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Improving the invoicing process for a construction company

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<p>Abstract</p> <p>The purpose of this thesis was to improve a construction company's inner sales invoicing process. The aim was to map the current sales invoicing process by collecting the tacit knowledge of the employees and improve the sales invoicing process with the help of Lean methods. The target was to start a continuous development of the inner sales invoicing process.</p> <p>The theoretical study concentrated on comparing what methods to use for the development project. The fundamentals of knowledge, Lean, value, value stream and waste are examined. The empirical research was conducted by interviewing the key persons and collecting the tacit knowledge. The tacit knowledge was then communicated as explicit knowledge and kaizen sessions were held to form explicit knowledge and get a standardized map of the current invoicing process. The outcomes of the kaizen session were small and cost-effective improvements to the invoicing process.</p> <p>The material for this research was collected by the means of action research. The approach differs from other research methods since it is spiral in its nature. Each cycle in the research were gone through by plan, act, observe and revise plan until mutual understanding and development occurs. Process map was made based on interviews, following up old invoices and observing the process.</p> <p>The research produced a standardized inner sales invoicing process and means to continue to develop the invoicing process further. The results of this research helps the company to educate new employees about the inner sales invoicing process and gives keys for developing even other processes with Lean to sustain a competitive edge.</p>		
<p><u>Key words</u> Lean, tacit knowledge, explicit knowledge, kaizen, value stream management</p>		

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1 INTRODUCTION

This Master's thesis is a practical development project of a medium and small size construction company's inner sales invoicing process. The purpose of this thesis is to promote a continuous development of the inner sales invoicing process, in order to stay competitive in the increasingly tightening competitive markets.

The study is timely, because the increased prices of construction material has affected the margins of the construction companies. It is important for the construction companies to increase the efficiency of invoicing in order to stay profitable. Rakennuslehti (2021) wrote that the construction costs continued to rise in July and stated that monthly changes of timber averaged seven per cent in April to June, but in July the timber price went up by 21 per cent. According to the Statistics Finland the cost of all construction materials rose in July 2021 with nearly six per cent from the previous year. Rakennusalan suhdanneryhmä, which is a task group within Ministry of State Resources in Finland, has predicted that the construction will grow with zero to two per cent 2021 and the renovation construction will grow by nearly two per cent in 2021 and still grow further until two per cent in 2022. The strong growth in input price of the materials and task force will slow down by the end of year 2021. (Valtiovarainministeriö, 2021, p. 14.)

This news has been a wake-up call for the construction companies, on how to stay profitable and how to patch the reduced profits that has become a reality when the input cost has risen from the calculated profit. According to Lohilahti (2017) the productivity of construction works has stayed at the same level, which it was in the 1970's. There are several reasons behind this phenomenon, one of the reasons is that the cities grow, there are always somebody who is willing to pay. The growth has also been blocked because of the quarrels that are caused by multiply participants on a construction site, which is maintained by a traditional project model. There are no common goals between the different actors. The more people and different professionals there are at one site, the more encounters and more possibilities there are for loosing valuable working time and create misunderstandings. Lohilahti (2017)

points out that traditionally the construction company who makes the cheapest offer is chosen to build the construction.

The topicality and necessity of the research topic is also justified by the fact that many startups have risen in the industry. This creates a constant need for staying on top of the digitalization and for developing the people and processes.

Puhtaustiето (2016, p. 7) has interviewed leaders at Finland's biggest construction companies about what trends will arise in the construction fields in the near future. Juha Metsälä from Pohjola Rakennus Oy stated that the industry change will be dramatic, there are a lot of small startups constantly rising and around industry that are developing the industry forward. He thought that the new winners will soon come from the crowd of startups. At the same time digitalization is a huge opportunity for companies. Instead of a balance sheet, information and knowledge management is needed. The CEO of YIT Oy sees digitalization as a possibility to establish new mode of operations. The board member of Fira Oy Juhani Vanhala's opinion was that the biggest change in construction is the diversification as a result of digitalization.

Juhani Vanhala stated that in his view, the world is not in the future black and white, it is rather grey when considering the options of how to operate. There is no longer a single operating model, but everyone must choose for themselves what is the right model for them to pursue the desired kind of future. The old model was based on one success equation. There will be many of these equations for success in the future. In his opinion it is time to start thinking, what is our equation of success? (Puhtaustiето, 2016, p. 7.)

The target organization for this master's thesis is well-established in Satakunta area, but the tightening markets set pressure on the company, to develop its processes to gain competitive advantage. Since the input prices are set for all actors in the market and price competition is no longer an option, it is time to consider how the inner processes of the company are organized. Invoicing is an important support process for the company, it is a good place to start developing processes, and learning Lean principles. This thesis will give a certainty that everything will be invoiced, secure a

steady money flow and the inner sales invoicing process itself, will be more adjustable to future changes. The implementing of Lean will give the customers more value and differentiate the company from its competitors.

2 PURPOSE AND OBJECTIVE OF THE DEVELOPMENT WORK

The starting point for the thesis is a problem that has been acknowledged in the target organization and for, which the thesis process has been initiated. The research problem is related to the internal service production and the development work is targeted to the inner sales invoicing process of the company. The theoretical framework has been established in order to bring the theory and the research problem together. The aim of the research is to find answers to the set research objectives and produce development suggestions for the target organization.

2.1 Presentation of the target organization and need for the thesis

The target organization for the development work is Rakennus Jalonen Oy, which is a privately owned small and medium sized construction company established in 1983. The construction company is mainly focused on construction of industrial and business facilities. One other important focus area is maintenance of buildings. Target customers are the municipalities, public sector and organizations within Satakunta area. (Jalonen-yhtiöt www-pages 2021.) Rakennus Jalonen Oy has a revenue of 4,7million (2021) and 27 employees. The author has been working as an assistant in construction industry since 2008 and started 2017 working for Rakennus Jalonen Oy. The author is the main user in the current it-environment and is participating in the sales invoicing-process. The author will participate in both describing the process as well as in the development of the process. The digitalization was begun 2020 when the company started to receive e-invoices and the next step is to improve the inner sales invoicing process to become more efficient. The thesis is also needed because some of the employees involved in the inner sales invoicing process are soon retiring and the need to collect the tacit knowledge becomes important.

The focus in this thesis will be in improving the inner sales invoicing process (figure 1). Sales invoicing process covers all steps from sales order until customer payment.

This research will concentrate on the step that is framed in the figure 1, issuing an invoice, which is also referred to as inner sales invoicing process.

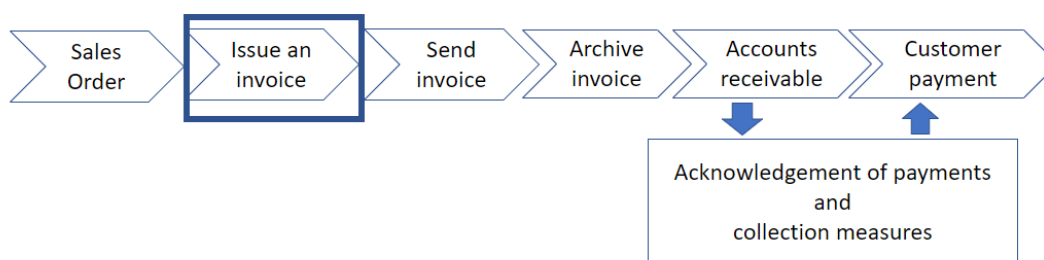


Figure 1. Sales invoicing process adopted from Lahti & Salminen (2014, p. 79)

The company has an established inner sales invoicing process that consists of collecting invoicing material from incoming invoices and hand filled timesheets from the employees. Each construction work has its own project number, which is used when referring to that job. The incoming purchasing invoices are rotated in an e-invoice program for getting the project numbers correct and approved for payment. The incoming invoices are invoices, where the seller has collected the purchases during a time span of two to four weeks. This leads to the fact that materials to several different construction works can be on the same invoice, which is then divided to the different projects. There are also materials in the warehouse, at the company's premise and sometimes a job is completed with using the stored material.

The lead time from when a construction job is done to a payment on the company's account depends on several variables. In fixed price construction works the lead time is shorter since there are less handlers before the sales invoice is sent out from the company. The invoices that are made by collecting manhours and materials from incoming invoices takes longer time to establish and several actors must be considered before the invoices are sent out.

The problem in the established inner sales invoicing process is that it lacks control over what have been invoiced, there is no standard on how the invoicing process is initiated to start. The persons collecting the data for the invoices cannot be sure that everything from the invoices has been collected and the supervisors cannot remember every item used for a particular project. Some of the materials can, in worst case

scenario, be left un-invoiced. The use of different programs, collecting data, various approvals and double work takes time, time that used more efficiently could lead to time and cost savings. The inner sales invoicing process itself is not written down anywhere, if someone in the invoice chain is on sick leave or retires there is no one who can do another person's work, which leaves the process highly vulnerable.

This master's thesis will concentrate on bringing visibility to the inner sales invoicing process, which gives a certainty that everything will be invoiced. When having a visible invoicing process, it is easier to detect possible bottlenecks and react to possible errors. By writing down the tacit knowledge about the inner sales invoicing process, will create a standpoint from, which it is possible to develop and make the process more adaptable to changes in the future.

2.2 Research objectives

This master's thesis is a practical development project, based on literature research and evaluations. The aim is to start a continuous development of the inner sales invoicing processes within the work community. This involves the development of the organization and thinking about the process from Lean perspective and using tools from Lean thinking.

A value stream map of the inner sales invoicing process will be conducted in order to measure the current state of the process. Value stream mapping is a tool that helps to see how the material and information should flow in order to achieve the goals that the organization has set as objectives. (Liker, 2020, p. 35.) The map of the value stream in the invoicing process will be made by interviewing and monitoring the people involved. As an outcome of the process the employees of the target company will get tools for continuously develop the inner sales invoicing process further, and a visible process where the bottlenecks and wastes are easily detected. At the end of this development project there will be a standardized written sales invoicing guide for all employees to follow.

The people involved in the inner sales invoicing process will together with the author search and find out the waste that are seen in the invoicing process. Waste is a central concept used in Lean ideology, to find and to minimize waste from the process. Mainly the waste is functional problems and bottlenecks that doesn't produce extra value for the customer. To ensure that the waste reductions produce value for the customer, the process will be measured before and after the improvements using time and money as indicators of effectiveness.

The objectives of this master's thesis are:

- map the current state of inner sales invoicing process
- improve the inner sales invoicing process using Lean approach
- measure processes' effectiveness using cost and time indicators before and after the development measures
- produce sales invoicing guidelines, of the current state, in written form

This master's thesis will only consider the existing inner sales invoicing process and available it-systems, it will not consider the different options of electronic timecard systems for employees. Tasks and matters related to the customer's activities for the development of the sales invoicing process are excluded from this thesis. Neither will the thesis consider the follow up of the different projects or the post calculation of different contracts.

2.3 Theoretical framework

Lean has been introduced to construction several times, as a savior to the low profits. In 1994 Rakennusteollisuus introduced Lean with focus on what brings the customer extra value, and this was executed by outsourcing everything (Rakennuslehti, 2017). The work planning and management have become more contract technology and it is no longer possible to gain by bargaining on acquisition prices. Effectiveness has diminished because everyone uses the same contractors as everybody else. Therefore, it is time to try to improve the profits from another perspective.

Because both sales invoicing and purchase invoicing processes are a back-office function, it is not always thought of as a tool for building competitive advantage. The sales invoicing is directly visible through the monetary flow into the company. By diminishing the time spent on invoicing shortens the time the financial and human capital is bound to a certain task. A more indirect impact of this thesis is that routine tasks will be automatic, which leads to more time available for the employees to develop their routines and work tasks forward.

The fundamental concepts of this master's thesis is mapping the current inner sales invoicing process by collecting tacit knowledge, standardizing the existing process and starting a continuous development of the process. Since there is no previous attempt on improving the sales invoicing process, the author has chosen to use Lean as a process improvement method in this thesis. The use of these key terms and the relation between them are shown in the theoretical framework, figure 2.

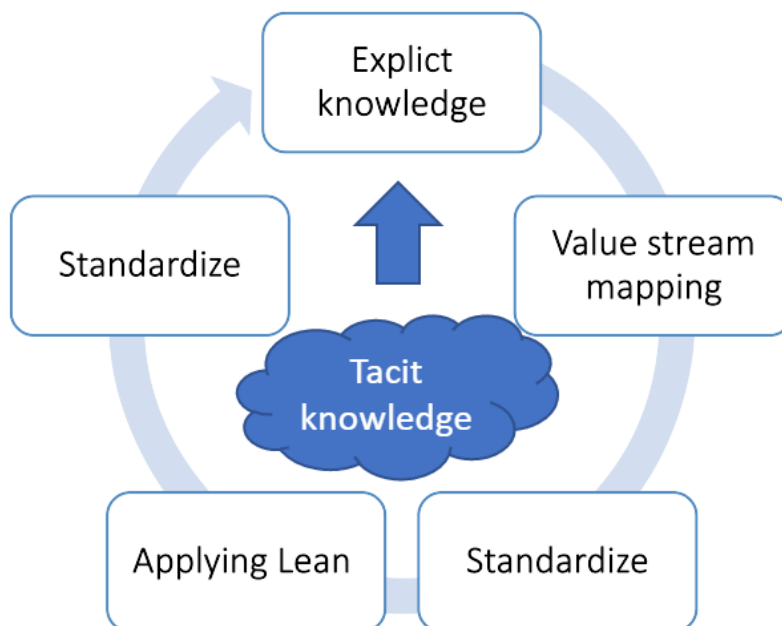


Figure 2. Improving the sales invoicing process.

In figure 2. the core for this research is based on tacit knowledge that persons within the sales invoicing process possess. This knowledge is collected and transferred as explicit knowledge to the others within the invoicing process. The knowledge of the

inner sales invoicing process will then be drawn into a value map. After value mapping the existing inner sales invoicing process, the first step will concentrate on standardizing the process, which is shown in the figure 2. According to Imai (2012, p. 54) standardizing means to do a task in a way that represent the easiest, best and safest way to do it. When the tasks are standardized, the process itself becomes less vulnerable for changes such as individual employees leaving the organization. Value stream mapping (VSM) means to collect the participants in the different tasks within same process to define the current process, where the team makes a visual plan on how things work today. After agreeing on the process, the group envisions future state and uses Lean tools in order to improve the existing process. (Locher, 2008, chapter 4. Assessing the Current state.) This process will then be continued so that the following cycle will improve the existing process and give a push to start a new development cycle as shown in figure 2

3 RESEARCH DESIGN

The Saunders Research onion is used as clarifying the research design in this master's thesis. Figure 3. Saunders Research onion.

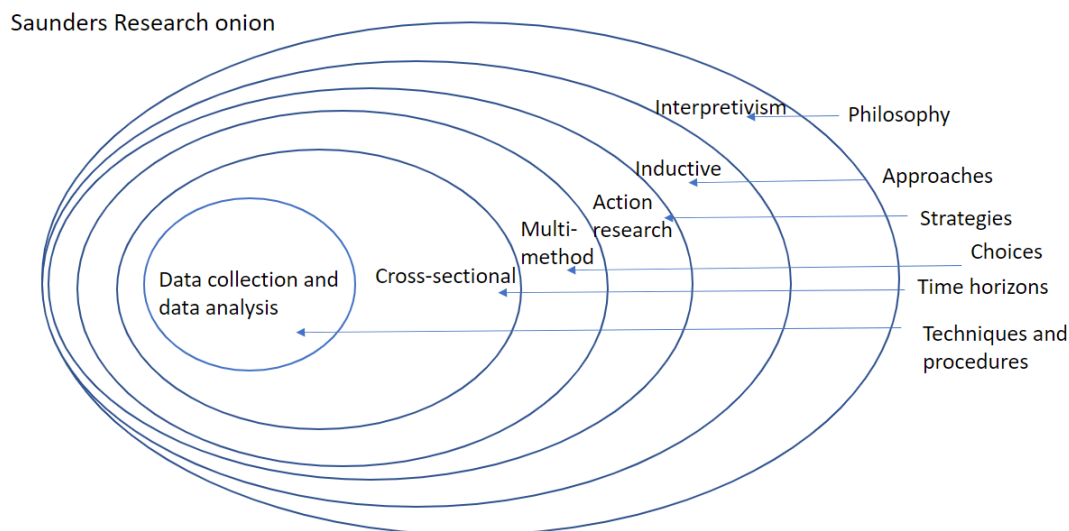


Figure 3. Saunders Research onion. Adopted from Saunders et al. (2007, p.130)

The onion was developed by Saunders et al. in 2007 in order to explain the different paths a researcher might take in order to approach the possible outcomes in a thesis. The onion is meant to be peeled one layer at the time starting from the outside, in order to explain how the researcher has approached the research. (Allassignmenthelp, 2017; Saunders et al., 2007, p. 101.)

3.1 Methodology

The outer layer of the research onion shows what beliefs are related to the reality that will be investigated (Kyrö, 2014). There are small differences between philosophical approaches, but a philosophy simply provides the justification for the research methodology.

This master's thesis is conducted with an interpretive view. This philosophy emphasizes the use of qualitative analysis upon the quantitative in order to get results. The interpretivist researcher is playing an important role in making sense of the collected data. This philosophy incorporates human view of the research study and recognizes the natural differences between people. (UK Dissertation Writers, 2019.) According to Saunders et al. (2007, p. 107) interpretive aspect is often seen as appropriate to use in case of business, since all businesses and situations are different.

In the second layer of the research onion the researcher must take a stand for what kind of approach will be taken whilst researching. Since the researched invoice system is unique, each organization has their own way of doing things, there is no information available in order to base the research upon. Therefore, the research will be conducted from an inductive point of view, starting with observation and description until analyzing the results. (UK Dissertation Writers, 2019.)

The third layer of the research onion tells how the researcher is going to collect the data for the research. This master's thesis will be conducted as action research. Action research is research that is involving the participants and the researcher and making them to collaborate on organizational problems in order to gain results. Action research requires a pragmatic touch of the researcher (Ojasalo et al., 2015, p. 37). Action research is process oriented and spiral, which is the difference compared to other research methods that are linear and structured in their nature. (Figure 4.) Spiral refers to the circular process of action research that is never ending, there is always room for improvement, it includes planning-> act and observe-> revise plan-> act and observe.

Action research

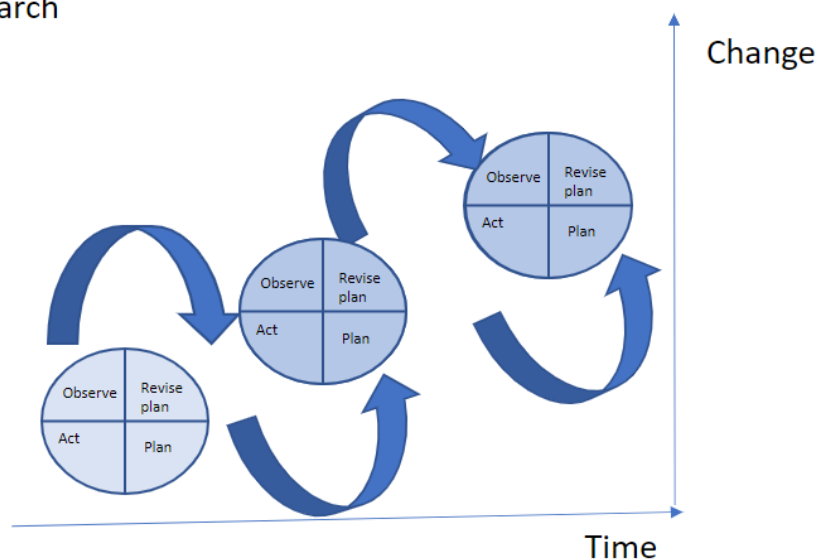


Figure 4. Action research adopted from Ojasalo et al. (2015 p. 60.)

Action research's goal is self-education at a rational and emotional level. The main advantage of Action Research Spiral model is the possibility to analyze the organizational problem deeper each time, which leads to better understanding of the problem. The outcome of the research is not only learning but also the practical use for the organization. (Rauch et al., 2014, p. 80; Research Methodology 2019.)

The involvement of the researcher is important since the researcher is the only one that can understand the logic of their own and in this way create interventions that are valuable for the system. In order to get results the researcher needs to be self-critical and self-reflective. Kurt Lewin, the father behind the idea of action research thought that only by participating in the process, the researcher can come up to results that are accepted by the group and therefore be effective for the change. (Rauch et al., 2014.)

The aim for this research is to create an organizational culture of constant improvement of the invoicing process. One of Lean tools is kaizen, which has the same features as action research PDCA-circle. Kaizen means continuous improvement; through small incremental changes and this method uses plan-do-check-act questions in order to get the employees to improve the standard process. The goal with PDCA and kaizen is to

develop the employees to think critically and learn to become problem solvers. (Fredendall et al., 2013, p. 77; Liker, 2020, p. 112.)

The fourth layer of the research onion is concerned with how the research is conducted. This master's thesis will be established by observing, reflecting, interviewing and co-operating with the peers in this respective invoicing chain, which are all qualitative methods. This means that the master thesis is conducted as a multi-method qualitative study (Saunders et al., 2007, p. 145).

The fifth layer of the onion is the timeframe of the study. As action research the evolving of the work environment will be going on further, but as a thesis it is necessary to conduct it as cross-sectional and just show at one point if the improvements have made a change for the better in the researched invoicing process (UK Dissertation Writers, 2019).

3.2 Data collection

In the core of the Saunders research onion is the techniques and procedures used for data collection and analysis. This layer should resonate with the other previous choices in order to get trustworthy results. (UK Dissertation Writers, 2019.)

Typical qualitative methods are theme, open, group interviews and participating observation. In qualitative methods it is typical for the researcher to be very close or even participate in the action. Interviewing is one of the most common ways of collecting data in both research and development work. The data for this research will be collected in the actual office where the sales invoicing process takes place. This will give more profound idea of the thoughts of the persons that are interviewed, since it is easier to explain and describe things when they are at sight. These interviews are called contextual interviews. There are different interview methods, depending on what information is needed for the research. The biggest differences in the interview methods are how strict the interviewer follows the question battery and how structured the questions are. This research is conducted by semi-structured interview where the interviewer has established questions but is able to change or leave out questions. This

method is usable in this case when there is no previous information about the tasks that the interviewee performs in the sales invoicing process. (Ojasalo et al., 2015, p. 105-116.) In interviews the most important thing is to be as focused as possible. The key questions are those that should be analyzed, and the rest are for keeping the conversation ongoing. There are three examples of interview analysis: explication of the data, thematic analysis and orderly approach. This research is conducted by comparing the interview scripts question by question in orderly approach. (Blaxter et al., 2010, p. 230-236.)

Another method used in this research is observation. By observing it is possible to gain knowledge about how people behave and what happens in the actual research environment. Observing is a suitable method when the research concentrates on developing processes. In this case the role of the observer is an active participant since the researcher takes part in the sales invoicing process and has come out with the development plans of the invoicing process for the participants in the invoicing process. The observation can be conducted as structured with plans on what to observe or as in this case as non-structured when there is a need to find as much and versatile information about the phenomena as possible. Observation brings the research a context and extension for the analysis being carried out. (Ojasalo et al., 2015, p. 105-116.) When observing the participants there is a risk that the author should be aware of. The author might filter the situation because the information in the everyday situation should be instantly decided on what to write down. The researchers that have spent time with the persons they will observe have higher probability to see and record data that is relevant to the research question than those researchers that are less familiar to the process. (May, 2002, p. 135.)

The secondary material of the study is the research diary that the author has filled in during the research and the authors personal observations and experiences of the case company. This tacit knowledge has been formed before the research has been initiated during the years working in the sales invoicing process. Information and observations accumulated during work as well as the understanding in this thesis is complementary, not primary. The experience gained during work is considered as a strength since it deepens the material interpretations made. The author will also use secondary data,

follow up old invoices and analyze documentary evidence, how and where they have been collected, in order to cross-check the outcomes of the interviews and to be sure that every step in the invoicing process will be documented and the results will be valid and reliable (Ojasalo et al., 2015, p. 43).

Second research objective, improving the invoicing process using Lean, will be a group effort, where the primary data will be collected as a kaizen event, which is a Lean tool and brainstorming session in order to improve the existing invoicing process. The author will collect the data by doing a blueprint and writing down the steps and changes made. The meaning of blueprint is to get a mutual understanding of the steps an invoice goes through before reaching the end customer. (Ojasalo et al., 2015, p. 44, 178.)

Lareau (2010, p. 122) suggests that during establishing the flowchart on a piece of paper, it is useful to include persons involved in the process and have them to review the process and have them to correct and pinpoint issues. It is also important to remember that the flow charts' task is to clarify the process for those who are not familiar with the process.

4 KNOWLEDGE

The primary target for a company is to make profit for its owners. The company should be able to maintain income and keep costs down. Further the company should differ from its competitors to succeed. An advantage can be combining the traditional assets to intangible assets as individual and organizational knowledge. This combination makes each company differ from each other and there are no company exactly like another. It is essential that companies start to look at knowledge as they look on raw materials or finances to find a competitive edge. (Virtanen & Helander, 2010, p. 1.)

Knowledge can be categorized into many types. But there are two broader types, which are explicit knowledge and tacit knowledge. Under these broader categories there are different structures of knowledge such as implicit knowledge, procedural knowledge, expert knowledge, just to mention a few. This chapter goes through the two main types of knowledge and at the end it is explained how this knowledge can be used to gain competitive advantage in an organization. (Staughton, 2022.)

4.1 Tacit and explicit knowledge

Tacit knowledge is knowledge that can't be expressed by data or symbols. Often tacit knowledge is forgotten or not recognized that it exists. A person knows for instance how to ride a bike. The person has at some point learned how to ride a bike, but can't explain how it exactly happens, it just comes intuitively to the person. (Staughton, 2022.)

The same phenomenon happens in organizations, tacit knowledge is the experience an employee has collected during the years working on a certain task. This experience is not easily transferred forward since it is not easy to write down. (Kleemola, 2005, p. 129.) Tacit knowledge is abstract, it can be expressed as behaviors, actions, habits, routines or responses. It is not possible to instruct a person to obtain tacit knowledge. Learning the work and gaining experience about a task is what raises the knowledge

quality. Ways of obtaining tacit knowledge is to simplify processes, going through experiences, test and fail, experiment and collect data during a research period. (Prabhakaran, 2021.) Tacit knowledge is the knowledge that, different people within the organization have collected about how to execute different work tasks. The sharing of this knowledge is necessary for gaining organizational knowledge. To get the experienced employee to share the tacit knowledge demands a situation where individuals need to interact face-to-face for understanding each other correctly. (Kleemola, 2005, p. 129.)

When the tacit knowledge is collected it is important that the persons involved in the invoicing process agrees on concepts used and can create explicit knowledge. Explicit knowledge means joint understanding of the tacit knowledge. (Kleemola, 2005, p. 129-132.) Explicit knowledge is a statement that can easily be stated as true or false. The knowledge can easily be transferred through words, numbers or symbols and it can be recorded or stored in physical/ electronical form. However as soon as the explicit knowledge is read or listened there is risk for misunderstandings depending on the receiver's prior knowledge. (Staughton, 2022.)

In a company's invoicing process, the explicit knowledge can for instance be the purchase invoices, everyone handling the purchase invoices can access them. The purchase invoices can be printed out as copies or shared on e-mail. The purchase invoices can be reviewed and the information on them can be processed.

4.2 Why and how should companies capture tacit knowledge?

Now the sales invoicing process is only as tacit knowledge in the organization. According to Kleemola (2005, p. 123) companies have not realized the value of the tacit knowledge. In other words, there is another possibility to build competitive advantage by collecting the tacit knowledge before the retiring employees leave the company. The benefit of collecting tacit knowledge is that it is possible to learn from other experiences. By collecting the tacit knowledge, the new employee will gain by not having to find the information by themselves, which saves time and effort. By documenting the findings, it is possible to see what works and what doesn't work,

which gives a direction for the future. Another benefit is that it helps communication between the parties. Many misunderstandings can be avoided when the information is visible and accessible to all participants. Human capital is the company's most important asset according to Prabhakaran (2021), to take into consideration each employee's experience is one of the best things a company can do. The employees have the firsthand knowledge of things, what works and what doesn't work in a particular situation.

The SECI model of knowledge (figure 5), is a model that has been made to explain how tacit and explicit knowledge is collected as organizational knowledge.

The SECI-model

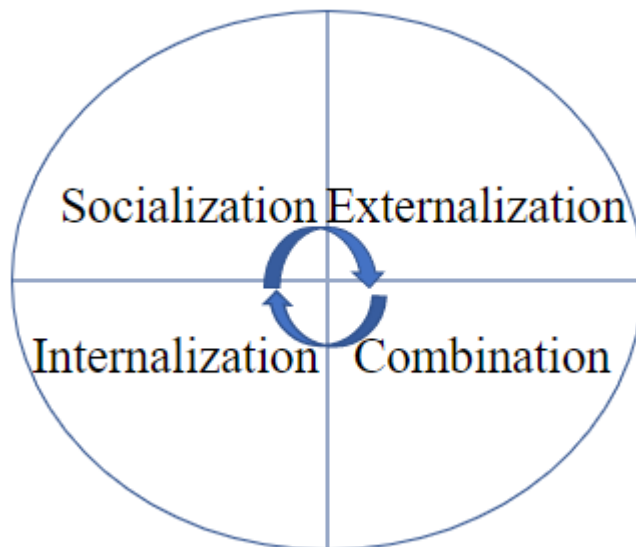


Figure. 5 The SECI -model of knowledge adopted from Nonaka & Takeuchi 1995, p. 284

The model recognizes four knowledge areas socialization, externalization, combination and internalization. Socialization is face-to-face sharing of tacit knowledge or through mutual experiences. Externalization is the phase between tacit and explicit knowledge, for example written documents is supporting this kind of action. Combination contains explicit knowledge that is gathered both from the inside and outside of the organization and then combined to form new knowledge. Internalization is when explicit knowledge becomes everyone's tacit knowledge and at the same time a collective knowledge in the organization. After the knowledge has

become an internal asset, the process continues at a new level in the spiral knowledge creation that is explained in the SECI model. (Nonaka & Takeuchi, 1995, p. 284.)

Capturing the tacit knowledge of how inner sales invoicing is done will give a competitive edge to the case company. By collecting the tacit knowledge of the employees gives a base on, which the development of the inner sales invoicing can be built and by using information from inside and outside the company refines and adds to the organizational knowledge. Tacit knowledge is the one thing that is irreplaceable in a company. Competitors can copy your business idea, strategies and tools but the human capital stays intact.

This chapter defined tacit and explicit knowledge and went through what benefits a company gains when collecting tacit knowledge. At the end the SECI-model was introduced as an aid to collect and refine the tacit knowledge.

5 PRINCIPLES OF LEAN

Lean methodology is commonly used to describe a philosophy, on how to continuously improve connected work processes. Lean is also used to get the people who work for the organization to improve themselves, and the way they work in order to provide greater value for the customer. (Liker, 2020, p. xx.) Toyota Production System (TPS) is the base for the widely practiced Lean methodology and most ideas and concepts originates from TPS. Toyota practices are not meant to be directly copied in order to be effective since they were developed for a certain situation in a certain time. It is better to learn and use the ideas in a way that best suits the situation, when trying to reach the goals as an organization. (Liker, 2020, p. xxx.) Lean is often misunderstood; it is a common mistake to think that the tools given by Lean are the problem solver but on the contrary the meaning of the tools is to bring out the problems.

This chapter goes through Lean principles and then Lean is examined from the aspect that is the main key areas for this study, customer value, waste and continuous improvement. The chapter moves on to examine another interpretation of Lean principles and explains the different aspects from that viewpoint. At the end the author goes through the points that are relevant for this study.

5.1 Lean philosophy

Everything that is done to achieve something in a company can be described as a process. There are a variety of ways to improve processes, Six Sigma, Agile Management, Re-engineering, Total Quality Management, just to mention a few. All the process improvements share many common features. They all share the thought that processes can always be improved and the closest worker to a process is able to improve it. The most common ones are Lean and Six Sigma according to Bradley (2012, p. 4).

The difference between Lean and Six Sigma is that the goal of Six Sigma aims to improve quality, reduce manufacturing errors, or reduce service and administrative

errors. Six Sigma is defined as an “application of scientific management methods, but it actually integrates many different creative, technical, and change management methods, tools, and techniques to improve business processes”. (Hayler & Nichols, 2007, p. 5.) Lean is a method of process improvement where the way to improve is to focus on the time spent performing the process from start to finish. Reducing lead time is one of the key goals. If lead time does not decrease, economic improvement is unlikely to be achieved. Lean concentrates on removing waste and analyzing the process profoundly. The processes are recreated around steps that add value and eliminating those that don't. (Gershon, n.d., p. 66.)

These two methods, Lean and Six Sigma, are the predominant for process improvement and can be implemented simultaneously. These two different approaches to process improvement can also be compared by comparing the tools used in both methodologies. Six Sigma is based on applying statistics to the processes in order to decide what is worth try to improve and test if the improvement solves the root cause. Statistics are collected from the process and statistical tools are used to analyze the findings. Whereas Lean is simple, intuitive and easily learned. (Bradley, 2012, p. 5.) It has also been said that Lean is easier to apply to services that is not complicated by nature (Mazzocato et al., 2016, p. 2). This is one argument to choose Lean before Six Sigma when choosing the process improving method. Another argument is that by applying Lean first results in a simpler process from, which it is easier to find quality errors to improve with Six Sigma (Bradley, 2012, p. 5).

Lean was created for manufacturing practices but recently it has been used for knowledge work and management. Lean encourages to continuously improve practices and respect people. (Do, 2016.) Liker (2020, p. 375-382) describes Lean by giving 14 management principles, divided in four categories. These categories are philosophy, process thinking, employees & partners and problem solving. This shows how holistic Lean can be implemented in an organization.

Lean philosophy:

1. Base management decisions on long-term philosophy.

Process thinking:

2. Create a continuous process flow to bring up problems.
3. Use traction systems to avoid overproduction.
4. Equalize workload.
5. Create a habit to stop and rethink when a problem occurs in order to retain quality.
6. Tasks that are standardized is the key to continuous improvement
7. Use such controls that it is possible to see with a glance if there is a problem.
8. Use only tested and reliable methods.

Employees and partners:

9. Develop leaders who fully understand the work, lives the Lean philosophy and teaches it to others
10. Develop exceptional people and teams that follow your company's philosophy
11. Respect your network of partners and suppliers by challenging them and helping them to improve.

Problem solving:

12. Go and see for yourself and understand the situation.
13. Make decisions first after carefully considering all options and then implement them directly.
14. Change your organization into a learning organization through continuous improvement.

By using Lean in basic management decisions means that the decisions are done with the long-term profitability in mind, despite possibility to short term profits. The Lean philosophy goes through the whole organization and works the whole organization towards a common goal that is not only to make money. The main idea of the organization is to build value for the customer, society, and the economy. (Liker, 2020, p. 377.)

Under the process thinking category, the focus is on finding waste and eliminating it. The basic thought is that it is possible to get right solutions with right process. Make

the flow visible in the organizational culture, the flow is the key to continuous improvement. There are several tools available to implement Lean in process thinking such as kaizen, Kanban, 5S and value stream mapping. (Liker, 2020, p. 378-379.)

At employee and partner level the emphasize is on respecting, challenging, and educating the employees. By constantly developing employees and bind the business partners, it is possible to increase the value of the company and get all to work for the benefit of the company. Fourth level concerning problem solving principles concentrates on constant improving and learning. The core of this level concentrates also on finding and understanding the root causes for problems. (Liker, 2020, p. 380-381.)

Another common way of describing Lean and its principles is developed by Womack & Jones (1991) in their book “The machine that changed the world”. Their five principles are considered as a way of improving the workplace efficiency. The principles are: 1. defining value, 2. mapping the value stream, 3. creating flow, 4. using a pull system and 5. pursuing perfection.

The first principle defining value means to understand what the customer is willing to pay for, sometimes the customer doesn't know what he/she want or are unable to tell what it is. In the second step it is crucial to use the customer need, as the point of reference and create a value stream from there, by identifying all steps that adds value to the customer. Activities that do not add value is considered as waste. The waste can be categorized as necessary but non-value and unnecessary non-value. By reducing and eliminating these waste steps it is possible to save time and costs. (Do, 2017.)

Third step is ensuring that the value stream flows without interruption or delays. Activities to ensure the flow, is to break down to steps and trying to re-organize the steps, organizing the workload and creating departments that include several functions. The flow can also be ensured by training the employees to be multi-skilled and flexible to changes. (Do, 2017.)

The fourth principle talks about establishing a pull. The biggest waste in a production system is inventory, therefore the goal of a pull-based system is to limit inventory and work in process. Pull-based systems are created based on the needs of a customer. By pursuing perfection in the fifth principle, means to create an organizational culture where the processes and actions are always aimed to give the best value for the customers. (Do, 2017.)

According to Bonaccorsi et al. (2011) moving from theory into practice might be demanding because of the need to change the organizational culture in a company. Even implementing Lean might be hard in a service field since the work itself in an office is highly variable. This collides with one of Lean main ideas of standardizing the work. By standardizing it is possible to measure performance. When there are no standards, it leads to variability in the service and in the tasks. Imai (2012, p. 55) claims that without standards there are no way to tell if the process has improved or not. Nevertheless, standardizing is the core for the improvement to take place. Unfortunately, most of the Lean tools have been used in technical purposes, which means that most ideas are aimed at doing things faster, instead of considering, what exactly needs to be done, in order to improve the service process. (Bonaccorsi et al., 2011, p. 428-429.)

From these two ways of describing Lean, Lean according to Liker is more focused on improving the production and organizational culture. Womack & Jones five principles are more general, which means that they are applicable to several different business fields. The difference between these two theories is value, Lean according to Liker focuses on removing waste and on cost reduction whereas Womack & Jones emphasizes to enhance value for the customers and removing nonvalue adding activities. (Hines et al., 2004, p. 994.) This master's thesis will use Womack & Jones (1991) five principles as guideline in order to improve the invoice system and change the organizational culture into continuous improvement of the invoicing process. The number of principles is easily communicated and learned by the employees who will use them. The principles are not always applicable in every aspect and therefore they should be used as viewpoints and ways of thinking instead of technics.

The theory of this thesis is linked to the research by using the Lean implementing model (figure 6).

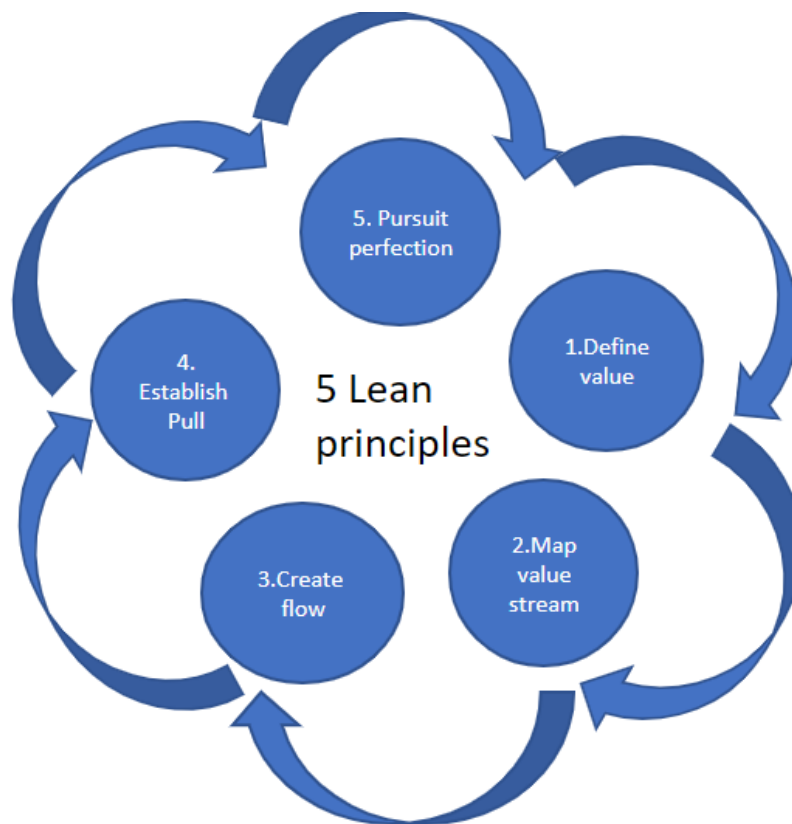


Figure 6. Five Lean principles adopted from Do, 2017

The research will be initiated by mapping the current situation. The defining of value (step 1.) is crucial before applying Lean techniques to the service. The value is found by understanding the customer, in this case the inner customer and knowing what steps in the process are valuable for the customer. First step included interviews with the employees who take part in the invoicing and creating the explicit knowledge of the existing invoicing process. When the value in the invoicing process is acknowledged, the value stream (step 2.) of the current invoicing process was mapped. In the second phase the interviews will be analyzed, and kaizen events will be held with the employees involved in the invoicing process. In the phase of creating the flow (step 3.) and establishing pull (step 4.) the potential improvements are acknowledged. In the third phase the success of the kaizen event is evaluated by comparing the old invoicing process to the improved invoicing process. According to the pursuing

perfection (step 5.) the value improvement is a never-ending process, which lead to continuous improvement.

5.2 Definition of customer value

In Lean thinking, the customer value should be the basic of a company's actions. Bohan & Jacques (2021) states that "There's just one goal for any Lean initiative: improving the value delivered to the customer."

The concept of value is defined by McNair et al. (2013, p. 2) as the recognized gains that the customer gets in return of price paid and the effort that the customer has made in order to get the product or service. Value is the time, money and energy that the customer has used throughout the whole value chain. All the business partners of an organization are involved in the customers final perception of value of the product or service.

Value can also be interpreted from a practical view as an opposite to waste. All that is not of value for the customer is non-valuable or waste. Activities in an organization are often classified as value-adding, non-value-adding or necessary non-value-adding. By reducing the non-value adding activities the organization can provide the customer more value-adding activities. (Vasisht, 2021.)

Lean is concentrating on mapping value flow through the whole organization and improve it all the way in order to transform the service to value that the customer procures. In this thesis the customer value is improved by reducing the non-value adding activities and constantly enhance the invoicing process performance.

5.3 Definition of waste

Waste in a process is non-value-added activity for the customer. In Lean it is referred to as eliminating Muda, which is a Japanese word for waste. The wasteful activities lengthen lead times, cause extra movement from one place to another, create extra

inventory, require double work because of errors or result in waiting. Waste can be people waiting for other people to complete a task, searching for something or processing the work. (Imai, 2012, p. xiv; Lareau, 2010, p. xv.) According to Lareau, (2010, p. 18) work-around waste is a common type of waste in office surroundings. Work-around means to use other means to accomplish a task instead of the given software.

Lean is a management system where the target is to get the workflow to be fluent. The three worst enemies of the flow are variation, overload and waste. The variation is the most critical factor since it is causing constraints to flow. In office the variation means for instance imbalance in different persons' skills, variation in workload different days or variation because of the way that, the organization has organized the work. (Torkkola, 2015, p. 25; Tuominen & Malberg, 2010, p. v.)

Overload is either equipment, system or human overload. Overloading the personnel leads to sick leaves and diminishes the ability to renew and learn new things. In expert work the human is crucial part of the work process. The wellbeing of the personnel is directly linked to development and flawlessness. (Torkkola, 2015, p. 25.) Tuominen & Malberg (2010) brings also out that the management needs to be committed to constant invest in the employees and to promote the development in order to succeed with Lean approach. Everyone in the team should have basic knowledge of Lean and should be familiar with the ten wastes of service (Table.1).

Table 1. Ten wastes of service industry. (Bonaccorsi et al., 2011)

1. Defects	data entry errors, lost files, lost or damaged goods
2. Duplication	data re-entering, multiple signatures, unnecessary reporting, multiple queries
3. Incorrect inventory	stock out, waiting time finding what was needed, unnecessary copies
4. Lack of customer's focus	unfriendliness, rudeness, poor attention to the customer
5. Overproduction	reports no one will ever read, processing paperwork before time
6. Unclear communication	incorrect information, lack of standard data format, unclear work flow
7. Motion/transportation	poor layout, ineffective filing, poor ergonomic
8. Underutilized employees	inadequate tools, excessive bureaucracy, limited authority
9. Variation	lack of procedures, lack of standard formats, standard time not defined
10. Waiting/delay	waiting for approvals, downtime, waiting for supplies

Continuous improvement is the goal of Lean. If the management of an organization is not familiar with the Lean techniques used, it is hard to sustain the improvement process. Lean strives to continuously improve every process in the organization by enhancing the activities that give value to the customer and removing those activities that are seen as waste. (Do, 2017.)

The different inefficient activities in an organization can possibly be categorized in several types of waste, but the important point is that an employee recognizes a waste. Therefore, the main task is to identify the waste and find a way to eliminate the activity from the process.

5.4 Kaizen as an improvement method

Kaizen brings perspective of continuity to development thinking. This contrasts with detached projects. Kaizen, continuous improvement, is seen as the heart of the Lean ideology. (Mazzocato et al., 2016, p. 2.)

Kaizen is a strategy within Lean that develops employees to problem solvers and the strategy is a commonsense low-cost approach to improve a workplace. Kaizen is a word that consists of two parts, Kai, which means small, and Zen means good. This philosophy aims at small improvements rather than innovation and big changes. Kaizen starts with three rules: housekeeping, Muda elimination and standardization. The first rule, housekeeping is basis for learning the employee's self-discipline. The second rule; in office surroundings Muda is information and services that a customer is not willing to pay for. The third rule of kaizen is standardization of the tasks. Standardization means that it is defined as the best way to do a job. Work done under kaizen is small low-cost improvements done to the process, which will have dramatic results in the long run. (Imai, 2012, p. xiv.)

Plan-do-check-act-cycle (PDCA-cycle) is one of the first steps of kaizen strategy when talking about continuous improvement. Plan phase envisions the future since there should always be room for improvement. Do means to implement the plan. Check phase is established in order to see whether the plan is still on track and has brought

the improvement intended. Act standardizes the procedure and ensures that the original problem will not occur again. Act can also refer to setting goals for new improvements. (Imai 2012, p. 5.) Each PDCA-cycle (see figure 1.) is a new experiment on improving the process hypothesis; test, reflect and learn. In order to begin the improvement process, it is essential that the process is standardized. Toyota uses standard-do-check-act (SDCA-cycle) in order to prevent relapses in the improvement regime. SDCA-cycle stabilizes the current process and PDCA-cycle improves the process. (Liker, 2020, p. 302.)

PDCA-cycle has been chosen as an improvement method to this master's thesis because of its continuous nature. The PDCA-cycle is used to address a problem or issue and then refine the solution to the problem until the participants are happy with the outcome. Another argument for choosing PDCA-cycle is its simple concept, it is easy to adapt and learn, which means that it is ideal in applying Lean efficiently and effectively. (Kliem, 2016, chapter 6.3.) The PDCA-cycle have though its weaknesses that is important to be aware of. Projects are often short and once a solution is found the project is over, whereas the PDCA-cycle is necessary to use several times before ensuring that the outcome is valid. The cycle does not require mathematics and it can create bias from peers and superiors against the outcomes. The important thing is to at least recognize that there is a possibility to prejudices. There is also a possibility to false assumptions and these assumptions must be willingly revisited in order to be stated as facts. The participants might be taking shortcuts and leave out some of the steps of the PDCA-cycle, which leads to solutions that are not so usable or can only be sustained a short time. (Kliem, 2016, chapter 6.4.)

This chapter went through two ways of implementing Lean to an organization. After defining the Lean principles, the concepts of value and waste were discussed and how they are linked with Lean. The strategy of Kaizen as an improvement method was explained. The PDCA-cycle was defined and the pros and cons of the method was discussed.

6 VALUE STREAM MANAGEMENT AND VALUE STREAM DESCRIPTION

This chapter introduces value stream management and value stream description method. First the principles of managing value streams are discussed and the process of describing and applying of value streams are gone through. Finally, the benefits and advantages of value streams are discussed.

6.1 Value stream management

Value stream mapping is the first step to Lean. Value stream management is an approach to plan and implement a change within cross-functional or cross company processes. Acabado (2020) sees value stream management as an approach to serve the end customers' challenges and ideas through best practices, which are formed through eliminating waste, time and resources. Best management practices are moving from separate departments into a model where the members concerning a certain value-stream are working as a team. The team has a decentralized structure where the team members re-view each other. The focus of the team should be on the value output and not only on doing the job. Bonaccorsi et al. (2011, p. 429) points out that application of the concept into service field is not always that easy, since the value stream as well as waste elimination is less tangible in-service processes than in manufacturing processes.

6.2 Value stream description

The purpose of a value stream map is to understand the big picture. A value stream mapping must be made first before implementing a strategy for improvement. A value stream map is a picture of how the value stream is at a given time. The picture of the value stream should be drawn by those who operate the process and give their vision on how the process works. It is not what people think or say it is doing. This picture

should be able to explain what all people do, how they do it, how they work and communicate with the employees on each side of them in the process, how the entire process proceeds. (Nash & Poling, 2008, chapter 3.) Value stream mapping is a flowchart that focuses to measure the time it takes to move a product or service through the value chain (Lareau, 2010, p. 23). Liker (2020, p. 32-33) refers to value stream mapping to see the flow of information and identifying wastes.

The current state map is the base from, which the improvements are made. The future state map shows how the value stream flows after improvements are done. The value stream map is made of the current situation of a specific information flow and another map is made as a future-state value stream map, which means to create a vision to strive for. Once a map is completed, the employees from different departments hold kaizen sessions on regular basis in order to brainstorm improvements that would help to reach the future-state value stream maps vision. (Imai 2012, p. 230.)

The value stream in this thesis will be mapped using Bonaccorsi et al. (2011, p. 431) extended set of standard icons that is created to meet the needs of a service process (figure 7).







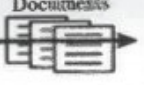

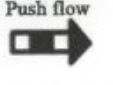



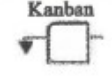
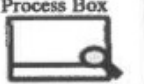
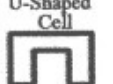









Material Supplier 	Data Supplier 	End Customer 	Service Issue 	Customer Presence 	Priority Queue 
Documents 	Electronic Data 	Push flow 	Pull flow 	Load Levelling 	Time Table 
Kanban 	Process Box 	U-Shaped Cell 	Worker/Employee 	Buffer 	IT Station 
Super Market 	Items Inventory 	Pool Resource 	FIFO Lane 	Queue 	Web Page 

Figure 7. Service process icons (Bonaccorsi et al. 2011, p. 431)

The process box icon is not applicable as such, in a service process, since it can include several tasks that the same employee performs, and the tasks can vary depending on the work that the employee currently is doing. Therefore, one icon is not enough to describe the task and an inspection lens should be included to show that there is more information. In service there is situations where the customer is physically present,

which is marked with the customer presence icon. Material and data supplier icons are also added to better specify from where the up-dated information or material are coming into the value stream. It is also important to notice that the inventory icon is a different thing in service stream, it can be materials or documents or both. When creating the invoicing process the team should go through the process steps and think about the steps from the inner/outer customer view and at the same time think about the waste in the steps. (Bonaccorsi et al., 2011, p. 431.)

Value stream mapping is always made by drawing the current state of a process, not adding anything or removing anything from the process, on a piece of paper. The map is drawn on a single sheet of paper to encourage the discussion in the group that makes the map and to give better knowledge of the process. It is important to consider the number of details in the flow, if the value stream is created on a level with too little information there is nothing that can be improved or discussed. If the process map on the other hand is too detailed, it becomes an overwhelming task for the participants. The map starts from the customer by a chosen icon from figure 5. The customer is drawn in the upper part of the paper. Underneath the customer icon will be a data box that describes the requirements that the customer has set. The next step is to draw the basic service process. One process box indicates one area of material or information flow. The data that is collected under each step in the process is important in deciding what the future state will be. Data contains information on how that process is done and who are responsible of that part of the process. The value map as a tangible drawing is always a byproduct, the understanding itself of the process is the main goal in drawing a value stream map. (Rother & Shook, 2003, p. 16-20.)

6.3 How to measure the improvement in Value stream mapping

In order to evaluate the success of the improvement in a value stream map, the improvement is measured by comparing the original process to the improved process by taking results from performance indicators and comparing them against each other. Takt time is measured in order to know at what pace the production should proceed or in this case how many invoices must be sent out per day in order to keep the company running, pay the salaries or rent for premises. As an example, if the workday is 360min

and 20 days a month and the needed income is 50000€, the demand is 2500€ worth invoices per day. Takt can be used to set the pace of the production and alert workers if they work too fast or too slow. Takt time is commonly used in manufacturing but by using imagination it is possible to extend even to service in order to be able to cut out the non-value adding activities. (Liker, 2020, p. 71.) Lead time is the time it takes for an input to go through all the process steps until the task is completed. The cycle time on the other hand is the amount of time that is used to one unit/step/process. The main Lean metric is defined as the proportion of time spent by a task or by the whole process in value added activities. (Bonaccorsi et. al., 2011, p. 433.)

Time spent by the task is called task efficiency, which is calculated:

Task Efficiency= Value Added Time/ Cycle Time

The Service efficiency is measured by:

Service Efficiency= Total Value-Added Time/ Lead Time.

The outcome in an ideal situation would be one, but it is impossible for most services. Therefore, cycle efficiency greater than 20 per cent is according to Bonaccorsi et. al. (2011) sufficient. There are also several other ways of other Lean metrics that could be used such as per cent of invoicing errors, per cent of customer complaints, throughput, customer retention rate or average waiting time.

6.4 The benefits of value streaming

The VSM gives an opportunity to see how the process works from beginning to the end and enables to track the performance of the process. By having an actual blueprint of the process gives the benefits of identifying the waste and bottlenecks. The process itself becomes more efficient and improves the collaboration between different departments. The value stream also improves the outcomes for the customer. Most importantly the value stream mapping gives everyone in the process a tangible goal to achieve. The view also gives the gain of a more holistic understanding of the process and the roles different actors play in order to finish the process. VSM is also the tool that gives a link between information and material flow. (Kissflow, 2021.)

By value mapping the invoicing process in this thesis, it is possible to get a current state evaluation of the information and material flow. The lead time and cycle time will be measured accordingly, in order to be able to pinpoint bottlenecks that hinder the flow. The sources of waste will be eliminated, and areas of improvement will be identified. The lead and cycle time will be remeasured to prove that the changes had an impact on the invoicing process. This chapter went through value stream management, how to describe and draw the value map. It also went through how to measure the value stream and explained what benefits value streaming a process provides.

7 RESEARCH PROCESS

This chapter describes the empirical part of this master's thesis in more detail. The data collection through interviews and observation is gone through. The gathering of empirical material of this research started by trying to understand what tasks and how the information flow is set in the current inner sales invoicing process. This knowledge was then developed by using tools from Lean.

7.1 The inner sales invoicing process in Rakennus Jalonen

The interviews included two persons that are involved in the company's inner sales invoicing process. According to the SECI-model the collection of tacit knowledge starts with socialization (see figure 5). The socialization phase requires that individuals in the organization talks and shares the knowledge of the inner sales invoicing process. The collection of tacit knowledge through interviews were conducted in Finnish since it is the native language of the interviewees. These two persons are the initiator for the inner sales invoicing process the construction foreman and the assistant that collects the materials from the incoming purchase invoices and working hours. The interviews were conducted as contextual interviews with semi-structured questions. It was important to interview these two, the foreman and the assistant (later referred to as assistant B), since both interviewees will soon retire from the company, and it was essential to collect the tacit knowledge. The actual sales invoicing process contains five persons but two persons, the CEO and the co-owner are merely giving acceptance for the invoices to be sent out. Therefore, the author chose to leave out these two from the interviewing process. Since the author is part of the invoicing chain, the information about the authors part in the process was written down by the author (later referred to as assistant A). The interviews were conducted at Rakennus Jalonen office in the respective places where the interviewees are located so that the author was able to observe and monitor the interviewee at the same time as the interview was conducted.

When the author planned the interview beforehand with the retiring foreman, the author got the impression that the foreman was afraid of not be able to tell everything related to the task, since the whole process was so automated in his mind. Based on this impression the author decided to map her own process as an example (figure 8) of the tasks related to the invoicing. It helped the interviewees (both the foreman and the assistant B) to relax since they saw the expected outcome. The figure with the assistant A tasks served as a base for the interview along with the interview questions (Appendix 1).

Tasks related to invoicing

Assistant A:

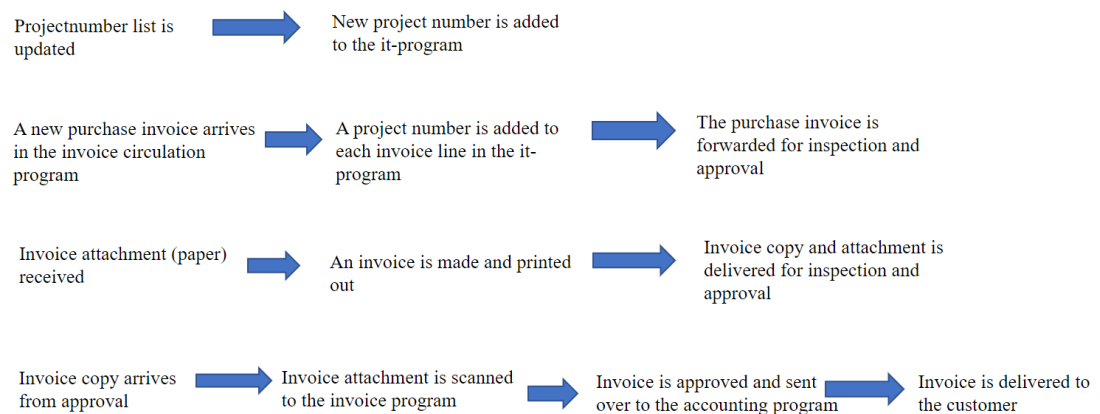


Figure 8. Tasks related to invoicing assistant A.

Assistant A get the primary information about a new project when the list of different projects is updated by the foreman. The assistant prints out the updated list from the received e-mail. The assistant creates the project in the production management program. When the project number is in the production management it-program and a purchase invoice arrives, the invoice circulation program recognizes the number and can redirect the costs to the right project. The assistant checks the received purchase invoice and sees to that the different invoice lines in that purchase invoice matches the given project number and sends it forward for approval. Assistant B prepares an invoice referral and gives it as a paper version to assistant A. Assistant A makes an invoice in the it-program and prints it out. The sales invoice and the attachment are delivered for inspection and approval. The invoice is approved by the CEO and the co-

owner. When the invoice copy arrives back to the assistant the attachment is scanned to the invoicing program and approved to the accounting program. The accounting program sends electronically the invoice to the customer or if the customer prefers paper invoices, they are printed out and put in an envelope for mailing.

The interview with the foreman was in the foreman's own office and each task related to the invoicing was gone through even visually. This was important for the research since the knowledge in the socialization phase is passed on through observation and really trying to understand by asking questions and listening without interrupting (Knowledge Management Tools, 2021). The foreman showed how the work orders looked and where the files were on the computers drive.

The process begins when the customer calls or e-mails the foreman. The foreman fills in the work order, which is a paper form (Appendix 2), since the customer can order by telephone, the calls can arrive when the foreman is on the road or on another construction site. When he arrives to the office, he adds a file in network drive based on the order. If the order exceeds 10 000€ it gets its own project number and if it is an order less than 10 000€ it is put under the small project file. This is a file, which contains all the smaller projects and has only one project number. If the order is based on an offer he has been giving to the customer, the foreman moves the offer and related papers from the offer file to the project number file in the drive. The project number list is then updated and sent by e-mail to all whom it may concern. The work order is given to the workers for filling in hours and materials by hand. If it is a fixed price work the project is prepared at the office for the workers by ordering materials and appointing one of the foremen to take care of it.

When a purchase invoice arrives in the invoice circulation program the foreman checks if the project number is correct. He also controls if the amounts are correct, and the material is correct and approves it if everything is ok. When the work order returns from the construction site, he sees it through and adds possible attachments to it if necessary. Then the work order paper is handed to the assistant B.

Assistant B makes a referral and attaches the copies of the purchases. When the foreman receives the referral, he makes the possible corrections, and it is delivered back to assistant B. Figure 9 presents the invoicing process from the foreman's perspective and is drawn based on the interview.

Tasks related to invoicing

Foreman:

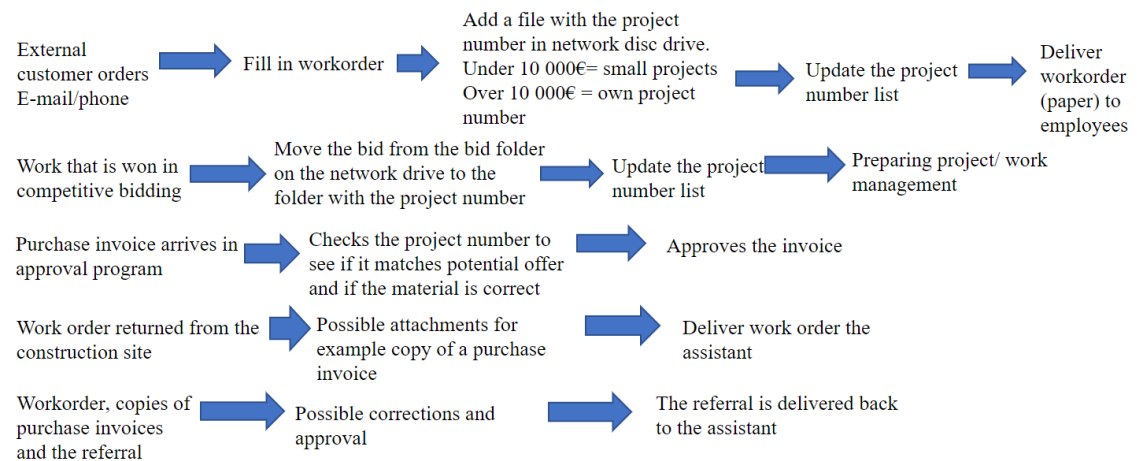


Figure 9. Tasks related to invoicing foreman

Assistant B primary opinion was that the process has been refined during several years that it might be that there is nothing to improve, but were anyway glad to help with explaining the assistant's part in the sales invoicing process. The invoicing process starts when a filled and approved work order arrives at the desk. The assistant checks if all the knowledge that are needed for the process is written down. Then the referral program on the computer is opened and the assistant searches from the customer list the correct customer or creates a new customer in the program. Then the invoice copies are fetched with matching project number from the compartment system (Picture 1).



Picture 1. Compartment system

The construction materials listed on the work order are compared to the invoices and the prices from the purchase invoices are added. If the work order contains material retrieved from own warehouse the used it-program contains a pricelist from, which the materials are added on the referral. The price for a manhour is also in most cases company dependent and can be found behind the customer in the it-program. If the customer is new, a general pricelist for manhours and materials are used.

When a purchase invoice arrives in the invoice circulation program, the invoice is printed out and checked that the project numbers on the actual invoice are the same as in the program. The project numbers might differ since the person that has retrieved the material has said the wrong project number or then the seller has filled in only the person that has fetched the material. Then when the invoice comes for approval, the foreman corrects the project number into the program, but the invoice copy itself is still the same. Therefore, the assistant B corrects with a marker the project numbers to the copy and puts them in the compartment with matching project number. Assistant B invoicing process is mapped based on the interview in figure 10.

Tasks related to invoicing

Assistant B:

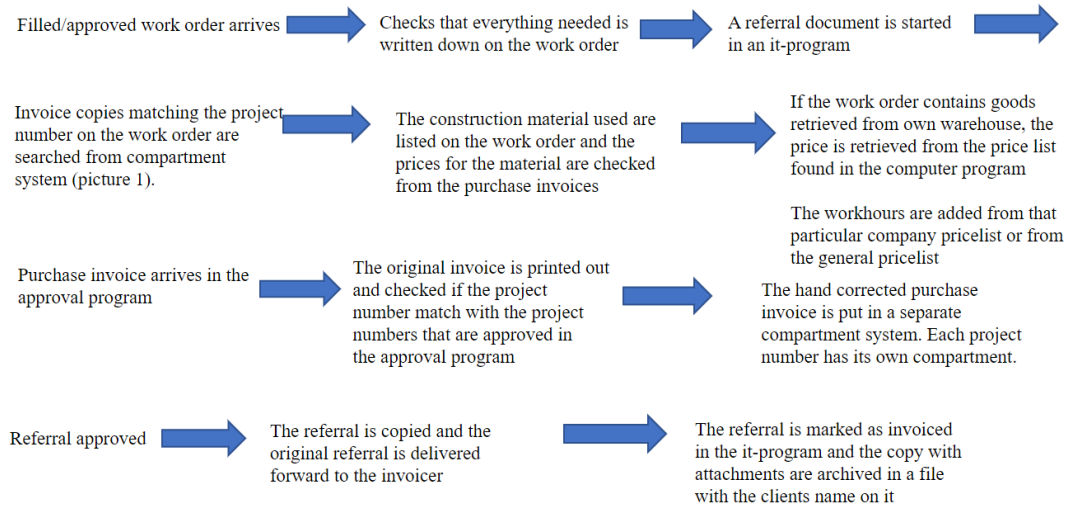


Figure 10. Tasks related to invoicing assistant B

After the referral has been approved by the foreman the assistant takes a copy of it and brings the referral with attachments to the assistant A. The copy is archived in a file labelled with the customer's name and the referral is marked as invoiced.

After author had established the figures of each participant, they were gone through with everyone separately to ensure that tasks had been understood correctly and that the author had taken all essential information into consideration. In the next phase the author also investigated the old sales invoices to back up the obtained information.

When the author was following up old invoices for the research an observation was made that the lead time for establishing invoices is long. Here the process metrics are a good way to show how a process perform. Measuring the statistics can help to assess and improve the process performance. Lead time reduction is an important part of process improvement. Looking for opportunities to shorten the lead time helps to focus on improvement actions. Reducing lead time through eliminating waste and waiting time gives a better control over the process. When a company has a short lead time in invoicing it has also a direct impact on the cash-flow in the company. (Logistiikan Maailma, 2022.)

Now when following up the referrals in the company there were referrals with construction work done 2.2 and 3.2.2022. The supplier has sent its invoice 21.2.2022 and the other supplier 7.3.2022. The referral was coming for invoicing 28.3.2022 and the invoice left with payment term 14 days net. The money is on the account 11.4.2022, which means that the invoicing cycle has taken 67 days. Another referral contained working hours from 7.3.2022 and it was invoiced 28.3.2022, which means it has taken 35 days until it is on the account. Third referral had working hours from 28.2.2022 and invoiced 28.3.2022, which means 28 days, plus payment time 14 days, which means 42 days before the payment is on the account. Fourth referral had manhours from 28.2.2022 and invoiced 28.3.2022, which means 28 days plus payment time 30 days, which means 58 days before getting paid. This means that when supplier send its invoices there might not be cash on the account if the payment terms are 14 days or 21 days net. This was just a cross section of the invoices that were gone through at that specific time, but it is obvious that it would be crucial to find ways of shortening the lead time that it takes for a ready project to be invoiced.

The interviewing of the peers in the organization felt easy since the author works everyday with the persons involved in the sales invoicing process. The peers were helpful since they realized that there is a need to collect the knowledge of the process. When establishing the workflows, they were also gone through mutually to improve the knowledge about each other's tasks. Externalization in SECI-model happens when the tacit knowledge is written down and the tasks within the inner sales invoicing process has been written in a manner that everyone in the organization understands the used concepts (see figure 5). There are two goals with externalization that was met in this research, the interviewees had considered what their tasks were in the inner sales invoicing process and this knowledge had been harmonized with what the organization expects from the invoicing process and the participants in the process.

7.2 Kaizen sessions

After interviewing the participants, the author organized a session in the organization with the intent to introduce Lean and share the collected tacit knowledge. These sessions where the inner sales invoicing process was presented and improved using

Lean are later referred to as kaizen sessions in this research. These sessions had also on the agenda to create combination activities based on the SECI-model from the explicit knowledge. This means to combine the explicit knowledge to the explicit knowledge that already exists in the organization. The inner sales invoicing process and the tasks that employees perform were presented to the participants in the session. This process become organizational knowledge that can be discussed and be developed based on opinions from peers in the organization.

It felt that the concept Lean was new for the participants in the kaizen session and the author made a brief introduction to the subject before going through the knowledge about the inner sales invoicing process. The invoicing process where then improved by kaizen. Kaizen focuses on analyzing a business process, finding the causes that create bottlenecks in the process and improving the process. Kaizen is a Lean tool that focuses on making small improvements to a workplace.

To start the continuous development of Rakennus Jalonen' invoicing process a kaizen event was held at the office 7.4.2022. The first kaizen session took approximately 1,5h. The persons present at the session were the assistants, the head of construction department, construction foreman, CEO and the quality manager of the company. At the kaizen session the author presented Lean as a concept and ten wastes of service to the participants. Waste refers to activities that doesn't add value to the process. The presentation caused lively discussion on several issues concerning the invoicing process.

Improvement points that came up in the session:

- invoice rotation program needs a software extension where each invoice with the same project number is possible to be assembled to a list from, which all the purchase invoices are found and possible to print out if necessary
- the pricelist in Assistant B it-program – who updates the list? Is it up to date?
- the fixed price works should be marked clearly in the project number list so that the invoices concerning the fixed price work is not printed out and put in the compartment folder

- CEO pointed out that the aim is to give fixed price works since works done for 1-2 hours is more expensive than the customers are willing to pay for
- the invoice referrals were considered too extensive meaning that for instance the work hours could be written down as hours/week, when it is now for the moment hours/day

When the author asked the persons attending the kaizen session how they know that everything gets invoiced, there were no clear answer. There is no way of knowing if the manhours are all invoiced. The employees write on a time sheet the complete set of two weeks hours for the salary clerk and the work orders that are filled in concerns only a specific project. Therefore, if the employee is five hours on one construction site and writes it down but forgets to fill in the work order for the other hours, there is no way of knowing. This is because the time sheets and the work orders never are compared to each other. Every invoice comes to the production control program but if the supplier sends the invoice late and the project has ended from our perspective, the invoice is eating the profit for that project. The time reserved for the first kaizen session was too short but on the other hand the author wouldn't want the development to be too extensive and start to feel too overwhelming for the participants. The kaizen session was ended by handing out a paper with the task for the people involved in the invoicing process to measure their current actions. This was also one of this research objectives to measure processes' effectiveness using cost and time indicators before and after the development measures.

In the session the concept of value streaming was explained to the participants and the value stream of the inner sales invoicing process was drawn to see how the process proceeds in the organization. Value stream mapping is a tool that helps the organization to understand the whole picture of the inner invoicing process. The value stream was drawn on a piece of paper and it was limited to the inner sales invoicing process. The two information flows were recognized in the value stream, the information flow in the different it-systems and the service delivery itself in the process boxes. One process box indicates one area of the material flow in the inner sales invoicing process. Under each process box are the actions that is made in that

particular process phase. Persons involved in the sales invoicing process established the value stream map figure 11 using service process icons from figure 7.

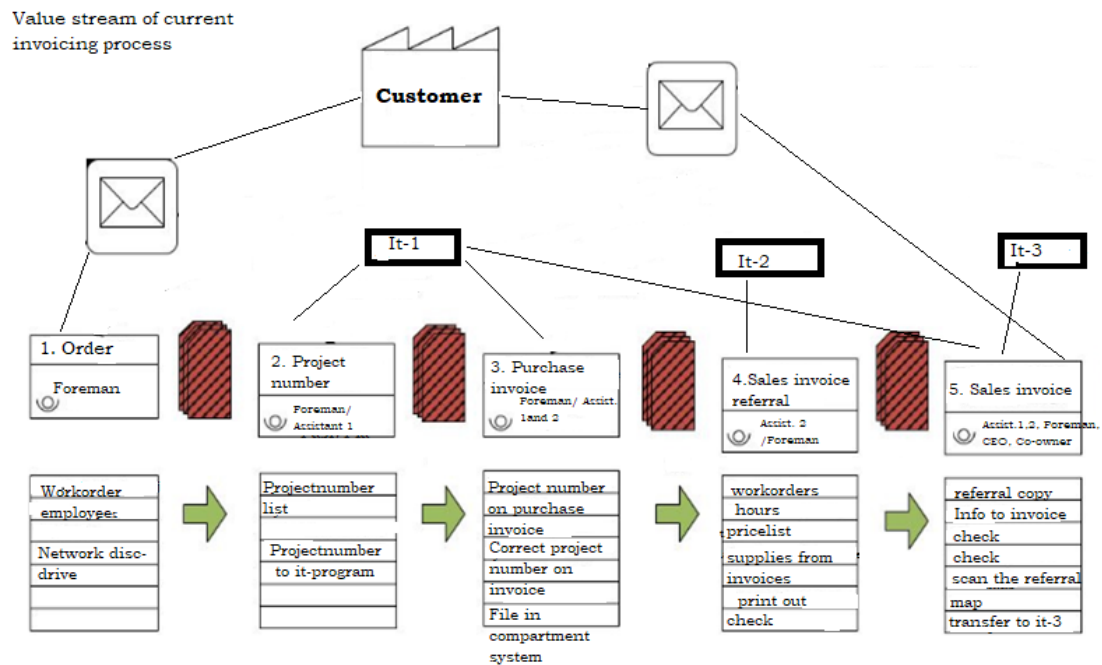


Figure 11. Value stream of current invoicing process

When the current value stream was written down, the author asked what the wastes of the value stream in this process were and how to improve the process. The following wastes were identified based on Table 1. Ten wastes of service industry. Table 2. presents the kaizen events outcomes on what wastes are visible in the current invoicing process.

Table 2. Wastes of current invoicing process

Defects	when work orders are misplaced or lost
Duplication	multiple copying: purchase invoices project numbers, referrals
Incorrect Inventory	Double checking
Overproduction	invoice copies on fixed work
Unclear communication	work orders are not clearly written
Waiting time	waiting for invoices, waiting for approval

Defects recognized were the work hours that might get lost due to employees forgetting to write down or the employees not knowing where to put the filled in work order. This was later heard by the author at a coffee room conversation. The work orders do not have an appointed place where to put the filled in work order and sometimes the work orders are found in work cars or in the employees' locker room.

Duplication was recognized as waste in this invoicing process. Wasteful activity is copying the project numbers from purchase invoices in it-program to the invoice copies. Copying the referral to the invoice takes also unnecessary time. Incorrect inventory was recognized to contain for instance the double checking of the sales invoices. Overproduction is linked to printing out invoices to project numbers that are fixed price works. Unclear communication can also be linked with not knowing what to write on the work orders or writing with bad handwriting. Work orders might contain nicknames for materials that is not familiar to the person who is finding the price for the item. Waiting time waste is waiting for suppliers' invoices and waiting for approvals.

The third research objective measuring process effectiveness was planned to be measured from the standardized value stream maps by using takt time, task efficacy and service efficacy. The author described the idea of measuring to the kaizen participants. This value stream map was then used when measuring the time of the different steps by the people involved in the invoicing process. The lead time and cycle time were made as an estimation by the participants themselves and by observing an invoice from, which each step in the process is given a time that is then measured by the different indicators until the final product, the invoice is sent out. However, the handling time of an invoice is highly variable and most of the steps when making an invoice are handled in such short time that it made no sense to measure the invoice process. Instead, the author decided on concentrating on finding out the possibilities for improvement.

Table 3. Value stream mapping

Invoicing process	Process time
Action	time in minutes
1. Order	
Work order employees	2
Project is opened on network disc drive	2
2. Project number	
Project number list is up-dated	1
Project number is created in it-program	2
3. Purchase invoices	
Project number line for purchase invoice is created	2
Foreman approves incoming invoices	1
Print out and check the invoices	2
File the invoice copies in the compartment system	1
4. Sales invoice referral	
Work hours are collected from work orders	5
Price for workorders are taken from it-programs pricelist	2
Material from purchase invoice	1
Print out referral	1
Foreman checks the referral	1
Copy of the referral to archive	1
Original referral as invoice attachment	1
5. Sales invoice	
Referral info is written on invoice	3
Invoice is printed out	1
Approval from ceo	90
Approval from co-owner	90
Referral is scanned to e-mail	1
The scanned referral attached to invoice	1
The invoice and attachment copy in the map	1
Invoice transferred to accounting program	1
Invoice printed out for customer	1
Invoice is put in mail	1
Estimated throughput time	215

The output of the current invoicing process is in general 215 min/invoice. What is not considered in this value stream is the waiting time. Waiting for approvals, waiting for completed work orders from employees and waiting for suppliers to send their invoices to our invoice circulation.

There were also a second kaizen session held 12.5.2022 at the office for the new foreman/ head of construction department and the foreman that was absent the first time. The other assistant also participated in order to have all persons that are included in the invoicing process. The aim was to get the information through how the invoices

current are handled in the company and to get the new foreman onboard on the development process. This kaizen session was merely informative but there were also some improvement points that was found out. These points were not directly related to the inner sales invoicing process, so they were left out of this research.

“Necessity is the mother of invention” is an expression that captures according to Imai (2012, p. 205) the kaizen spirit. This is also true when talking about the inner sales invoicing process in Rakennus Jalonen and collecting the tacit knowledge from the retiring employees. The value mapping of the sales invoicing process pinpointed the various approvals and time-consuming copying. Even if the measuring the value-stream proved to be tricky it revealed that the approvals of the invoices are the most time-consuming part of the value stream. The approvals as it is for now stand for 80% of the through put time. Lean was also used for revealing waste in the process, table 2. One defect in the process that was revealed was that the work orders can be ready to be invoiced. But instead of being handed in to the foreman the work orders lay in an employee’s car or misplaced somewhere on the premises. This problem doesn’t show in the measuring the value stream table 3. but it certainly affects the invoicing. What if the work order gets lost and the foreman forgets that particular work has been done? Another procedure that causes waste in the process was recognized when the assistant B prints out all the invoices from the invoice rotation system and puts them in the compartments, what happens if an invoice copy gets lost and isn’t in the compartment when it’s time to make a sales invoice from the material gathered? There is also the possibility that the project number is wrong on the invoice and the assistant misses to correct the project number on the copy.

This chapter went through how the tacit knowledge were collected based on SECI-model from the persons participating in inner sales invoicing process of Rakennus Jalonen. The value stream was drawn as a collective effort in a kaizen session and an attempt on measuring the value stream was made.

8 RESEARCH RESULTS

This chapter analyses the research results based on the data collection and provides the answers to the research questions with the support from the collected literature. The results consist of the interviews with the participants in the inner sales invoicing process and the use of Lean to develop the process.

8.1 Research objectives

The collection of the tacit knowledge in this thesis can be viewed through the SECI-model, which is presented in figure 5. The research process started by collecting the tacit knowledge in social interaction with the participants of the inner sales process. In this case it meant how the materials for the sales invoices were collected. Where the invoice copies were placed when making a referral and observing what caused the “gut feeling” in the participant that something must be invoiced. In creating explicit knowledge, the tacit knowledge is then formed into written form that can be stored or saved on a hard disc. Here the author wrote down the different tasks about what the foreman and assistant did when invoicing and got the participants to go through the text that the author had written down about the tasks to be sure that it is actually how they act when creating the sales invoices. In combination phase this knowledge was taken to a kaizen session where this knowledge was transformed to common knowledge by combining the explicit knowledge with the participants aspects to a map of the sales invoicing process. When answering the first research objective in this thesis the collected knowledge by the means of SECI-model will become organizational knowledge in the internalization phase and a base from, which a new level of knowledge can be built.

The first research objective was to *map the current sales invoicing process*. When the author retrieved the tacit knowledge from the interviews it was processed by the participants in the kaizen session and the process was drawn to a map of the current invoicing process at Rakennus Jalonen figure 12.

Map of the current invoicing process

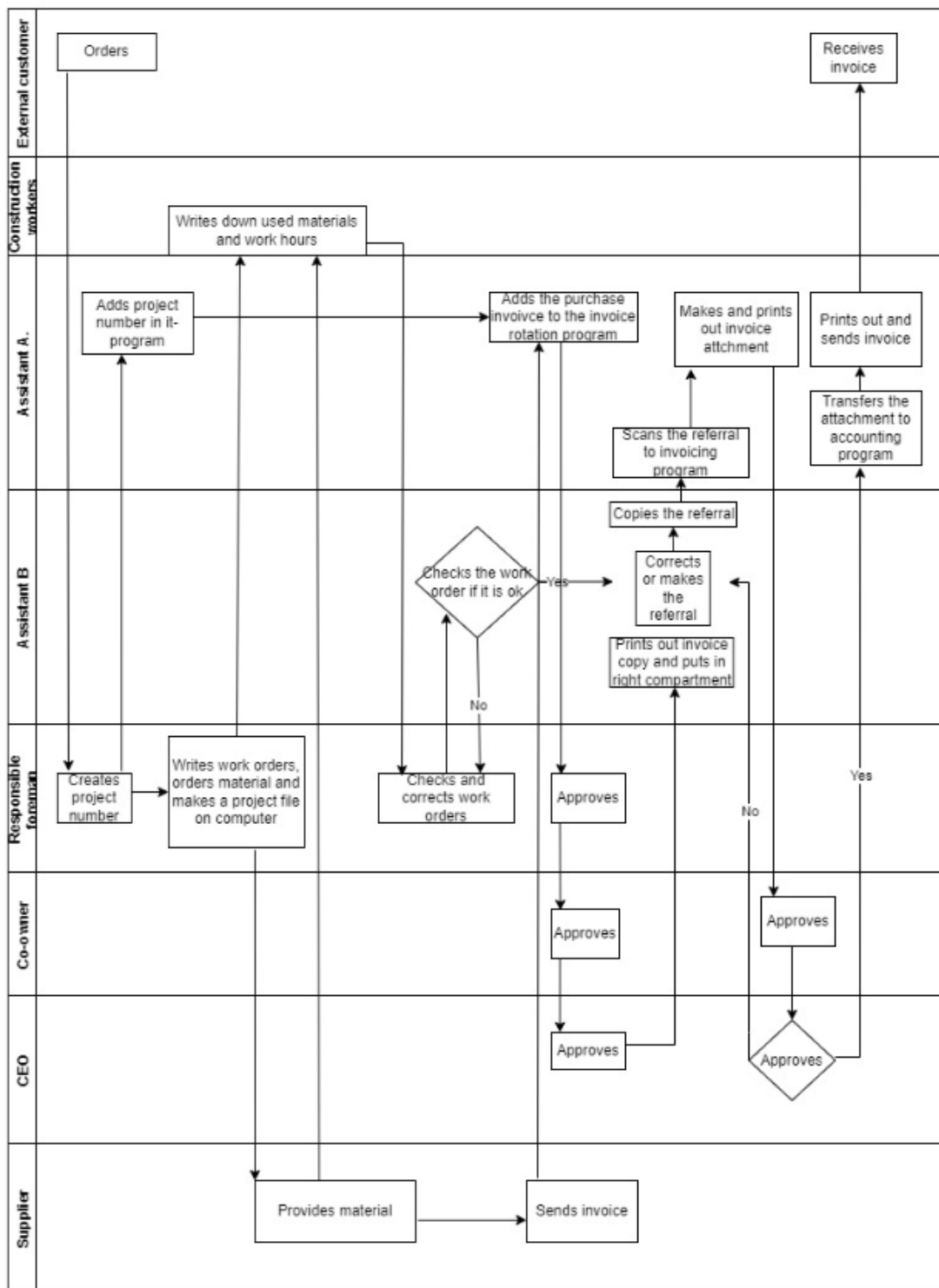


Figure 12. Map of the current invoicing process based on collecting the tacit knowledge

The current invoicing process starts when a customer phones or e-mails the responsible foreman. The foreman decides if it is a small project, which means that it is under 10 000€ or if it is a bigger project over 10 000€ and gives the project number accordingly. Then he creates a folder where he starts to gather information on that project in the it-drive named with the project number. He also updates the project number list, which is then forwarded to assistant A. The project number is then used by the project management tool to collect the information from the purchase invoices and the salary program to show how much a specific project has cost and how much has been invoiced for that project. The tool contains also a purchase invoice rotation system where it is possible for the assistant A to forward the invoices electronically to the foremen to check if they contain the right project number and contain the material that have been ordered. The invoice rotation program proceeds from one foreman to another until all of them have approved the invoice and then it returns to assistant A who then makes a claim to the supplier.

After receiving an order from the customer, the responsible foreman then makes a work order, which is a paper form (Appendix 2) where he writes down the address and the work for the construction workers to fill in. The foreman also orders needed construction material for that specific project. When the construction workers receive the work order they write down by hand the hours that they work on that specific project and the material they use. When the project is ready the foreman collects the work order and checks that it contains the needed info and delivers it further to assistant B. Assistant B controls that the handwritten order is understandable and opens a new referral on the computer. The assistant searches the invoice copies with matching project numbers from the compartment system and takes the prices for the used material from there. The invoices in the compartment system have been printed out from the invoice rotating system and checked that the project number is the same as the foremen have corrected in the it-system. The price for manhours is either taken from the general pricelist or then from the company specific pricelist. When the referral is ready it is copied and brought to the other assistant who makes an invoice attachment and scans the referral to the it-program. The invoice attachment is then printed out and brought to the co-owner who looks it over and the CEO who also approves the invoice. If there is something that should be improved the invoice

attachment and its referral is brought back to assistant B, who corrects the referral, and it goes back to being approved. When the invoice attachment is approved it is transferred electronically to the accounting program and the invoice is printed out and send by post or if it is an e-invoice it is send electronically direct to the customer. This map was then standardized by bringing it to knowledge for all participants in the sales invoicing process and was used as base from where the improvements will be made.

The second research objective *improve the inner sales invoicing process using Lean approach* was executed by organizing a kaizen session within the organization. The value stream map of the inner sales invoicing process was made as a joint effort by the participants in the session. The value stream map was then used to find waste in the process. Based on the waste findings the small improvements according to kaizen that was made in the first PDCA-cycle were following: A place was arranged at the employees' social facilities where the readymade work orders are placed. The foreman was given instructions on to inform the employees of this improvement. The assistant B will be informed about the fixed price works by the foreman, and they will not be printed out anymore to the compartment system. When a referral is ready it is scanned straight to the assistant A e-mail where it is attached by the assistant to the invoice. The purchase invoice it-program that circulates the invoices was modified so that the different projects can be searched by project number and all the invoices on that specific number will appear on the screen. This enables for instance the assistant to check that everything that has been purchased will be invoiced by comparing the amount of money spent to the referrals end sum. The referral program contains the pricelist behind each customer, and these were updated to match the up-to-date material prices.

The third research objective to *measure processes' effectiveness using cost and time indicators before and after the development measures* proved to be tricky to establish. According to Bonaccorsi et al. (2011 p. 438), it is clear that there is a significant difference in manufacturing to, which Lean has been developed and the service industry. Applying metrics to services is challenging and the Lean concepts must be reinterpreted or redefined to function in a proper manner. In this research the used time for establishing one invoice is short and varies a lot depending on how the information

for the invoice is acquired, how many people it takes to establish the invoice and how well the work order has been written. When measuring a process, the thought behind is to increase productivity, but increasing productivity in a service might decrease the quality of a service. The quantity of sent invoices are not a good thing if the customers receive invoices with errors. Determining the productivity of an employee in service industry is difficult because the metric could be total euros invoiced or total amount of satisfied customers.

This research brought out the lead time for the inner sales invoicing process by making a value stream map and having the participants giving an estimation on how long it takes for one step in the process. This value stream map revealed the most time-consuming parts that will be developed and improved in the future. But as for bringing out the process effectiveness using the given indicators was not successful.

The fourth and last research objective was to write down the *guidelines for invoicing of current state for the organization*. Since the organization language is Finnish, it is written in Finnish and added as Appendix 3 to this thesis. The research results are in the next chapter analyzed from the reliability and ethical point of view.

8.2 Validity and reliability

The purpose of this section is to demonstrate this thesis reliability and validity. This section shows that the author has measured and described what was intended and implemented the research procedures in a precise and consistent manner. It will also show that the author has interpreted the data in a strategic and unbiased way. This section will provide enough detail to be able to replicate the study. This empirical research is carried out by qualitative methods. This method was chosen because an interpretive aspect is preferred in business since each business is unique and there is no previous information to base the research upon.

Kock (2002) defines three threats to action research: uncontrollability, contingency and subjectivity. The uncontrollability threat means that the environment that is researched might sometimes change in a way that is completely unexpected. The

change might force the author to rethink the research before a single cycle in the action research has been completed. In worst cases the author must start from the beginning since the study is out of the author's control. A contingency threat might appear when a large amount of data is collected and there is a problem with generalizing research findings to apply in the research. The subjectivity threat arises when the author is personally involved in the research and is pushed to interpreting the collected data in subjective ways and in worst case scenario end up completely wrong.

This research faced an uncontrollability threat when the foreman that was part of the invoicing process was due to an accident on sick leave before retiring. Luckily the foreman was willing to come to the office for explaining his part of the invoicing and take part in one of the kaizen sessions. The contingency threat was tackled since the research area is small and the researched organization is a medium and small sized company. Evaluating the time spent on a single invoice and the different activities linked to invoicing felt hard by the participants in the invoicing process. To summarize the time spent proved to be challenging and the author chose to leave out the measuring part from the value stream mapping. The subjectivity threat has been taken into consideration by finding the explicit knowledge after the interviews and in the kaizen sessions.

To fully apply the action research method in this research would have required for the research to last more than one PDCA-cycle. Now the research contains the standardized knowledge of the inner sales invoicing process and the suggested improvements to the process but to be considered as successful action research it would have required at least one more development cycle to the inner sales invoicing process.

The research was conducted in co-operation with the company, which means that the researched subject is approved in the company. During the research the author considered the fact that the researched problem is very specific and contains only a few persons. Here lies a risk that the anonymity of the persons involved is at endangered, and the author has made the decision of generalizing comments and ideas that might have come up during interviews or kaizen sessions. The following chapter

concludes this master's thesis and presents the suggestions for developing further the company's invoicing process.

9 SUMMARY AND CONCLUSIONS

This thesis was based on a need to improve the invoicing process of Rakennus Jalonen Oy. It is even more important than ever since there is a need for keeping the cash flow continuous to keep up with the materials ongoing price rally. The war in Ukraine and Covid-19 pandemic has risen the material prices by double and some of the construction materials has become so scarce, that it is worthwhile to buy into storage if there is any to buy (Vallin & Mattila, 2022). This research will give ideas on how to improve the sales invoicing process of an organization by using Lean and show how important it is to collect the tacit knowledge of the employees. This research gives the keys to the commissioner for continuously develop not only invoicing process but also the model on how to start developing other processes as well in the company.

The outcome of this thesis could have been how the improvement of the inner sales invoicing process can improve the cash management of the company and what benefits the improvement would have for the whole company. However, the aim and urgent need for this thesis was to collect the tacit knowledge of the retiring employees about the current inner sales invoicing process. The tacit knowledge was written down and explicit knowledge of the process was obtained using SECI-model. The research fulfilled this purpose and the outcome is shown in figure 12. New employees are educated with the help of the guidelines (Appendix 3) that are made during this research. Another aim was to create a standardized process map that serves as a base for developing the inner sales invoice process. Lean was not a familiar concept for the employees from before and it takes time to implement and make a habit of using Lean when developing the processes further. Lean as a philosophy is not about doing better than competitors, it's about going beyond and creating superior processes, which certainly is a competitive edge against the competitors in the field.

Previously the persons involved in the invoicing process didn't know what happened next in the process and there were and still is overlapping procedures. This causes waste in the process. Now when the invoicing process has become explicit knowledge and it is mapped it is easier to remove wasteful actions. Also, digitalization has given

possibilities that no one has been aware of. By modifying the invoicing circulation program, the possibility that something is left invoiced is diminished since all participants in the invoicing chain has the information of the costs in a project to their disposal. This research also revealed serious matters that directly affects the company's cash flow. There is a lack of knowledge if all the hours that the employee gets paid for are in fact invoiced. This is because the work hours are written down on the work order and a project can be shorter than the eight hours written down on separate time sheets, that are given to a different department within the organization and a completely different person, the salary clerk. The work orders and the time sheets are not compared to each other in any stage of the invoicing process, which leads to that some of the hours might be left out from the invoicing (see the chapter 7.2 Improving invoicing process...) As a recommendation for next development work is to find a digital solution that distributes the working hours to both invoicing and salary programs in the company.

The research faced obstacles when starting to measure the process. It was proven difficult to measure the invoicing process since the handling times varies and are short. The throughput time for an invoice in this case is approximately 215minutes. Some changes were made, but for instance removing a phase of copying an invoice takes about a minute, so when the improvement in each cycle is made by kaizen it doesn't affect the overall throughput time noticeably. Bigger need for reducing lead time was shown to be outside the actual invoicing process at the point when a project is done until the work order arrives at the office. This time gap was found when the author followed up old invoices for the research (see the chapter 7.1 Current invoicing process...) Electronic time recording would also help to decrease this timeframe since the office would be up-to date about the work hours at the same time as they are recorded in the program. All in all, there is no need of saving a couple minutes in the process, more important is that the invoicing process is now standardized and written down. Therefore, the research left out the measuring part and concentrated on creating explicit data of the invoicing process and finding ways of improving the process. Nevertheless, thinking of the time used made it easier to recognize wasteful actions in the process so making the value stream (table 3) didn't feel as a waste of time according to the employees involved.

There is still room for improvement in the inner sales invoicing process. Further improvement stages include removing workaround waste such as the compartment files and printing out the invoice attachments for approval. The company has started an ongoing development process with the help of kaizen sessions for the invoicing process to stay up to date. This will ensure a steady cash flow even in the future.

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APPENDIX 1

Interview questions:

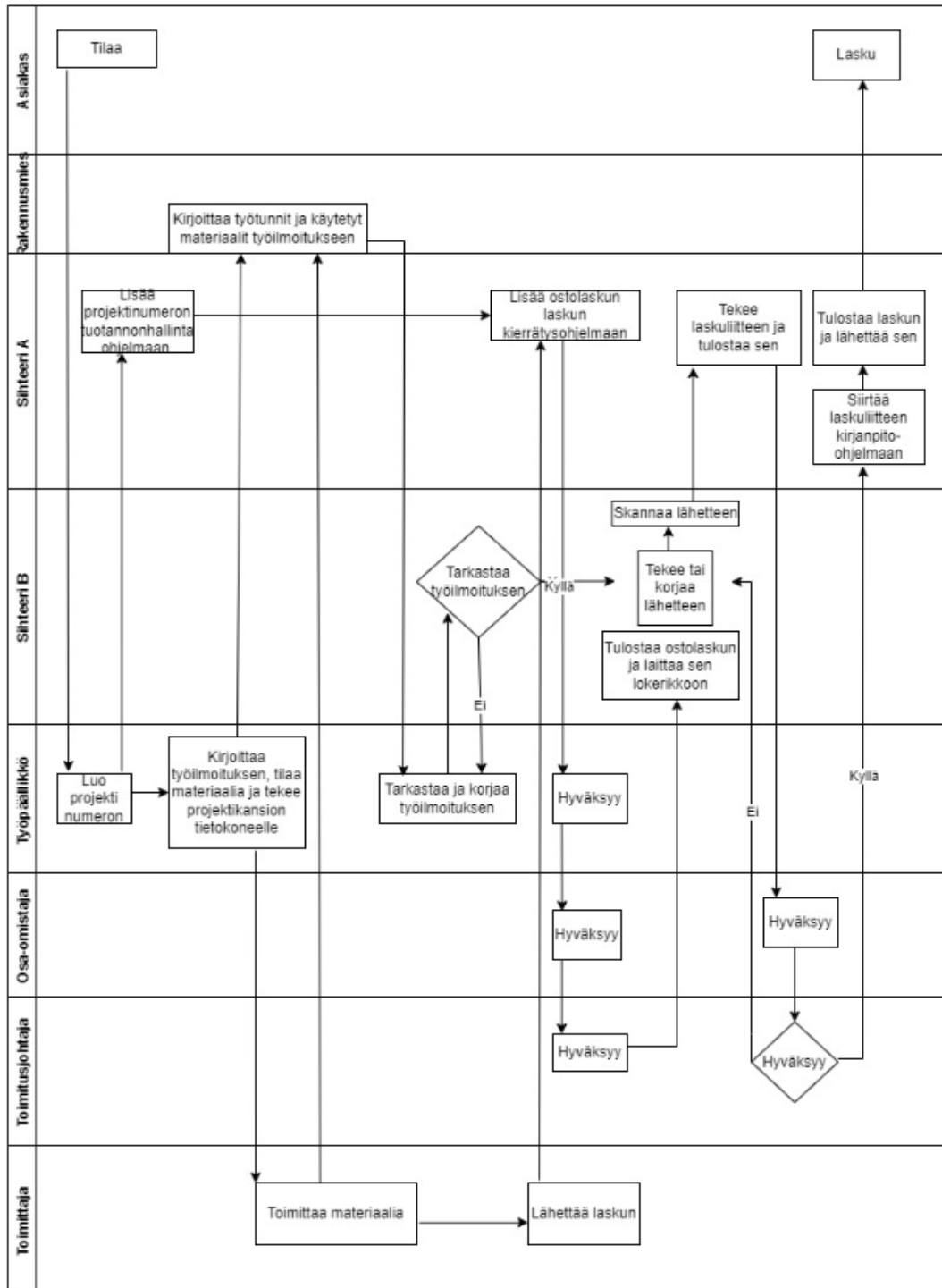
The interview questions that were formed at this stage were as following:

- How is the invoicing process initiated?
- At what point are the work numbers established?
- How is the work communicated forward to the other parties in the invoicing process?
- How is the knowledge of the used materials acquired?
- How is it confirmed that everything is invoiced?
- How is the knowledge of persons working hours acquired?

Work order

Työilmoitus Rakennus Jalonen Oy							
Tilaava yritys:			Tilaajan yhteys henkilö:				
Työselostus:			Työnumero:				
pvm:	työntekijä:	tunnit:		pvm:	työntekijä:	tunnit:	
Autokuljetukset:				Jätteet:			
Alihankkijat:							
MATERIAALIT:							
tuote:			määrä:	mistä:			
VUOKRAVÄLINEET:							
kone:			numero:	vuokra-aika:			

Rakennus Jalonen laskutusprosessi



Nykyinen laskutusprosessi alkaa, kun asiakas soittaa tai lähettää sähköpostia työpäällikölle. Työpäällikkö lajittelee työt siten, että alle 10 000€ projektit laitetaan saman projektinumeron alle ja kustannuksiltaan suuremmat kuin 10 000€ saavat oman projektinumeron. Tämän jälkeen hän luo kansion nimettynä projektinumerolla tietokoneasemalle Z://. Tähän kansioon hän kerää kaiken tiedon liittyen projektiin. Hän myös päivittää projektinumerolistan, jonka skannaa eteenpäin niille, jotka sitä tarvitsevat. Sihteeri A saa tällöin tiedon uudesta projektista ja lisää numeron tuotannonhallinnan ohjelmaan. Tuotannonhallinnan ohjelma osaa tämän jälkeen kerätä tiedot palkanlaskennasta käytetyistä työtunneista sekä ostolaskuista. Ohjelma näyttää sitten litteroittain paljonko projekti on käyttänyt rahaa ja paljonko yritys on laskuttanut jotain tiettyä projektia. Tämä työkalu sisältää myös laskujenkierrätysjärjestelmän, jossa sihteeri A laittaa laskut hyväksymiskiertoon sekä korjaa mahdolliset projektinumeroiden virheet ostolaskuilla. Hyväksymiskierrolla lasku tarkastetaan usean henkilön toimesta, jonka jälkeen lasku palautuu sihteerille A:lle, joka laittaa laskun maksatukseen. Jos laskussa on virheitä, ne korjataan hyväksymiskierrolla. Virheitä voi esimerkiksi olla virheellinen työnnumero, jonka voi korjata suoraan ohjelmassa. Jos laskun sisältö poikkeaa toimitetusta materiaalista, lasku korjautetaan toimittajalla.

Asiakkaan tilattua työn, työpäällikkö tekee työilmoituksen (paperi), johon hän kirjottaa työn osoitteen ja työn kuvauksen ja toimittaa sen työntekijöille täytettäväksi. Työpäällikkö myös tilaa tarvittavat materiaalit toimittajalta, jotka toimittavat tavarat työmaalle. Kun työntekijät saavat työilmoituksen, he täyttävät käsin työtunnit sekä käytetyt materiaalit. Työn valmistuttua työntekijät vievät työilmoituksen työntekijöiden sosiaalituloissa olevaan lokeriin ja työpäällikkö tai joku työnjohtajista noutaa sen sieltä toimistolle. Työilmoitus tarkastetaan työjohdon toimesta ja välitetään eteenpäin sihteerille B:lle, joka tarkastaa onko kaikki laskutukseen tarvittava tieto kirjattu työilmoitukseen. Sihteeri B avaa tietokoneella läheteohjelman ja aloittaa uuden lähetteen. Sihteeri B hakee lokerikosta kaikki työilmoituksen projektinumeroa vastaavat laskujen kopiot ja hakee työilmoituksessa olevien materiaalien hinnat laskuista. Lokerikoissa olevat laskut on tulostettu ulos laskunkierrätysohjelmasta ja kopioihin on korjattu mahdolliset työnumerovirheet, jotka ovat tulleet esille laskun tarkastamisen aikana. Työtunnit on hinnoiteltu jokaisen vakioasiakkaan taakse erikseen. Jos asiakas on satunnaisasiakas niin löytyy myös

yleishinnasto, josta läheteeseen tulee voimassa olevat hinnat. Läheteen valmistuttua se skannataan sihteerin A:lle, joka tekee laskuliitteen omalla ohjelmallaan ja liittää siihen läheteen. Tulostettu laskuliite hyväksytetään toimitusjohtajalla ja osaomistajalla. Jos laskuliitteessä on virhe se palautetaan sihteerin B:lle, joka korjaa läheteen ja laskuliite lähtee uudelleen hyväksymiskierrokselle. Laskuliitteen ollessa hyväksytty, se siirretään sihteerin A:n toimesta kirjanpito-ohjelmaan, josta se tulostetaan ja lähetetään asiakkaalle postitse tai sähköisesti.

