thinking to project management?
6. Are there any types of projects where the principles of design thinking could serve as such as a priority approach?
7. Should design thinking be taught as part of project management?

6.2.1 The First Interview

In the first interview, Mari Strang of Fujitsu Finland was interviewed. The purpose of the interview was to get answers from the interviewees perspective to the questions listed in the previous section. The answers to the questions asked during the interview were recorded so that they could be compared with other results obtained during the section.

The First question:

What is your background in this field (project management / design thinking)?

Answer:

So, from the project managements points of view, I would say that in a way or another I have sixteen years of experience. First from Rautaruukki as a customer and then from Fujitsu as a consultant. The reason why I'm saying that I have experience from project management all the way from 2006, is that I've been a part of a huge ERP projects as a training organizations project manager. In this project, a clear project management methodologies were systematically utilized and from that point of view, I consider to have a firm understanding of project management.

From design thinking perspective, I have gathered experience from a shorter amount of time. If taken into consideration that design thinking wasn't utilized in this way, at least with the IT projects, so the modern use of it is a relatively new thing. From that, I have somewhere around four years of experience. I've done many different kinds of design thinking projects and accomplished certifications from this area of expertise.

The Second question:

Are you familiar with waterfall, lean, agile project/process management tools and with design thinking?

Answer:

I’m familiar with all of them, waterfall, lean, agile and design thinking. Regarding waterfall, it’s still has a great value. More complex the project, more the waterfall method is recommended to be used with it. It definitely hasn’t changed and a very interesting thing is that the method I used in 2006 is very similar than the project management tool that SAP uses with their most modern projects. When we’re dealing with very complex projects, they can be cut to smaller pieces in testing phase, in order to be handled with agile.

However, when we’re talking about software development projects, it is essential that agile is used and in a way that some of the people will be working in the same places with the cycles defined in agile.

And what comes to lean, my current work place is a lean house. The idea of it is that we aim to do things smarter and by not inventing the wheel again. This is done by learning from earlier innovations and found working solutions.

The Third question:

Do you see similarities between design thinking and modern project management? If so, why?

Answer:

Yes, I see and I think it’s a really wonderful thing that you have put these things together. In my opinion, design thinking should be connected to modern project management in many ways and specifically it should be taken as such. If we would further think about the perspective of IT projects, we should understand that when you’re implementing IT systems, there’s always changing processes in the background and thus, change management is needed. And in the end, the ones affected to all this are actual people who use the software.

For this reason, I think that utilizing design thinking really is very important and more and more so as the time goes by. In design thinking, you’ll always put the people to the center of

everything because you need to think what's the best possible way for them utilize and benefit from the software.

In a way, this all does kind of waver the old way of thinking, in which the engineer invents the solution and is always the best expert there is without any communication with the end user at all. Service design and design thinking approaches this from the other way around. In design thinking there's always the key persons from the technical side, end users, support groups and stakeholders who all work towards the common goal. Overall, there's definitely a lot of similarities and design thinking really should be utilized more and more as a project management method and tool.

The Fourth question:

Could the customer-centered planning process of design thinking be used in conjunction with the more traditional ways of methodologies mentioned above?

Answer:

Yes, design thinking can be used well with agile and waterfall models. As I stated earlier, for example, a complex ERP projects cannot be completed entirely with agile. Waterfall is to be used and smaller parts can be done with agile. When these kinds of projects are executed, there's always many different workshops and that's one example of where you could use human-centric way of thinking. In order to succeed, it's very important to value the people and change management. Of course, with the exception of purely technical projects. Even though I cannot give an expert opinion on lean, I can state that the lean ideology can be used together with project management and thus, with design thinking as well.

The Fifth question:

Have you previously applied the principles of design thinking to project management?

Answer:

Yes I have. Last year I was a part of a massive ERP project and we completed design thinking workshops when ever we could. It always took relatively lot preparations since no one else in the organization who was familiar with the design thinking. Since there was only one expert available, the best possible value couldn't be reached. The workshops were none the less successful because the people to whom the change affected were able to participate.

And again yes, I have applied design thinking to project management. I've also done one inquiry in which design thinking was heavily included. This was in a way design thinking together with the project management methodologies with a new modern twist and also in an agile way. In this case the customer did request sort of an older and more traditional way to run the project.
But overall the answer is yes. I have utilized and like to do so even more in the future.

The Sixth question:

Are there any types of projects where the principles of design thinking could serve as such as a priority approach?

Answer:

Yes, I believe there are many different types of projects, in which design thinking could serve as the main approach and the more traditional waterfalls and such could be moved aside, while using for example a double diamond.

One time, I participated the start-up event slush, in which a designer presented a project which was completely done trough design principles and it had exactly the same elements as project management models. I thought it was a very interesting basis even though the topic was from my opinion, relatively unsexy, workflow build between the different payment methods. It was however done with the means of design thinking. And as an answer to the question, yes there are and it definitely can be used.

The Seventh question:

Should design thinking be taught as part of project management?

Answer:

Yes, I think it would be very good to teach design thinking as a part of project management. As an argument for that, the world is changing fast and understanding design thinking would be very beneficial for any project manager. Also in a way that you can have a bag full of useful tools from the design thinking which can be utilized for the different phases of the projects. This would smoothen up the worked topics in a way that it wouldn't be an addition, but it would lighten the operation as a whole.
The concept could be approached by when going through the different project management methodologies, the possible design thinking principles to be integrated would also be taught.

Overall, the answer is yes, and it would be great if design thinking would be taught together with the other project management methodologies.

6.2.2 The Second Interview

In the second interview, Satu Nikula of Acceletic was interviewed. The purpose of the interview was to get answers from the interviewees perspective to the questions listed in the previous section. The answers to the questions asked during the interview were recorded so that they could be compared with other results obtained during the section.

The First question:

What is your background in this field (project management / design thinking)?

Answer:

I have gathered 20 years of experience from project management and I have completed a training in the Project Management Institution. I am also familiar with design thinking from my master's degree of computer science. Especially when going through user interface development. However, I've yet to have design thinking experience from an actual project environment even though I definitely understand how important the topic itself and service-oriented approach is as my role as a consultant.

The Second question:

Are you familiar with waterfall, lean, agile project/process management tools and with design thinking?

Answer:

Yes, I am. In a modern field of work, they are often used all together and a great example of this is the large ERP projects. Usually, in those kinds of projects, the bigger milestones are done by using waterfall model. Lean is used as a basis of handling the processes, and the development parts, especially the software development is done by using agile.

So yes, I'm very familiar with all of them and in today's field of business, all of them are used in a larger scale projects by dividing them to the different areas in which they are best suited for.

The Third question:

Do you see similarities between design thinking and modern project management? If so, why?

Answer:

I definitely do see the similarities between them in the modern project management. Design thinking and service design are some of the most important skills that a consultant can have.

The reason for this is the need to be able to give the exact knowledge and the skills which are required for the job. These are some of the most essential tools to have in order to give the customer the best possible financial benefit from the project. So to sum this up, design thinking is absolutely important in project management and the right knowledge, skills and ability to provide the best possible outcome are the main reasons why this kind of work is needed.

The Fourth question:

Could the customer-centered planning process of design thinking be used in conjunction with the more traditional ways of methodologies mentioned above?

Answer:

The quality of the service and design can be taken into consideration when using different project management and process management tools. In a way, that also means that the perspective of design thinking should also be taken into account. This works especially well in the consulting projects since the knowledge and skillset are the main things to be offered in a first place.
And yes, from my opinion, it can be utilized in all kinds of projects together with all kinds of tools since the main thing it provides is quality and thus, it is very important.

The Fifth question:

Have you previously applied the principles of design thinking to project management?

Answer:

I have always thought that design thinking and service design brings quality and are very important to the customer. However, I haven’t utilized the methodology as such before but I have always taken it into consideration when finding the best possible solution for a customer. Because I always work in a side of the customer, it is without exception, very important to acknowledge.

The Sixth question:

Are there any types of projects where the principles of design thinking could serve as such as a priority approach?

Answer:

Yes there are. Especially those kind of projects in which the end goal is not necessarily clear, and the project focuses more on to preliminary study of the target topic. Other example is the projects in which the system itself is not going to be built but instead designed. And if the customer wants consulting for any kind of project, it is good to approach the subject from the design thinking point of view by going through what kind of value are we actually going to deliver for the customer.

The Seventh question:
Should design thinking be taught as part of project management?

Answer:

Well, from my opinion, it is very important. It should be taught and integrate into the different tools of project management. Things like how it could be utilized in waterfall, lean and agile are essential. Another approach should be like how the different stages of the more traditional tools could benefit from the design thinking principles. So my answer is yes, first with the tools and methodologies themselves and secondly with the different stages and processes of the said models.

6.3 Thoughts of the Results

Based on the collected observations, it can be concluded that it is very logical to utilize the design thinking methodology and mindset model as a project management tool. The purpose of the students' work was to give as objective an interpretation as possible of the compared topics, as these groups had no previous knowledge or experience of the topics given to them. Students in the beginning of their careers often have a relatively broad overall picture of their

chosen field after their studies have been completed, as there has not been too many external influences. For this reason, the objective view of the student groups on the topic was sought to be included in this study.

The long work experience together with expert-level knowledge and skills of the two professionals interviewed, served as a contrast for the previously mentioned party. The influence of work life competence and perceived practices on their interpretations of the given topics was intended to give a clearer direction in which direction design thinking has developed and will develop in the project management environment.

In principle, the research distinguishes students need to try to adapt the design thinking to every different aspect of the project management models given to them. Although the clearest contradictions and the most challenging points of integration became clear, the groups still had the solution to utilize the empathy phase applied in the design thinking model to increase the relevance of the work done. This was especially the case where the clearest similarities could not be exploited. An excellent example of this was student's idea of applying design thinking's empathy-based approach through lean ideology in order to find the optimal solutions more effectively. Instead of trying to apply these quite different ways of thinking directly to each other, a better solution was considered to be applying the design thinking models processes to the different lean tools for maximum benefit.

According to the results of the groups, the adaptation of the principles of design thinking with the waterfall and agile can be implemented more smoothly, as these models are inherently similar. For Waterfall, the joint use of the models would be best suited right from the start of the project, where the ideation of the design thinking process and understanding of the right goals could potentially be of great benefit to the waterfalls planning phase by minimize the risks in the second half of the project.

With Agile, the principles of design thinking were felt to fit together very well as such. The models were found to be very similar by the students, and the greatest benefit was felt to be in the ability to reduce the number of sprints required, thanks to a more detailed understanding of the client's needs. Design thinking was also felt to be more effective, especially in the implementation of development projects. The idea behind this was a clearer vision of the desired result made possible by the empathy process.

The interviews conducted in the study clearly provided the basis for the students observations. Both of the interviewees felt that design thinking offers excellent opportunities to enhance more traditional project management models, especially in situations where its principles can be used in solution or application design work.

From a project management perspective, design thinking was seen as fully applicable as such as a tool for project management, as long as the nature of the project itself is appropriate for a human-centered design, testing, and application framework. Interviews raised up the possibility of applying this model, especially to projects where the desired outcome is not entirely clear. An excellent real-life example was also mentioned, where design thinking had served as the primary approach.

Based on the answers, it was possible to notice that design thinking has been used as a concept for a relatively long time. An excellent point was that the best possible application of the principles of the model may not even have been found yet. With the development of the technological environment, the strengths of the model have only recently begun to receive attention worthy of their potential, and the further the system solutions go, the more important it is to be able to find the best possible solutions from the end-user's perspective.

However, the most important observation that emerged from the interviews is that the customer-oriented design process of design thinking is perceived as very important, both from the perspective of the customer and the project implementer. The fact that this methodology is considered a very important part of future project activities provides a clear basis for further research, and for coordination with different tools. It was also important to note that the findings of the student groups corresponded to the ones highlighted in the interviews.

At the end of both interviews, it was concluded that it would be very important to teach design thinking as an integral part of project management, both as such and when applied with other more traditional tools. Overall, understanding the topic was seen as a very important part of the future work environment and the skills needed by future professionals.

7 CONCLUSION

Overall, project management and managing of different entities are a very complex and, above all, diverse subjects. There are many different types of projects and environments, and in order for all of them to be implemented and operated in the best possible way, creating as much added value as possible during the process, the tools and operating models must be just right for each situation. Some projects are straightforward and require a strong planning and preparation base for their optimal implementation. In others, the goals are not clear from the beginning, so a different operating model capable of rapid change is needed. Whatever the project or environment, the unifying factor with these is that they are carried out by people to people. The purpose of this study is to explore the possibilities of how service-oriented and empathic way of thinking in the use of any tool could enhance the outcome, bringing significant added value to the target environment.

This work, with all its steps, can be summarized in such a way that its main purpose was to go through the design thinking methodology as well as the different project management models from the perspective of their structure and way of working in detail. The main purpose of this was to give the reader a clear idea of how these tools, frameworks, and operating models can be best utilized in an ever-evolving environment.

The background to this was the idea that design thinking could have excellent potential uses that have not yet been exploited, at least as widely as would be and possible. For this reason, all the major project management and process management tools and thinking models covered in the first part of the work were reviewed, especially in terms of their phased structure. The underlying idea for this was to try to first dismantle design thinking and then the more well-known models in such a way that their similarities and differences would be clearly perceptible. This allows these models to be compared at such a level that ideas can be formed about what parts of design thinking could be used to enhance more traditional models.

In the first part of the study, design thinking, the waterfall method, the lean operating model, and agile’s mindset were opened at the theoretical level. All models were disassembled into smaller sections at the level of their phases and values. In particular, the aim is to give the

reader an understanding of the perspective from which the topics are compared and what similarities are sought.

In the latter part of the study, these opened concepts were compared by two different parties. The first of these was students with no previous experience in the subjects covered. The second group consisted of two long-experienced professionals with a clear understanding of the best uses for the operating models and tools. Groups of students sought answers to the questions given, and professionals participated in separate interviews related to the topic.

The outcome of both was very positive for the background idea of the study, as students found clear areas of utilization between design thinking and each project management model researched. People-centric approach was considered to be very important in an environment of accelerating technological development in order to make the most of the potential offered by technology. The same results were obtained in the interviews conducted. The value of design thinking was already considered very important in today's work environment, and the increasement of its need was considered an essential part of the future work environment.

Overall, the outcome of the study was clear, and the ideas of the target groups in the empirical section provided a clear picture of future developments in design thinking. Project management develops together with its environment, which in turn develops through new technology solutions and trends. However, this development is driven by people, focusing on the design of human-centric solutions is one of the most important parts in achieving the best possible outcome.

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