

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Management



Master's Thesis

**Migration from Waterfall to Agile methodology and its
impact**

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DIPLOMA THESIS ASSIGNMENT

Antonio-Ante Šerić

Economics and Management

Thesis title

Project Management – Migration from Waterfall to Agile methodology and its impact

Objectives of thesis

The objectives of this thesis are to identify the differences between Waterfall and Agile project management methodologies in ideology and in practice.

The thesis will also identify the obstacles and challenges that a small company might go through when changing the project management style, and how long it takes to adapt.

Methodology

This thesis is in two main parts: Theoretical and Practical.

The theoretical part is based on a review of current academic and other reliable literature, whilst the practical part will be based on close observation of a small Croatian company as it transitions from using traditional Waterfall methodologies to more Agile techniques using Scrum principles.

The impact of transitioning methodologies on the overall outcome of the company will be measured, together with changes to the productivity of the employees, and the overall satisfaction of the owner and the customers.

Financial measurements will be taken from the company's official reports. "Softer" parameters will be based on observation, and questionnaires and interviews with the owner, employees, and customers.

The proposed extent of the thesis

approx 60-80 pages

Keywords

Project Management methodologies, Agile, Waterfall, Productivity, Satisfaction, Croatia

Recommended information sources

Ajam M., (2018), Project Management beyond Waterfall and Agile, Routledge (2021), ISBN-13: 978-1032096025

PROJECT MANAGEMENT INSTITUTE. *The standard for project management and A guide to the project management body of knowledge : (PMBOK GUIDE)*. Newton Square, Pennsylvania: Project Management Institute, Inc., 2021. ISBN 978-1-62825-664-2.

SCHWABER, K. – BEEDLE, M. *Agile Software Development with Scrum*. Upper Saddle River: Prentice Hall, 2002. ISBN 0-13-067634-9.

Thesinga T., Feldmanna C., Burchard M., (2021), Agile versus Waterfall Project Management: Decision Model for Selecting the Appropriate Approach to a Project, *Procedia Computer Science*, 22 February 2021 Volume 181, Pages 746-756, ISSN 1877-0509, <https://doi.org/10.1016/j.procs.2021.01.227>.

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Declaration

I declare that I have worked on my master's thesis titled " Migration from Waterfall to Agile methodology and its impact" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 31.03.2023

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To D. Without whom I wouldn't be where I am today. Your unwavering support pushes me forward each day. Thank you.

Migration from Waterfall to Agile methodology and its impact

Abstract

Choosing the right management approach is a challenge for many companies. Maintaining a positive culture, creating a sense of well-being among the team members, and allocating time more effectively may all be achieved by selecting the right project methodology. There are various methodologies that have different principles from each other, and it is up to the company to choose the most suitable one. Several internal and external factors can affect the choice of the methodology. Such was the pandemic outbreak. Covid-19 pandemic forced many businesses in different sectors to shift their working online. Such immediate changes require the companies to be more flexible. In order to quickly adapt to these updates, companies need to implement management methodologies that are able to provide the required flexibility. One of the most flexible methodologies is Agile because it gives organizations the capacity to respond swiftly to shifting demands, protocols, technologies, and external circumstances. Adopting Agile principles requires significant modifications to the projects' designs. The adaptation might require more time if the change is done from rigid methodologies like Waterfall.

Keywords: methodology, principles, pandemics, Agile, flexible, Waterfall, rigid, technologies, changes, process

Přechod z Waterfall na Agile metodologii a jeho dopad

Abstrakt

Vybrat správný přístup k řízení je pro mnoho společností výzvou. Udržovat pozitivní firemní kulturu, vytvářet pocit pohody mezi členy týmu a efektivněji alokovat čas lze dosáhnout vhodným výběrem projektové metodologie. Existuje několik metodologií, které se liší svými principy a volba nejvhodnější je na společnosti. Výběr metodologie může ovlivnit několik interních i externích faktorů, jako například vypuknutí pandemie. Vypuknutí pandemie Covid-19 donutilo mnoho firem v různých odvětvích přejít na online práci. Tyto okamžité změny vyžadují větší flexibilitu firem. Aby se společnosti dokázaly rychle přizpůsobit těmto změnám, musí implementovat metodologie řízení, které jsou schopny poskytnout požadovanou flexibilitu. Jednou z nejflexibilnějších metodologií je Agile, protože organizacím umožňuje rychle reagovat na změny v požadavcích, protokolech, technologiích a externích okolnostech. Přechod na Agile principy vyžaduje významné úpravy návrhu projektů. Adaptace může vyžadovat více času, pokud se změna provádí z rigidních metodologií jako Waterfall.

Klíčová slova: metodologie, principy, pandemie, Agilní, flexibilní, Waterfall, rigidní, technologie, změny, proces

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1 Introduction

A project is characterized as a set of tasks that must be carried out in order to achieve a particular result. Projects are defined as transitory activities having a clear beginning and finish by the Project Management Institute (PMI). Those can be handled by one person or hundreds, depending on how complicated it is (Project Management Institute, 2017). In order to be able to finalize a project successfully, project management methodologies need to be applied. These methodologies help in arranging, planning, and controlling resources to accomplish the goal of the company (Miranda & Hardy, 2022). Management methodologies can be useful whether it is about delivering a project in a construction company or creating software. To accomplish a goal, these tactics require making plans and assigning duties to the staff members. Management approaches ensure that the objectives of the project are clear for everyone working on it. Through the phases it divides the project and the tools used, the management methodology captures the requirements for the final solution and establishes the processes to fulfill those.

There are various management methodologies that have evolved with time. Depending on the industry, team and requirements, the most suitable management methodology should be chosen for different projects. Based on the goal of the project, the companies can shift from one methodology to another. Often the issues identified by following the concepts of one methodology can be eliminated by implementing another one. There are various factors that can affect a company to change its project management methodology.

In 2020 and 2021, the Covid-19 outbreak drove many businesses and organizations to switch to remote working. Under such circumstances, many businesses had to shift to a more flexible project management methodologies that allowed them to manage the deliverables even while working remotely.

One of the most flexible management methodologies that was widely implemented since covid-19 breakthrough is Agile methodology. Agile provides businesses the ability to react quickly to changing business needs, procedures, technology, and environmental factors (Batra, 2020). Adopting Agile in a company that has been previously applying a different management methodology can be challenging. It would require a shift in the mindset of the staff who will apply Agile to their tasks. The need to have a good understanding of Agile principles and adopt those into practice by reorganizing the workflow.

1.1 Objectives

The objective of this thesis is to study the transformation of the management methodology in a website creation company that operates in the Croatian market and has 18 employees. The management change is from Waterfall to Agile methodology. The aim is to first describe the current website creation process and how its phases are designed following Waterfall principles. The purpose of illustrating the Waterfall designed processes is to identify the existing obstacles in the workflow that keep the company from having optimal results and reaching its goals.

The goal of the change in the methodology is to solve these obstacles that are present in the process when following Waterfall methodology by implementing the Agile concepts. During the research work of the thesis is observed the change and are described the differences in the newly designed workflow while applying the Agile principles.

The research focuses on three performance indicators: efficiency, staff satisfaction and client satisfaction. The study period is March- November 2022. To support the goal of the thesis, there will be data collected and analyzed for each methodology and further compared between them to prove the success of the Agile implementation.

1.2 Research Hypothesis

Waterfall methodology is a rigid methodology that organizes process phases in a linear way thus those do not overlap each other. The following phase starts only if the previous phase has been completed and there is no return in the earlier phases (Charvat, 2003). This method of organizing the process has created bottlenecks that the company of the case study faces difficulties in overcoming. There is a need to eliminate the problems that are present by applying another more flexible methodology, Agile. Agile has the advantage to adapt to changes without reducing the speed of performance (Chin, 2012). Since this is an advantage of Agile compared to Waterfall, the aim of the transformation is to improve the performance of the company by applying Agile principles. Thus, the research question is: “Does the transformation from Waterfall to Agile methodology improve the performance of the company in terms of efficiency, staff satisfaction and client satisfaction?”

The question of the research will be answered in the last chapter of the thesis where is done the comparison of the measured data for both methodologies applied in the company.

1.3 Methodology

The research done in this thesis aims to answer the hypothesis question. It has been divided into two main parts: theoretical and practical. The theoretical background covers the literature review where there are explained different managerial styles. It elaborates in more detail the two methodologies studied in this research: Waterfall and Agile. The aim is to compare the differences between the principles of each methodology and highlight the advantages and disadvantages of each one. The literature review chapter gives the information needed to understand the background of the research described in the practical part.

Further in the thesis is presented the background of the company where the case study has been observed. For the study is important to describe the services that the company provides and the staff that works on delivering those services.

In the practical part are presented the data gathered are. The data are collected through the surveys created in Microsoft Forms and sent to the staff and clients. In order to estimate the impact of Agile in the company, it is important to define the measurement metrics and capture those before and after the implementation. Thus, the data is collected twice, before when the company applies the Waterfall methodology and once Agile has been implemented.

In the last chapter of the thesis is done the comparison of the data collected to answer the hypothesis question. The data is processed in Jamovi software and presented through Microsoft Excel histograms.

2 Literature Review

In this chapter of the thesis, it is described the project management concept and there are listed the phases that a project needs to go through. Further are given some of the most used management techniques and shortly described their mindsets to highlight the differences among them. Among the various approaches that exist, the ones chosen to be analysed are Waterfall and Agile. There will be presented their principles, advantages, and disadvantages. Since the topic of the thesis is to describe how to transition from Waterfall to Agile, a comparison of both methodologies is performed to highlight their differences.

2.1 Definition of project management

In order to explain project management, it is necessary to first define what a project is. According to the “Project Management Institute” (2017), one of the most commonly used definitions explains a project as a temporary initiative that creates a unique product, service or result. The temporary nature of the project indicates a precise beginning and end. The end is reached when the project objectives are achieved or when the project is terminated because its objectives will not or cannot be achieved or when there is no longer a need for the project (PMI, 2017).

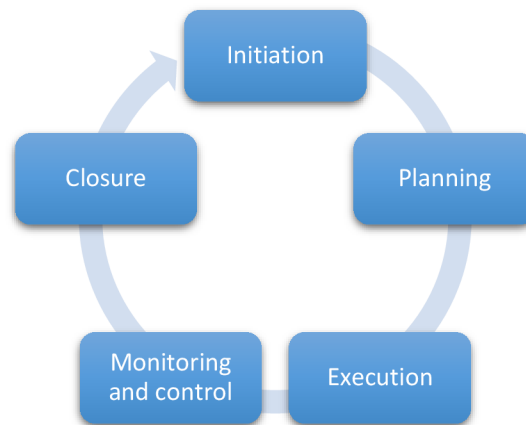
Project management refers to applied knowledge, skills, tools, and techniques to project activities in order to reach the goals and requirements set before the project by interest-influential groups (PMI, 2017).

Time is very important in the business, and when it comes to completing projects on schedule and under budget, project managers are frequently faced with the same challenges. The world of project management is always changing especially in recent years, and achieving success demands a variety of strategies to be applied. Planning and managing projects are made simpler and more productive by using project management strategies. No matter the business industry or field, the management methodologies can be adjusted.

Each project has a life cycle which is a set of phases that are usually consecutive and do not overlap, and whose names and numbers are determined by the monitoring needs of the organization involved in the project. Regardless of who (individual or company), what (the project they start with) and why (short-term and long-term goals) they work on, every project goes through the same stages in its life cycle (Aston, 2023). According to Project Management Institute (2017), successful project management requires a systematic

approach, which includes a series of phases which are initiation, planning, execution, monitoring and control and closing:

Figure 1: Phases of Project lifecycle



Source: Project Management Institute, 2017

Initiation Phase: The initiation phase is the first phase in project management, where the project is formally authorized. During this phase, the project's feasibility is assessed, and the objectives, scope, and goals are defined. The project manager identifies key stakeholders, and are evaluated their expectations and the resources required to deliver the project. A business case is developed, which outlines the project's rationale, expected benefits, and estimated costs.

Planning Phase: This is the phase where the project plan is developed. The project manager identifies the deliverables, creates a work breakdown structure and assigns resources. A schedule and budget are developed, and risks are identified, analyzed, and addressed.

Execution Phase: The execution phase is where the project plan is put into action. During this phase, the project team executes the project management plan, and the project manager monitors the project's progress.

Monitoring and Control Phase: During this phase, the project's progress is monitored, and corrective actions are taken as necessary. The project manager uses project management

tools and techniques to monitor project performance, identify variances, and implement corrective actions.

Closing Phase: The closing phase is the final phase of project management. During this phase, the project is completed, and the project manager obtains final approvals. All project deliverables are finalized, and the project is transitioned to the appropriate stakeholders.

2.2 Project management approaches

The term "methodology" is derived from the Greek words "methodos" (which means "way") and "logos" (which means "word, speech," "science of," and "study"). The study of scientific research procedures is known as methodology. Methodology is a branch of science where different general and specialized scientific methods are evaluated and openly described (Zelenika, 2000).

There are various methodologies and each of them has its own advantages and disadvantages, but not all of them are suitable for every project. Depending on the desired results that the company wants to achieve, and the products or services it wants to launch on the market, it is very important to correctly assess which method of project management should be used in further work on the project. It is not a matter of where there is only one good or a bad strategy, but it is a matter how to apply the guidelines that help into completing the assignment, as well as rules, principles, and practices that help completing a project (Ajam, 2018). Even after adopting one of the management techniques, if the workflow doesn't exactly match up, it can always be modified into a more suitable approach.

There are various approaches that exist in the project management field but a few of the most popular ones are (Kurowski, 2016):

Six Sigma- This is a methodology that was first presented by Motorola engineers in the middle of the 1980s. It aims to increase project quality and success by figuring out what isn't working and eliminating it from the process. To cut down on errors, it primarily uses quality management systems that draw on statistical, empirical, and expert information.

Kanban- It is a visual technique that creates a picture of the project workflow system. This way bottlenecks can be found during the early stages of product development. It was initially created in the 1940s to enhance Toyota manufacturing production lines.

Lean- This approach seeks to reduce waste by maximizing customer value while using fewer resources. It originated in the Japanese manufacturing sector. Lean places a strong emphasis on eliminating waste as a means of raising quality while cutting costs and production time.

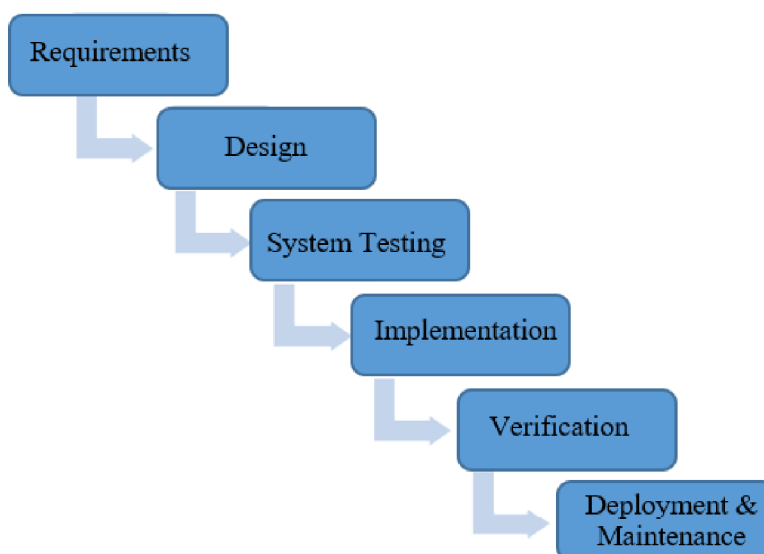
Waterfall- It adopts a sequential and linear design strategy in which progress "flows" downward in a single direction. It firstly appeared in the industrial and construction sectors, where plans are strictly structured, and experimentation and change are expensive.

Agile- It requires classifying a number of upcoming milestones into quick-deliverable requirements for the team. Agile project management is an effective method for tasks that call for quickness and adaptability.

2.3 Waterfall methodology

One of the earliest software development methodologies to be presented was the Waterfall model. Felix Torres and Herbert D. Benington were the first ones to present the application of such approach at the Symposium on Advanced Programming Methods for Digital Computers. Even though the term "Waterfall" isn't mentioned in the publication, Winston Royce's article contains the first official graphic of the mechanism that would eventually be known as the "Waterfall model" (Royce, 1970).

Figure 2: Royce's Waterfall phases illustration



Source: Royce, 1970

The methodology didn't have an official name until Bell and Thayer's 1976 study was published where the term "Waterfall" was first used to refer to Royce's approach. There were various defects found in the initial approach, thus several modifications have been made to it since then. Royce believed that it had serious faults and came up with the simplified model which is the one that is used nowadays as a project management technique. It consists of the following stages (Royce, 1970):

1. Collect requirements – At this phase, the client's requirements will be collected. The business analyst then thoroughly reviews the requirements' specifications with the development and testing team in order to their perspective. This stage involves discussing and analyzing the specifications needed to build the solution based on actual requirements. The outcome of each stage in the waterfall model serves as an input source for the stages that follow.
2. Design- A concrete solution concept is created during the design phase using the previously identified requirements. In this stage, is created the project architecture and a thorough plan for building the solution.
3. Develop- The project strategy and design are carried out throughout the developing phase to create the intended product/service. The requirements and specifications from the preceding phases are assimilated into creating the final solution. Documentation of everything that occurs during this stage should be precise.
4. Testing- Testing confirms that the implementation phase's product satisfies all of the project's requirements. If not, the project team must examine the initial phase of the project to determine what went wrong. Any issues are found and reported by testers. The project might need to go back to phase one for reevaluation if significant problems show up. The success of the project is evaluated during the testing phase using a variety of quality measures and client satisfaction.
5. Maintenance- The maintenance phase follows the testing phase of the project. In this phase are made minor improvements if there are any mistakes that were missed when

testing. During the maintenance phase, the customer uses the product and finds bugs and the production team makes adjustments as needed.

2.4 Waterfall advantages

Waterfall methodology was broadly implemented in various industries because of the advantages it offered (Nead, 2021):

- *Clear documentation*- This methodology emphasizes the importance of documentation. In case an employee leaves during the development process, his replacement can start where his predecessor left off: familiarizing himself with the information contained in the documents. It is ideal for projects that are easy to define from the very beginning, those that require the maintenance of strict phases and deadlines or projects that have been done several times and where the chances of surprises during the development process are relatively small.
- *Predictability*- Waterfall is a predictable approach where needs are fixed and well documented since teams must follow a set of processes before moving on to the next phase.
- *Structured processes*- The approach uses a clear structure of processes. In contrast to other methods, Waterfall places the greatest emphasis on a precise, well-defined set of phases.
- *Clear objectives*- One of the key elements of Waterfall is to identify the end result early. It helps the team understand the main objective from the start of projects to have clear goals (Charvat, 2003).

2.5 Disadvantages of Waterfall

Despite its many advantages, Waterfall has a few limitations which become more visible depending on the scope, structure, and goals of the project. Some of the disadvantages that come from implementing Waterfall are listed below (Charvat, 2003):

- *Rigid structure*- Each stage of the waterfall model needs to be finished before the second stage begins. Multiple phases cannot be worked on at once. It lacks flexibility and this is one of the main reasons why it can't be adapted on a large scale. This method doesn't allow for last-minute modifications like a change in scope or

objectives. The project's parameters could suddenly change, making most of the work that has been done up to that point meaningless and delaying the entire schedule.

- *Minimal involvement of clients*- The Waterfall methodology places little emphasis on clients. They participate in the project in the initiation and at the delivery. Waterfall will generally function successfully for a team if the projects have clear, unchanging goals from the start and do not involve informing clients during the development process.
- *Delays*- Waterfall requires that teams test their products at phase four after all development has been finished. The issues might not be identified until near the end of the project. This can result in severe delays to correct those issues

2.6 Agile approach

The origins of Agile project management come from the IT industry. Software teams discovered in the 1990s that the approaches being utilized weren't flexible enough for the way they wanted to work. They discovered that these heavyweight approaches had drawbacks that made it more difficult for them to respond to due to lack of flexibility, adaptability, and even autonomy (Varhol, 2019).

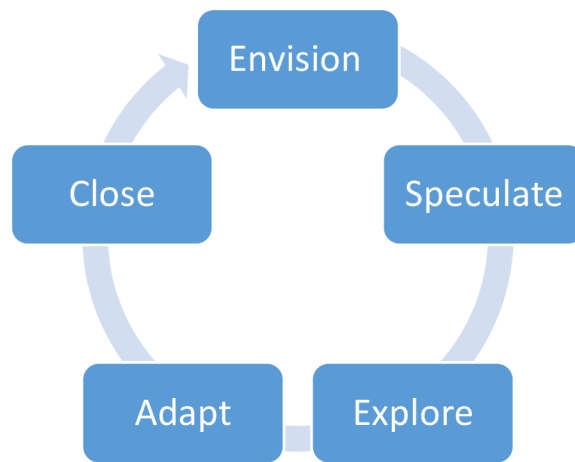
Change is a basic part of software projects, unlike other industries where the process is fixed, and the results are dependable and steady. Stakeholder requirements can change, or testing can show that something doesn't function properly when it is in the hands of an end user. The use of Agile techniques for managing projects emancipated teams from being constrained by the project management plan they established at the outset and allowed them to take such changes into account to produce the best possible output. They required more constant input and testing, shorter development cycles (sprints), and an ongoing process to accomplish this (Pratt & Torode, 2020).

A group of software engineers gathered together in 2001 to investigate the underlying concept of Agile and its guiding principles in-depth. They came up with "The Manifesto for Agile Software Development" as a collection of principles and rules to help teams embrace Agile techniques. The Agile Manifesto lists four essential values for the technique (Beck et al, 2001):

- Individuals and interactions over processes and tools.
- Working outcomes over comprehensive documentation.
- Customer collaboration over contract negotiation.
- Responding to change over following a plan.

The Agile methodology requires that a project goes through below phases (Highsmith, 2011):

Figure 3: Phases of Agile project management methodology



Source: Highsmith, 2011

- *Envision*- In this phase, the vision, mission, goals, and objectives of the project are established. At this point are defined the people who will be engaged in the project.
- *Speculate*- At this stage, the initial requirements are analyzed, and is created an iteration plan and the solution design. In this phase is decided the schedule and the project is broken down into a number of stages.
- *Explore*- During this phase, the team works on developing the final product based on the requirements that were gathered earlier.
- *Adapt*- At this point, the team evaluates the solution by testing and making any necessary adjustments that can be required.
- *Close*- The project is finalized and delivered. The final solution is checked against the requirements of the clients to ensure those are covered.

2.7 Advantages of Agile

The fact that business today moves quickly is one of the reasons why Agile project management has gained popularity. Various teams execute best practices in different ways, the advantages of Agile project management will vary from situation to situation. However, it is widely acknowledged that Agile provides the following advantages (Ries & Summers, 2016):

- *Putting the customer first*- A key component of the Agile approach is making sure that customers' needs are thoroughly understood through ongoing communication. Agile involves regular checks with clients and collecting their feedback. Based on that feedback they act on ongoing improvement for a better result with the intention of making it perfectly suited for the final user
- *Effective communication and transparency*- Teams should continuously discuss their work progress. Face-to-face contact and online ongoing interaction are prioritized by Agile teams. This makes it possible for everyone to comprehend what and how their peers are doing which facilitates discussions about how to do it better. Team members are also encouraged to openly discuss their problems and suggestions without worrying that doing so could jeopardize their position on the project.
- *Flexibility*- Agile emphasizes an iterative method where teams break down their project and regularly produce little pieces of it while maintaining flexibility, as opposed to creating one large batch of work. Since project deliverables are flexible, teams may simply review their strategies and realign their objectives to meet updated targets (Ajam, 2018).
- *Lower risk* -Developers constantly evaluate their performance during sprints, giving them increased project insight and the ability to identify possible roadblocks rapidly. These minor problems can be resolved prior to become more serious, resulting in an efficient risk reduction procedure, and increasing the project's likelihood of success.

2.8 Disadvantages of Agile

Agile is proven to be a successful methodology in many industries and has numerous advantages, but there are some disadvantages that if not paid attention can negatively impact

the teams that adopt the methodology. Some of the disadvantages found in Agile are (Koi, Akrofi & Matey, 2019):

- *Insufficient documentation*- The work in Agile is planned in sprints and there are planned tasks for each sprint. In tasks is included a description of work expected to be completed by that task. Thus, often there is no documentation that holds the information of the whole project. Since the information is spread between tasks, it can be difficult to access it unless found the specific task that has that data.
- *Unpredictability*- Agile highlights the flexibility in the processes. By designing flexible processes, teams might need to often adjust the deliverables and need to replan the initial scope. The continuous changes, if not kept on track can make the team feel overwhelmed and make poor decisions that can negatively impact the project.
- *Time management inefficiency*- Agile requires continuous meetings with the team: daily sprints, planning, retrospective and reviewing. These meetings need to be planned earlier to be efficient for all the team members. Otherwise, it can be time-consuming and can slow down the performance of the team.
- *Long-term planning*- Planning for the long term since the early stages of the project can be very challenging especially when work needs to be divided into sprints. If not done accurately, the work will not be spread equally, and sprints at the end of the project can be overloaded with tasks that can become challenging to be accomplished in time.

2.9 Waterfall vs Agile methodology

The limitations of the rigid infrastructure identified in the Waterfall methodology inspired the creation of the Agile approach. Agile it's a significantly more flexible type of project management as a result. Different from Waterfall, Agile was created to accept the changes of direction even late in the process and to take stakeholders' comments into consideration at all times (Smart, 2016).

There are several aspects that differentiate the two methodologies from one another:

- *Process Model*- Waterfall follows a linear and sequential process model, while Agile follows an iterative and incremental process model. In Waterfall, each phase of the

process must be completed before moving on to the next phase, Agile projects are typically broken down into smaller, more manageable chunks of work, called sprints, which. This allows for more frequent feedback and testing and enables the team to adapt to changes in the project requirements or market conditions more quickly (Thesinga, Feldmanna & Burchard, 2021).

- *Time Frame*- While for Waterfall there is a set timeline, where the project's start and end have already been planned out from the beginning, an Agile timeline is more flexible (Thesinga, Feldmanna & Burchard, 2021).
- *Exclusion of Clients*- Except for specified check-ins or deliverables, Waterfall does not include the client or project owner during the process once the end goal has been set. Since the project's path is predetermined from the beginning, taking into account client feedback is not a continuous step in the procedure. On the contrary Agile emphasizes the importance of including clients in many stages of project development. As the project moves through its phases, clients are expected to be involved and provide input to the software development team (Sinha & Das, 2021).
- *Flexibility*- Because each phase must be finished before moving on to the next, waterfall is less flexible than Agile. This makes Waterfall more appropriate for teams with a clear understanding of where they are headed from beginning to end because the project is planned out in advance. The Agile methodology is designed to be flexible and accept changes in different phases of the project (Ciric, 2019).

3 Research Methodology

The research methodology used for the study of the company “X” transformation in management methodologies was descriptive. This research technique explains the features of the population or the phenomenon under study. It is used to describe specific behaviors that take place in a specific environment. In this type of research, the data is gathered, processed, calculated, visualized, and explained. Descriptive research techniques come in a wide range of methods (Nassaji, 2015). In this thesis are used 3 types of descriptive research methods:

- Case study- This is a methodology that aids in the exploration of the phenomenon within a specific circumstance using several data sources (Crowe et al, 2011). The case study of the diploma thesis is the study of company “X” though the timeframe March-November 2022. There is obtained various data to measure the performance when applying Waterfall and Agile principles.
- Observations- One of the most accurate ways to collect information about a subject's behavior in a natural environment is through observation (Mcleod, 2023). In order to have a better understanding of the company's performance, it was required to attend some of the team meetings and meetings with clients.
- Surveys- Through surveys can be collected the data that is later examined for frequencies, averages, and patterns (Cohen, Manion & Morrison, 2018). In this thesis, there are 2 surveys created: staff and clients surveys. The staff surveys will be used to measure the efficiency of the processes in the company through the employees' lenses and their level of satisfaction. The clients' survey aims to measure their level of satisfaction with the services they received from the company.

The surveys contain Likert scale type of questions. These kinds of questions are crucial for evaluating a participant's attitude or view about a certain topic (Hartley & Betts, 2010). The questions will contain a voting range from 1 (lowest) to 5 (highest). The surveys will be sent twice: once in March 2022 when the company applies Waterfall principles and in November 2022 when the company has already implemented Agile methodology.

The data gathered through surveys will be processed in Jamovi software and there will be applied the exploratory descriptive analysis. This type of analysis is used to summarize the raw data and evaluate the results in the context of the situation (Cohen, Manion & Morrison, 2018). From the descriptive analysis, it will be possible to evaluate the mean, median, and mode of the factors measured and the distribution of the data. The data will be presented in histograms to show the frequencies of the variables' distribution in the collected answers. In order to be able to answer the hypothesis question that Agile improves the performance of the company, there should be made a comparison between values measured in Waterfall and Agile. To compare the variables gathered through the surveys, it will be used paired t-test. The result will be observed under two hypotheses: null and alternative hypothesis. Depending on the p-value will be decided which one is going to be accepted or rejected. The p-value indicates the likelihood that the test findings will be seen if the null hypothesis is true (Paired T-test, 2022).

4 Practical Part

This chapter describes the background of the company where the case study was conducted by providing a description of the company's history and the services it provides. The company name is not stated, due to the agreement with its representatives. It is referred to by the term "X" company. Getting familiar with the business environment helps in understanding the workflow and problems identified while applying the Waterfall approach. Having an insight into the company processes facilitates the interpretation of the transformation to Agile methodology. An important part of this chapter is the introduction of the staff and their specific roles in the value creation processes of the company. Agile transformation is described and further in the chapter the measurements of the company's performance are compared to define which method had a better impact.

4.1 Company "X" Case study

"X" Company is a Croatian e-commerce website creation company that started as a start-up in 2018. Since Croatia joined the EU in 2013, the country has seen an increase in e-commerce. As businesses have already created e-commerce platforms and users are now accustomed to the idea, the COVID-19 epidemic has driven an increase in e-commerce use, and the tendency is expected to continue (McKinsey, 2020).

The headquarters of the company "X" are in Osijek, Croatia and it mostly operates in the local market. Its customers are some of the main regional businesses but also companies from the Croatian market. The services the company offers, are in Croatian and English language.

According to estimates, 40% of Croatian companies are engaged in e-commerce, and sellers are more and more utilizing new technologies and business models (Export.gov, 2019). To overcome the challenges of the market, gain and maintain the relationship with customers, the company should provide flawless services. Over time they need to adjust their services according to market developments and need to analyze, update, and run tests on their solutions. While trying to keep up with the market updates and the number of clients rises, the coordination gets tougher and the room for service flaws decreases. From the observation done in company "X", it was concluded that the services they offer are divided into main services and complementary services. The main services are categorized into three different

packages depending on the number of pages needed for the website and the level of complexity:

Main services:

Basic package- Includes five main pages. Each one of those can be renamed according to the customer's needs. The last page is optional and can be removed from the package. In this package, the user is allowed to create his profile on the website.

- **Homepage-** The first page that users will initially see when they visit a website. An overview of the website and links to its other pages are often found on the home page.
- **Product/Services page-** On this page are described the company's products or services and it is possible to add those to the basket and complete the transaction by buying them.
- **About Page-** This page serves as a way to introduce the business to customers: what it offers, how it got founded, what its philosophy, core values and purpose are.
- **Contact Us page-** The Contact page offers all the specific information regarding how you can get in touch with them. The email address, telephone number, and location are all listed. If a business has multiple locations, it might include them all on the contact page to make users aware of their presence.
- **Blogs (optional) -** These are regularly updated web pages used to publish formal or informal info. Here readers can leave comments in the section that is usually included at the bottom of each blog article because blogs are frequently interactive.

Intermediate package- Includes all pages from the basic package and additional pages that are optional and can be adjusted based on the client's requirements:

- **FAQ-** Frequently asked questions page includes the most common questions on the website. These pages are often used by companies to avoid answering multiple time the same questions and has proven to be a time saver. It is helpful because the customers get beforehand the information that they might be missing to close the deal.

- Pickup Points- In order to optimize the customers' experience, websites include this page. Here the user of the website can provide his address and find the place to collect his order.
- Event Calendars (optional)- There is an online calendar on the page, updated with the latest activities that the business plans. Depending on the area they operate, this can be very beneficial for the companies. Usually, those are used to inform the customers of the launch or sale dates.
- Promotions- This page offers a list of deals and promotions that are currently available on the website. This is one of the most visited pages that attract more sales.
- Photo Gallery- In the gallery there are different pictures of the products or services that help customers visualize and understand how those can be utilized.

Advanced package- Besides the functionalities of the Intermediate package, the advanced one includes additional pages that are listed below. The companies can add up to 15 more pages regarding their demands. Another benefit compared to other packages is that users can update the profiles they have built on the website.

- Best sellers- There is a list of the most sold products/services on the website. Based on the most recent order information, the server produces a best-seller list every day. Customers who see those, may be inspired to buy catalog items that are top sellers by the list.
- Last minute deals- These are the offerings that have a limited availability time. Those are usually offered at a special price compared to their usual price.
- Others- This page is the most customizable one depending on the client. Here is listed the information that doesn't fit on the other pages, but is important for the customers.

Complementary services:

- **Logo designing-** From the experience of company "X" many of the companies which need a new website are either new in the market or are trying to modernize their business by approaching the online presence. Those who are new, in most cases are missing a logo and those who are trying to modernize are usually open to the idea to update their current logo. This is one of the most commonly requested services by customers. It includes designing a logo that best represents and symbolizes their

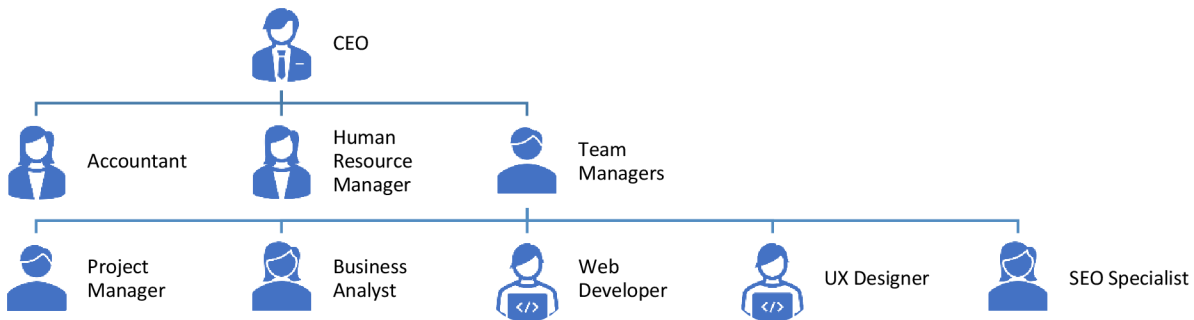
company. From the data provided by the company, for the year 2022, there were 85% of the clients who requested this service.

- **SEO Service-** Search Engine Optimization is a service that helps websites rank higher in the search engine based on the wording they use and increase the company's visibility in search results (Yalçın & Köse, 2010). Based on the data from the year 2022, more than half of the businesses requested this service once their website was built, 67% of all customers.
- **Marketing email automation-** These services reduce the manual labor and creates personalized and targeted emails that help increase the organic traffic to the website. (Sabbagh, 2021). By the observations of the “X” Company, only the biggest companies are interested in this service. Only 39% of the companies that had their website built, implemented automation of the marketing emails.
- **Analytics of the website-** Website analysis studies the visitor’s activity on the website. Having this data, helps companies make better business decisions (Almeida, Furtado & Gomes,2019). From the clients of the company “X”, usually companies that have a website built for the first time are the most interested ones in the analytics. Those are for the first time in the online market and need more insights to understand the client’s behavior.

4.1.1 Human Resources

In the “X” Company at the time when the case study was conducted (March- November 2022) there were working 18 people, in different roles and duties. All the people who work in the company are located in the city of Osijek and its suburbs. They work in a normal full-time schedule of 40 hours per week: Monday to Friday, starting at 9.00 am until 5.00 pm. From the observations and discussions with the staff of the company there is concluded a description of their roles and duties in the website creation process:

Figure 4: Staff Structure illustration (source own)



1. CEO- The founder of the “X” company is the CEO of the company also. His role is to administer and lead the business in the direction of it achieving its main objectives. He monitors hiring decisions taken at the company's top level and oversees the managers in the assessment of key decisions. CEO has a background in IT and has a detailed insight into the projects that the company is working on at any given time. He attends the majority of the business meetings with clients and often joins team meetings. CEO needs to be informed about the project’s progress by the team managers. Since this is a startup with a small number of employees, it is very important for him to get to know the staff that works there. He observes closely the interviewing and hiring process of the new employees to make sure that they fit the position and the company culture.
2. Accountant- In a small company such as company “X”, in the staff, there is only one accountant. Main accounting tasks he needs to complete on regular basis include gathering, accurately registering, examining, and providing information on the financial activities of the company. He works closely with the CEO, human resources staff, and the managers of the teams. Those 3 need to align with each other to be on the same page regarding the cost of the project, budget when hiring/promoting staff members, and unpredicted extra costs that can come up.
3. Human Resource Manager- In the whole company “X” there is one HR manager. He reports directly to the company’s CEO. The HR manager consults regularly with the

accountant and communicates with team managers to be updated regarding the vacancies. He needs to make sure that the human resources of the company are treated as the most valuable asset. This involves finding and hiring workers with the right skill sets to achieve the organization's targets, organizing benefit packages, and recommending plans for their career progression. The HR role is to advise managers on a variety of issues relating to staff and how they can assist the corporation in reaching its objectives. Often, they need to be acting as advisors rather than employees in a business function.

Developing teams- There are two teams that share the projects among them. Each team is made of a team manager, project manager, business analyst, web developer, UX designer.

4. Team managers- In each team there is a manager responsible for the continuity of the project. They are in charge of overseeing the tasks of each member of their team. Their role includes defining goals for the team as a whole and for each one of the team members. Managers are the ones to provide a framework for the way work is done and assist staff members with any problems that may come up when following it. They have a responsibility to ensure that everyone on the team is aware of and committed to achieving the team's goals. Managers in company “X” have agreed on using the Waterfall methodology as their management approach. They play a key role in the diploma thesis study since they are the first ones who will be implementing the Agile framework in their teams.

5. Project manager- It is the role of project managers to prepare the strategy for how the project will be completed. There are two project managers, one dedicated to each team. One project manager works parallelly on different projects. Since teams work on more than one project at a time, it is very important that project managers keep good track of every stage of each project in a timely manner. Following the Waterfall approach, they need to break down the project into stages and define the milestones for each one of those. They need to set the meetings with clients and are the main point of contact for them. Project managers make sure that clients are updated in case of delays, extra costs, issues that can come up during the project, or if some more input is needed from the customers' side for the continuity of the project.

6. Business analyst- There are 2 business analysts in the company. A business analyst works closely with the project manager, especially at the initiation of the project. They need to understand the client requirements and translate those into tasks: The project manager needs to estimate the complexity and the time frame for those meanwhile the business analyst needs to communicate those to the web developers. There is a business analyst per each team. He leads the kickoff calls with clients, explaining to them the project's specifics.

After that, they need to have daily calls for 2 weeks with the clients to understand their demands and gather their input. They need to help clients to decide which one of the available to take, which additional services, and what level of adjustment they need for their websites. After the input is taken, it is concluded in a document that needs to be signed by the clients and the project manager in order for the work to continue to further phases. Then the communication with clients is paused until the last phases of the project. Then the focus of business analysts shifts to web developers to make sure they have an understanding of what they need to build. The business analyst needs to have a clear understanding of the whole project and each one of the functionalities included in the website.

When it is finalized, he needs to test it himself if it contains all the requirements agreed upon with the client. The business analyst is responsible to present the final product to the customer, walk them through and keep track of the fixes that need to be applied if something is not working as expected.

7. Web developer- There are in total six web developers in the company, three per team. They need to be flexible and shift between projects depending on which one is the priority. Sometimes each one of them is responsible for one website and sometimes they need to join forces into working together based on the complexity of the project. Their main tasks include designing and building websites from scratch. Their primary duty is to develop website layouts and user interfaces by applying HTML/CSS guidelines. It is their responsibility to guarantee that websites live up to customer expectations by making sure they are appealing, function well, and provide simple access points without any error messages across pages. They need to often

attend meetings with clients, especially at the finalization of the project to explain the functionalities of the website.

8. UX designer- There are two User Experience designers in the company, one working with each team. His role is to analyze and come up with a design for the website that is effective for the users. They design the website in a way to improve the customer experience when interacting with it. The UX designer needs to look at the website through the eyes of the clients and remove everything that might cause confusion or make the experience unpleasing. It is important that the UX designer attends the initial meetings with clients to understand their company and visualize the potential website user. They need to do research, build prototypes, and show those to clients until they come to an agreement on what the final solution will look like. The UX designer is responsible for the logo creation of the websites which need this additional service.
9. SEO Specialist- There is one SEO Specialist in the company since SEO services are among complimentary services, not the main ones offered by “X” Company. He can work parallelly on different projects and needs to work closely with the web developers. SEO should be flexible and attend the meetings of each team depending on the project he is working on. The role of SEO specialist in the company “X” requires an understanding of the digital marketer too. As he understands very well the marketing strategies, the SEO Specialist prepares the marketing email automation if requested.

4.2 Waterfall Methodology application

At the beginning of the study period of the thesis, March 2022, Company “X” was applying the Waterfall methodology in organizing its website creation process. Website creation starts after the clients have agreed on the services they will need from the company and the package they will take. Even though most businesses already know the package that fits them the most, there is always a consultation session. In this meeting, the business analyst explains the available services and packages to the customers and makes a proposition about which ones are the most suitable for them. After this meeting, there is a waiting time of two to five business days to let the business decide. Once they take the decision a contract is signed by

both parties: the company and the customer. In the contract are clearly stated the details of the services, packages, and deadlines expected. Consequently, the website creation process starts.

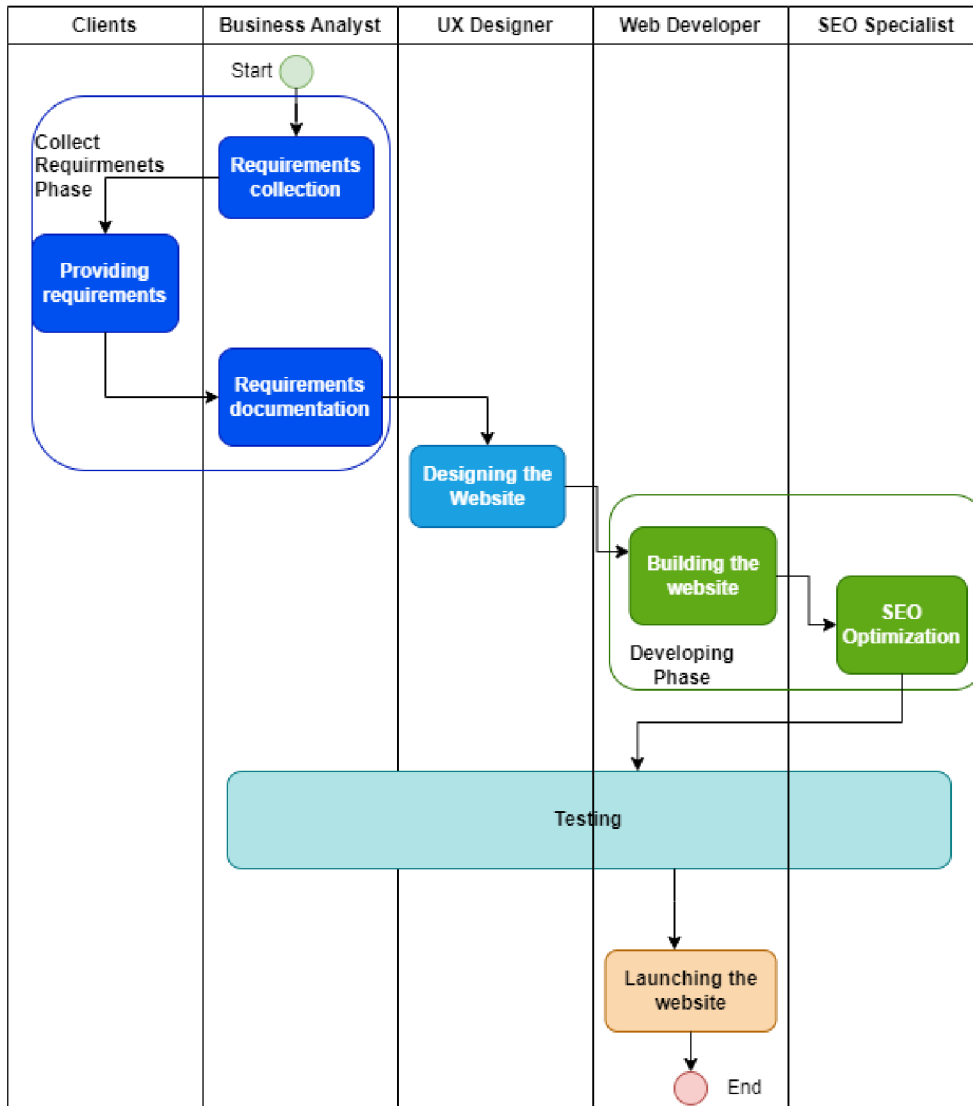
Following the principles of Waterfall methodology the process should be divided into five phases (Royce, 1970), in company "X" it has been adjusted to the following phases:

1. *Requirement's collection*- This phase starts after clients have agreed on which package they will take. The purpose is to capture their requirements and adjust the package according to those. There are a series of meetings between the customers and the business analyst, project manager, UX designer, and often one of the web developers of company "X". Project manager makes sure everyone understands the deadlines and project timelines. The business analyst's role is to collect the data. In the meetings, the main purpose is to clearly understand the customers' requirements for the website and gather the info that is needed from the developers to build the website. Those data are documented in MS Word files and are used by the developers in the later phases. The UX designer attends the meetings too to get a perception of customers' expectations of how the final result should look like. Usually, during these meetings there are shown examples of templates that are similar to the expected solution. After all the required data is collected from the client, there is a last meeting to overview it and make any last changes. After that, there is no more input taken from them until the project is finalized. The collection of the requirements phase lasts for two weeks.
2. *Designing* – In this phase the key person is the UX designer. After he has understood the type of websites required by the client, he needs to come up with a design for the website structure. He has to take into consideration various elements when creating the website layout such as the area of the products/services offered by the client's company, the brand colors, and the logo or patterns they might have. Designing phase depending on the complexity of the website takes up to a maximum of eight weeks.
3. *Development*- After the design has been completed, the development initiates. At this point in the process, the developers play the main role. They need to create and run codes to make the website perform as expected. The work for developing the pages

usually starts from the home page and to other pages that are more complex. The development of the website requires from five to 12 weeks. In case the clients agree to have SEO services, the SEO specialist works parallel with the developers. As soon as the website is finalized, the content from SEO is uploaded to the website.

4. Testing- Before the website goes live, testing needs to take place. All the pages, links, and other components on the site need to be checked to guarantee that those work as expected. This phase takes up to five days, but the more complex a website is and the more pages it has, the more time dedicated to testing it is required. This is a team activity where every team member needs to test different scenarios to make sure the website works and fulfills what the client has initially requested.
5. Release- After the testing has been successfully completed, the website can be released. The meeting with the client is set according to the project plan and they are presented with the solution. Once the website goes live, some issues can appear. It is important that those are immediately identified either by the team or the customer and are reported to the business analyst. The business analyst needs to communicate those to the developers to solve and keeps track of their progress while informing the clients until those are solved.

Figure 5: Website creation process workflow (source: own)



4.2.1 Obstacles

Theoretically Waterfall had created a process where each phase of it has a clearly defined timeline, actors, and responsibilities. In practice, the results of the company were not optimal. The obstacles that the company was facing became even more obvious when they had to switch immediately to working online due to the Covid-19 breakthrough. It was a challenge to adjust to the new way of work. The staff worked fully online from March 2020-September 2021. Since then, it has been a combination of online and in-office work. Even after the staff started going back to the office, the obstacles identified during Covid-19 online

work, are still present to some degree. The bottlenecks identified were categorized into three main groups: issues that come from workflow, from employees, and from clients.

- ***Workflow related obstacles***

Delay - There were many recorded cases of delays in different phases of the process which resulted in an overall delay in the website delivery. The main reason was that client's requirements changed in different phases of the project. Following a Waterfall process, the team didn't have the flexibility to address those changes in time. It required reorganization of the work and reallocation of resources. It became even more challenging when switched to fully online work. The organization of work and coordination was slowed down and impacted the delivery date. The project manager had to continuously adjust the timelines of the project and keep track of the progress. With time, the teams learned to manage the deadlines better, but they didn't have the same performance as before when it came to meeting deadlines.

- ***Employee related obstacles***

Poor coordination- One of the main reasons behind deadline delays was the miscommunication between the team members. Before the year 2020, each one of the team members would come to the office and work from there. Being in the office made it easy to access every team member in case of questions or discussions. This would help the transparency in the team and every staff member could familiarize himself with the processes and the responsibilities of each one in the team. In case unexpected issues were happening, the majority of the team would be flexible to sit and discuss it during working hours in the office.

Due to pandemic adjustments, all the meetings in person between team members and clients were substituted with online calls. This approach highly impacted the quality of work and the communication between the team members. There was more hesitation in reaching out to one another online, which would slow down the process. Even after the measures of Covid-19 were removed and the staff could return to work, the attendance in the office was low.

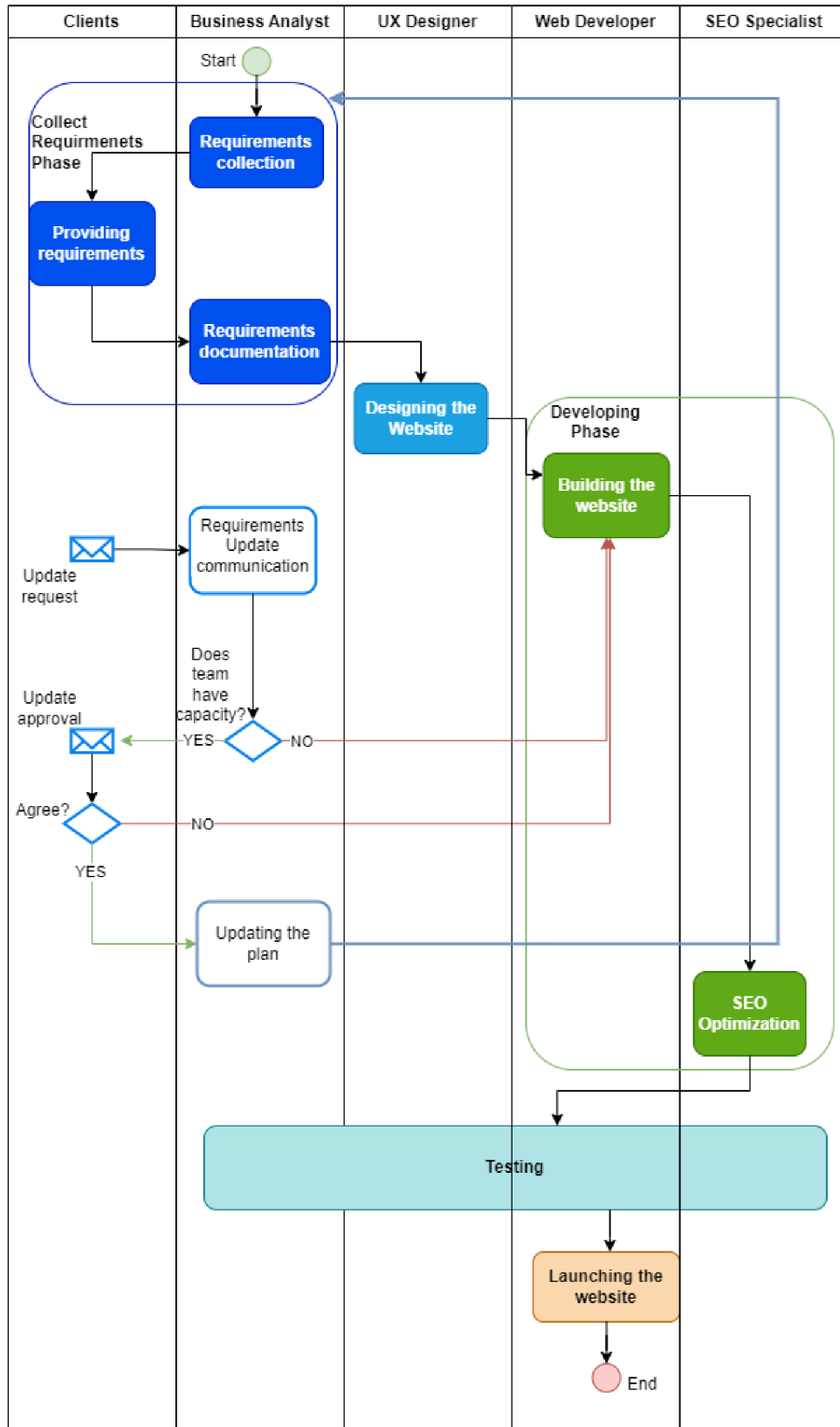
- *Client related obstacles*

Client's Requirements update- This is one of the main challenges that company "X" faces which has been present even before Covid-19. The consultation with clients happens during the requirements collection phase. The clients' expectations are set, and the deliverables of the projects are defined. There is no more input or discussions with the customers. Usually, it takes months before the website is finalized and during this time customers happen to request changes to what was initially agreed. They either want to add/remove services, change the web pages, or other similar updates.

Making changes while applying Waterfall concepts is very difficult. It is a rigid methodology where there are no modifications once the process has been initiated (Smart, 2016). The updates required by clients are not automatically rejected. The clients meet with the business analyst to explain the request they have. The Business Analyst consults with the team to check the capacity of the staff to apply those updates. If it is agreed, then they estimate the cost and delay it. The business Analyst and project manager meet with clients to notify them about the new deadline and costs. In case the client accepts, the process of creating the website starts from the beginning.

Since the Covid-19 breakthrough, many of the clients that were in the process of getting a website from company "X" requested many changes. They wanted to offer more home delivery or services that were adapted to the Covid-19 isolation. For the company's "X" staff it was very challenging to accommodate the client's requests while they were facing issues adapting to the fully online work. This resulted in prolonged working hours and postponing the project's deadlines. Even after the Covid-19 measures were removed, the team didn't have the flexibility to adjust quickly to changes that customers request. Often their requests need to be rejected and this impacts the client's overall satisfaction with the final website.

Figure 6: Workflow of the process with updated requirements (source: own)



4.3 KPI definition

Identifying the obstacles that the company faces is important for defining the key performance indicators. Each one of the listed obstacles in the previous chapter serves as a key performance indicator for the thematic analysis of the data. The data is taken from the interviews and surveys conducted with the employees and clients. From the analysis, there were found three main categories that can be used to measure the performance of the company.

1. Effectiveness of workflow- It determines how well and precisely the business accomplishes its objectives. The effectiveness of the company “X” can also be measured by evaluating key factors that affect the performance of the company such as:

1.1. *Understanding the clients’ requirements-* This is the level of understanding of the client’s needs. The business analyst, project manager, and the rest of the team need to have a good understanding of the requirements. It helps them avoid confusion or dissatisfaction when the website is launched. If the requirements are not well understood, then the result is not as expected and it will be needed to do corrections which is duplicate work for the team.

1.2. *Planning accurateness-* In previous experiences projects were delayed due to unpredicted factors. Thus the accuracy of planning is one of the main factors that measure the effectiveness of the work. Being able to realistically plan the phases and the main dates of the project sets the expectations clear for all parties involved in the project. The clients will know when to expect the website launch and the team will know how long each phase will take. This requires the involvement of the whole team not only the project manager as the main person responsible for the project timelines.

1.3. *Workload management-* This metric measures the ability of the staff to manage the workload they have. Not being able to manage the tasks on time results in delays in the process and an overload of the team. Each one of the team members needs to define up to what level they are able to complete their assignments within the defined deadlines.

1.4. *Adoption to changes-* As described in the previous chapter, one of the main obstacles of the current process are the changes that are requested by clients in different phases

of the project. It is important to know how flexible is the team in adopting changes without prolonging the delivery time.

1.5. *Issue-solving efficiency*- There can be various issues coming up during a project. It is important to measure the ability of the team to adjust and adapt to these issues without allowing them to slow down the work.

1.6. *Meeting deadlines*- This metric measures the degree of following the milestones set and completing them in the defined time. Being able to deliver the website at the promised date to the clients, helps them build trust in the company. It is a measurement of efficiency because a project that is finalized in time requires no extra work from the team or additional costs.

2. Staff Satisfaction- Employee satisfaction at work is one of the main indicators that define the success of the company. This KPI measures their overall level of satisfaction but there are other factors that measure specific aspects related to satisfaction:

2.1. *Involvement in the decision-making process*- This indicator measures the level of staff's involvement in the company when there are decisions being made. It is crucial for the employees to feel that their voice matters and that their opinions are heard.

2.2. *Availability of resources*- In order to have higher performance, the staff needs to have the resources that help them perform better. The resources in the company include the machinery needed to perform their tasks such as laptops, headsets, and screens which are given to any employee. Resources also include the information and the data that is needed by them. The availability of resources should be ensured for each staff member. It is insightful to know at what level the staff feels that they can access all the resources they need.

2.3. *Adjustment to hybrid work*- During the last three years the staff needed to switch from going daily to the office, to fully working online and then to a combination of online and in-office work. The adjustment was experienced differently by each team member. It helps to get an understanding of how comfortable they feel with the hybrid way of work and understand how that can impact their performance.

2.4. *Process organization satisfaction*- It is important to know what the satisfaction of the staff members is with the designed processes.

2.5. *Clear understanding of their role*- This metric measures the level of understanding employees have for their roles and the tasks they need to perform.

2.6. *Recognition*- Recognition at the workplace refers to all the ways the company uses to express gratitude to its staff. It could be a monetary contribution but not always so (Prossack, 2022). Being recognized encourages employees to feel more energized and motivated in their performance. They feel like they are seen and their contribution matters. To understand how the company is performing, it is crucial to understand how the staff feels and if they feel recognized.

3. Client Satisfaction- By measuring the overall satisfaction of the clients, the company understands if they were content with the delivered solution. Besides the overall level of satisfaction, there were other components measured in the client's survey that impact their level of satisfaction:

3.1. *Involvement in the website creation process*- In order to be satisfied with the final result that will be delivered, the clients need to be involved in the website creation process. It is important to measure the level they feel included in the process and decide if there is a need to include them more frequently or not.

3.2. *Meeting of deadlines satisfaction*- It is crucial to understand if clients are satisfied with the company "X" performance at meeting deadlines. The company needs to get the client's perception of how the company's timeliness is seen from their eyes.

3.3. *Final solution understanding*- The main goal of the company is to deliver a website that satisfies the needs and fulfills requirements of the clients. The customers should have a fully understand of webpages and all website components. They should be able to use it after the launch. It is necessary to know the level of website understanding that customers have.

4.4 KPI measurement- Waterfall

To measure the performance of the company while it implemented the Waterfall methodology, there was prepared a Likert scale questionnaire in Microsoft Forms and sent to all team members of the staff, but not to the HR manager, Accountant, and CEO of the company. The survey was used to capture the insights of the teams that work directly on the projects and are affected by the way the process is designed. It was used to measure the company's efficiency and staff satisfaction level. A similar survey dedicated to customers

was sent to them to measure their satisfaction with the company’s performance. The questionnaires were sent on March 2022 while company “X” was still applying the Waterfall methodology. The collected answers from the staff survey were analyzed in qualitative data analysis in Jamovi software and represented in Microsoft Excel charts.

4.4.1 Staff Survey- Efficiency measurements

Staff Survey contains two main sections. The first one is dedicated to measuring the efficiency level and its components such as shown in the picture below:

Figure 7: Staff questionnaire- section 1 (source own)

Please complete the questions with one of the numbers 1 (lowest rating) - 5 (highest rating).

	1	2	3	4	5
How effective is the website creation process?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clear are the clients' requirements ?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate is the planning of the process?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How able are you to manage your workload ?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is the adoption to changes done effectively in the company?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are the issues solved efficiently ?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often the deadlines of the project met ?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4.4.1.1 Overall efficiency level

The first question of the survey measured the overall satisfaction level that is perceived by the employees. After running the descriptive analysis, the below tables illustrate that median and mode have the same value. The most common answer on the survey was 3 which shows that the major part of the employees (53.3%) sees the process as somewhat effective.

The voting varied between values 2-4. There were no registered votes for the lowest and highest level possible. It meant that the staff estimated the efficiency of the work in between medium values not very high or low. On a scale of 1 (the lowest) to 5 (the highest), the mean was equal to 3.2 which represented the calculated average rating from the voting of staff members. The skewness value showed that the distribution of the data was fairly symmetrical, and the data was normally distributed.

For the efficiency level as one of the main KPIs defined, the analysis of the result are illustrated below:

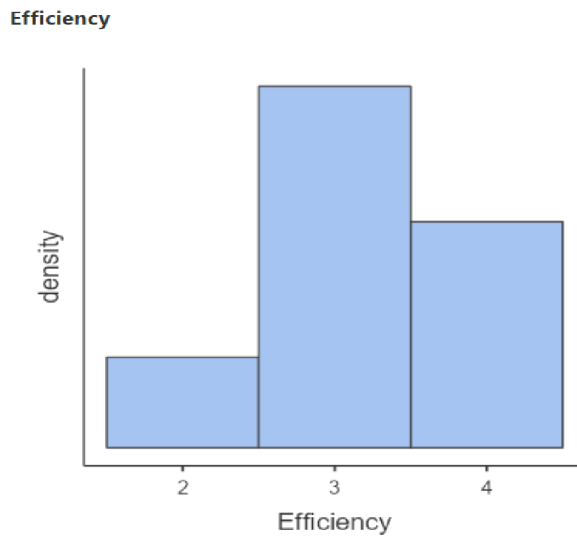
Table 1: Efficiency descriptive metrics (source: own)

Descriptives	
	Efficiency
N	15
Mean	3.20
Median	3
Mode	3.00
Standard deviation	0.676
Minimum	2
Maximum	4
Skewness	-0.256
Std. error skewness	0.580

Table 2: Efficiency frequency metrics (source: own)

Frequencies of Efficiency			
Efficiency	Counts	% of Total	Cumulative %
2	2	13.3 %	13.3 %
3	8	53.3 %	66.7 %
4	5	33.3 %	100.0 %

Graph 1: Efficiency distribution plot (source:own)



4.4.1.2 Other efficiency indicators

Other indicators that measured the efficiency of the company “X” were analyzed and their mean value was calculated. From the values calculated it was found that the mean of each factor was relatively low. The highest rating was measured for the clients’ requirements understanding. The staff had a good understanding, but the requirements could be updated through the project timeline. This could be an issue with staff understanding the new requirements in a timely manner which would impact the deadlines of the project. Employees gave a higher vote to workload management which showed that despite the fact that they had to work with unpredicted issues and requirements changing, they could somewhat manage those.

The main pain point identified from the measurements was the efficiency in solving issues and meeting deadlines. The ability to handle the issues directly affected the deadlines. If the teams had difficulty managing the issues that happen, then the deadlines of the projects need to be extended. Deadlines were also affected by the ability to adapt to changes, which had a low vote too. The adaption was challenging due to the team capacity but also the way the project was designed in Waterfall, following a linear structure (Charvat, 2003).

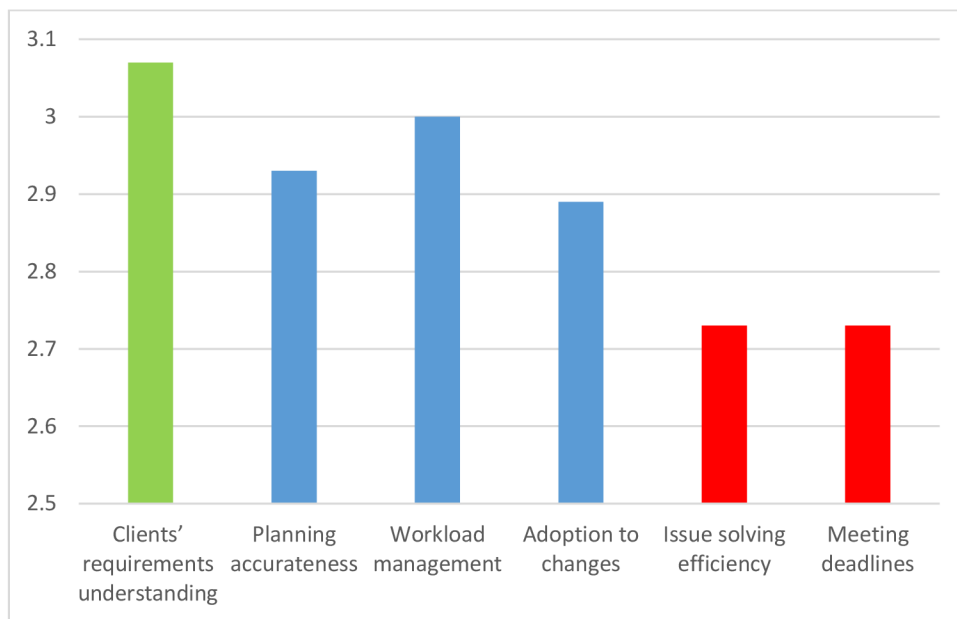
Their low ability to solve issues in time, meet deadlines and adapt to changes, affected their ability to plan accurately the project, and in the survey, it was not ranked high but with an average scale of 2.93. All the values measured were less than the overall level of estimated

efficacy which was 3.2. It meant that when asked about the efficiency of the company the staff estimates it higher than the other components, such as illustrated below:

Table 3: Efficiency components descriptive metrics (source: own)

Descriptives							
	N	Mean	Median	Mode	SD	Minimum	Maximum
Clients' requirements understanding	15	3.07	3	3.00	0.704	2	4
Planning accurateness	15	2.93	3	3.00	0.704	2	4
Workload management	15	3.00	3	3.00	0.655	2	4
Adoption to changes	15	2.87	3	3.00	0.743	2	4
Issue solving efficiency	15	2.73	3	3.00	0.704	2	4
Meeting deadlines	15	2.73	3	3.00	0.884	1	4

Graph 2: Efficiency components distribution plot (source:own)



4.4.2 Staff Survey- Staff Satisfaction measurements

The second section of the staff survey was dedicated to questions regarding their level of satisfaction such as pictured below:

Figure 8: Staff questionnaire- section 2 (source own)

. Please complete the questions with one of the numbers 1 (lowest rating) - 5 (highest rating).

	1	2	3	4	5
How would you rate the overall staff satisfaction ?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How high is your involvement in decision making process?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How available are the company's resources ?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well are you adjusted to hybrid work?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How satisfied are you with the process organization ?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How clearly do you understand your role ?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How recognized do you feel in the company?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4.4.2.1 Overall Staff satisfaction level

According to the calculations done for the staff satisfaction survey, the average satisfaction level (mean) was 3.67 which is a smaller value than the middle point of the values registered (median) which is 4. The skewness value showed that the data was moderately skewed to the right, which meant the majority of the votes were lower than the calculated average.

From the answers was found that voting varies on a scale from 3-5, no employee chose the minimal level of satisfaction in the survey. This shows that there were no employees that were unsatisfied, but the majority didn't give the highest ranking when completing the survey. The most often ranking provided by eight out of 15 employees that took the survey was 4, which was the mode of the data

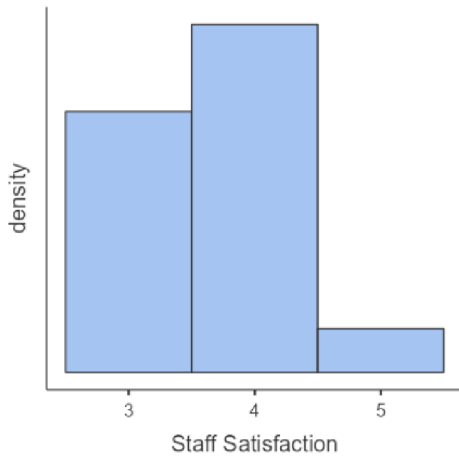
Table 4: Staff's satisfaction descriptive metrics (source: own)

Descriptives	
Staff Satisfaction	
N	15
Mean	3.67
Median	4
Mode	4.00
Standard deviation	0.617
Minimum	3
Maximum	5
Skewness	0.312
Std. error skewness	0.580

Table 5: Staff satisfaction frequency metrics (source: own)

Frequencies of Staff Satisfaction			
Staff Satisfaction	Counts	% of Total	Cumulative %
3	6	40.0 %	40.0 %
4	8	53.3 %	93.3 %
5	1	6.7 %	100.0 %

Graph 3: Staff's satisfaction distribution plot (source:own)



4.4.2.1 Other indicators of staff satisfaction

From the calculated data gathered for other indicators of the staff satisfaction level, the highest recorded mean was of the recognition level. The majority of employees felt recognized while working for company “X”. They only voted on between scale of 4-5 and the calculated mean was 4.6. The second highest mean belonged to role understanding. The staff had a clear understanding of what was their responsibility. The majority of the employees had been working in the company for years and that helped their understanding of the way work is done.

The mean for resources' availability had the same mean value such as role understanding. At all times the employees had access to all the needed resources to perform their tasks. They had access to the documentation they needed for their assignments and the online trainings that the company had in its database. To help them adapt to the online work, new hardware resources such as screens, chairs, and tables were provided to them during the time they worked from home. This initiative had a positive impact on their satisfaction with resource availability which was reflected in the survey.

Hybrid work had also a high average (mean =4), which was higher than the average value on the voting scale of 1-5. Besides that there were no specific policies set inside the company on when to work from the office, the team had adjusted its way of work. They had the flexibility to work online or in the office and they combined those according to individual schedules.

The involvement in the decision-making process was relatively low, compared to the other components. In Waterfall, the phases of the project are sequential (Royce, 1970) and each team member completes the phase they are responsible for. In this methodology, it is not encouraged collaboration between team members who execute different phases unless those successive stages of the project. Thus they were not much included when there were taken decisions in a specific part of the project unless it directly impacts their work.

The lowest value recorded was regarding the process organization. The staff was the most unsatisfied with the organization of the process. In a linear methodology like Waterfall, there is no room left for flexibility to adjust to changes. This is one of the main disadvantages the methodology has (Charvat, 2003). This disadvantage impacted the satisfaction of the team with the process design.

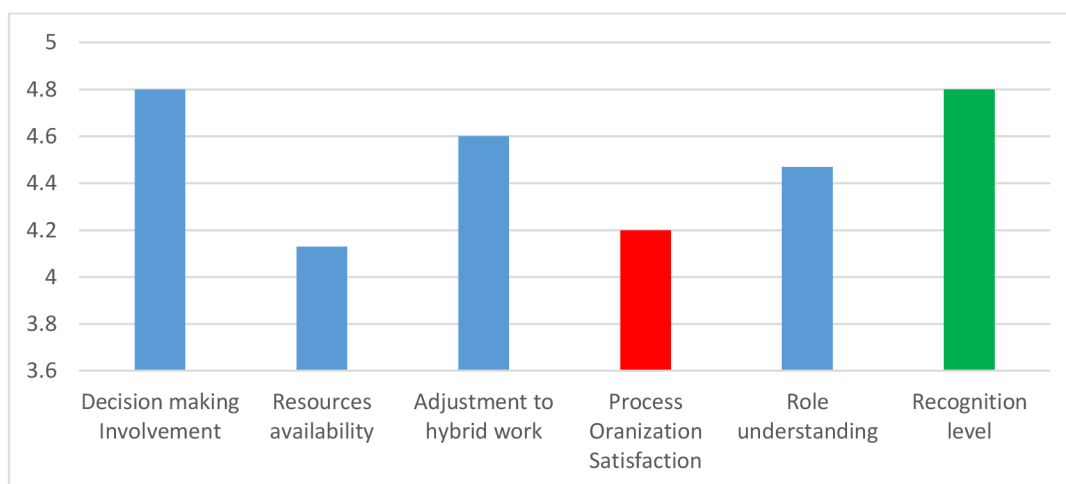
From all the other factors measured, only the process organization and involvement in the decision-making had a lower mean than the overall estimated satisfaction (mean = 3.28).

The analysis of measured components is illustrated below:

Table 6: Staff's satisfaction components descriptive metrics (source: own)

Descriptives	N	Mean	Median	Mode	SD	Minimum	Maximum
Decision making Involvement	15	3.13	3	4.00	0.834	2	4
Resources availability	15	3.87	4	4.00	0.915	2	5
Adjustment to hybrid work	15	3.67	4	3.00	0.724	3	5
Process Organization Satisfaction	15	2.67	3	3.00	0.976	1	4
Role understanding	15	4.00	4	4.00	0.655	3	5
Recognition level	15	4.67	5	5.00	0.488	4	5

Graph 4: Staff's satisfaction components distribution plot (source: own)



4.4.3 Clients Satisfaction Survey

A similar style of questionnaire was prepared and sent to clients the company had been working with for the last 3 years. There were 86 recipients of the survey, and they had a deadline of two weeks to complete it. At the end of the deadline, there were collected 32 replies.

Figure 9: Employee questionnaire (source own)

Please complete the questions with one of the numbers 1 (lowest rating) - 5 (highest rating).

	1	2	3	4	5
How satisfied are you from Company "X"?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How would you rate your involvement in the website creation process?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How accurate was company "X" in meeting deadlines ?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well did you understand the website delivered?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4.4.3.1 Overall Client satisfaction level

From the analysis of the questionnaire's first question, the average score of the overall satisfaction level from clients was calculated to be 2.97 (mean), which was lower than the middle of the data set (median =3). Even though the values were different, the difference between them was not significant and the skewness had a low value (0.04). It meant that the data had a fairly symmetrical distribution. There were an almost similar number of votes on a scale of 2-4. The mode was 3, which explained that clients voted the satisfaction from

company “X” with an average value. There were no votes on a scale of 1 or 5 in the questionnaire which meant there were no clients who were unsatisfied or that had maximal satisfaction during the collaboration with company “X”. The surveys responses data is illustrated in tables and graph below:

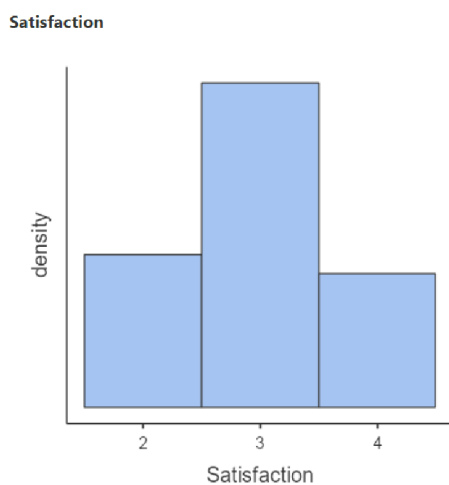
Table 7: Clients’ satisfaction descriptive metrics (source: own)

Descriptives	
Satisfaction	
N	32
Mean	2.97
Median	3.00
Mode	3.00
Standard deviation	0.695
Minimum	2
Maximum	4
Skewness	0.0415
Std. error skewness	0.414

Table 8: Client’ satisfaction frequency metrics (source: own)

Frequencies of Satisfaction			
Satisfaction	Counts	% of Total	Cumulative %
2	8	25.0 %	25.0 %
3	17	53.1 %	78.1 %
4	7	21.9 %	100.0 %

Graph 5: Clients’ satisfaction distribution plot (source:own)



4.4.3.2 Other indicators of clients satisfaction

To get a better understanding of the clients' satisfaction level, other metrics were measured in the survey. From the analysis, the lowest-rated mean was measured for the clients' involvement. Following Waterfall principles, the website creation process had limited inclusion of clients. They participated only at the beginning of the process when the requirements were collected and then at the end when the website was launched. From the survey, seemed like clients were not satisfied with the frequency of involvement and would like to be more involved.

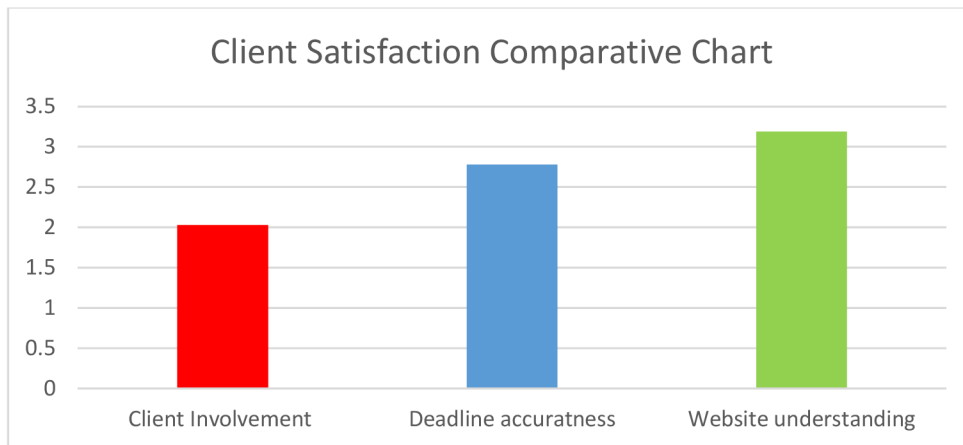
The deadline accuracy average was calculated to be 2.78. This meant that clients were not satisfied with the performance of the company regarding meeting the expected deadlines. Due to Waterfall's lack of flexibility in the process design and the team not being able to address changes in time (Charvat, 2003), the delivery delay impacted the clients' satisfaction. The highest ranked from the clients' survey was website understanding. They had a good understanding of the final product and were more satisfied with that than the other factors measured in the survey. Clients had consultation meetings and then requirements gathering meetings where they would get a detailed explanation of the website and its functionalities. In these meetings, all the clients' questions would be answered, and agreed on the expected outcome before the development process started.

The overall level of the client's satisfaction had a higher value compared to each of the other factors that impact their satisfaction. Their measured values are concluded in the tables below:

Table 9: Clients' satisfaction components descriptive metrics (source: own)

Descriptives							
	N	Mean	Median	Mode	SD	Minimum	Maximum
Client Involvement	32	2.03	2.00	2.00	0.695	1	3
Deadline accuratness	32	2.78	3.00	3.00	0.706	2	4
Website understanding	32	3.19	3.00	3.00	0.738	2	5

Graph 6: Clients; satisfaction components distribution plot (source:own)



4.5 Agile Implementation

After identifying the main obstacles that the company was facing and after evaluating the survey responses, it was decided to implement the Agile methodology in company “X”. The methodology would be a good fit for the company because the Agile core values address the main issues identified in the company:

Agile Core Values (Beck et al, 2001):

- People and interactions
- Customer Collaboration
- Adopting to change
- Working outcomes over documentation

Obstacles found in the company:

- Employee related
- Client related
- Efficiency related

- People and interactions value- Employee related obstacles

According to the Agile manifesto (2001), this methodology puts the main focus on people and the interaction between them rather than the tools that are used. Agile encourages the concept of openness and transparency by emphasizing the objectives and results rather than strict procedures that may not suit everyone's working style (Pratt & Torode, 2020). When the staff will have better visibility of the process, adjust to it, and have a clear understanding of the results, they will be able to estimate their workload and not feel overworked. Since people are at the center of the methodology, it is expected to help with the employee demotivation identified in the company. Agile aims to encourage employees to take

responsibility for their work (Ries & Summers, 2016). As a result of feeling empowered to make choices and take action, employees may be more motivated and engaged. The Agile approach places significant value on communication, which may promote cooperation. Employee motivation and productivity may increase as a result of feeling appreciated and encouraged by their coworkers. Implementing Agile methodology would be an effective strategy for inspiring empowering workers, and promoting teamwork and communication (Ajam, 2018).

- Customer Collaboration value- Client's related obstacles

Collaboration between the development team and the client is emphasized in Agile methodology (Ries & Summers, 2016). From the customer survey, it was discovered that they had low involvement in the process. When Agile will be adopted, there will be a higher engagement of the customers in different phases, and they will be more updated about the progress of the website. To guarantee that the client's demands and expectations are satisfied, frequent briefings and communication channels need to be set up. The final product is more likely to meet the client's expectations due to their increased engagement in the project. In case there will be requirements updates from the customer can be quickly included in the planning process. When the customer is aware of how the website was created and has witnessed its development from the beginning, their engagement can improve satisfaction and trust in the result.

- Adopting to change & Working tools values- Efficiency related obstacles

Differently from Waterfall which has rigid processes, Agile processes are expected to be flexible (Beck et al, 2001). Throughout the development process, adjustments can be made quicker by using the agile approach. Its adaptability to changes makes it possible for the development team to react rapidly, which might result in a more effective procedure.

One of the main focal points of Agile is dedicated to ensuring that the final solution delivered to clients works as planned. The methodology focus is more on the result rather than the documentation process. It is important to use the right tools to organize the teamwork and keep track of progress instead of documenting each step of it (Beck et al, 2001). This can help the staff dedicate more time to their tasks rather than documenting it

4.5.1 Agile framework

The implementation of Agile was driven by team managers. The management transformation was initiated on March 2022. The change of methodology was decided to be implemented in the ongoing and newly initiated projects.

The transformation into Agile required that the whole staff goes through Agile training to familiarize themselves with the methodology and its core concepts. They had to complete online training and then participated in a three-day workshop in the office. They had to practice complex exercises of how methodology is applied and study cases of similar companies adopting it. It helped them visualize the new workflow and understand the principles that needed to be applied in the process. This was a one-time phase that was needed only at the beginning of the transformation. The following phases were done on regular basis.

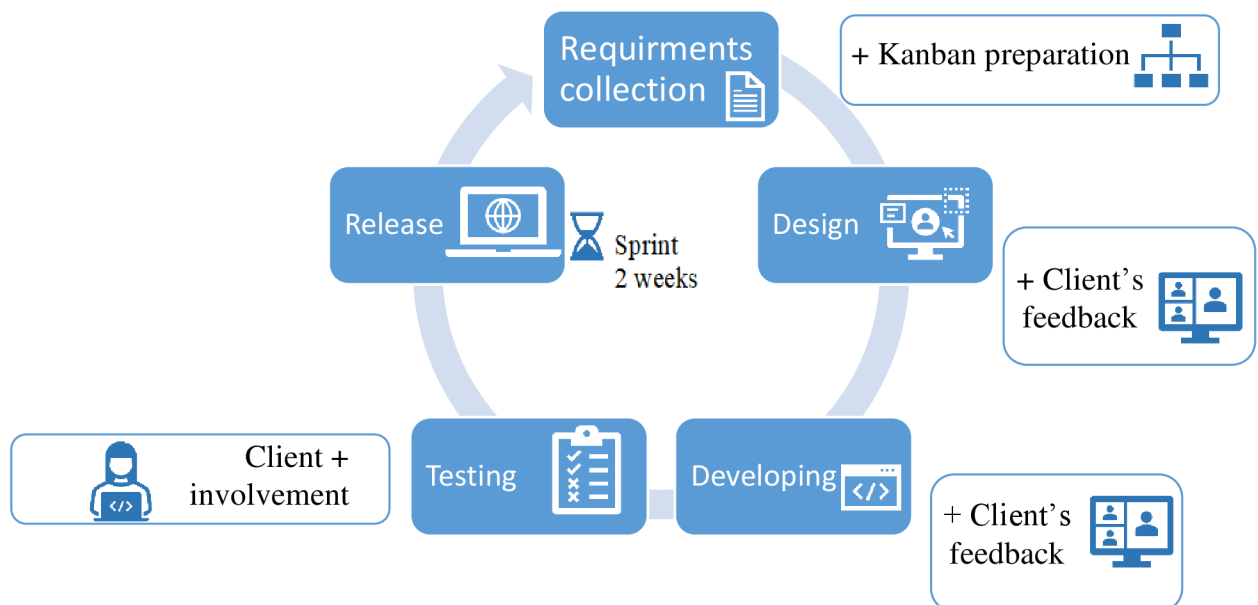
The team felt familiar with the phase of the process so they kept the same five phases but decided to reorganize those differently, not in a linear structure. They adjusted the project stages according to the Agile framework. New elements of the Agile methodology were implemented in the work such as:

- *Kanban preparation*- After the requirements collection phase, the backlog preparation initiates. The backlog holds the plan of the development organized into tasks (Damij & Damij, 2022). The planning of backlog happens only at the beginning of the project. When the new project starts, they need to list all the activities that need to be completed until the launch date. For each activity, there is a task created. The tasks are documented and tracked. For each task, there is added a short description of the activity, the period how long it can take to be solved, and the priority it has. Tasks need to be assigned to the respective team member who is going to perform the task.
- *Sprints planning*- Once team knows the activities they will develop; they need to organize those into sprints. Sprint is the timeframe set in the team to perform the work and then review it. In Agile the most common length of sprint is 2 weeks (Koi, Akrofi & Matey, 2019). In company “X” it was agreed to keep that time frame.

- *Daily Meetings*- During those 2 weeks, teams have daily 30min calls to discuss the progress of the tasks that are planned in the sprint. The comments made by the team were recorded on the Jira tasks. Daily calls help the team keep updated with the progress of each member and work faster (Koi, Akrofi & Matey, 2019). This way they are more prepared and react faster if a change needs to be implemented. Also, by discussing the status of the work, it is easier to identify earlier if there are any potential problems.
- *Review and Retrospective*- At the end of each sprint, there are meetings to review and do the retrospective. The purpose of this meeting is to analyze which tasks were completed as planned, which tasks need to be closed because those are not relevant anymore and what remains in progress. After the review is done, the team does the retrospective which is the overall evaluation of the sprint. The team needs to list the things that went well, those which didn't go well, and what needs to improve. After this phase, the planning for the next sprint starts again (Koi, Akrofi & Matey, 2019).

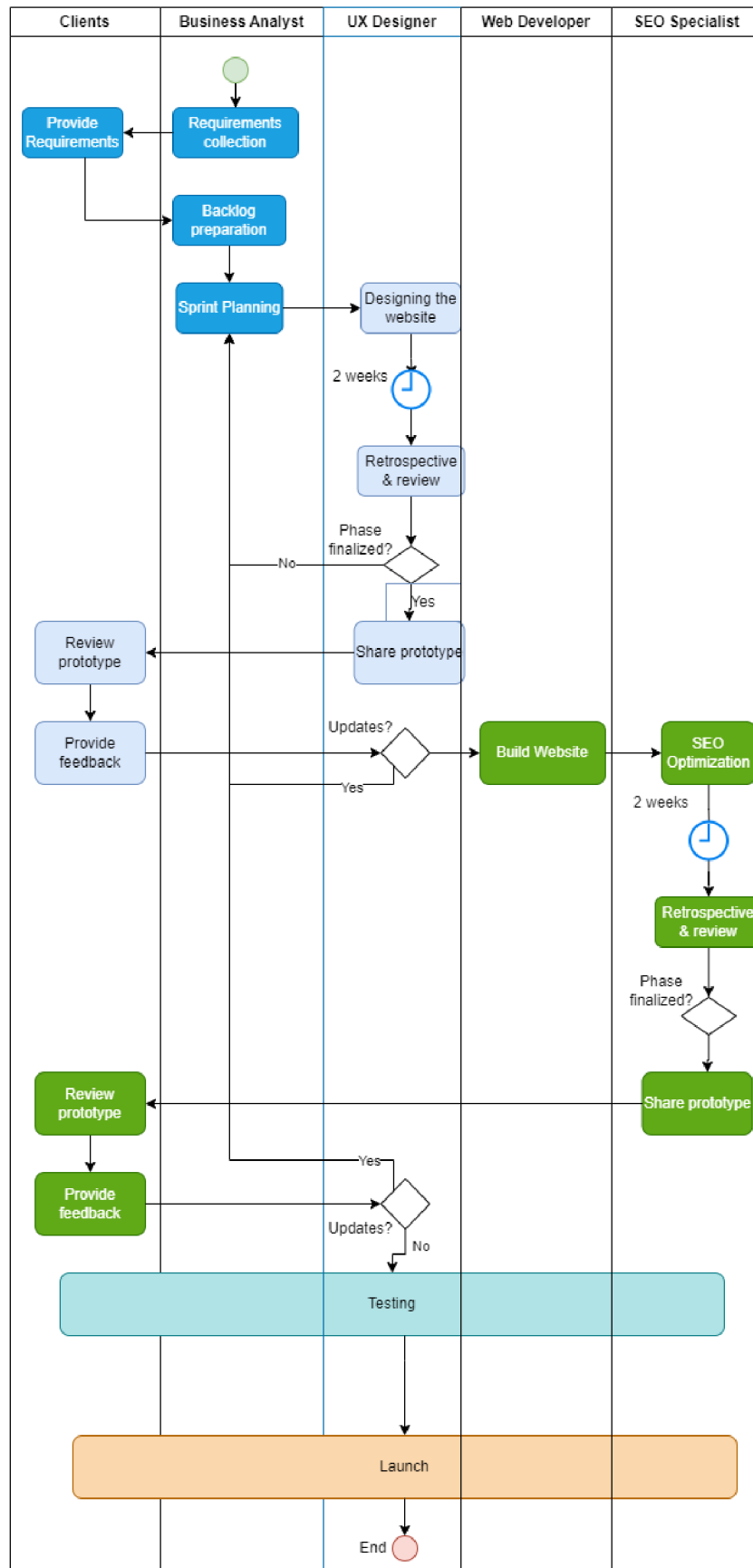
After implementing the Agile principles, all five stages of the website creation process were organized into 2 weeks sprints and the new way of working looked like:

Figure 10: Agile designed process (source:own)



1. *Requirments collection phase-* The meeting with the clients is organized the same as before. The only update is that the requirements are collected through Jira tasks and those are used for keeping all the information gathered from clients. After each team member understood the requirements to implement Agile, the backlog preparation was initiated.
2. *Designing* – After the web designer finishes the design prototype, it is shared with the clients. The team meets with the clients to explain the progress and what is expected to happen in the next phase. It is important to consult the clients at this phase to get their feedback on the design and if there are any updates they need to apply. The team has more flexibility to adopt the changes if those are required in the early phases of the project. After the design, if there are any updates needed, the backlog is updated, and the new tasks are assigned to the sprints. The new workload needs to be estimated if it has any possible impact on the project deadline. In case the clients have no requests, the process continues to the developing phase.
3. *Developing-* At the end of the phase, the website model is shown to the clients to hear their opinions. It is important to explain to them the functionalities of the website at this point and what is pending until it is finalized. In case there are updates, the same logic as in the previous step is followed: Kanban needs to be updated, and newly created tasks assigned to a sprint.
4. *Testing-* After the project is finalized, the testing phase continues. Differently from before, in the testing phase are included representatives of the clients. They get their access credentials, and they can join the team when testing the websites in different scenarios. In case there are issues with the pages, or something is not following clients' requirements, it is still possible to raise bugs and correct them.
5. *Release-* After the testing phase has been successfully completed and all the testing scenarios have been completed, the website is ready to launch. When the release happens, the market is prepared for the final result.

Figure 11: Website creation process workflow- Agile (source: own)



4.6 KPI measurement- Agile

After Agile methodology was implemented in the company “X”, in November 2022, the same surveys were sent again to the staff and customers that had been working with them from March. The results of the survey illustrate the performance of the company adopting Agile concepts.

4.6.1 Staff Survey- Efficiency measurements

From the staff questionnaire, the answers to the first question were analyzed to measure through the staff lenses the efficiency of the processes. The participation in the survey was 100% of staff. All 15 team members completed it.

4.6.1.1 Overall efficiency level

The average vote for the overall efficiency was calculated to be 4.6. There was no voting below scale 3 and the maximum of votes was at scale 5 from 66.7% of the employees. This made the mode and the mean to be at the highest value. The skewness value showed that the distribution of the data collected by the survey was highly skewed to the left and the majority of the data were above the average value. Overall, it meant that staff saw the process workflow adopted to Agile as efficient and estimates its value very close to the highest scale.

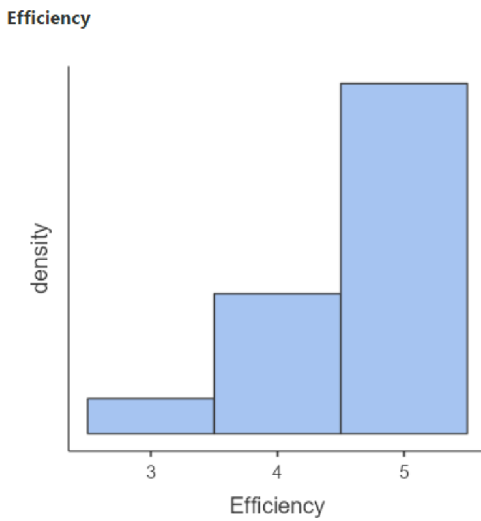
Table 10: Agile efficiency level descriptive metrics (source: own)

Descriptives	
	Efficiency
N	15
Mean	4.60
Median	5
Mode	5.00
Standard deviation	0.632
Minimum	3
Maximum	5
Skewness	-1.41
Std. error skewness	0.580

Table 11: Efficiency level frequency metrics- Agile (source: own)

Frequencies of Efficiency			
Efficiency	Counts	% of Total	Cumulative %
3	1	6.7 %	6.7 %
4	4	26.7 %	33.3 %
5	10	66.7 %	100.0 %

Graph 7: Efficiency level distribution plot- Agile (source:own)



4.6.1.2 Other efficiency indicators

From the analysis of the other factors that estimate the efficiency it was found out that after implementing Agile, there was no voting below scale 3. The model for all the factors varied between 4 and 5.

Due to the changes in the workflow and continuous consultations with clients in different phases of the project, meant that staff had a better understanding of the client's needs. This was reflected in their votes because the client's requirement understanding had the highest mean from the survey.

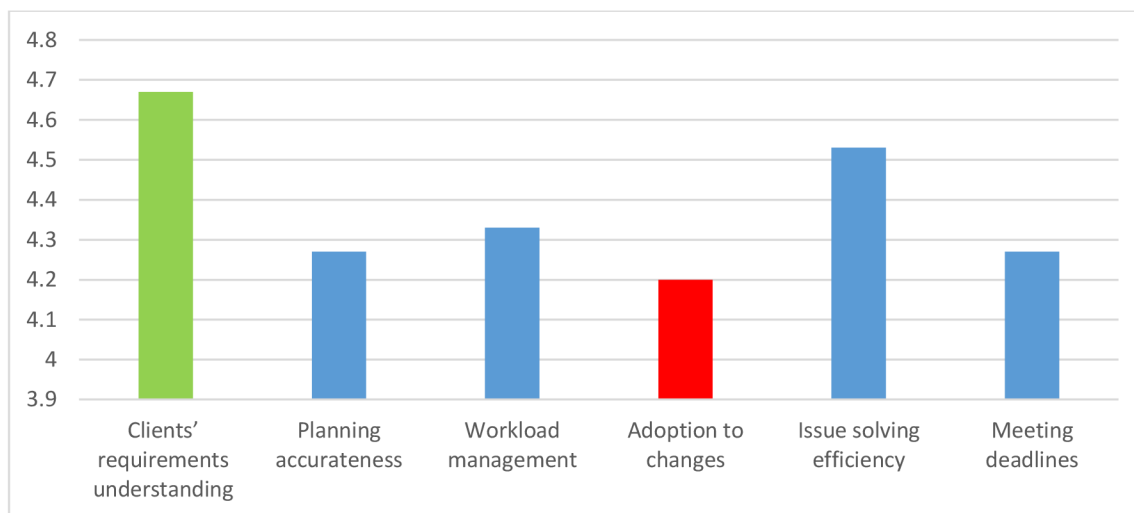
The lowest calculated mean was registered for the adoption of changes. Even though the Agile methodology aims to achieve the flexibility to adapt to changes (Ries & Summers), staff needed to work more into adopting it into practice. Changes can come in different phases of the project and the later the phase, the more challenging it can be for the employees. This was affecting the planning accurateness of the project which had the 2nd lowest mean calculated together with meeting deadlines.

Although the team has backlog and sprint tasks, due to the changes they need to reestimate the project deadlines. Sometimes they need to shift project dates, and this makes their initial estimations not fully accurate. Besides the changes and the need to replan, the staff gave a higher vote to workload management and issue-solving efficiency. It meant that they were able to adapt quickly to the updated workload and managed it successfully meanwhile solved in a timely manner the issues that appeared in the website creation process.

Table 12: Efficiency components descriptive metrics- Agile (source: own)

Descriptives	N	Mean	Median	Mode	SD	Minimum	Maximum
Clients' requirements understanding	15	4.67	5	5.00	0.488	4	5
Planning accurateness	15	4.27	4	4.00	0.458	4	5
Workload management	15	4.33	4	4.00	0.617	3	5
Adoption to changes	15	4.20	4	4.00	0.414	4	5
Issue solving efficiency	15	4.53	5	5.00	0.516	4	5
Meeting deadlines	15	4.27	4	4.00	0.458	4	5

Graph 8: Efficiency components distribution plot- Agile (source:own)



4.6.2 Staff Satisfaction

4.6.2.1 Overall Staff satisfaction level

Staff satisfaction after Agile implementation has a calculated average of 4.67, very close to the highest scale available. The votes were divided between 4 and 5 and there were no lower evaluations. The mode was 5 which meant the majority of the staff had voted the maximal

satisfaction level in the survey scale. There were twice employees that voted in a scale of 5 compared to those that ranked the satisfaction level 4. From the skewness, the level was concluded that the mass distribution of the data was on the right side, towards higher values. Overall was a positive evaluation for the implementation of the Agile methodology, knowing that staff was highly satisfied with the updates applied.

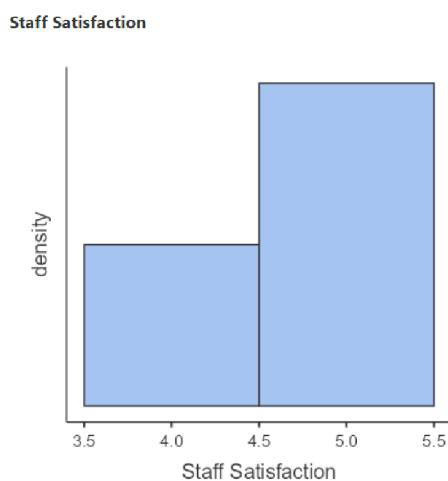
Table 13: Staff's satisfaction descriptive metrics – Agile (source: own)

Descriptives	
Staff Satisfaction	
N	15
Mean	4.67
Median	5
Mode	5.00
Standard deviation	0.488
Minimum	4
Maximum	5
Skewness	-0.788
Std. error skewness	0.580

Table 14: Staff's satisfaction frequency metrics- Agile (source: own)

Frequencies of Staff Satisfaction			
Staff Satisfaction	Counts	% of Total	Cumulative %
4	5	33.3 %	33.3 %
5	10	66.7 %	100.0 %

Graph 9: Staff's satisfaction distribution plot- Agile (source:own)



4.6.2.1 Other indicators of clients satisfaction

The measurement of the satisfaction factors showed that staff ranked the highest among those the involvement in decision-making and the recognition level. This shows that the principles of Agile were followed and applied correctly. According to Agile Manifesto (2001), people and interactions come before tools, thus it is important to know that this concept is reflected in practice and that the staff feels involved and recognized.

The high rate of involvement in decision-making was related also to the planning and work organizing of tasks. Each staff member is responsible for the creation of their tasks, and their progress and participates in decisions about sprint planning. They have more consultations with clients through the process of creating the website so continuously they need to make new decisions. The adjustment to hybrid work had a higher average point. Agile requires regular meetings for planning backlog, sprints, and daily calls to check the progress, review, and do the retrospective. Employees of the company “X” decided to combine the meetings in the office and in person. The outcome of this combination seems to have a positive impact on the staff, and it has helped them to adjust better to the hybrid way of working.

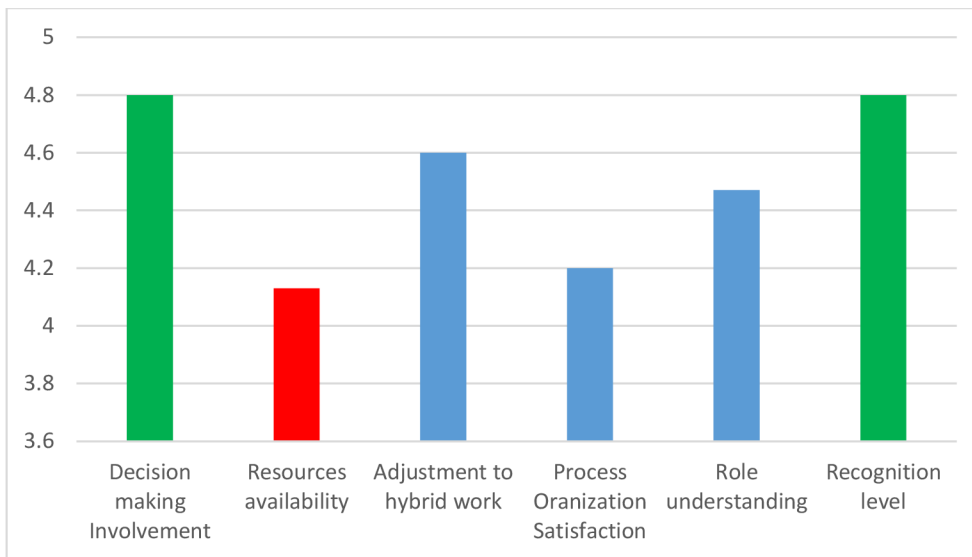
From the survey, answers seemed like each team member had a good understanding of their role. When Agile was implemented, the roles in the team didn't change, the update was only in the processes. Besides that, the roles remained the same, team members were responsible for creating their tasks in the sprints and this gave them a better understanding of what is expected from their roles.

The change in the processes and the new way of reorganizing the workflow were measured to have an average satisfaction rate of 4.2. It shows that the team has been adjusted to the updates. The lowest average score was recorded for resource availability. When a team member needs information about the project, they need to reach out to the specific task that has that info. The overall documentation is shorter, and the details can only be found in the Jira tasks. It requires some investigation from the team to find the data they need; thus, the resource availability has been voted on a scale from 3-5 in the survey.

Table 15: Staff's satisfaction components descriptive metrics- Agile (source: own)

Descriptives							
	N	Mean	Median	Mode	SD	Minimum	Maximum
Decision making Involvement	15	4.80	5	5.00	0.414	4	5
Resources availability	15	4.13	4	4.00	0.743	3	5
Adjustment to hybrid work	15	4.60	5	5.00	0.507	4	5
Process Organization Satisfaction	15	4.20	4	4.00	0.676	3	5
Role understanding	15	4.47	4	4.00	0.516	4	5
Recognition level	15	4.80	5	5.00	0.414	4	5

Graph 10: Staff's satisfaction components distribution plot- Agile (source: own)



4.6.3 Client Satisfaction

Since the implementation of Agile initiated in the company from March until November 2022, there were 21 clients registered. The survey was sent to all of them, and the response rate was 100%.

4.6.3.1 Overall Client satisfaction level

From the survey, clients' overall satisfaction level was measured to have an average rate of 4.62 which is very close to the maximal value of 5. The mode of the answers was 5 which meant that the majority (61.9%) of the clients had maximal satisfaction with the services of the company. It shows that the changes applied in the company had positively impacted its relationship with clients.

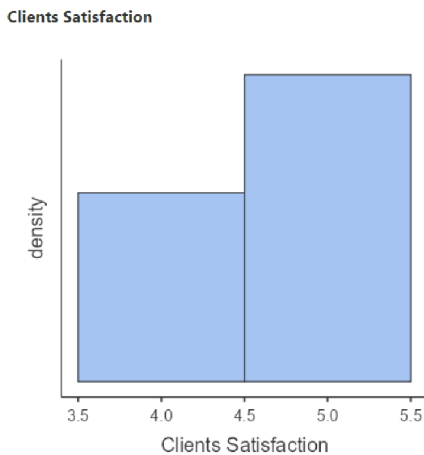
Table 16: Clients' satisfaction descriptive metrics- Agile (source: own)

Descriptives	
Clients Satisfaction	
N	21
Mean	4.62
Median	5
Mode	5.00
Standard deviation	0.498
Minimum	4
Maximum	5
Skewness	-0.529
Std. error skewness	0.501

Table 17: Clients' satisfaction frequency metrics- Agile (source: own)

Frequencies of Clients Satisfaction			
Clients Satisfaction	Counts	% of Total	Cumulative %
4	8	38.1 %	38.1 %
5	13	61.9 %	100.0 %

Graph 11: Clients' satisfaction distribution plot- Agile (source:own)



4.6.3.1 Other indicators of clients satisfaction

From the other factors measured in the survey, the highest value was calculated for clients' involvement. When the process was updated following the Agile principles, the interaction with the clients was increased. There were consultations at the beginning of the process to gather the requirements and further the clients were included in different phases of the

project to show them the prototype or when the testing happened. This seems to have increased the overall satisfaction of the clients about their involvement in the project.

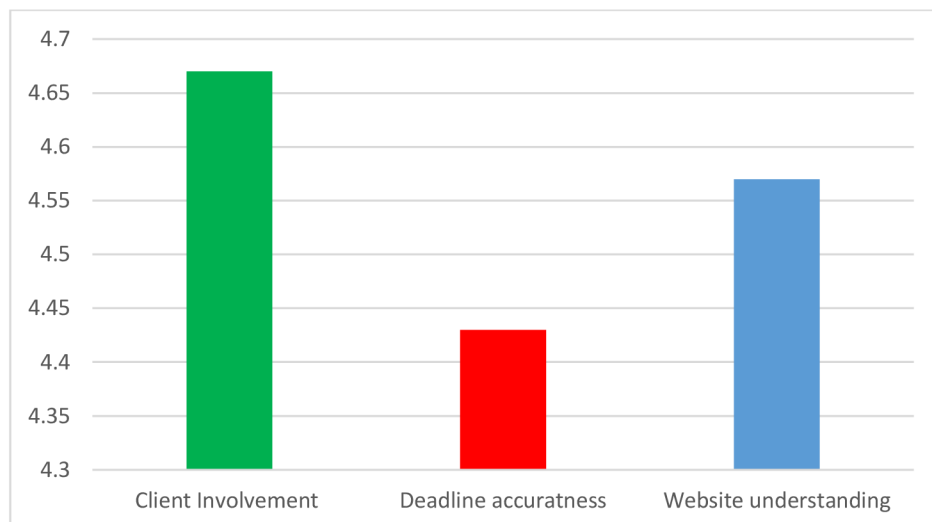
Since they get to know the website in its early phases until the testing, they get to have a more detailed understanding of its functionalities. This was reflected in a high website understanding vote given by the clients in the survey.

Deadline accurateness had a high average too, but among the three factors measured this was the lowest. Its mode was 4 which means that the majority of the clients that completed the survey were not maximally satisfied with the deadline's accuracy. The deadline needed to change frequently if there were updated requirements or if during the testing phase major issues were The rating of the deadline varied on scale 3-5 which means there were no clients who were highly unsatisfied with the delivery date.

Table 18: Client's satisfaction descriptive metrics- Agile (source: own)

Descriptives							
	N	Mean	Median	Mode	SD	Minimum	Maximum
Client Involvement	21	4.67	5	5.00	0.483	4	5
Deadline accuratness	21	4.43	4	4.00	0.598	3	5
Website understanding	21	4.57	5	5.00	0.598	3	5

Graph 12: Clients' satisfaction components distribution plot- Agile (source:own)



4.7 Comparison

To have a better understanding of the company's performance while it was applying Waterfall principles and later after the implementation of Agile methodology, the data gathered from 2 phases of surveys will be compared to each other. For the comparison of the data are used t tests in Jamovi software.

Since the hypothesis question is to decide if implementing Agile improves the performance of the company, it is expected that the results of the second survey to be higher than the first survey's results.

The results of the first survey that measured the performance of the company while applying the Waterfall methodology are represented by measurement 1 in Jamovi calculations. Measurement 2 represents the collected results of the second survey after the Agile modifications. Taking into consideration these factors, when the data is analyzed in Jamovi, it will have the following hypotheses:

- Ho- Null Hypothesis: The means' difference of the paired variables is equal to zero.
 - (Measurement 1- Measurement 2 = 0)
- Ha- Alternative Hypothesis: The mean of the first measured variables is smaller than the mean of the second measured variables.
 - (Measurement 1- Measurement 2 < 0)
- The significance level= 0.05

4.7.1 Efficiency comparison

Table 19: Efficiency comparison metrics (source: own)

Paired Samples T-Test			statistic	df	p	Mean difference	SE difference
Efficiency-Waterfall	Efficiency-Agile	Student's t	-5.96	14.0	< .001	-1.40	0.235
Clients' requirements understanding-Waterfall	Clients' requirements understanding-Agile	Student's t	-6.81	14.0	< .001	-1.60	0.235
Planning accurateness-Waterfall	Planning accurateness-Agile	Student's t	-5.74	14.0	< .001	-1.33	0.232
Workload management-Waterfall	Workload management-Agile	Student's t	-6.32	14.0	< .001	-1.33	0.211
Adoption to changes-Waterfall	Adoption to changes-Agile	Student's t	-6.32	14.0	< .001	-1.33	0.211
Issue solving efficiency-Waterfall	Issue solving efficiency-Agile	Student's t	-6.87	14.0	< .001	-1.80	0.262
Meeting deadlines-Waterfall	Meeting deadlines-Agile	Student's t	-7.12	14.0	< .001	-1.53	0.215

Note. $H_a: \mu_{\text{Measure 1}} - \mu_{\text{Measure 2}} < 0$

From the comparison of the variables that define the efficiency of the company “X”, it was found that for all the measured variables, the p-value was smaller than 0.001. It means that null hypothesis H_0 will be rejected, and the alternative hypothesis is accepted.

In the table is represented the mean difference (Measure 1-Measure 2) which is a negative number. It shows that all variables measured after “Agile” have a higher vote in the survey. The biggest difference among means is measured for issues solving efficiency (-1.8). The difference in the process following “Agile” principles made the team more efficient in handling the issues that appear in the process. The teams are more organized to manage an issue that can appear in different phases of the process.

A significant difference is measured in the voting that staff provided for the clients’ requirements understanding. Increased meetings with clients through the process of creating the website, had a positive impact on the staff which explains their high voting.

The 3rd biggest difference in the means is among the overall estimated efficiency. After “Agile”, employees estimated the efficiency of the process as 1.4 points higher than the efficiency measured during “Waterfall”. The updates applied in the process, have positively impacted the staff in their efficiency evaluation.

The lowest difference among means is measured for the adoption of changes and workload management. The staff voted those higher in the 2nd survey but the difference is lower

compared to other factors measured. This means that they are still not fully efficient but there is an improvement compared to the state before.

4.7.2 Staff Satisfaction comparison

Table 20: Staff's satisfaction comparison metrics (source: own)

Paired Samples T-Test

			statistic	df	p	Mean difference	SE difference
Staff Satisfaction-Waterfall	Staff Satisfaction-Agile	Student's t	-7.246	14.0	< .001	-1.0000	0.138
Decision making Involvement-Waterfall	Decision making Involvement-Agile	Student's t	-7.174	14.0	< .001	-1.6667	0.232
Resources availability-Waterfall	Resources availability-Agile	Student's t	-0.774	14.0	0.226	-0.2667	0.345
Adjustment to hybrid work-Waterfall	Adjustment to hybrid work-Agile	Student's t	-4.525	14.0	< .001	-0.9333	0.206
Process Organization Satisfaction-Waterfall	Process Organization Satisfaction-Agile	Student's t	-5.002	14.0	< .001	-1.5333	0.307
Role understanding-Waterfall	Role understanding-Agile	Student's t	-2.449	14.0	0.014	-0.4000	0.163
Recognition level-Waterfall	Recognition level-Agile	Student's t	-0.564	14.0	0.291	-0.0667	0.118

Note. $H_a: \mu_{\text{Measure 1}} - \mu_{\text{Measure 2}} < 0$

The p-value for overall staff satisfaction is below 0.001 which means the alternative hypothesis can be accepted. The mean of the staff satisfaction measured after Agile is bigger than the one measured during Waterfall, by one scale higher. Overall, the staff is more satisfied with the company after the Agile implementation.

For many of the measured factors, the means' difference is significant, such as involvement in decision-making, the way processes are organized, and adjustment to hybrid work. In every sprint, the team has planning and reviewing meetings where they need to discuss and make new decisions about the continuity of the project. This helps the staff be more proactive in the decision making process.

Remodeling the process team follows according to Agile concepts seems to provide a higher satisfaction level to the staff. The development of the website is a complex process and breaking it down into multiple tasks can help in monitoring the progress and having more control over the process. As part of the Agile implementation, the staff needs to align and have continuous meetings which have altered the way they collaborate in person and online and have increased their efficiency in hybrid working.

Role understanding has a measured p-value of 0.014 which is still smaller than the significance level of 0.05, but the difference between means is small (0.4). After Agile, the staff got a better understanding of their role. The majority of the staff already had a good understanding of what their tasks are but a few of them have improved their knowledge of what are their responsibilities. They need to regularly update the Jira tasks that they work on with the description of the work, thus this has improved their comprehension of the role. For resource availability and recognition level, their p values are bigger than the significance level. It means that null hypothesis H_0 is accepted. Despite that the mean values are not identical, the difference between them is not significant. The means' difference for both these factors is negative which means there was an improvement after Agile, but these factors already had a high vote from the first survey. Applying the Agile concept hasn't changed the access of the staff to the available resources, those were always easily feasible for them. The staff's recognition level was measured both times to be very close to the highest scale available in the survey.

4.7.3 Client satisfaction comparison

Table 21: Clients' Satisfaction comparison metrics (source: own)

Paired Samples T-Test

			statistic	df	p	Mean difference	SE difference
Satisfaction-Waterfall	Satisfaction-Agile	Student's t	-6.87	20.0	< .001	-1.38	0.201
Client Involvement-Waterfall	Client Involvement-Agile	Student's t	-17.02	20.0	< .001	-2.52	0.148
Deadline accuratness-Waterfall	Deadline accuratness-Agile	Student's t	-7.36	20.0	< .001	-1.57	0.213
Website understanding-Waterfall	Website understanding-Agile	Student's t	-6.04	20.0	< .001	-1.10	0.181

Note. $H_a \mu_{\text{Measure 1}} - \mu_{\text{Measure 2}} < 0$

The means measured from survey 2, have been higher for all the factors that define the clients' satisfaction. For all of them, the p-value is smaller than the significance level thus alternative hypothesis can be accepted. Overall, the estimation of their satisfaction after Agile has increased by 1.38 compared to their voting in the first survey. The highest difference among means has been captured for the client's involvement. In the updated processes of the company, there are different touch points with clients to gather their inputs and show progress. This change seems to have a positive impact on their satisfaction.

There is a significant change in the accuracy of meeting deadlines. Seems like clients are more satisfied with the way company “X” manages work and is able to meet the deadlines. After Agile the website understanding is higher. Getting involved in different phases and getting to know the project since the prototype phase, has helped the clients apprehend the website better.

5 Conclusions

From the comparison of the KPIs before and after the implementation of the Agile methodology, it can be concluded that the performance of company “X” has improved. All the aspects measured were ranked higher in the second survey.

The biggest difference measured by staff about the company’s efficiency was the ability to solve the issues. The team has improved the way of handling issues in a more efficient way without prolonging the delivery dates. Following the principles of Agile to divide the work into sprints (Pratt & Torode, 2020) and have daily calls, the teams gained the advantage to identify the issues in time and start working towards their solution earlier. The process is more flexible and adaptable, allowing teams to respond quickly to changes in requirements, priorities, or feedback. This resulted in faster delivery of websites, and better alignment with customer needs

Regarding the improvement in staff satisfaction, the biggest difference was measured in their involvement in decision-making. One of the main core values of Agile is to focus on individuals and interactions between them rather than on tools. It emphasizes collaboration and teamwork, promoting a culture of communication and transparency (Beck et al, 2001). This led to better solutions, as ideas and feedback were shared openly, and to higher levels of employee involvement in decision-making, as team members feel more engaged and invested in the project which impacts their overall level of satisfaction.

From the clients’ survey, the biggest difference was in clients’ involvement. The team included them in distinct phases of the project and increased the consultation session not just at the beginning of the program. This goes accordingly to the core values of Agile which emphasize the importance of continuous collaboration with clients and making them part of the program (Beck et al, 2001). This increases the transparency of the process and open communication between the team and clients, unlike in Waterfall where they had no visibility until the website was delivered. Earlier involvement of the clients in the project development and during the testing phase improved their understanding of the website.

Overall Agile is more efficient for company “X” than Waterfall in terms of delivering the solution quicker, scoring higher levels of satisfaction among staff and clients, increases the collaboration between teams while balancing their hybrid way of working. It offers a quicker and better organization of work divided into 2 weeks sprints which gives them more control over the process, and changes and helps them to continuously improve their performance.

From the results of the case study, it can be accepted the hypothesis that the transformation from Waterfall to Agile methodology improved the performance of the company in terms of efficiency, staff satisfaction, and client's satisfaction.

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