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Customizing Agile-Lean in Delivery Projects

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PREFACE

This thesis journey has been challenging and rewarding, Encouraging personal growth and development. I am grateful to my supervisor for his invaluable support, and guidance. I dedicate this work to my supportive friends and family, especially my wife and parents, who have stood by me through tough times. I hope my research can inspire others and provide valuable insights. Thanks to everyone who has been a part of this journey, showing that dedication, hard work, and passion can lead to great achievements..

Helsinki, 14.04.2023

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Abstract

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The purpose of this thesis was to investigate how Agile-Lean's Scrum and Value Stream Mapping (VSM) methods can be applied and customized to delivery projects, making them more efficient and improving quality. The planning delivery project was chosen as a case study of the target organization in order to get concrete examples of the benefits and challenges of the methods.

The work combined analysis of the current situation, existing knowledge, best practices, and interviews and discussions during the data collection phase. Using these, a new framework proposal was created, which was applied and validated in the organization of research cases. The study showed that Scrum and VSM offer benefits such as flexibility, collaboration and continuous improvement, which help organizations respond quickly to customer needs and improve value, quality and speed of delivery.

The research revealed that Scrum and VSM promote better resource management and prioritization, help identify and eliminate waste, and make operations more efficient. The methods also support communication and cooperation between teams, which increases job satisfaction and commitment.

Ultimately, it is important that organizations critically evaluate their own processes and choose the most appropriate methods and tools to support their goals and resources. Scrum and VSM are powerful methods for improving delivery projects, but should be used in conjunction with other approaches to achieve the best results.

Keywords: Agile, Lean, Value Stream Mapping, Scrum, Delivery Project.

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List of Abbreviations

AP	Accountable Person
BTS	Base Transceiver Station
CSA	Current State Analysis
ML	Material List
PPT	PowerPoint File
RAN	Radio Access Network
SLA	Service Level Agreement
SPOC	Single Point of Contact
VSM	Value Stream Mapping

1 Introduction

This thesis work analyzes the planning process for installing Base Transceiver Stations (BTS) in the target organization, covering the entire process from order to delivery. The main objective of this study was to identify process inefficiencies and propose solutions to reduce lead time, improve delivery quality, and enhance team spirit and employee satisfaction. Although the scope of this work is limited to the target organization's planning process, the findings and proposed solutions can serve as a prototype for improving any delivery project.

1.1 Business challenge

The study case project currently follows the traditional waterfall principle in software projects, which may no longer be the most efficient or productive approach. In contrast, Agile-Lean principles have proven to be more cost-effective and productive in many software projects. Thus, this thesis aims to validate the effectiveness of Agile-Lean principles and create a customized process to transform the current project into an Agile-Lean one.

1.2 Objective and scope

In the case study project, Delivery Projects, several challenges have been encountered such as long lead times, high costs, and low quality. However, by applying Agile and Lean principles to software projects, it has been observed the potential to apply these methodologies to any delivery project since they offer continuous improvement and transformation.

The Lean principles of "eliminate waste" and "optimize the whole" are crucial in achieving efficiency in delivery projects. "Eliminate waste" refers to identifying and eliminating any non-value-adding activities in the project process, while "optimize the whole" focuses on optimizing the entire system, rather than individual parts, to achieve maximum efficiency.

One useful tool to achieve these Lean principles is value stream mapping. In this thesis, the Base Transceiver Station (BTS) planning project is examined as a system and the flow of work from input to output is analyzed, measuring the lead time. All types of waste are identified and analyzed to determine their root causes. Subsequently, corrective actions are identified to optimize lead time, improve quality, and boost team spirit using Agile methods.

1.3 Outcom

This Master's thesis is based on the hypothesis that adopting Agile-Lean methodologies in delivery projects (BTS planning as a case study) can lead to notable improvements in value streams value, quality, and speed (1).

1.4 Thesis structure

This thesis is organized into six main sections. Section 1 provides a brief introduction to the scope of the study, including the research problem, approach, and desired outcomes. Section 2 outlines the methodology used in the research, including the design and data collection plan. Section 3 analyzes the current state of the studied project and its associated research problem. Section 4 presents a review of existing knowledge and a comparison of different project management methodologies. In Section 5, a new and improved process is proposed by integrating the existing methodologies with best practices. Finally, in Section 6, the proposed solution is evaluated, and conclusions are drawn and summarized.

2 Method and Materials

This section provides an overview of the research methods, study design, and data collection strategies. The research design is constructed with a specific focus on improving the current processes and practices within the targeted organization.

2.1 Research Approach

This thesis employs an action research approach, which involves a systematic analysis of the current state to gain a comprehensive understanding of the problem before taking corrective action to improve the current practices and processes in the targeted organization's planning department. To achieve this, various research methods such as interviews, observations, and questionnaires are employed to gather data on the current situation. It is crucial to thoroughly understand the history and background of the organization before initiating any development work to ensure that the root cause and not just the symptom is addressed (2). This approach aims not only to change activities and practices but also social habits of the organization's members, and it requires several experimental phases where planning and implementation alternate. The findings obtained from the research guide the progress of the thesis work. The activity research is expected to be completed within a year (January 2022 – December 2022) using qualitative research methods for data collection.

2.2 Research Design

Figure 1 clarifies the research design carried out in the thesis.

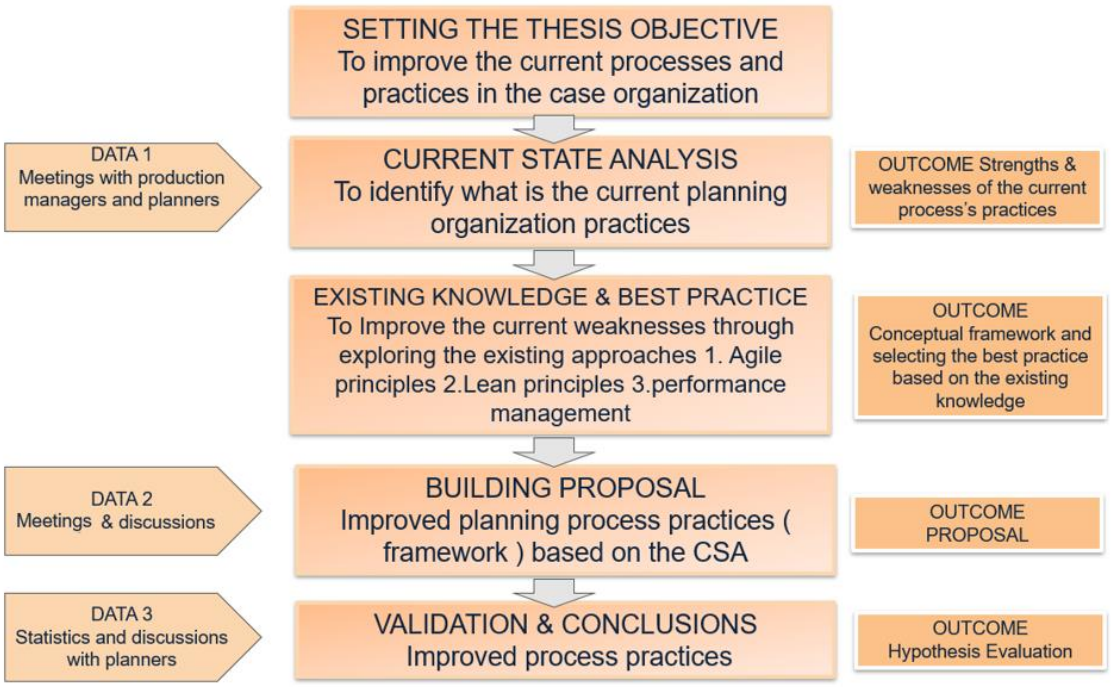


Figure 1 Research Design.

The figure presented above illustrates the step-by-step research design, starting with defining the objective and followed by a Situational Current Analysis (SCA). The SCA focuses on exploring the strengths and weaknesses of current practices within the scope of the business problem, specifically the current workflow of PTS planning. Next, the existing knowledge and best practices from available literature are selected. A conceptual framework and a suitable proposal are then built, discussed, and implemented. Finally, the proposal is evaluated, and conclusions are drawn.

2.3 Data Collection and Analysis

This thesis follows the three data collection stages shown in following table.

Table 1: Data Collection and Analysis Phases.

	Content	**Type**	**Timeline**	**Outcome**
Data1: Current state analysis	Interviews with: Production managers & planning engineers	Online meeting & face to face meetings	Feb 2022-Apr 2022	Identification of the current process weaknesses

				& the possible part to improve
Data2: Proposal Building	Interviews with: Production managers & planning engineers	Online meeting & face to face meetings	May 2022-Aug 2022	New proposal
Data3: proposal evaluation	Informal discussions with the team beside statistics	Meetings and statistics from the company systems	Sep2022-Dec 2022	Result and conclusions

The table shows the three data collection phases of this thesis (data 1,2 and 3).

In the first stage, several production managers, work managers beside planning engineers who were involved in the existing processes are interviewed to understand current practices. These interviews were conducted virtually, and each interview included a free-form discussion that discussed the details of current planning process practices and their possible weaknesses. The output of the conversations is being added to the in a QA format.

Moving onto the second phase, the objective was to utilize the studied existing theory of Agile-Lean to develop with production managers a new process that would be effective beside re-maintain the team structure to be aligned into Agile-Lean. To accomplish this, additional interviews were conducted with planning engineers and production managers. The output of the conversations is being added to analysis and proposal section.

In the third stage, the goal is to validate the proposed new framework. The collection of the data in phase2,3 sometimes overlapped and sometimes simultaneous because the process is iterative. All interviewed parties were actively participated in the process by giving feedback, and the proposal framework is fine-tuned based on the feedback. The statistics and feedbacks were used to conclude and evaluate the framework change.

3 Current State Analysis

This section describes and analyzes the current BTS planning processes and practices used in the case company. Also describes the roles of the planners and the responsibility scope of the project team. As a result, the research will list the strengths and weaknesses besides the scope of possible change parts of the process.

3.1 BTS Planning Processes and Practices

The planning team comprises of multiple engineers who serve three distinct projects. Each team member possesses specific technical knowledge that covers a particular operator's technical area. The planners work under the guidance of implementation managers. The projects consist of various order types, which are categorized as BTS planning, indoor network measurements, indoor network planning, and renovation planning. The planners hold bi-weekly meetings with the work managers to review the open orders. During the meetings, each work manager provides updates on their respective planners who only possess knowledge on the technologies utilized in their particular project.
Below chart illustrate the oorganization and team hierarchy.

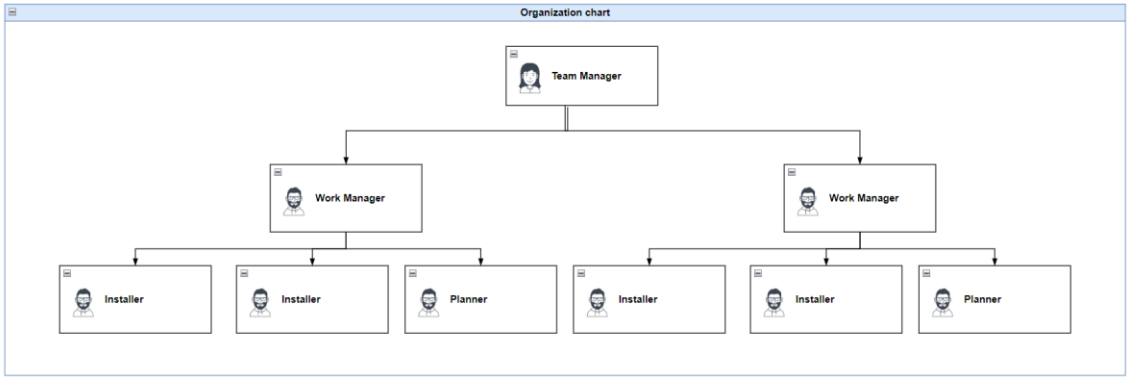


Figure 2 Organization and Team Hierarchy.

The planning process from order to delivery involves several stages, as outlined below:

- Operators submit site design orders in their systems

- The service center creates orders in our company's systems for the planning team to work on
- Work managers assign one of four different types of orders to the planning team
- The planning team works on each type of order separately, producing a plan as output
- The plans are submitted to the customers' systems, and the order is considered complete
- Our company invoices the planning part of the order, while the customer orders the implementation part..

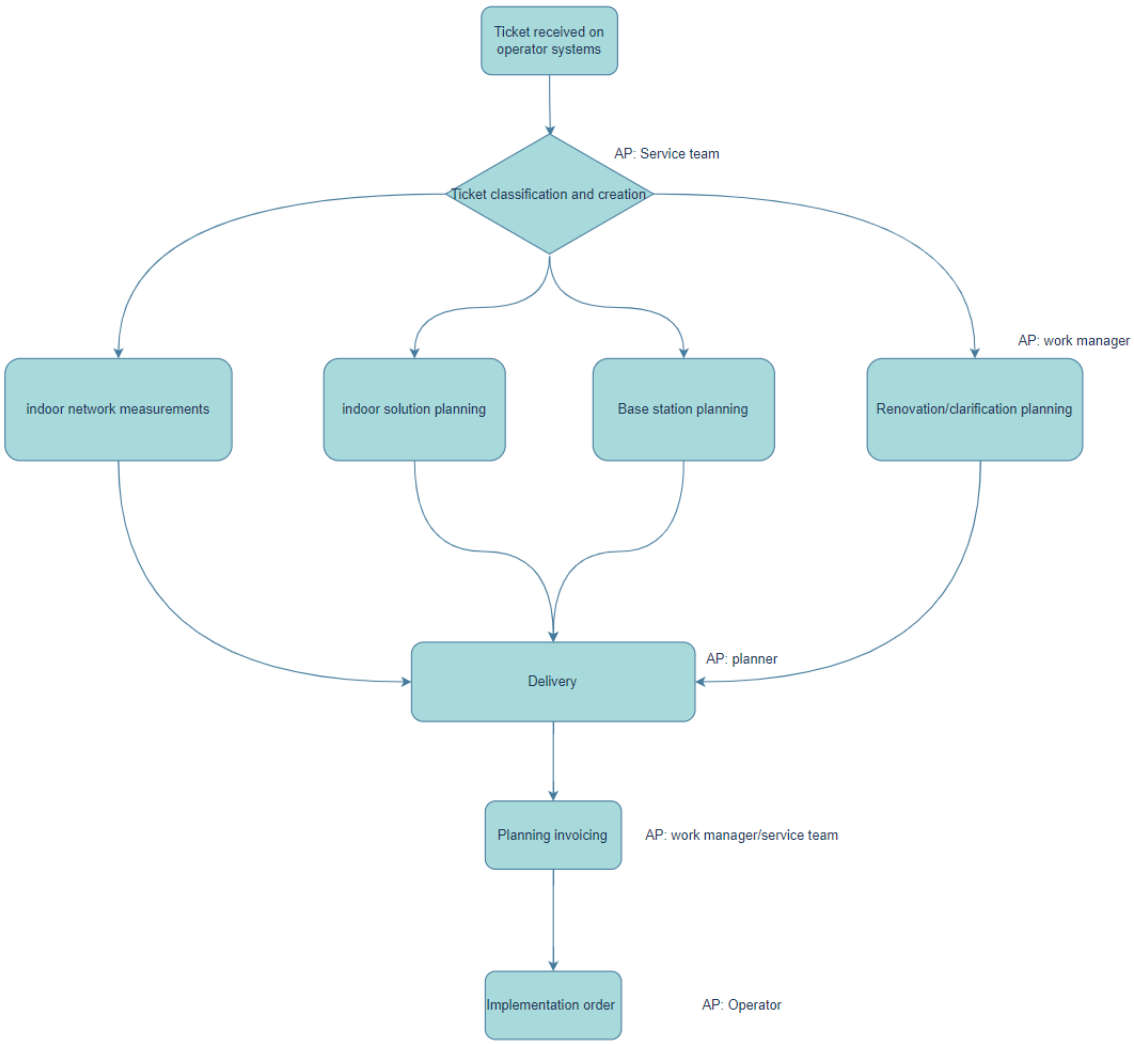


Figure 3 Planning Process from Order to Delivery as Input Output.

Each of the four types of orders has a specific workflow, which is illustrated in the following charts. The workflows for indoor measurements and indoor solution planning will be combined, as the indoor solution plan follows a similar process to normal base station planning.

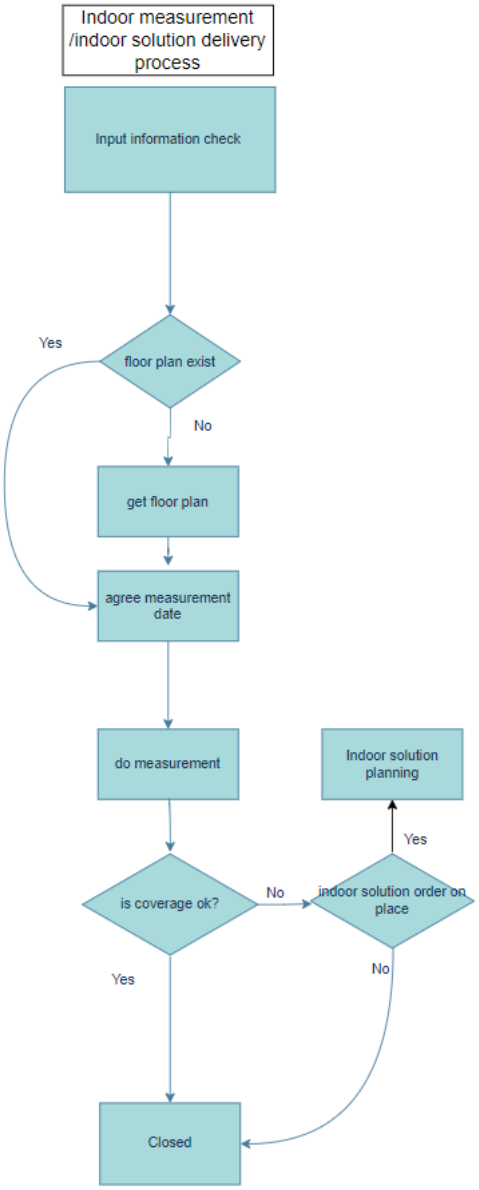


Figure 4 Indoor Measurement and Indoor Solution Process.

Figure 4 shows that the indoor solution plan follows a similar workflow as the normal BTS planning. The planner starts by checking the contact person information and if a floor plan exists. If it doesn't, the planner contacts the contact

person via email to obtain it. Once the floor plan is obtained, the planner reserves the measurement equipment for the agreed date of measurements. After the measurements are taken, a measurement report is created, and the planner determines whether indoor coverage enhancement is required. If it is, the planner continues with the indoor solution plan, which follows the normal site plan procedure.

The second type is the normal base station planning, illustrated in the following figure.

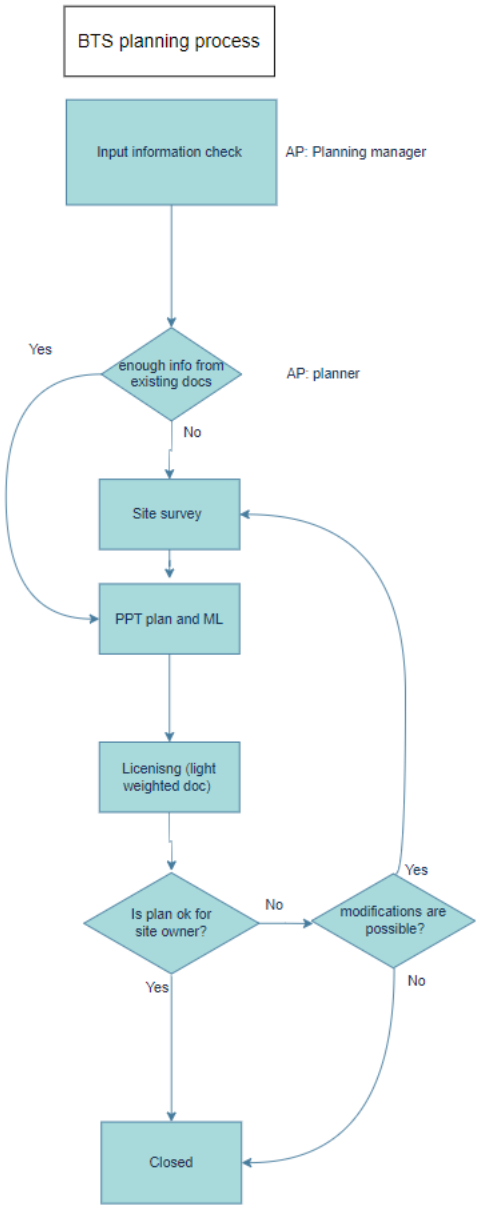


Figure 5 Normal Base Station Planning.

In this type, the planner reviews the requested changes from the radio network planner and determines if a survey is necessary based on existing documentation. After the survey, the planner creates a PowerPoint presentation and Material List (ML). The lightweight plan is then sent to the site owner, who can accept or reject the proposed changes. If the changes are accepted, the plan, material list, and relevant system markings are completed, and the order is closed for invoicing.

The third type of planning is renovation planning, which is used when a building is undergoing renovations and BTS materials need to be moved or removed from the renovation area. The renovation PTS planning process is illustrated in Figure 6.

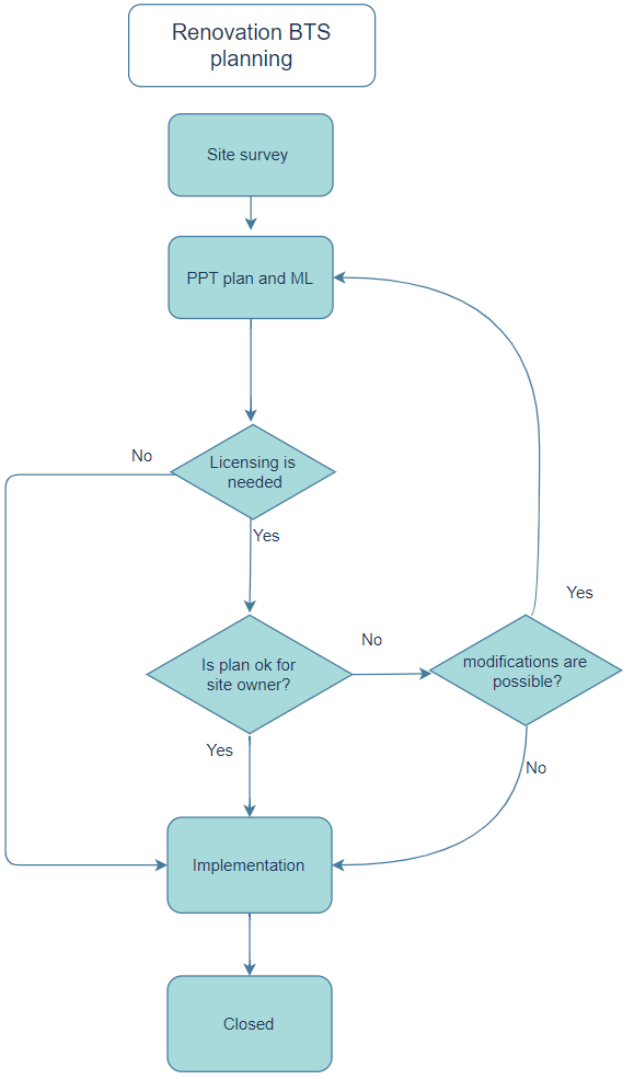


Figure 6 Renovation PTS Planning Process.

For this type of planning, the planner begins by scheduling a site survey with the renovation company and reviewing the plan on-site. Once the plan is completed, it is sent to the work manager for implementation and invoicing.

3.2 Key Findings of CSA

In this part, a detailed examination of each mentioned part of the above charts, including the organization structure, the orders process flow, and managing practices, will be conducted. The purpose is to search for possible wastes and analyze the project management approach. Afterward, the mentioned Agile-Lean tools will be explored to suggest improvements and test the new framework proposal. Several meetings and interviews were conducted with production managers, work managers, and planners to understand the current processes and practices.

Below the key memos collected via the interviews to identify the wastes according VSM among our process listed as Q&A (Data1)

1- How frequently do you encounter delays or waiting times during the planning process? This can vary depending on the type of work order and workload, but delays are a common occurrence.

2- Do you have a clear understanding of the overall goals and objectives of your work process? While generally three have been a clear understanding, there are times when planner may feel uncertain and consult with my work manager.

3- Have you noticed any unnecessary steps or redundancies in your work process? Yes, there are instances where planners must review plans twice - once during the licensing process and again when the permit is obtained from site owners.

4- Are there any bottlenecks or constraints that impede the work process? Yes, there are repeated inquiries from site owners during the licensing stage that can slow things down.

5- Are there instances where work is passed back and forth between team members? This is not common, but there are times when plans are sent back and forth between planners and installers.

6- Is there effective communication and collaboration among team members? Yes, team members generally communicate effectively and are willing to provide help when needed.

7- Are there any unnecessary inventory or stockpiles during the implementation process caused by the planning process? Yes, material lists may sometimes include incorrect materials, leading to unnecessary inventory or stockpiles.

8- Have you noticed any defects in plans that cause rework or additional steps? Yes, there is a lack of systematic work checks that would help to ensure plan quality.

9- Are there any unnecessary routine tasks or out-of-scope work in the current process? Yes, there are many reporting tasks and system updates that can affect focus and lead to decreased efficiency.

Based on the responses, it appears that there are several challenges and issues within the current process and practices. However, it seems that there has not been sufficient time or effort dedicated to thoroughly analysing and addressing these problems from start to finish.

The table 2 is showing the key findings of the current state analysis.

Table 2 Key Findings of the Current State Analysis.

Strengths	• Effective planning teams and processes are critical components of an organization's operations. • planning team members possess the necessary competencies and a wide range of expertise related to their respective projects • Smooth communication between planners and work managers
Weakness	• The organizational structure and practices appear to be misaligned with the requirements of agile methodologies. • The implementation phase is affected negatively due to significant delays in delivery • The company is experiencing low levels of profitability, with negative figures not uncommon • The implementation of adequate quality control measures is lacking, which raises concerns regarding the quality of the plans provided • The presence of technical knowledge gaps and a lack of continuous improvement processes further exacerbate these concerns. • Finally, the presence of unused competencies and untapped creativity further highlights potential areas of improvement for the organization.

3.3 Targeted Parts of Improvement

In this part, the theory section helps determine the targeted sub-parts of the process, allowing us to examine the best practices of Agile methodologies for addressing organizational flow issues. Simultaneously, this thesis will identify the

wastes in the order handling process and utilize the best practices of Value Stream Mapping to improve the entire process and eliminate waste.

Firstly, the targeted area is the organization structure of the planning team, aligning it with Agile, specifically Scrum. In the current organization, there is a noticeable lack of time and motivation for follow-up and continuous development of team skills, rotations, and addressing the current career stagnation of the planning team. For instance, the workload can become too large in some projects, resulting in long delays, while other projects have less volume, even causing some planners to take unpaid leave. Additionally, there is no team spirit due to the absence of continuous skill improvement.

Secondly, the current framework and processes for order handling suffer from several wastes defined by VSM that have not been recognized previously, causing unmet reaction requirements. Many day-to-day modern management methods used in the Scrum approach are also missing. The planners are not able to objectively evaluate priorities and scheduling. The entire framework is analyzed, and detailed improvements are carried out in the framework and processes.

Lastly, a critical factor that plays a vital role in ensuring smooth implementation and profitability is quality. Regrettably, the plans being delivered are not systematically checked for faults, resulting in a high defect rate of the total delivered plans. These defects can vary in size, with some being minor and others major.

4 Theoretical Background

Agile-Lean methods are popular methods in software development that emphasize flexibility, speed, and customer collaboration (4). These methods have become increasingly popular due to their ability to quickly adapt to changing customer needs and requirements. However, there are many other development models and methodologies that can be used in software and production projects.

To provide readers of the thesis a comprehensive overview of these various models, this literature section presents contextual knowledge on those commonly used development models. While only a few of the most widely recognized project models have been featured, this section provides a broad overview of the different approaches that can be applied in various ways. This will allow readers to better understand the approaches used in the thesis, without the need to refer to external sources.

4.1 Waterfall Model

The waterfall model is one of the earliest software production process models, introduced by Winston Royce in his seminal article "Managing the Development of Large Software Systems (5).

The waterfall model is characterized by a linear sequence of stages in which product development progresses incrementally. Each stage begins only after the previous one has been completed. The model commences with the specification of requirements, followed by the design of the architecture and application. Once the plans have been finalized, the coding or manufacturing phase begins, culminating in the testing phase. Each of these stages is further divided into sub-steps, and requires multiple checks and careful documentation.

Figure 7 shows the simplest waterfall model from Royce's article. Royce himself criticized model in the same article. However, the model was very popular.

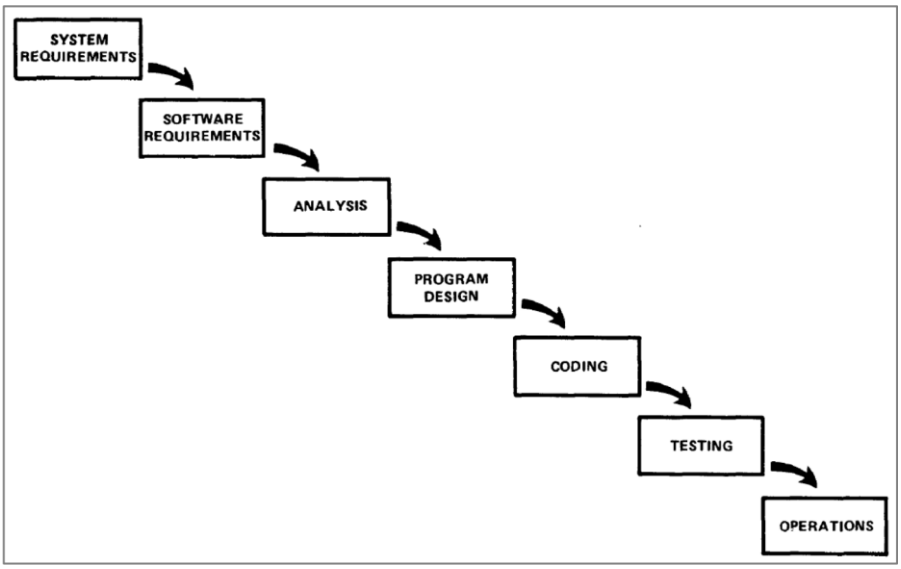


Figure 7 Royce's Waterfall Model.

Traditional project management methods such as waterfall often suffer from three main problems: the inability to handle uncertainty, a lack of flexibility, and poor communication. These issues can result in delayed project completion, missed deadlines, and budget overruns. Additionally, when quality management, i.e., testing, only takes place at the final stage, the necessary repairs will take an unpredictable amount of time and will be expensive. The problems of the waterfall model have been answered with various agile methods (6).

4.2 Agile/Scrum

Agile is an iterative and flexible approach to project management and software development that emphasizes collaboration, adaptability, and continuous improvement. Its most important principles include valuing individuals and interaction over processes and tools, prioritizing functional software over documentation, collaborating with the customer over contract compliance, and reacting to changes over following a rigid plan. The agile development process is iterative and incremental, with software evolving through several short development cycles.

Scrum is a methodology for agile software development that promotes self-organization and collaboration. In this approach, the team works in sprints, which typically last 2-4 weeks. At the beginning of each sprint, the team conducts a sprint planning meeting to decide what to accomplish during that period. The team also has a brief daily meeting to review their progress. At the end of each sprint, the team presents the completed work to the customer for evaluation. The Scrum framework values flexibility, adaptability, teamwork, and customer collaboration, which are implemented incrementally and iteratively throughout the development process (7).

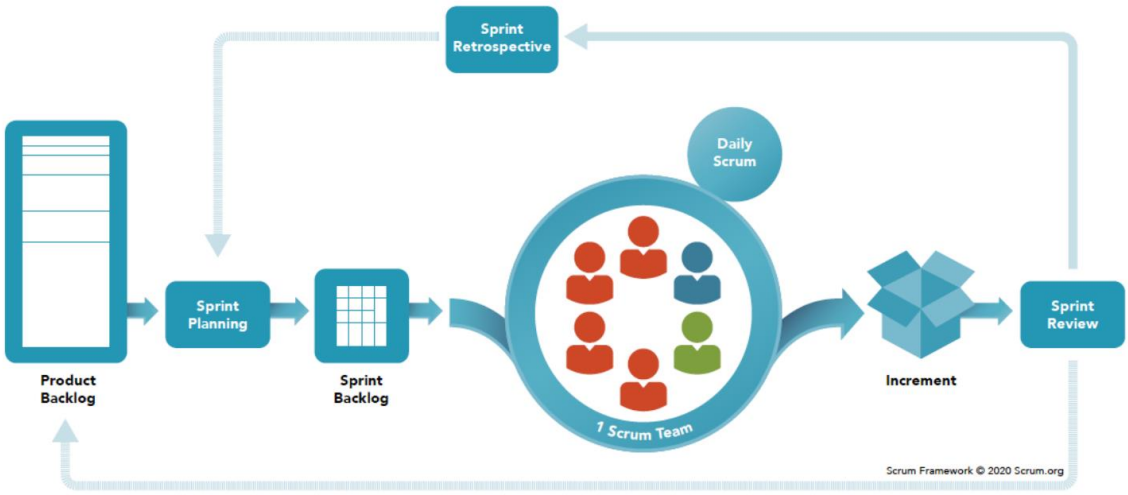


Figure 8 Visual Representation Illustrating Scrum (8).

4.3 Lean/VSM

Lean is a way of thinking and operating that strives to continuously improve the organization's performance by eliminating waste and focusing on creating value for the customer. This happens by developing operating processes and turning them into flows where products and services flow seamlessly through the organization. In addition, Lean emphasizes involving people, continuous learning and development, and cooperation with customers.

Figure 9 Visual Representation Illustrating Lean Concept (9).

Value Stream Mapping (VSM) is a method that helps to identify and remove from processes everything that does not bring value to the customer. The method is based on an accurate analysis of the processes and cutting out non-value-producing work in order to make the processes flow as efficiently as possible. Value stream description consists of four main steps: drawing up a value stream diagram, analyzing the current state, determining the target state and planning development activities. Value stream mapping helps companies achieve cost savings, improve quality management and shorten delivery times, which leads to better customer satisfaction and competitiveness (7).

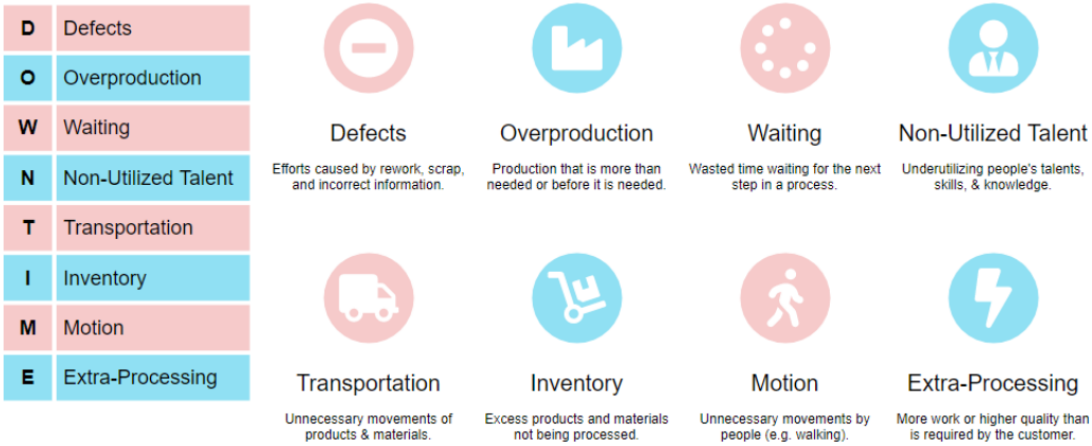


Figure 10 Visual Representation Illustrating 8 Wastes of VSM (9).

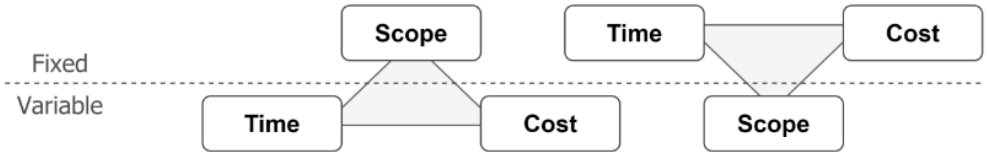
4.4 Combining Agile-Lean

The principles of agile development and Lean thinking can be combined in several ways. First, thanks to the short development cycles of agile development, production can be optimized and accelerated. Secondly, the value stream description of Lean thinking helps to detect development bottlenecks and focus on what is essential. Third, agile development practices such as continuous integration and testing help avoid waste and ensure quality. Finally, following the principles of Lean thinking helps keep teams motivated and focused on a common goal (7).

4.5 Agile-Lean vs Waterfall

There is a fundamental difference in philosophy and practice between Agile-Lean thinking and the waterfall model. The agile approach emphasizes flexibility, collaboration and rapid value creation, while the waterfall model focuses on precise planning and predictability. The approach in accordance with Agile-Lean thinking emphasizes flexibility, iterativeness and close cooperation with the customer. The goal is to develop value for the customer as quickly and cost-effectively as possible. The waterfall model, on the other hand, is based on a linear and predictable process, where each step is completed before moving on to the next (7).

Table 3 Waterfall vs Agile: A Comparative Visualization of Different Aspects

	Waterfall	Agile
		
Focus	On processes	On people
Management	By plans	By changes
Development style	Waterfall / Long iterations	Incremental, iterative, short iterations
Requirements	Planned at the beginning	Updated before every iteration
Customer involved	At the beginning and the end	All the time
Feedback	Minimal	Frequent
Social aspects	Plan and control	Trust, responsibility, motivation
Team organization	Hierarchical	Self-organized teams
Leadership	Directing	Coaching
Change management	Minimization of changes	Accept and adapt to changes
Documentation	Exhaustive	Just enough
Communication	Mainly written	Mainly personal
Product delivery	As a whole at the end	Frequent, but partial

5 Analysis and Proposal Building

This part presents an analysis and proposal to improve BTS planning processes and organizational structure in the case company according to the theme of Agile-Lean. The proposal is based on the analysis of the current situation, the literature and the information collected from both interviews (Data 1&2).

The research questions focus on the organization's transition to a self-directed team organization in accordance with Agile-Lean. The goal was to get answers from team members through meetings, which consists of three subject areas: changing Agile-Lean work and management methods, adaptation and commitment of team members, and developing an agile lean management model. There are also completely open answers to some of the questions, so that the respondents are not led too far and get a deeper understanding of the subject under investigation. The work includes an overview of the structure of the proposal, corresponding proposals and a summary of the process.

5.1 Analysis and Overview of Proposal Building

The aim of this thesis is to create new proposal to improve the BTS planning framework and related process development methods in the target organization. It was taken into account that the improvement of these methods was already planned by creating the new roll of planning manager.

To improve the BTS planning framework and process development methods in the target organization, several steps were undertaken. First, the current BTS planning practices in the case study company were analyzed to understand the existing methods and their status. These observations helped identify crucial areas for improvement, followed by a literature search for best practices to use in enhancing the process. Then, the Data 2 phase involved interviewing relevant production managers and planners to formulate a proposal.

The proposal had two main objectives: eliminating VSM wastes in the organization's practices and optimizing team performance management based on customized Scrum methods. The team used findings and new information from the Data 1 phase to review and discuss these issues with relevant production managers and team members during the Data 2 phase.

The initial step to analyze and eliminate process waste was identifying the value streams of the planning process. This was achieved through discussions and meetings with production managers and planners. Key insights collected from these interviews to identify the value streams are listed below as Q&A (Data 2).

1- How are customer needs and requirements identified and understood?
Primarily through contracts with customers, which specify planning and implementation order details, life span, and quality guarantee SLAs.

2- What resources, tools, and technologies are used in various planning and implementation stages?
Project and operator-dependent; some use conventional Excel methods, while others use automated data monitoring platforms. However, all work orders are created in the company's internal ticketing system.

3- How effectively are schedules, resources, and costs managed?
Efficiency varies by project, but planning teams often struggle to follow schedules due to multiple obstacles.

4- How is quality assurance and testing performed during the project?
Some templates exist for self-checks, but they are not consistently used and do not guarantee plan quality.

5- Is the process systematic and comprehensive?
The planning process has numerous deficiencies, making framework renewal essential for the organization.

6- Is there a process for continuous improvement?
Monthly meetings are held to update planners on new guidelines.

7- How do installers and planners communicate with each other?
Communication between installers and planners is mostly informal and individual, with no formal feedback communication channels.

8- In summary, what would you determine as measures that verify the success of the planning framework and process?
Time-Quality-Cost

Based on the discussions, it is evident that the organization's targeted value streams are traditional, often referred to as the Iron Triangle. However, follow-up discussions with planners and production managers were conducted to highlight the more efficient value stream aspects (Value-Quality-Speed) of Agile-Lean methodologies, which are widely adopted by modern organizations. To emphasize these Agile-Lean value streams, a comparison is presented as follows:

-Value: In Agile-Lean, value is the primary goal, and producing it for the customer is at the center of all actions. In the iron triangle, creating value for the customer can be seen as part of the quality and cost aspects, but is not necessarily a factor that is emphasized directly.

-Quality: Both approaches emphasize the importance of quality, but their approach is different. In the iron triangle, quality is one of the three factors to be balanced, and it can be compromised if the schedule or costs require it. In Agile-Lean, quality is built into every iteration and process, and it strives to ensure continuous improvement of quality.

-Speed: In Agile-Lean, speed is a key factor, and it is related to the ability to react to changes quickly and flexibly. In the iron triangle, the corresponding factor is time, which focuses on the project schedule and its compliance. The speed of

Agile-Lean makes it possible to generate value for customers faster and more agilely in changing conditions.

In summary, the value, quality, and speed of Agile-Lean value streams stand in contrast to the traditional aspects of the Iron Triangle. Agile-Lean stresses the significance of producing value for the customer, constantly improving quality, and rapidly responding to changes. Conversely, the Iron Triangle concentrates on balancing schedule, quality, and costs, which can result in differing priorities within a project. It was decided that value, quality, and speed would be the primary value streams to focus on while developing the new proposal.

5.2 New Framework Proposal

This section outlines the proposed and implemented changes aimed at improving specific process areas identified in the CSA section (3.3). These changes were developed based on the insights gathered from Data 1 and Data 2, as well as an understanding of the theoretical framework.

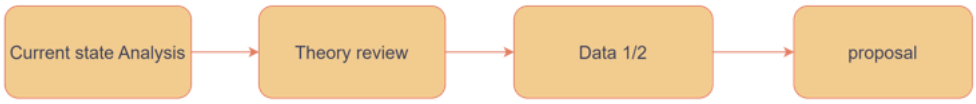


Figure 11 Rationale for Developing the Proposal.

5.2.1 Organization Structure Change

The current organization structure followed the typical hierarchical style in which Team members often specialize in specific products and projects, which can reduce flexibility. Communication among team members tends to be inadequate, and there is a lack of continuous feedback between planners and the field. Work managers are often too preoccupied to focus on continuous improvement. As a result, it became crucial to introduce a new role overseeing the planning department and emphasizing agility.

For continuous improvement, the planning manager assumes the role of the Scrum Master, while the work manager serves as the Product Owner. The business owner works closely with the team manager. The Scrum methodology addresses many of the issues mentioned above.

On the other hand, the most significant wastes in the team structure, as identified by the Value Stream Mapping (VSM) analysis, are:

1- None utilized talent, each planner's area of expertise is limited to specific products and operators, which restricts the full utilization of their skills and knowledge.
2- Extra production, Work is frequently done beyond the contract scope, leading to unnecessary tasks and wasted resources.
3- Extra processing, Plans are often revised multiple times, once during the licensing process and again after obtaining the necessary permissions, resulting in redundant work and inefficiencies.

To address the above mentioned challenges and incorporate the principles of Agile (Scrum) and Lean (VSM), the organizational structure was modified as shown in Figure 12.

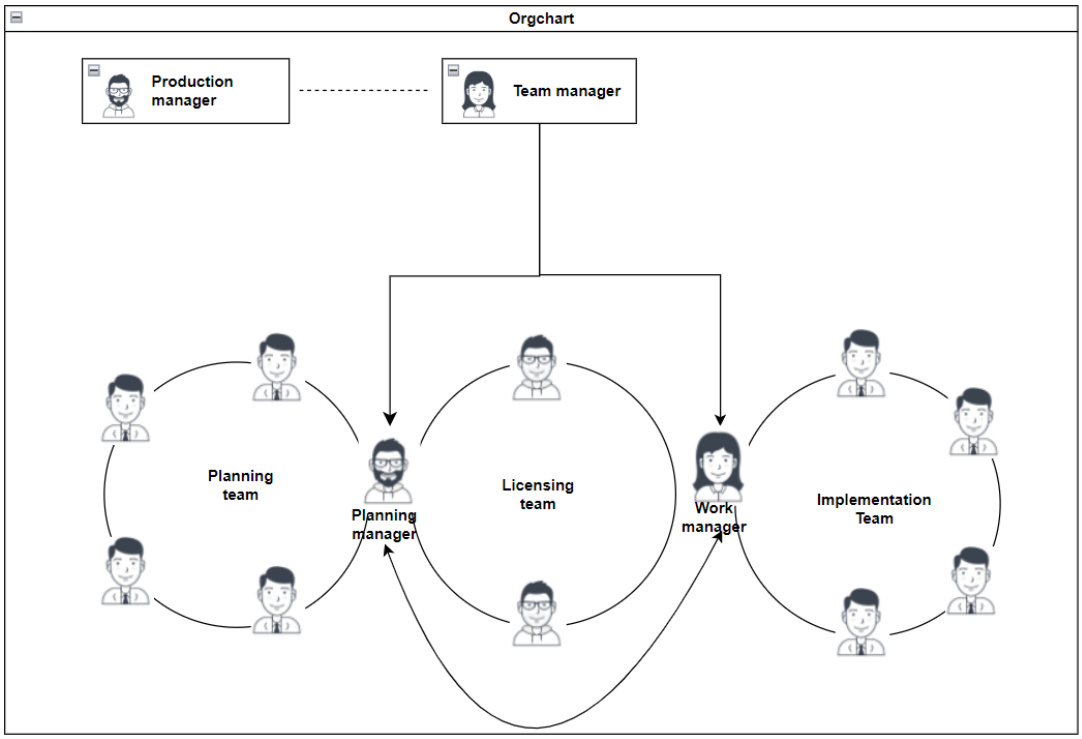


Figure 12 New Organization Structure.

In this updated organizational structure, the principles of Scrum have been taken into account. Daily stand-up meetings may not be feasible; however, a few status update meetings are held weekly, along with a sprint meeting every two weeks. Additionally, a monthly meeting for all planners is conducted to exchange expertise. Planners no longer specialize in just one project; instead, multiple training sessions are held to enhance and broaden their skill sets, enabling them to cover various product providers, operators, and technical solutions.

5.2.2 New Framework for Work Order Handling

In this section, the framework is examined in detail, referencing Value Stream Mapping (VSM) to identify the main areas of waste. By considering the new organizational structure and Agile methodologies, a revised framework featuring detailed processes and practices is proposed to address these inefficiencies.

First of all, some of the VSM wastes within the broader process are identified (Figure 3). These wastes are categorized as follows:

1- Waiting: Delays often occur when accessing work orders from the operator's systems and transferring them to the organization's own systems. This is primarily due to the service team's response time, which often exceeds the agreed-upon timeframe. Additional delays arise until the work manager notices the work orders, assigns them to a planner, and processes the invoices.
2- Extra processing: Work orders are forwarded to each planner without considering the details or the planner's expertise.
3- Defects: There is a lack of systematic checks for plans and material lists.
4- Inventory: A high defect rate in material lists leads to excessive inventory budgets and unnecessary material ordering.

To address these challenges and incorporate the principles of Agile (Scrum) and Lean (VSM), the general framework has been modified as shown in Figure 13.

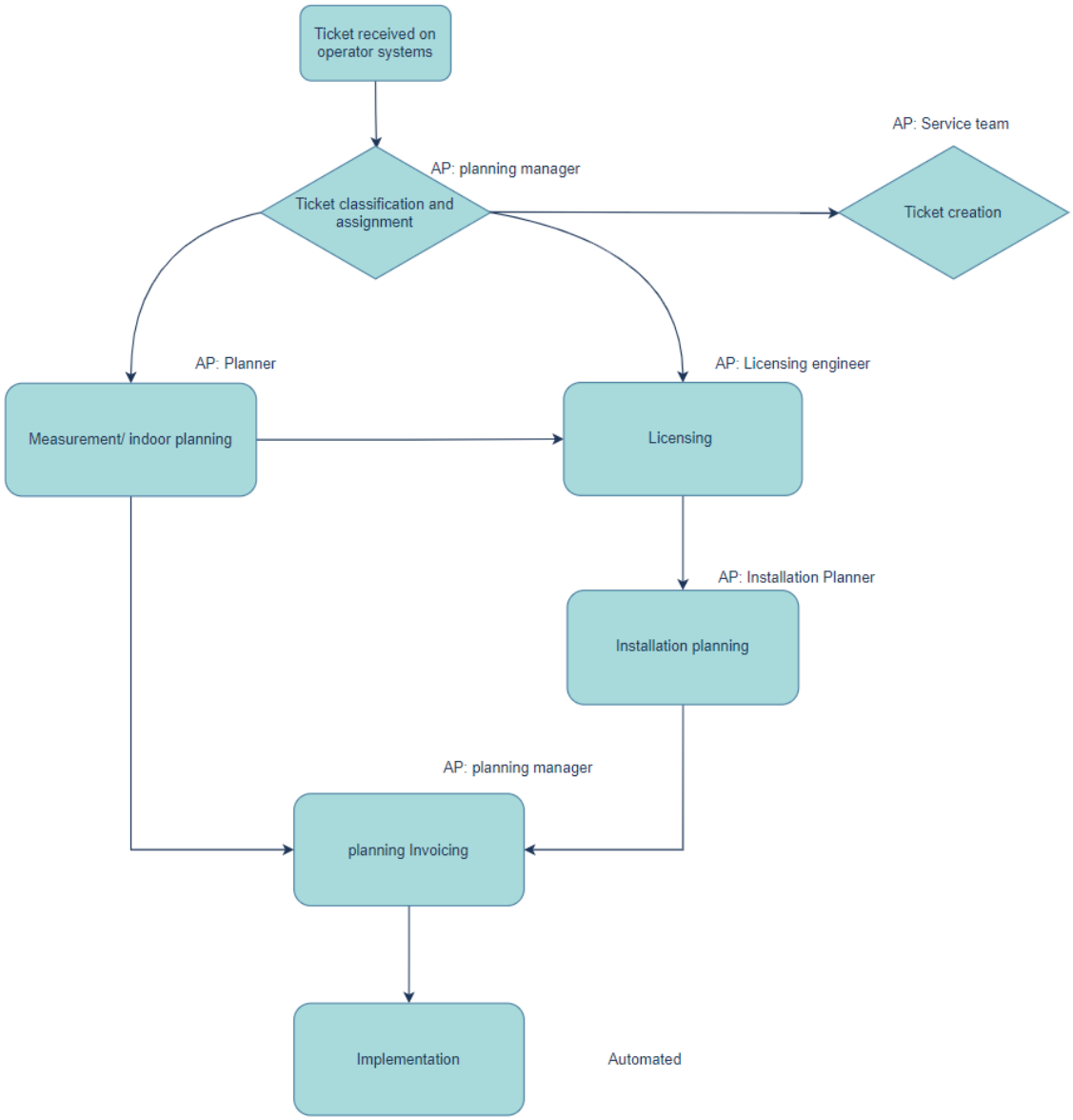


Figure 13 General Framework Proposal.

In the new proposal, a new role for licensing has been created, and all planning, measurement, and invoicing have been integrated into a single framework. Work managers then use the output for implementation. Additionally, the invoicing of planning work orders has been automated to minimize delays and ensure efficiency.

Going deeper into each work order (WO) type's processes and practices, potential VSM waste and opportunities for workflow refinement can be identified. The main planning processes, as agreed upon with the customer, are divided into

two distinct stages: the first stage involves licensing the changes, and the second stage focuses on the actual planning.

First stage: BTS change licensing

In order to gain better control over delays and expenses, the BTS changes were given their own process, including invoicing, following discussions with the customer. The flowchart below illustrates the new practices for this stage.

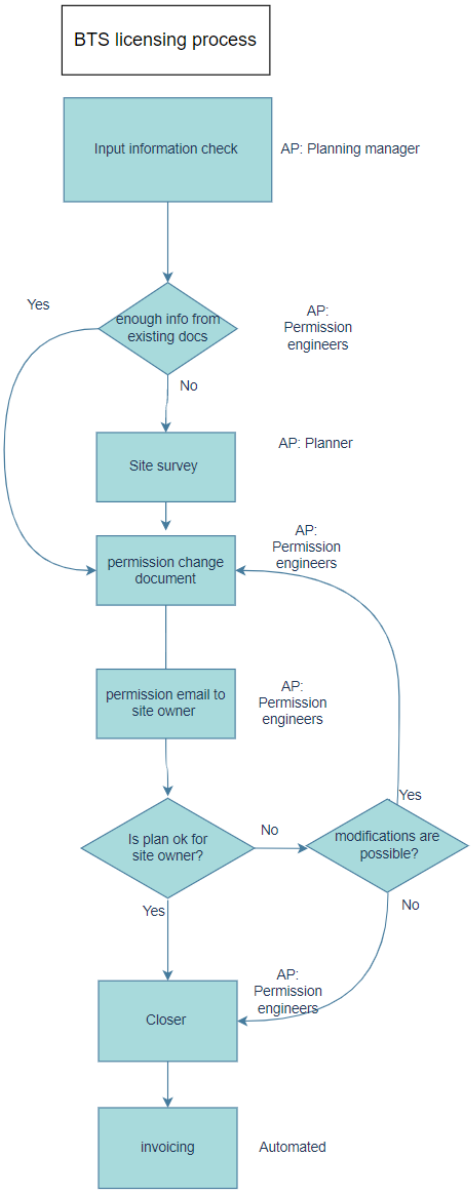


Figure 14 BTS Change Licensing Process.

The second crucial stage following BTS change licensing is the actual planning of BTS changes. According to the new process, a separate WO is submitted by the customer for this purpose. The new process is illustrated below.

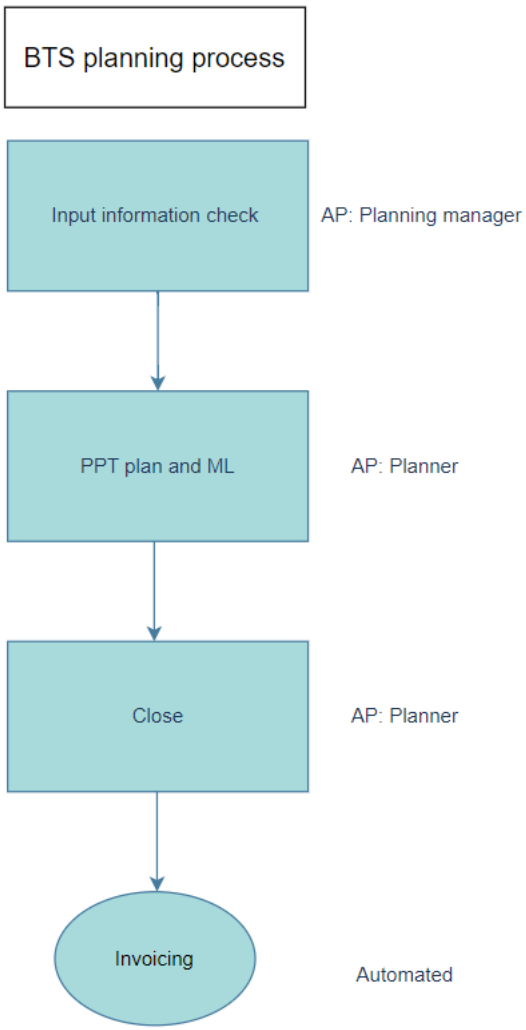


Figure 15 BTS Planning New Process.

The third work order type is indoor measurement and planning. In this section, one combines both measurement and planning into a single flow chart to simplify and provide an overview of the changes. In the new process, the floor plan is obtained at the time of receiving the WO, which significantly speeds up the process. The indoor solution planning follows the same steps as BTS licensing and planning. The new process is illustrated below.

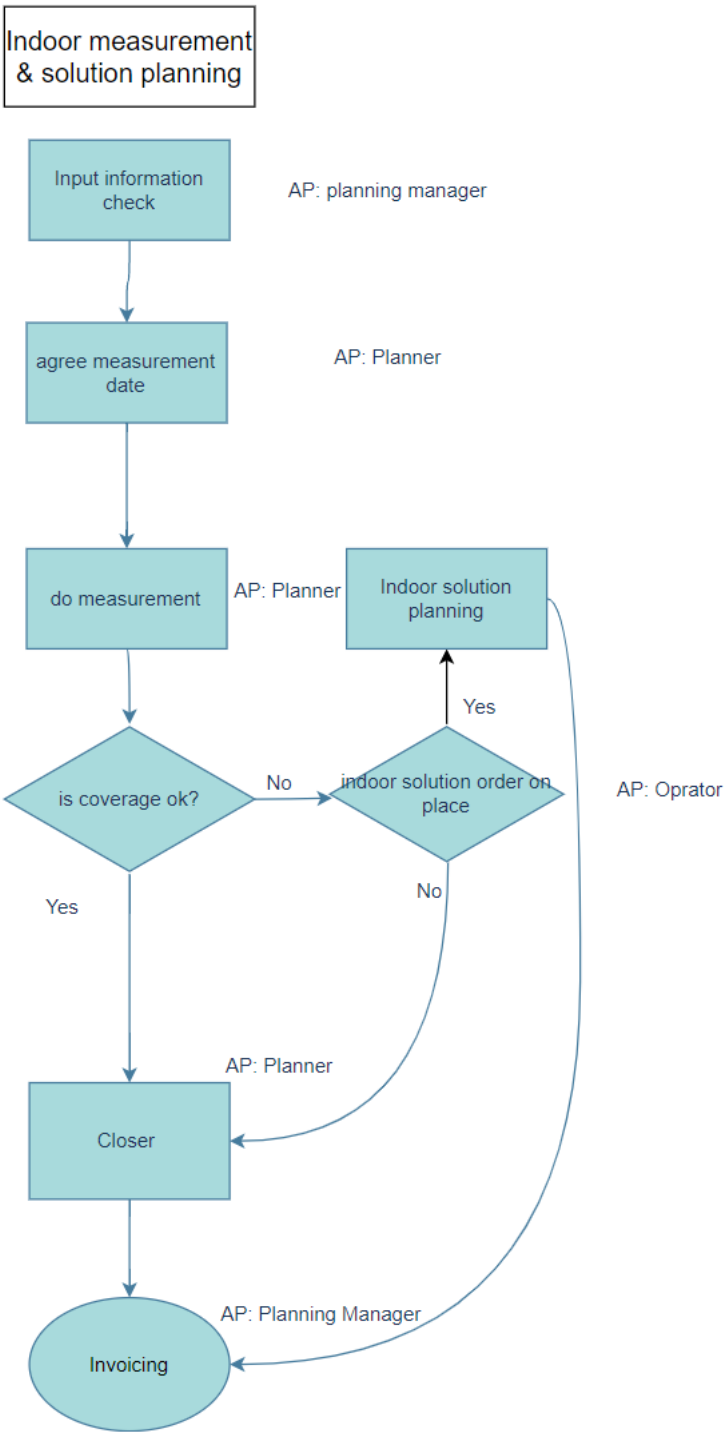


Figure 16 Indoor Measurement & Solution Planning.

The final type of the work order handled by the planning team is renovation planning, which involves planned equipment shifts, demolitions, or installations in buildings or towers undergoing renovations. The difference between normal BTS planning and renovation planning is that licensing occurs after the plan, and invoicing takes place after the implementation of the planned changes. To

simplify the process, it is combined with normal BTS planning. Additionally, the initial communication with the renovation subcontractor occurs as soon as the work order is raised by the operator. This saves time and eliminates the risk of dismantling equipment before the planner begins working on the plan. The new process is illustrated below.

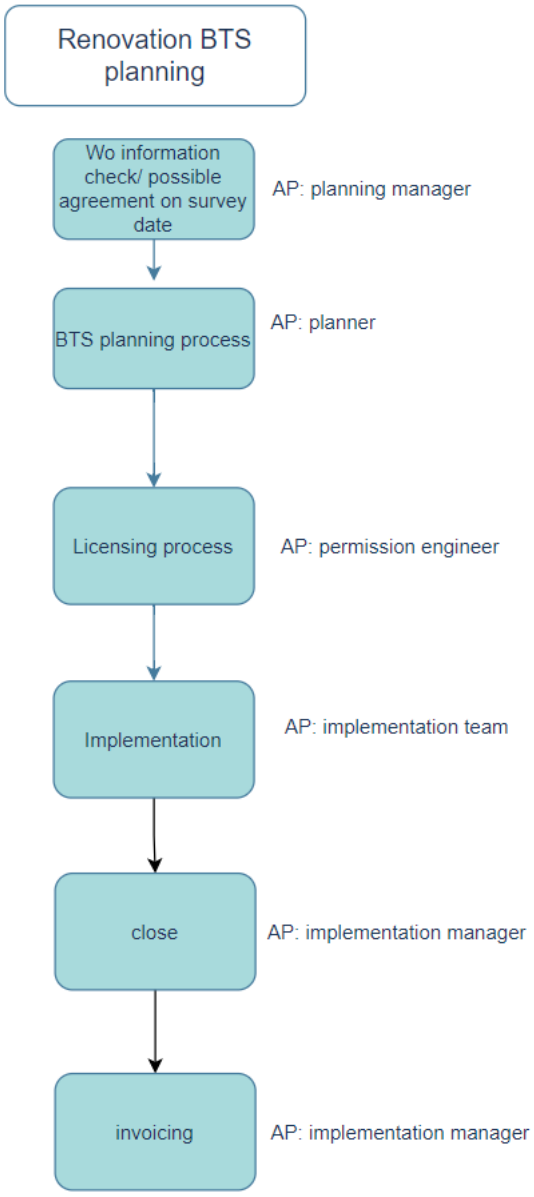


Figure 17 Renovation BTS Planning.

5.2.3 Quality Check Process Creation

The third targeted area for improvement is the quality aspect, which directly or indirectly affects the cost and lead time of the implementation stage. Several wastes have been identified according to VSM:

1- Defects: Previously, a systematic quality check of the completed plans did not exist, leading to significant quality issues.
2- Wait: The main direct waste caused by a lack of quality is delay, for implementation and replanning.
3- Inventory: Due to the lack of quality checks, essential materials were sometimes missed.
4- Extra processing: When a plan has defects, it requires the involvement of multiple parties, such as the planner, planning manager, implementation manager, and sometimes the operator.

These issues have been addressed by creating a new framework dedicated to quality assurance within the team. This framework benefits from the flexibility of Agile (Scrum), with customized sprint meetings every two weeks and two stand-up meetings with individual engineers. These meetings emphasize the importance of continuous improvement and systematic quality checks. A 100% automated self-check is integrated into the acknowledgment system, and 20% of the entire planning mass is reviewed by planning manager.

Additionally, a monthly quality meeting has been added, with the attendance of work managers to exchange expertise and feedback. The Figure 18 below illustrates the main details of the new process.

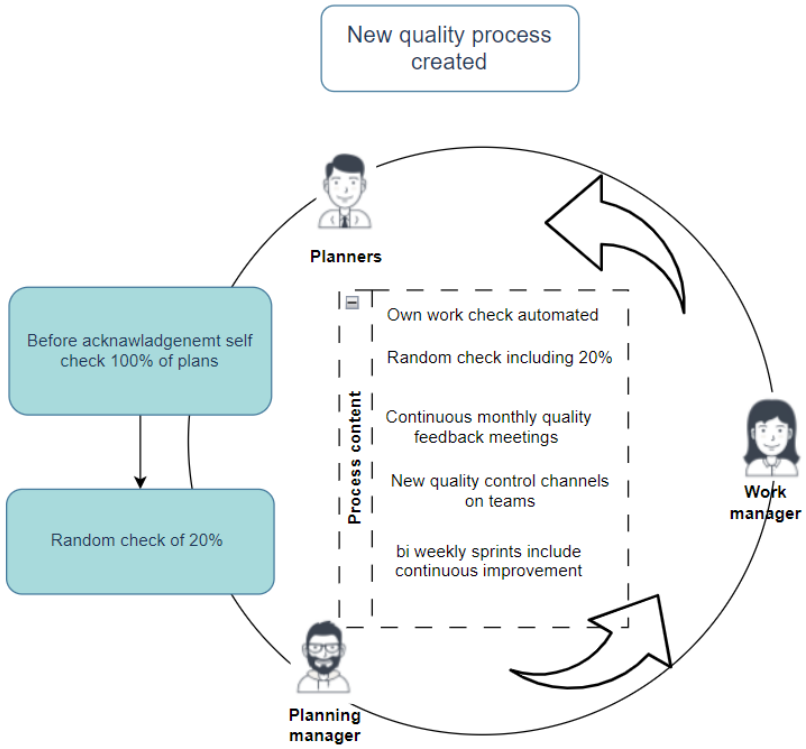


Figure 18 Quality Process Visualization.

6 Discussions and Conclusions

This section aims to assess the previous framework proposal through the lens of the Agile-Lean methodology, with a focus on the value streams identified in the introduction, namely value, quality, and speed. A summary of the validation will be presented, along with any recommendations for improvement. The Future section will provide possible insights into potential alternative approaches that could be tested in delivery projects

6.1 Validation of Proposal

In this part, a detailed assessment of how the three components of the improved framework proposal in Section 5.2 has succeeded to improve the three value streams (Value, speed, Quality) through the lens of agile-lean. This assessment was carried out among informal discussions and some statistics from case study company (Data3).

1. Value

Under this value stream “the added value that the organization produces for its customers” was taken as a meter, to check how new framework proposals met the purpose through the lens of agile-lean. The results are presented
in the below table.

Table 4 Evaluation of New Framework's Enhanced Impact on Customer Value.

Criteria	Before Implementation	After Implementation	Impact of VSM & Scrum
Customer Satisfaction	Longer delays and scattered response of customers' work orders, less understanding of customer requirements	Increased speed and responsiveness of customer work orders with a SOP for the licensing process	VSM: Improved information flow; Scrum: Regular meetings, transparency
Value-added deliveries	Nonstandard licensing email templates, leading to more questions from site owners and challenging requirements	Ongoing enhancements to valuable licensing document templates and plans	VSM: Identifying and eliminating waste; Scrum: Regular reviews and adjustments

Alignment with Customer Needs	Each planner working independently	Improved alignment with customer goals	VSM: Enhanced teamwork and coordination; Scrum: Improved collaboration
Timely Delivery	Common delivery delays	Improved success rate of on-time delivery	VSM: Reduction in waste and lead time; Scrum: Faster iterations and adaptability
Cost-effectiveness	Higher rent rates for equipment space and stricter contract conditions	Lower renting rates for equipment space and greater value for the customer's investment	VSM: Optimized resource usage; Scrum: Efficient planning and prioritization

2. Quality

Under this value stream “The quality of given planning WO” was taken as a meter, to check how new framework proposals met the purpose through the lens of agile-lean. The results are presented among below table

Table 5 Evaluation of New Framework's Enhanced Impact on Quality.

Criteria	Before Implementation	After Implementation	Impact of VSM & Scrum
Defect Rate	High defect rate	Reduced defects and errors	VSM: Streamlined quality processes, fewer errors; Scrum: Faster iterations and adaptability
Quality Assurance Processes	No systematic quality check process	Consistent and reliable output	VSM: Systematic checks and monitoring; Scrum: Regular feedback and improvements
Re-work	High warranty work rate	Lower warranty work rate	VSM: Consistent processes and practices; Scrum: Shared understanding of quality criteria
Continuous Improvement	Limited knowledge sharing and improvement opportunities	Encouragement of continuous improvement initiatives	VSM: Ability to respond to changes; Scrum: Agile approach to change management
Team Expertise	Specific expertise tied to individual team members	Broadly knowledgeable team members, team empowerment for	VSM: Elimination of unused talent resources; Scrum: Shared understanding of project goals and knowledge

		decision-making and improvements	

3. Speed

Under this value stream “The Lead time of accomplishing WOs” was taken as a meter, to check how new framework proposals met the purpose through the lens of Agile-Lean. Statistics about time improvement was looked from internal systems in favour of evaluating the effect of VSM and scrum on speed. The improvements are shown in percent so the accumulated lead times of different stages for different wo types are measurable.

The accumulated lead times stages are shown below:

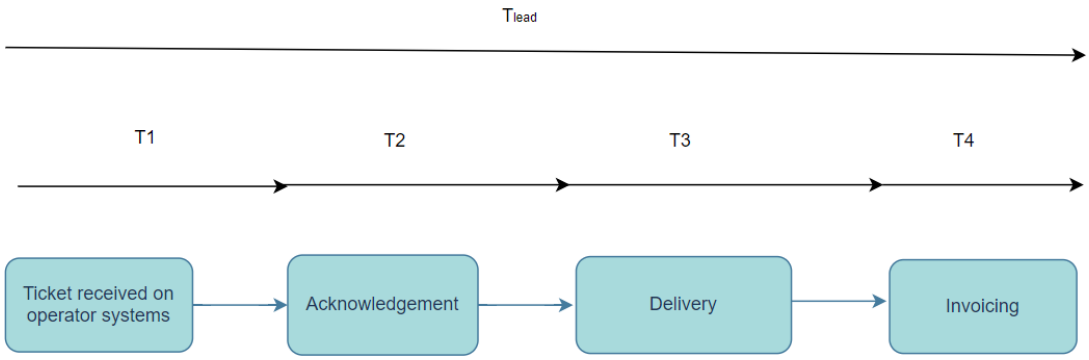


Figure 19: Work Order Life Span and Associated Lead Time Stages

The percentage improvement results are presented in the below table.

Table 6 Lead Time Improvements

Criteria	**Improvement percentage %**
Average Lead Time (T_{lead})	40%
Acknowledgement Time (T1)	50%
Time in Queue (T2)	20%
Time in Progress (T3)	15%
Invoicing Waiting Time (T4)	80%

The impact of agile lean methods on reducing the average lead time for each phase were following:

- VSM: Identifying process bottlenecks and bottlenecks and creating new roles allow streamlining the team's workflow, which helps to map the process and detect unnecessary transfers.
- Scrum: An iterative approach to set plans and an emphasis on task prioritization, supporting continuous improvement, transparency, and iterative progress.

Although the adoption of VSM and Scrum provided evident benefits when customized for delivery projects, it is important to recognize that not all aspects of these methods are applicable in every situation. Thus, the implementation of these methodologies within traditional delivery projects should take into account the unique characteristics and specific requirements of each project.

One of the major challenges in the case study concerning the adaptation of Scrum is the fact that the team engages in group work rather than teamwork (each planner independently works towards a shared goal and does not necessarily rely on other planners). Furthermore, another significant challenge in adopting VSM is that not all waste types are relevant in delivery projects. As a result, only some suitable wastes were considered, rather than all eight wastes.

6.2 Summary

As a summary, this thesis shows how Agile-Lean's Scrum and Value Stream Mapping (VSM) approaches can be customized to delivery projects and what kind of benefits can be obtained from them. Scrum and VSM offer many benefits such as better collaboration, flexibility, efficiency and quality. These methods can be used to identify and eliminate waste, prioritize tasks and resources, and continuously improve processes. In addition, these methods help organizations react quickly to customer needs, which is central to maintain competitiveness in today's fast-paced business environment.

However, it is important to note that Scrum and VSM do not solve all project-related challenges. Examples of challenges that these methods may not be able to solve are cultural changes, which may require more extensive change management and training. Therefore, it is important to invest in team training, open communication and continuous improvement in order to apply Scrum and VSM effectively in delivery projects and achieve the creation of customer value that is important for the success of the organization.

This thesis studied the suitability of Agile-Lean methods, such as Scrum and VSM, to delivery projects. Other useful methods such as Lean Six Sigma and Kanban can be used to complement these approaches depending on the organization's needs, culture and project nature. In future studies, it would be good to develop methods and tools to measure the efficiency and effectiveness of the application of Scrum and VSM in delivery projects, helping organizations to evaluate their real benefits and identify areas for improvement.

In the end, it is important that organizations critically evaluate their own processes and choose the most appropriate methods and tools to support their goals and resources. Scrum and VSM are powerful methods for improving delivery projects, but should be used in conjunction with other approaches to achieve the best results.

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