PROJECT HANDOVER FROM SERVICE CONFIGURATION TO SCM

A major customer’s waste service solution

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ABSTRACT

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TIIVISTELMÄ

Tämä opinnäytetyö tutki ison asiakkaan jätehuollon aloitustietojen siirtoa jätehuollon palveluja tarjoavan yrityksen SCM organisaation sisällä toiminnolta toiselle. Tavoitteena oli selvittää, miten siirto voidaan tehdä onnistuneesti ja kehittää siihen liittyviä työkaluja. Tutkimuksen rajausta varten palvelunaloitus kuvattiin tarjouksentekovaiheesta siihen asti, että tilaus-toimitusketju on ottanut alkaneen jätehuoltopalvelun hoitoonsa. Tarkan rajauksen ansiosta tutkimus keskittyi siirtoprosessiin, jonka alkaessa kaikki tieto on valmiina aloitusta varten ja jonka päättyessä uudelle asiakkaalle lähtee ensimmäinen jätehuoltopalvelua koskeva lasku. Tieteellisenä viitekehyksenä tälle toimintatutkimukselle on Lean ajattelu, sen tarjoamat prosessikuvaustyökalut sekä prosessin parantamiseen liittyvät työkalut.

Jätehuollon aloitustietojen siirtoprosessin nykytila kuvattiin opinnäytetyötutkimusta varten järjestetyssä työpajassa. Työpaja tuotti visuaalisen kuvauksen prosessista, siihen liittyvistä tehtävistä toiminnoittain sekä prosessiparannusehdotuksia. Työpajassa käytiin myös läpi aloitukseen liittyviä dokumentteja sekä käytettyjä tiedonjakotapoja, joista löydettiin tarve standardisoida sekä dokumenttipohjia että tiedon varastointitapoja. Työpajan jälkeen kirjoittaja teki kuusi tietojen välittämiseen ja tiedonhallintaan liittyvää parannusta ja näiden lisäksi kolme investointeja vaativaa parannusehdotusta. Käyttöön otetut parannukset ovat luoneet pohjan jatkuvalle parantamiselle, jonka avulla jätehuollon aloitustietotarpeita sekä tietojen siirtoa SCM toiminnoille voidaan kehittää edelleen. Toimeksiantajana opinnäytetyölle oli Fortum Waste Solutions Oy.

Avainsanat Lean, SCM, prosessikuvaus, palvelu

Sivut 67 sivua, joista liitteitä 13 sivua

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This thesis focused on researching a major customer's waste service solution's implementation data handover within the waste service provider company's SCM organization from function to function. The objective was to clarify how the handover can be done successfully and how to develop related tools. In order to define the scope for this thesis, the service configuration of a beginning waste service was described from quotation phase until the phase, where the supply chain order fulfilment is taking care of the customer's beginning waste services. Due to defining the scope so carefully, the research focused on the handover process, which begins in situation where all the data is ready for the waste service implementation and ends in a situation where the first invoice is sent to a new waste service customer. The theoretical framework for this action research is Lean thinking and its process description and process improvement tools.

The current state of handover process was described in a workshop arranged for this thesis research. The workshop produced a visual description of the handover process and process improvement suggestions. In the workshop also handover documents and the ways of sharing data were examined on. As a result, it was found out that there was a need for standard document templates and a uniform way for storing data. After the workshop the author made six improvements concerning communication and data management. In addition, three improvements which require investments, were suggested. The implemented improvements have created a foundation for continuous improvement of the handover process. This will enable further improving waste service implementation data requirements and data handover to SCM functions. The commissioning party for this thesis was Fortum Waste Solutions Oy.

Keywords Lean, SCM, process mapping, service

Pages 67 pages including appendices 13 pages

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1 INTRODUCTION

This thesis research concentrates on the handover process of the finalized waste service solution to be implemented at a major customer's site. The author's interest in developing the service configuration process and especially the handover process further aroused from the experiences when participating in several different projects concerning the beginning waste services at different customers' sites. The lack of standardization and the vast amount of data collected during the projects caused the need for reinventing the process every time to serve the on-going project. A challenging part in the process is the handover to waste service provider company's supply chain management's (later SCM) order fulfilment, where every employee should know what to do, when the first contact with the new customer takes place. The challenges are caused by the fact that each customer case is unique, and each waste service solution consists of several different services.

Maximizing the service's value to customer by minimizing activities that do not add value and using less resources is the core of Lean thinking in an organization (Simon & Canacari 2012, 85). Lean thinking provides tools for both mapping the process and process improvement. Therefore, Lean thinking was chosen as the theoretical framework for this thesis research.

1.1 Thesis scope, research questions and objectives

Defining the scope was began by describing the service configuration process. The author began gathering the description by mapping the process steps using recent major customers' waste service solution implementations as examples. Each step from exploring the waste service quotation material to concluding the service configuration project was described by the author with main points to be considered and the data examples were presented in concrete pictures. The finalized process description came down to four main stages, which are in table below and altogether fourteen steps (Appendix 1).

Table 1. Service configuration stages

Stage	Description
1	Mapping and drafting a plan
2	Making a detailed plan
3	Implementation
4	Service begins

To go through the service configuration process with visual examples, two workshops were arranged in order to discuss the process and to define responsibilities for the tasks involved. Workshop participants were managers and specialists from both sales department and supply chain management. In both workshops some adjustments were done within the steps, but the big picture with four stages and fourteen steps remained unchanged. The final version of service configuration process in the form of a PowerPoint presentation was presented as an introduction to service configuration to all SCM employees as well as to management. Each introduction gave interesting points of view and comments from different functions. The following table shows how the service configuration process description and introductions progressed.

Table 2. Timetable for service configuration process description

Service configuration (SC) process	Timetable
Mapping the SC process	November 2018 -
1 day workshop - responsibilities	13.12.2018
½ day workshop – responsibilities continued	3.1.2019
SC process introduction to SCM employees	4 consecutive Tuesdays in January 2019
SC process introduction to SCM management	12.2.2019

After describing the service configuration process from the beginning to the end, it was evident, that the project handover takes place in stage 3, which is implementation (Table 1). In the end of stage 2 the detailed plan has been completed and it has been approved by the customer. Thus, all the data is ready for handing it over to the supply chain management, preparing for the implementation and beginning of the waste services at customer's site. This was an interesting topic to be researched, because there has been no predefined process or tools for doing the handover. A successful handover results in not only a satisfied customer, but also successful waste service solution implementation and correct invoices and reporting to the customer. This was a practical development task, which concentrated on describing and developing new customer's waste service solution's handover to SCM order fulfilment. The research focused on the internal process, which takes place within departments and functions at the supply chain management.

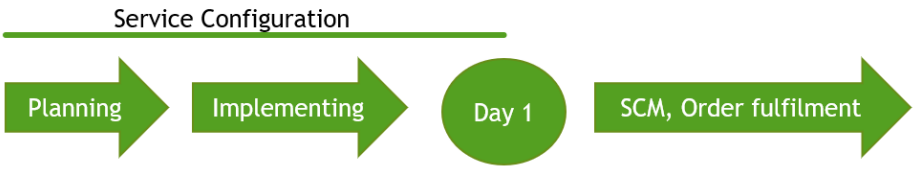

Figure 1. Service configuration simplified

The objective of this research was to answer the question: How to make a successful project handover from Service Configuration to SCM order fulfilment? To get deeper into the topic, the research answered also the following elaborating questions: How is the handover done at the moment? How to make the handover efficiently? And how to develop the handover process and related tools? With reference to Lean thinking the next chapters will go through how this research proceeded from studying the process mapping and improvement tools, mapping the handover process, finding objects for improvement and finally implementing improvements and making observations.

1.2 **Target organization**

The research was done for Fortum Waste Solutions Oy (later FWS), an environmental service company based in Riihimäki. The company was originally established in 1979 for treating hazardous waste by the name Oy Suomen Ongelmajäte – Finlands Problemavfall Ab and later from 1985 to 2017 it was known by name Ekokem. Since establishment the business has grown to cover all industrial commercial waste management services and municipal waste incineration. In 2012 the company expanded to Sweden by acquiring Sakab Ab and in 2015 to Denmark by acquiring Nord. The latest addition to Riihimäki plant was opening of the circular economy village in 2016. In August 2016 Fortum Oyj acquired Ekokem and integrated it as a part of its City Solutions division. The company has got 30 offices and treatment centres in the Nordic countries and approximately 650 employees. (Fortum 2019). This thesis research focuses on the internal process that takes place within the company's supply chain management organization. The service configuration team is the initiatory function in the handover process. The rest of the functions involved in the handover process are masterdata, collection equipment service, customer service, logistics and back office. FWS order fulfilment process is handled in the supply chain organization with enterprise resource planning (ERP) system. For document handling and internal communication, the organization uses Office365 applications.

National waste management plan to 2030 lays down the objectives for a sustainable circular economy in Finland in which high standard waste management plays an important role. This means saving natural resources, decreasing volumes of waste, increasing recycling and re-using, recovering valuable raw materials from recycled materials, making material cycles less hazardous and investing in high quality waste sector experiments and research. (Laaksonen et al. 2018, 11-12). This provides the framework for future waste management and the waste service solutions that are developed in cooperation with industrial customers and waste service solution providers. FWS provides industrial customers a full-service waste solution from planning and developing a comprehensive waste service solution to implementing services and providing the customer with one customer service for all the waste services. With these on-going changes

in waste management on the background, the customers expect not only the cheapest way of managing waste services, but total waste management services from one service provider. In addition, the service is expected to include flexible and agile pick-up of waste and good and easily accessible customer service.

1.3 **Concepts**

ERP stands for Enterprise Resource Planning system. The orders generated to the system by supply chain organization flow in the system from one function to another, from customer service until invoicing and reporting.

Project refers to a beginning waste service solution at a major customer's site. Project involves several stakeholders both internal and external. The project is started prior to handover and it includes all the preparation work for waste service solution implementation. The project therefore contains all the data needed for the implementation. In this thesis research Company X's waste service solution was used as a representative sample project for handover.

Handover is the process, which begins when the waste service solution implementation plan is ready to be implemented to company's ERP system. The handover process ends, when all the SCM functions have had their first contact with the new customer. After the handover has taken place, customer's waste services are run as daily operational routines and each SCM function knows how to proceed when the task input arrives.

Service configuration is used for describing the process in which the customer's waste service solution is drafted, planned in detail and finally implemented. The process was described before defining the scope for this thesis. This thesis research is focused on a small part of service configuration process, the handover. Service configuration is also a function, which is part of the SCM organization. The role of service configuration team is active involvement in mapping and in defining the customer specific requirements and needs with the sales managers. The objective is to develop service portfolio and enable cost saving and value creation for Fortum's customers. Service configuration team creates customer specific service setups and service execution plans. The team also ensures successful service implementations at customers' sites and at the SCM order fulfilment, including documentation and ERP setup.

SCM stands for supply chain management. SCM integrates supply and demand management across a company (Myerson 2015, 4.) SCM organization consists of several teams: masterdata, collection equipment service, customer service, logistics planning, logistics procurement and Supplier Relationship Management (SRM), back office and service configuration. Order fulfilment organization within the SCM handles the customers' request from waste bin emptying to invoicing and reporting.

2 A LEAN PROCESS

The theoretical framework is formed from Lean thinking literature, articles and webinar materials. This chapter begins with defining what is Lean and what makes an organization Lean. This is followed by value stream and process mapping theories, which reveal how to make a workflow visual. The end of this chapter bites into the process improvement.

2.1 What is Lean?

In the 1950s the Japanese car manufacturer Toyota was nearly bankrupt. In order to stay in business, the production needed to be redesigned and the company's assembly shop manager Taiichi Ohno was assigned to the task. Based on scarce financial resources and lacking economies-of-scale, he established three rules: build only what is needed, eliminate things that don't add value and stop if something goes wrong. Ohno is considered being the driving force for today's Toyota Production System (TPS). (Charron 2015, 48.) Modig and Åhlström in their book This is Lean (2013; 131-141) describe Toyota's philosophy with a pyramid of values, principles, methods, tools and actions. Above all are the organization's values, which define how to act. The values highlight the customer and fulfilling of customer's expectations. Principles define how decisions are made and what is important to the organization. These principles assisting organization in maintaining satisfied customers, are Just-in-time and Jidoka. Just-in-time describes the principle, in which the organization creates and maintains flow from function to function to complete the work. Jidoka is the principle, which ensures that every member of the organization knows what is going on. In Jidoka principle the aim is that an organization is so visual, that if something does not proceed as planned, it will be caught and fixed before it goes further. By applying these two principles, the employees can concentrate fully on the customer while completing tasks. Methods are standardized ways of working and completing different tasks. Standardized methods highlight the values and support the two principles. They make it easier for the organization to interrupt, if things are not done as planned. To be able to follow the methods, tools and actions are needed.

At Fortum the company's values are curiosity, responsibility, integrity and respect. The company culture is based on these values and they act as a guide for decision making and evaluating opportunities. (Fortum, 2019). The methods, tools and actions enforcing the Lean principles relative to service configuration handover process, will be presented in the handover process improvement chapter.

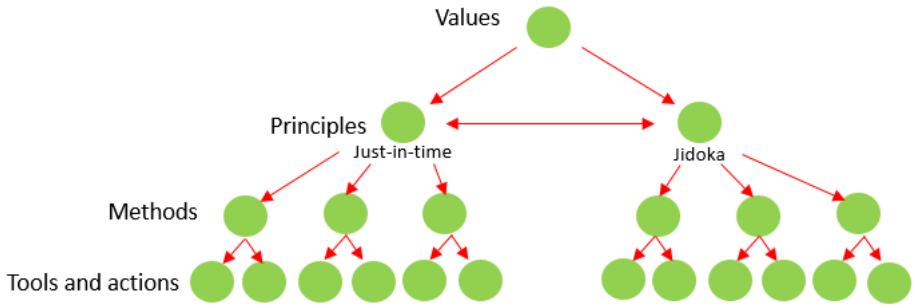

Figure 2. Lean philosophy described in the form of pyramid, applied from Modig (2013, 138)

The term lean and its opposite term buffered were introduced in 1988 in an article, in which John Krafcik from Michigan Institute of Technology compared production efficiency and quality of car manufacturers. Lean was used describing Toyota Production System (TPS). According to his research TPS consisted of following characteristics: high standardization of work, moderate span of control, small inventories, small buffers, very small repair areas and high levels of teamwork. He claimed that in these lean operations low inventory levels reduced costs, each problem with quality was detected and corrected quickly and that continuous flow of production was assured by not buffering (Krafcik 1988, 45). Lean term was made popular by a book written in 1990 by James Womack, Daniel Jones and Daniel Roos: The Machine That Changed the World (Samuel 2015, 1387.)

According to Kouri (2010, 6-9) the essence of Lean is to recognize the activities that add value to the customer and direct organization's resources to these activities. Developing lean operations in an organization follow the five Lean principles:

1. Define value: What is the customer prepared to pay for?
2. Map value streams: Defining the processes and functions that add value to the customer. Non-value-adding processes are minimized, and value-adding processes are made more efficient.
3. Create flow: Ideally work flows from function to function without stopping and being idle.
4. Establish pull: Work done based on orders or other impulses, no buffering.
5. Pursuit perfection: Processes are continuously improved by solving problems and removing waste.

Although Lean thinking was originally adapted in the manufacturing industry, it can also be applied in office environment and service industry. The core of Lean is the system approach, which means that the focus should be on the organization and its functioning as a whole. Paying

attention to further improving parts of organization should be done only after that. (Bicheno 2008, 8.) At FWS the supply chain organization was reorganized in 2014. After organization's reformation order fulfilment tasks were divided into different departments, so that flow was created from function to function. The organization has been developed further and one of the new functions at SCM organization is the service configuration. This thesis research concentrated on a process that covers all the functions at the SCM organization and is an important part of the value stream.

Primary focus of Lean is in problem solving and learning. We are forced to learn by solving problems. Organizations that copy what others have done with Lean thinking, Lean tools and techniques, fail to understand that learning is essential to success. Lean is a culture of experimentation and exploration and the focus is on learning from all that happens, failure or success. Paradigms for everything need to be continually challenged. (Hensley 2018, 50-65.) A Lean organization is based on continuous improvement in which all the employees are participating in. In the change management process used Plan-Do-Check-Act cycle has an objective to problem solving by trial and error (Plenert 2007, 264). In plan stage the expectation is to clarify the potential for improvement or the problem to be solved. Planning entails getting down to root cause and selecting the most appropriate method with clear objective and measurement of the expected results. The plan defines the process of the experiment and how it is implemented. In do stage, the experiment is carried out according to the plan to achieve results. In check stage the results of experiment are confirmed and compared to expected results stated in the plan. In case of deviation, the cause should be studied whether the results were lower or higher than expected. Only by learning, the organization's ability to solve problems and create solutions is improved. In act stage the experiment is found either successful or failed. In case the experiment was a success the new process should be standardized, and the knowledge should be shared within the organization. In case results are not what was expected, then act stage should be a review of the experiment (Hensley 2018, 103-104). Act stage reinitiates the cycle by taking corrective action if desired results don't take place. (TKMG 2010, 11.) In order to learn to maximize value for customers, the organization needs to think for themselves. As a by-product of thinking and learning, the organization reduces the amount of waste produced. People need to be encouraged and allowed to experiment, to make mistakes and to learn by doing so. (Hensley 2018, 82-83).

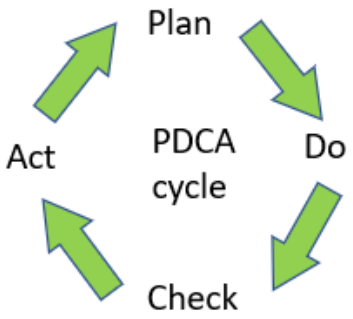

Figure 3. Plan-Do-Check-Act cycle for continuous improvement

Moving beyond tools, techniques and quick returns on investment, application of Lean should focus on using our brains for thinking and learning instead of just doing. (Hensley 2018, 140). In order to focus on thinking and learning how to make a successful project handover from service configuration to supply chain management's order fulfilment, it is essential to research the handover process thoroughly. The next paragraphs describe the theories of how a process can be made visual and easily understandable. By learning the current state of the process, the improvement opportunities can be seen and acted on.

2.2 **Process mapping lean tools**

Process can be defined as a sequence of activities taken to deliver, produce or design a good or service. In lean thinking the processes are examined through the value that is created for the external customer. Consequently, the processes can be defined either value-adding (VA), necessary non-value-adding (N) and unnecessary non-value-adding. Processes consist of three components inputs, activities and outputs. Inputs can be placed in different forms. They can be human, electronic, verbal or physical. Outputs of processes are generally goods, services or information that are required by the customer. Activity is the work done between the input and the output. There are benefits for documenting process inputs, activities and outputs: the output quality is related to the consistency and quality of inputs and the process itself, understanding the process assists in identifying the wasteful activities that can be eliminated and documentation is necessary for training workers, continuous improvement and measuring how the process is performed. Well defined and executed processes are competitive advantages in the continuously changing environment. (Martin 2013, 1-3.)

Service configuration handover to SCM functions is a process in which inputs, activities and outputs can be defined and analyzed by following a recent example. The justification for using a recent example case is that each function is familiar with the case and this enables concrete discussion about each process step. In order to determine how this could be done, the author studied both value stream mapping and metrics-based process

mapping to learn the concepts and preparations needed for these particular mappings. The following paragraphs clarify how these mappings are done and how they differ from each other.

2.2.1 Value stream mapping

Value stream mapping (VSM) is a process map that studies flow within the process. The mapping aims at maximizing efficiency and eliminating steps, which are non-value adding or waste. (Duffy 2013, 82.) Value stream of an organization includes all the actions that are needed for delivering the service to the customer from customer's first contact to delivered service or product. It is a useful lean tool for evaluating the current situation and presenting it visually within the organization. The current situation specifications can be learned with another lean tool, gemba walk through, which means walking through the value stream among the employees who work along the value stream. (Torkkola 2015, 131.) Value stream mapping is a team-based methodology to visualize the service process in an organization. Value stream consists of the organizations activities to fulfil a customer request (Martin 2014, 2.) Mapping is used as a tool for identifying Lean improvement opportunities by finding waste (Plenert 2007, 234). Value stream maps are often cross-functional, and they offer a holistic view of the workflow in the macro level.

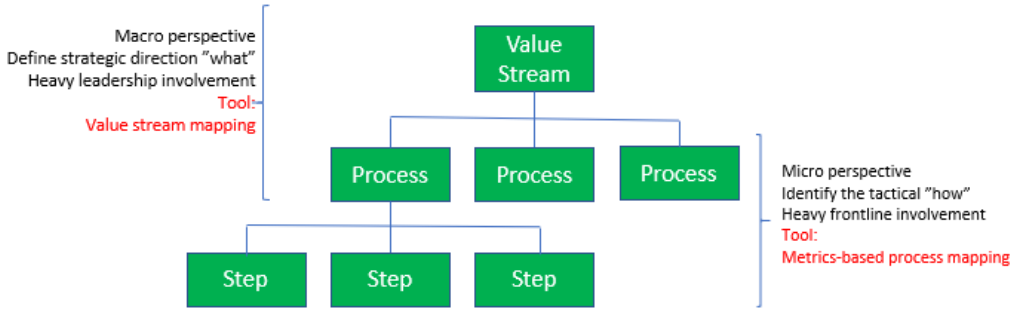

Figure 4. Macro and micro perspectives of an organization, applied from figure 1.1 Martin 2014, 8.

Value stream mapping consist of five stages: preparing, understanding the current state, designing the future state, developing and executing transformation plan. Preparations should be done well in advance and using a charter (similar to metrics-based process mapping charter in appendix 3) is an efficient way of defining the framework for the mapping. The planning starts by defining the scope and naming the value stream that will be observed. The specific conditions include or exclude certain conditions from the mapping activity and the demand rate quantify the volume of incoming work within a certain timeframe. Trigger initiates the workflow and first and last steps define the starting point and the ending point of the mapping process. In the charter it is also possible to define

limitations to mapping, for example number of employees or IT related limitations. Improvement timeframe is when the future state should be implemented. (Martin 2014, 31-37.)

Defining the current state problems and business needs are something that should be well thought of in order to build consensus and prepare the leaders involved in for the change. Measurable target condition should be something concrete, raw numbers and/or per centages. Benefits to customer and business assist reducing the resistance for change and clarify the understanding of the big picture. Important part in getting the future state improvements implemented is to assign the right persons to be the responsible parties. Executive sponsor should be a leader, who is ultimately responsible for the improvement. Value stream champion should be closer to the value stream and someone that participates in the mapping process. Choosing the right kind of facilitator is also an important factor in a successful mapping process. Logistics coordinator is responsible for the practical mapping arrangements and the daily briefing attendees are both people from the mapping team and the leaders following the process from outside. (Martin 2014, 38-41.)

Ideally mapping team consists of managers and leaders that represent all the functions in the value stream. The smaller the mapping team, the easier it is to do the mapping. Maximum of 10 participants in the mapping team will allow the mapping to be done efficiently. There may be some additional expertise needed occasionally during the mapping. Those experts can be invited as on-call supports. If it helps committing to value stream mapping process, it would be recommendable to have executive sponsor, value stream champion and the facilitator to sign the charter before socializing the charter to the leaders of the organization. There are three groups that should understand the charter: affected leadership, the mapping team members and the workers included in the value stream walks to understand the current state. The final preparations for the mapping event include collecting data that assists in grasping the current state as well as prospects for the future state. It is also worthwhile to walk or talk through the current value chain in order to define the time needed to do the mapping process and size of the map needed. (Martin 2014, 45-50.)

An effective way to execute the value stream mapping is to organize a three-day event of understanding the current state, designing the future state and finally developing a transformation plan for the execution of the future state (Figure 8). The three-day event should be started with a kickoff in which the team introduces themselves and the executive sponsor addresses his or her expectations for the mapping process. After this the charter is gone through once more and the general rules of the event are told to everyone. In case the team is not familiar with Lean thinking, PDCA cycle and value stream, these facts should also be overviewed by the facilitator. (Martin 2014, 51-55.)

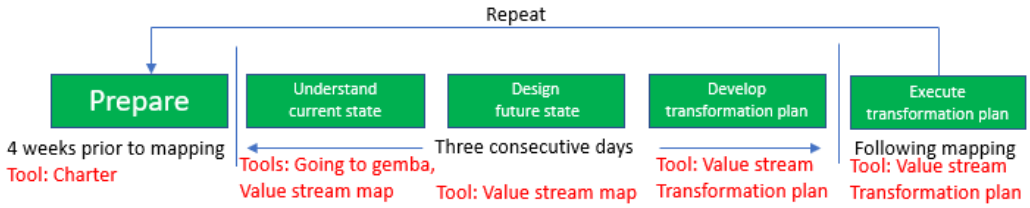

Figure 5. Value stream mapping stages, applied from figure 2.1 Martin 2014, 28.

Steps for defining the current state are: walking the value stream, laying out the map, walking the value stream a second time, adding details to the map and summarizing the map. The Japanese term gemba means the place, where the work is actually done and walking the value stream means going to the gemba. This is critical step for creating the value stream map as walking physically through the value stream gives the mapping team an understanding of the current situation. When the team returns to the base camp or event facilities, they start constructing the current state map with post-it notes defining the processes following each other. Post-it notes at this stage should include the process and the function that performs the process. After defining the processes, the team returns to gemba to find out performance in terms of time and quality. (Martin 2014, 56-67.)

Key metrics for each process is process time (PT), lead time (LT), percent complete and accurate work (% C&A), value adding work (VA), necessary non-value adding work (N) and unnecessary non-value-adding work (true waste). Process time (PT) is work that is done actively converting input into output. It does not include time that the work waits in queue or waits for corrections. Defining if the effort is value-adding (VA) is dependent on whether the work is valued by the external customer and customer is willing to pay for it. Non-value-adding work is divided in two categories: necessary non-value-adding (N) work that is needed in order to stay in business, for example things required by the authorities and unnecessary non-value adding work that can be reduced or even eliminated and it does not affect doing viable business or customer satisfaction. Lead time (LT) is the time that elapses from the moment that the work is available to the moment that it is handed over to the next process. Percent complete and accurate (%C&A) is metric that defines how much of the work is handed correctly to the process. If 30% of the work must be corrected before it can be processed and sent forward, then the upstream process is delivering 70% complete and accurate work. The downstream customer has three ways of handling the incoming incorrect input: correct information or material that was received, add information that should have been supplied already or clarify information that should have been clear. (Martin 2014, 68-73.) All these metrics can be applied to handover process steps, when using a recent example case of a typical handover of a major customer.

After the second value stream walk the metrics of the process and number of people working in the processes are recorded to the post-it notes. Also, barriers to flow are written down in case they are recognized including the piling of work before, during or after the process. To make the value stream information flow more visual the systems and applications that each process works with can be added to the map to clarify the IT architecture. Finally calculating the summary metrics gives the big picture of the current state. The map created acts as a visual storyboard of the value stream, which clarifies how work is done and reveals the flaws. (Martin 2014, 79-98.)

Designing the future state is based on 1) defining the work that should be done 2) making the work flow and 3) managing the work in order to continuously improve the performance. Defining the work should mean improving quality, eliminating delays and reducing labor effort, frustration and unnecessary costs. The Lean thinking is based on eliminating waste (muda), overburden (muri) and unevenness (mura), however in value streams this may mean also adding work. If work is added upstream, it may create net gain on the value stream. Removing processes and process steps from the value stream should prioritize in the unnecessary non-value adding work that was recognized in the current state mapping. After that attention should be paid to reducing effort for performing the necessary non-value adding work (N) and finally the value-adding work (VA). (Martin 2014, 99-102.) The goal of future state workflow is to deliver high quality as inexpensively and fast as possible. Ideally in the future state map all key metrics are reduced: process time (PT), lead time (LT) and percent complete and accurate (%C&A). As a result of improving value stream in a labor-intensive organization is freed capacity. This will for example allow the organization to absorb more work without hiring new staff. Value streams in the process level need two to five key performance indicators (KPIs) in order determine whether the specific targets are met. (Martin 2014, 106-110.)

The future state planning begins with reviewing the charter and revisiting the scope of the value stream mapping. Reviewing the current state findings highlights the key problems and wastes observed and the summary metrics. In this stage it is important to remind the team that bold change is vital to improving the value stream performance. Examples of improvement activities are building quality at the source, standardizing work and visualizing work. Other improvements might be moving teams physically closer or even considering cross-functional work cells. The making of future state value stream map begins with questioning the current state. While talking through the process the future state begins to form as team members select and prioritize the improvements. The future state value stream map should be done as the current state map with post-it notes including the metrics. When the mapping is done the summary metrics will be added to the same table with the current state metrics in

order to count the projected percentage of improvement. (Martin 2014, 111-121.)

The next stage is to visualize the improvements needed in the value stream map. These improvements are “kaizen burst” or irregularly shaped tags that state what should be done within the process step. For realizing the future state, a transformation plan is needed. In order to succeed with the plan, it requires the following facts: a well-done plan, consensus, the discipline to stick with the plan, the restraint to deviate from it only when absolutely necessary and the wisdom to know when to adjust the plan. The final task in value stream event is to create a value stream transformation plan similar to a charter. The plan should include the following facts: value stream name, accountable parties and the date it was created. Each improvement should have a measurable target, proposed countermeasure, defined execution method (Just-Do-It, kaizen event workshop, project etc.), owner, timeline for execution and status indicator. When the plan is created it is time for the final briefing in order to inform all affected leaders. To keep the transformation on track, there should be a sole accountable party responsible for running the status meetings. This could be for example the value stream champion. It is also critical that the executive sponsor of the value stream is committed to the transformation. (Martin 2014, 122-134.)

Service configuration functions in several processes within the value stream of the organization. However, for this research, the project handover from service configuration to SCM is a single process within the value stream. Therefore, the author did not organize a value stream mapping event but chose to do the current state metrics-based process mapping, which is described in the next paragraph.

2.2.2 Metrics-based process mapping

Metrics-based process mapping is a stand-alone improvement tool considered, when there is a need to map the steps within a process of the value stream. Metrics-based process mapping is done with frontline workers, who represent the functions that are included in the process. It considers the tactical view of how the work is done now and how it could be improved in the future. Metrics-based map is a visual analysis tool, which integrates the traditional swim lane process maps with the key lean metrics in time and quality. The tool highlights the disconnects, wastes and delays in a process. It also serves as process monitoring tool and it assists in training the workforce. Metrics-based process mapping is used for current state analysis and future state design. The preparation steps for the mapping include making a charter that defines who, what, where, when and why. The scope is defined with first and last steps including the set conditions. The team for the mapping should consist maximum of 10 people and it should include representation of each function who currently

work within the first and last steps, including customers and suppliers when applicable. (TKMG 2009)

Table 3. Mapping charter template to be filled in prior to the event

Applied from https://tkmg.com/books/value-stream-mapping/

Metrics-Based Process Mapping Charter

Scope		Accountable Parties		Logistics	
Process		Executive Sponsor			
Specific Conditions		Facilitator		Event Date & Time	
Demand Rate		Logistics Coordinator		Location	
Trigger				Meals	
First Step					
Last Step					
Boundaries & Limitations		Briefing Attendees **required *optional		Briefing Dates & Times	
Improvement Timeframe					

Current State Prolems & Business Needs		Mapping Team			
1			Function	Name	Contact Infromation
2		1			
3		2			
4		3			
5		4			
Measuarable Target Condition		5			
1		6			
2		7			
3		8			
4		9			
5		10			
Benefit to Customers & Business		On-Call Support			
1			Function	Name	Contact Infromation
2		1			
3		2			
4		3			
5		4			
Relevant Data		Agreement			
1		Executive Sponsor		Facilitator	
2					
3		Signature		Signature	
4		Date		Date	

Metrics-based process mapping current state documenting requires a sheet of paper with swim lanes posted on the wall. The mapping is done in ten steps. The first step is labelling the map. The label should include process name with potential elaborations and date of documenting. Also, facilitator's and team members' names can be written on the label to make mapping team visible. The second step is labelling the swim lanes with functions. This can be done by sticking post-it notes on the left end of each swim lane. External functions are included if applicable in the process that will be mapped. The third step is documenting the tasks of each function sequentially on post-it notes. Task note should contain a verb, a noun and function's employees by title. When functions and tasks are placed on the sheet of paper, the fourth step is numbering the tasks in the order that they are performed. Tasks may be either sequential or parallel. The fifth step concentrates on adding information to each step's task notes. The information includes number of people performing the task, barriers to flow and key metrics process time (PT), lead time (LT), percent complete & accurate (%C&A). The sixth step is drawing of the critical path through the task notes, which visualizes the workflow from step one onwards. The parallel tasks outside the critical path are tasks, which do not stop or delay workflow. In step seven process times (PT) and lead times (LT) of critical path are written under the swim lanes for each step. In step eight summary metrics are calculated and the results give the process time (PT) for the critical path and lead time (LT) for current state of the process. Activity percent can be calculated with the following formula: Activity % = PT/LT x

100. Notice that both times must be in same unit, for example in hours. Additional metrics counted are rolled first pass yield, which is counted by multiplying all the factor of percent complete and accurate (%C&A) and total process time (PT) including also all the parallel tasks. The ninth step is to go each task through once more and determine whether the task is identified as value-adding or non-value adding activity when thinking of the customer. Value-adding tasks are marked with label (VA) and non-value adding are considered whether they are necessary (N) or unnecessary waste (left unlabelled). The last and tenth step is to circle a task step, which indicates the greatest opportunities for improvement. When documenting the current state at the workshop, the facilitator should keep the team focus on the current state. The ideas for improvement can be written down in this stage and then moved forward with the current state. Moving on to the future state improvement ideas in the metrics-based process mapping workshop is began by focusing on steps 9 the value-adding and non-value adding activities and 10 the task step chosen to be one that has the most opportunities for improvement. There are several considerations in proceeding with the future state design and planning for improving the current state of the process. These will be presented in the following chapter. (TKMG 2009)

Considering the service configuration handover to SCM, the metrics-based process mapping enables making the process visual, understandable and internalizable to SCM employees and managers. It includes similar elements to value stream mapping and points out the tasks, which are value adding to the customer, but concentrates on a single process from a predefined starting and ending points.

2.3 **Process improving**

The two process mapping tools in previous chapter gave the foundation for understanding process mapping and the justification for choosing the appropriate tool for visualizing the current state of handover from service configuration to SCM process. This chapter concentrates on process improvement, how to make a process leaner. A summary of considerations for current state process improvements suggested by TKMG (2009) are listed in the following table. The considerations include improvements concerning the overall process steps and input controlling, the physical locating of functions and single steps and tasks within the process.

Table 4. Potential current state process improvements

Eliminate steps / handovers	Create organized, visual workplace
Combine steps	Reduce changeover
Create parallel paths	Eliminate motion & transportation
Alter task sequencing and/or timing	Standardize work
Implement pull	Eliminate unnecessary approvals/authorizations
Reduce / eliminate batches	Stop performining non-value adding tasks
Improve quality	Co-locate functions based on flow; create cells (teams of crossfunctional staff)
	Balance work to meet takt time requirements

Lean improvements should be focused on adding value to the customer by eliminating work that is not necessary i.e. waste (muda), removing unevenness of work coming in (mura) and avoiding overburden (muri) in the organization (Martin 2013, 101.) According to Torkkola (2015, 23-28) unevenness is the most important to tackle, since it causes the two others. She lists seven wastes that the customer is not ready to pay for and elaborations on how these are found in the office environment: Overproduction; too much is done too soon, or work is done just to be on the safe side. Uncompleted work; work that has been started but is waiting for to be completed. Waiting; either work waits for the employee or the customer waits for service. Extra motion of employees or material; using of several applications, classifying or searching for data. Transport; transferring data from person to person, department from department. Failure demand; work that must be redone because either external or internal customer is not satisfied with the service. Inappropriate or over processing; work done because it is not known what the customer really wants.

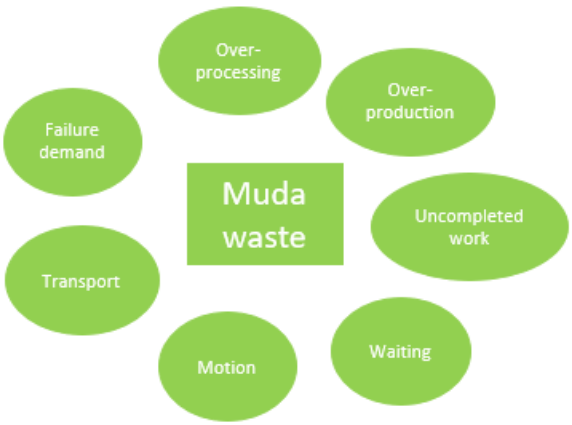

Figure 6. Summary of the types of waste in office environment

Employees may not have trained eyes to see all the inefficiencies, defects and waste in our environment and they seldom see what they could improve themselves or with the help of their own team. Therefore, to find process improvement areas, the process map with the measured metrics and amount of work performed should be made visible and published. It is also important, that the processes are owned by the teams performing them. In general, a process should be simple, visible and standards should be introduced to stabilize the process. When standards are set, they should be challenged regularly to further improve the process. (Medinilla 2014, 101-116.) In the handover process many of the steps follow the path of routine order fulfilment, but nevertheless the process is unique due to plenty new data concerning the customer and a new combination services and potentially new set of service providers. These features add the need for a visible process that could be standardized and further improved over time.

2.3.1 Visualizing and standardizing

Making the process visual by placing the process steps on a map was described earlier. This paragraph concentrates on how to make the process or the individual steps further visual and standardized while the work is being done. These methods are applying the lean tool 5S, using a digital or a physical communication board and introducing standard methods and tools.

Being the most popular tool in lean service, 5S objectives are reducing waste, especially time spent for searching, improving productivity and reducing variation (Bicheno 2008, 151). 5S consist of following steps:

1. Sort / Seiri
2. Simplify / Seiton
3. Scan /Seiso
4. Standardize / Seiketsu
5. Sustain / Shitsuke

5S system is a visual method of putting the workplace in order. It is a standardization and organization system. Although effectiveness of this system was first documented for manufacturing, 5S has been used successfully also in other kinds of organizations, for example in hospitals and front offices. In office environment the five steps can be defined as follows. Sort – Separate the necessary from the unnecessary, for example documents. Throw away things that don't hold value anymore. Clear off space for other materials that support the organization more effectively. Simplify – Numbering, labelling and proper placing of material. Making material easy to find and use. Scan – Straightening up the office space, keeping the equipment clean. Standardize – Standardize sorting, straightening and shining to a way of performing these activities with certain materials or objects. Standardizing will facilitate cross functional

ways of performing. Sustain – Sticking to 5S procedures in the long term will require setting a schedule for the 5S. 5S results in a visually clean workplace. (Duffy 2013, 82-84.) Promoting process visibility is the main purpose of 5S. It makes improvement opportunities obvious. (Hensley 2018, 95-96.) In order to successfully implement 5S in an organization it is important to include the entire facility, entire staff and especially the managers and executives. The process needs to be done including all the five stages and employees need be given time to understand the process. (Charron 2015, 259.) 5S results in an organized workplace, which brings about improved efficiency, reduced searching time and a foundation for all other improvement activities. (Myerson 2015, 288). This lean tool is not directly applied to service configuration handover process, but 5S steps are applied in the handover data storage for standardizing and visualizing.

Visualization is a means to highlighting problems and to bring them to the surface by providing transparency. The more transparent the process can be done the easier it will be to spot the problems early. The earlier the problem is spotted the easier it could be solved. (Hensley 2018, 95-100.) In service situations communication board is an important visual device for improvement. It is used for communication purposes, for problems and resolutions, for team working and waste reduction. The board serves a team in short daily meetings and it may include different charts to serve team's purposes. Examples of charts used are progress chart and task allocation chart. (Bicheno 2008, 272-273.) Lean experts agree that physical team boards are better to any digital alternative. Digital tools should never be a real substitute to a physical board, but they can be used as add-ons. The reasons for this are (Medinilla 2014, 92-94.):

- A digital tool is visible only when accessed. The information on a digital tool is accessed only, when information is needed. People are not constantly exposed to information as they would be with the physical team board.
- Absence of visibility will place no peer pressure on the team. Real power of making one's commitment public, comes from updating progress on a visual tool on a daily basis.
- A physical board adapts easily to different teams' needs. A digital tool easily forces teams to use common standard.
- A physical board ensures that everyone on team is active in the daily updating of the board and this creates real collaboration. A digital tool in a team meeting, usually means that only one team member is using the keyboard and doing all the changes. This creates a message that anyone can update anyone's work at any time. Even if everyone on the team updates the digital tool by themselves, a digital tool allows to pay attention to only tasks assigned to the person doing the update, leaving the visual aspect of the situation aside.
- Sense of ownership is harder to create with a digital tool than with a physical, adaptable and daily updated board.

- Team identity cannot be built with the lack of adaptability and ownership. A digital tool is not likely to contribute as a physical team space does.
- Engagement of cognitive mind is higher when drawing or writing by hand. It is lower when listening to speaker, using a keyboard or staring at a screen.
- Using digital tools is like old style reporting. The physical board makes a team motivated, proud of their visual board and they even often have fun by the board. The contrary is often true with the digital tool.

A communication or a team board is a recommended tool for making a successful project handover from service configuration to SCM order fulfilment. Especially when there are several simultaneously ongoing projects, a team board would be a way of keeping up with and following the progress of all the handovers, related tasks and their scheduling.

Standardization can be described as the best work practices. It makes operations reliable, repeatable and ensures reduced variability and high productivity. By standardizing, tasks are organized in the best know sequence and by the most efficient combination of methods, materials and people. (Myerson 2015, 288.) Standardized work not only provides the best possible quality in the shortest time and the least amount of effort, it also provides a system for identifying problems, a baseline for analyzing problems and a template for sharing the knowledge that has been gained from the problems that have arisen and been solved. Standardizing also provides a system for coaching and guiding frontline workers and introducing tools that focus on improvement. Standards are not only foundations for improvement, but can be described as current best practices, something used as a measure in comparative evaluations or higher agreements of how a process should be accomplished. Standards should provide a system for identifying problems. A standard cannot be too vague, because it is difficult to see whether a problem exists or not. For solving a problem, a standard gives a baseline for understanding what went wrong. When assessing the chosen solution, it must be ensured that at a minimum, the standard is maintained. A standard is a remarkable sharing mechanism for learning from solutions that turn into process improvements. (Hensley 2018, 73-93.) The service configuration handover process did not have an elaborately described process previously. This thesis research produced a visual handover process map. This produced process map could be used as the standard baseline acting as a foundation for process improvements. The best work practices can be introduced by providing templates and checklists, which are visual aids for completing the task according to standard.

2.3.2 Mistake-proofing – pokayoke

Pokayoke or mistake-proofing is a concept for preventing mistakes that was introduced by Shigeo Shingo to Toyota Production System (TPS). Later

the concept has been developed also for services. For example, in enterprise resource planning (ERP) system, when entering an order, certain information is required, and the form of data is defined in order to complete the output correctly. (Bicheno 2008, 181.) In the service cycle, pokayoke can be applied before, during and after the service is provided. Before the service, mistakes can be removed by eliminating unnecessary handovers or multiple data entries. During the service the mistake-proofing can be done by facilitating work with colour coding, check lists and general ergonomics. For detecting mistakes during the service, in data entry can be applied non-completion of required fields notification. After the service, mitigation actions can be used reducing the mistake implications. Mitigation actions include double-checking, cross checking and reminding customers to do certain procedures. Replacing human actions by automated actions for mistake and safety reasons is another method for removing mistakes (Bicheno 2008, 185-186.) In any lean process, pokayoke is an important quality improvement tool. There are four quality levels, the fourth being the perfect quality level. In the first level the quality is inspected by the customer. The second level inspection takes place in the end of line before the delivery to the customer. In the third level, quality inspections become part of each process. For every Just-In-Time system, this is the basic quality level. In the fourth level quality, inspection is no more a separate step, but a built in pokayoke tool. In the fourth level perfect quality is built in and the redesigned process both validates and eliminates quality errors. (Plenert 2007, 259-260.)

In the service configuration handover process pokayoke features should focus on eliminating mistakes before the waste service solution is implemented at customer's site. By directing the service configuration handover according to a standardized process, with mistake proofing tools involved, one of seven the lean wastes mentioned by Torkkola (2015, 26) failure demand can be reduced. If the customer is not satisfied with the implemented service, the service configuration will need to be redesign the service entity to measure up to the customer's expectations.

3 THE HANDOVER PROCESS

The service configuration handover to SCM order fulfilment process was not previously accurately described at FWS. The objective of this thesis was to make the process visible, to develop the process and to create appropriate tools. This chapter begins with explaining action research in process development, which provided the suitable methodology for the research. This is followed by planning the workshop, implementing the workshop and a summary of findings during the workshops. The process improvements both introduced and suggested are gone through in the fourth chapter.

3.1 Action research of the handover process

Action research was first mentioned in an article published in 1946 by a psychologist Kurt Lewin. His article concerned minority problems in society, and he claimed that research, which generated only books would not be enough to induce change. (Lewin 1946, 34-35.) Action research is connected to practical work life issues and it aims at change, which is a continuous cyclical process (figure below). It involves people, who daily do the work related to the topic of the research. It tackles the problems making them visible and removable. Here in lies the power of action research, since people who are dealing with the problem, are able to find solutions together and this also commits them to the change. Cooperation is an essential element of action research. In traditional qualitative research no actions are taken during the research. All the results are based on inquiries, observations and interviews, and the researcher is not allowed to influence the researched phenomenon. Action research breaches this last principle as the researcher is involved in both action and research. (Kananen 2014, 11-16).

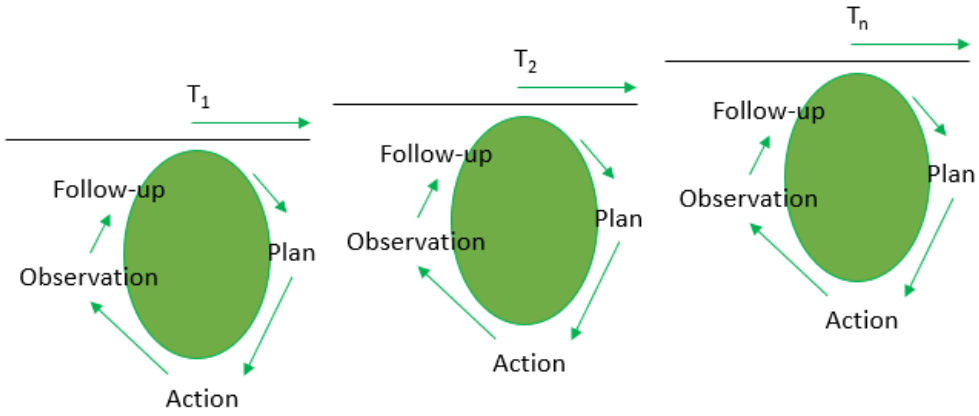

Figure 7. Action research aims at change

Action research combines different research methodologies. It can contain data collection and analyzing methods from both qualitative and quantitative research. Qualitative research concentrates on a single event and gives new ways of understanding the phenomenon in depth, whereas quantitative research concentrates on a group of events and cannot detach single events. Because processes are complex, they are mainly researched by qualitative methods. The less is known about the phenomenon, the more likely qualitative research is chosen as the research methodology. Example cases for choosing qualitative research are: There are no existing knowledge, theories or research, the phenomenon needs to be interpreted deeply or the phenomenon needs to be described thoroughly. The relationship between action research and qualitative research is described in the figure below. (Kananen 2014, 22-26).

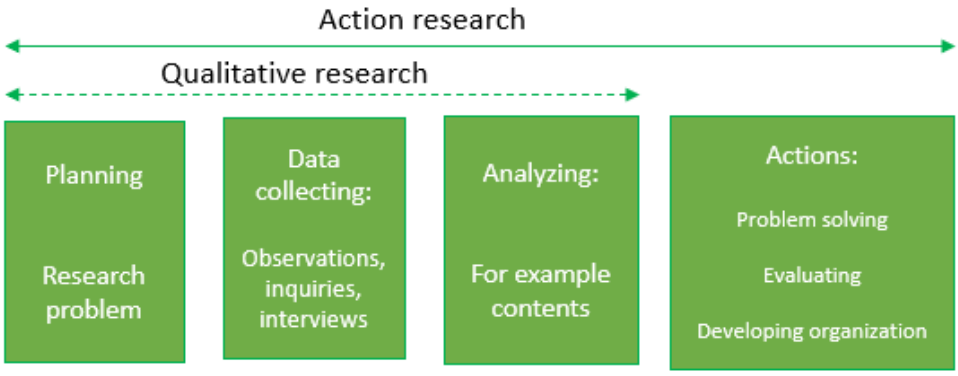

Figure 8. Relationship between action research and qualitative research

Action research requires involvement from not only the researcher, but also people that are involved in the phenomenon that the research concentrates on. The researcher is responsible for a successful research and in addition to research he or she must have social skills in order to handle the group behaviour of the involved people. When facilitating a group session, the researcher should encourage the group to utter opinions and ideas. The researcher's role should be acting as a listener and a coach. (Kananen 2014, 67.) The objective of action research is always change. The objectives for change are often processes and actions, which concern organization's employees. For scientific purposes implementing changes is not enough. For scientific research producing implementable solutions for different problems is part of qualitative research. For action research is provided that solution is implemented, and its consequences are analyzed. (Kananen 2014, 117.)

Action research provides the suitable methodology for the thesis, since the objective is not only to understand the handover process and suggest improvements, but also to implement improvements and continuously develop the process further. The action research timeline and steps are in the following table.

Table 5. Action research timeline and steps

Step	Task	To do	Date
Step 1	Define handover	Service configuration process description	11/2018-1/2019
Step 2	Plan workshop, invitations	Handover process of company x, collecting & analyzing documentation	2/2019
Step 3	Facilitate workshop	Metrics based process mapping, document analysis	14.3.2019
Step 4	Summary of findings	List of suggested improvements	4/2019
Step 5	Implementing improvements	Planning execution of improvement	5/2019
Step 6	Observations	Adjusting improvements	6/2019 – 7/2019
Step 7	Follow-up	Results of improvements	8/2019

3.1.1 Data collecting and analysing

In action research as well as in qualitative research, data collection methods are observations, interviews and documents. Observations are always part of action research and often observations are complemented with interviews in order to confirm that observations are interpreted correctly (Kananen 2014, 29.) When planning the thesis research at author's workplace, it was decided that the current handover process is described by using an existing example. The case chosen to be used as an example, was agreed to be based on the following criteria: major customer, recent waste service solution implementation, covered both hazardous waste and industrial commercial waste and the case was a well representative case of handover process. This chosen customer is named company x for the research purposes. The data collection methods for research were participative observation, gathering of handover documents used in the handover process and a workshop arranged for going through the handover process step by step and the documentation involved in the handover.

Participative observation done by the author produced a preliminary process description. To confirm the observations, the process was further discussed and developed in the workshop, which included representatives from every SCM function involved in the handover process. The handover documentation was categorized by the stakeholder and each document was numbered. Also, three additional documents were introduced at workshop, that were not involved in the original handover. The summary of data collecting and analyzing methods prior to implementing the suggested improvements are in the table below.

Table 6. Collecting and analyzing methods

Data	Collection method	Analyzing method
Handover process	Participative observation	Introducing the process in the workshop
Handover process metrics	Workshop, metrics-based process mapping	Analysing the metrics and improvement suggestions
Handover document	Gathering and printing all handover documents	Grouping by stakeholder, numbering

Change is always the objective of action research. In order to verify the change, the impact of intervention should be measurable. A defined factor should be chosen and measured before the intervention (T0) and then after (T1). The impact of intervention is T0 - T1. The prerequisites for action research are realization of change cycle, researcher's involvement in the change, research and collaboration. (Kananen 2014, 119.) In this research the change can be measured by reducing both process time (PT) and lead time (LT) of the handover process steps. Furthermore, measurable improvement can be reached by improving the amount of correct and accurate input from one task to another. This can be applied to pricing issues that are unclear as well as collection equipment ID recording inaccuracies.

3.1.2 Reliability of the research

The basis for reliability of action research is the precise documentation of the research including data collection, methods and results. Results of the action research are valid only for the phenomenon that was researched. The successful results of action research can be defined by the objectives set on the research itself. Qualitative research is always influenced by the researcher and it can never be fully objective. Subjectivity can be reduced by justifying choices in data collecting and analyzing methods (Kananen 2014, 134-137.)

This thesis work was done under supervision of both thesis supervisor at the university of applied sciences and the commissioning party's supervisor at author's workplace. The data and documentation collected before the workshop was began during the handover process of company x by participative observation by the author. The handover process and documentation were introduced at the workshop for the employees, who did the actual work during the handover process. This increases the reliability of the research, since the process and development ideas, were all talked thought together. The improvements, both implemented and suggested, were introduced to commissioning party's supervisor beforehand. All the implemented improvements were observed and

followed-up in the research diary. This was done in order to record the timeline and list of adjustments done for each implemented improvement. The results for this thesis research are valid only for this particular service configuration handover process.

3.2 **Handover process workshop planning**

Metrics-based process mapping (MBPM) is an efficient tool for analyzing the current state of a process within a value stream. It was chosen to be the used lean tool based on Martin's (2014, 8) indication that value stream mapping consists of the macro perspective of all the processes in the value stream of an organization and micro perspective concentrates on a single process at the time and breaks down to the actual tasks or steps of which the process consists of. This research was done on company x's waste solution implementation, which took place in October 2018. The preliminary process map including the SCM functions involved as well as the process tasks, were gathered by the author by participative observation when involved in the actual process. To finalize and analyze the process mapping, the author was given permission to organize a half day workshop. The objective of the workshop was to make the handover process visual, to get the metrics involved in the example case and most of all, to get ideas for improving the process.

3.2.1 Preparations

Planning of the workshop was begun approximately 6 weeks prior to the event. The event date was set to be March 14th, 2019 and the appropriate meeting room was booked from early morning to afternoon. The physical map needed a sheet of paper posted on a wall, that was big enough to include all the SCM functions in their own swim lanes as well as all the tasks in steps along the timeline from left to right. This mapping was prepared by using three combined flip board papers, drawing six swim lanes for SCM functions: Service configuration, master data, collection equipment warehouse, logistics, customer service and back office. These six were written in pink post-its and they were placed in the beginning of each swim lane to the left end of the sheet. Below the swim lanes was left empty space for any extra functions that might turn up during the workshop and for counting the total process times (PT) and lead times (LT) for the critical path. In the upper right corner was placed the heading for the mapping process, which included name: Waste solution implementation data handover to SCM functions. It also included the specifying notion that this was the mapping of the current state process, name of the facilitator and the date of mapping workshop. In addition to mapping paper sheet it was necessary to reserve equipment for doing the actual process visual to the map. Post-its we reserved in different colours: pink for functions, yellow for tasks, green for tasks that add value to the customer (VA), blue post-its for tasks that don't add value to customer but are necessary for the current

process (N). Pins, pens, markers, scissors, tape and paper for making notes were also reserved to the meeting room.

Figure 9. Process map before the workshop begins

For the research purposes, video camera reserved to be set ready to record the workshop on a tripod in the corner of the meeting room. Also, camera was prepared for taking picture prior, during and after the workshop. For facilitating purposes PowerPoint slides were prepared for the workshop's different tasks. The PowerPoint show was constructed so, that all the workshop's topics had a slide that could be kept on the background at the meeting room's big screen, while the discussions were going on. The slides included approximate of the workshop's timeline and the process mapping scope that had to be revised before starting the mapping. There was a slide clarifying the metrics counted for tasks and this was left on the screen during the mapping. The rest of the slides included list of handover documents sorted by provider and numbered, the list of functions and what documents each function needs and then list of the places where handover information can be stored in or informed at.

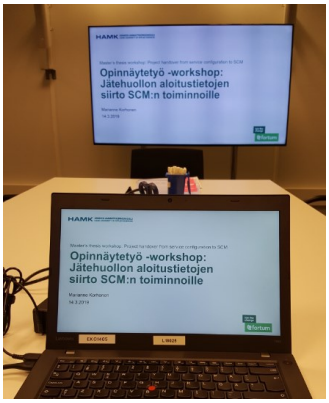

Figure 10. PowerPoint prepared for the workshop

3.2.2 Participants

According to Martin (2008, 43) the smaller the team the better the results. This is provided that each function is represented at workshop. To get the experience and expertise of the employees, who do the daily work in the order fulfilment functions, the participants had to be chosen carefully. Since the process steps and the handover material were defined by company x's waste solution implementation, it was clear that employees who are familiar with the company x are priority choices. Another important factor in choosing the participants was that each function had to be represented. Participating outside eyes would have been an asset, but because of limitations in time and space, the author decided to concentrate on SCM employees. The invited six participants are clarified the table below. The author, Specialist in Service Configuration, acted as a facilitator of the mapping event. In order to have more expertise available one more participant was agreed to be as on-call support if needed. This participant was a Customer Service Advisor, who has been working in both customer service and back office.

Table 7. Workshop participants

Function represented	Job titles of participants
Masterdata	Masterdata Specialist
Invoicing/customer service	Customer Service Advisor
Waste equipment business	Product Coordinator
Logistics	Transport & Logitics Coordinator
Back office	Customer Service Advisor
SCM	Supply Chain Manager
Service configuration	Specialist, Service Configuration

3.2.3 Metrics-based process mapping charter

In order to make sure that every detail was thought of before the workshop, a charter (Appendix 3) was created by applying the value stream charter template (Martin 2014, 32). The process was named the handover of waste solution implementation data to SCM functions. The specific conditions for the process were set to reflect the company x's, waste solution implementation. The process is triggered by the customer's acceptance of waste solution implementation plan. When the plan is accepted, all the data is ready to be handed over to SCM functions. The first step is done by service configuration specialist, when the data is made available to the SCM functions. The last step in the handover process is when the first invoice is sent to customer. In case of a waste solution implementation, the first invoice includes mainly the delivering of waste collection equipment to the customer's site.

Boundaries and limitations did not exist preliminary, but when the author began to draft the process steps, it became clear that purchase invoices were not a vital part of any single company's waste solution implementation. Purchase invoices consist of invoices from waste equipment purchasing, waste treatment in facilities other than suppliers own and logistics subcontractors. Excluding these invoices and their cost centre postings simplified the process and made it easier to concentrate on the tasks that concern specifically company x's waste solution implementation. The charter summarizes current challenges and development needs as well as measurable objectives. These all were thought of from the service configuration's point of view. Firstly, the handover situation lacks uniform process and value adding tasks from customer's point of view are not defined. All the rest of the development needs concern data. The amount of data, the storing places and ways of transferring of data and how to make sure that the right kind of data is available when needed.

3.2.4 Handover data

There were essential data that had to be gathered before the workshop. It included handover documents, listing of all the possible storing places for the documents and counting of the company x's waste service solution implementation in numbers (in table below). The last mentioned was important data especially for estimating process time (PT) for different tasks. The numbers we counted from enterprise resource planning system and from different handover documents made in Excel.

Table 8. Company x's handover case in numbers

Company x	#
Customer numbers	4
Waste collection points	104
ERP pricing lines	162
ERP contract	163
ERP contract lines	556
Route charts	8
Collection equipment	226
Export orders	86
Routes	7

For the workshop all documents involved in company x's waste solution implementation were gathered from different locations, printed and numbered from one to twelve. Also documents that could have been used in the handover, were printed and marked with a, b and c. Below is a description of all the different documents gathered for the workshop and a summary of all the documents in the table below.

Table 9. Summary of handover documents

Company x	Fortum sales	Fortum service configuration	Fortum logistics, procurement
1. Site, building maps	4. Contract (incl. price lists etc.)	5. Waste collection point listing	11. Logistics service descriptions
2. Waste fractions, EWC codes		6. Waste collection point map	12. Driver and vehicle permits' listing
3. Invoicing and reporting units		7. Waste stream chart	
		8. Waste solution implementation plan	
		9. Final collection equipment list	
		10. Export order instructions/collection equipment	
		a. Summary b. SCM internal service description c. Poimapper	

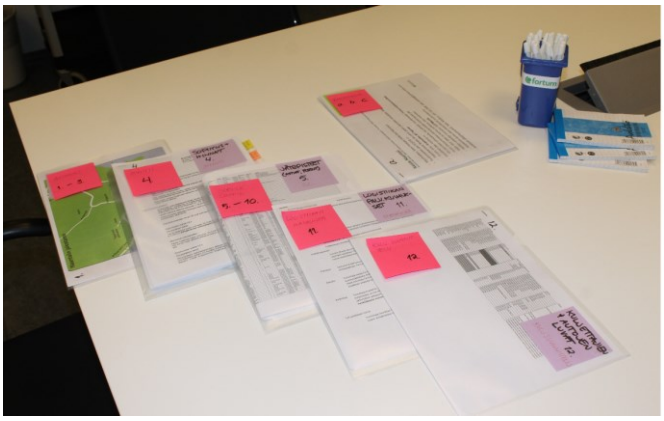

Figure 11. Documents at the workshop

In company x's waste solution implementation customer provided different kinds of maps from the site. One of the maps covered the area with names for different buildings and it gave a good overview of the industrial site. For making a waste collection point map a set of different maps were needed in order to mark the collection points either outdoors or indoors within a building. For customer's waste reporting to continue consistent after the waste operator change, the customer provided also a list of previously used European Waste Codes (EWC) with equivalent names used for the waste fractions. The customer structure for invoicing and reporting purposes required understanding of how the customer's different departments are divided in entities. Company x also provided a clear chart of reporting entities.

Sales managers and key account managers are responsible for negotiating the contract and getting the contract signed by company x's representation as well as vendor's representation. The contract included important data such as price lists, service descriptions and the period of validity. The contract terms take time to negotiate and due to this, contract was being fine-tuned weeks after the service had already began. In company x's case the service began on October 1st, 2018 and the contract was signed on November 19th, 2018. This means that the service framework and price lists used in the handover were preliminary, but service implementation took place as if the contract already existed with interpreted terms.

Most of handover material was produced and gathered in the planning stage. The waste stream chart was a tool that gathered all the important information for each waste fraction: name of the waste fraction, European Waste Code, waste collecting equipment used, logistics details including the subcontractor information and impulse for order, downstream details including waste treatment facility's name, address and treatment code. The waste stream chart gave an overview of the waste solution to be implemented. Waste collection point listing went into details of each waste collection point, defining what each collection point contained. Waste collection point listing was also used for planning the customer structure for invoicing and reporting, so that each point was defined for the entity it belonged to. As a side product for listing waste collection points, waste collecting maps were produced using the maps provided by company x. There was available a digital mapping tool for waste collection point listing, but this tool was not used at company x's site due to facts that taking pictures was not allowed at the site and part of waste collection points were located in areas, where normal electrical equipment was not allowed. However, for the workshop, an example of another digital mapping document was printed.

Waste solution implementation at customer x's site required a detailed plan with timeline, equipment and staffing. For collection equipment there were two kinds of lists produced: Lists of total quantity of equipment for checking whether every equipment is available at request and lists of equipment export orders to be done to the ERP system. The logistics involved in the beginning of customer x's waste solution required two kinds of documents: Lists for drivers and trucks that have received permissions to enter customer x's site and logistics service descriptions that were done to describe the waste collecting at company x's site. The latter documents were attached to the frame contracts, which had been made earlier with the logistics subcontractors by logistics procurement.

In January 2019 service configuration work of waste solution implementation at new customers' sites was introduced to SCM employees. During the introduction sessions, it became obvious that a summary of a new customer would be welcome addition to all the data that is available at handover. A summary should tell in one or two pages the essential facts of, in this case company x's waste service solution. The author made an example of a summary to be discussed at the workshop (Appendix 2). Another additional document taken to the workshop was an example of an internal service description. Altogether the data was gathered and produced in digital form, mainly with Office365 tools Excel, Word and PowerPoint. Maps and other documents were in either .jpg or .pdf-formats. There hasn't been a standard set of documents for handover and there hasn't been standard naming of the documents. The storing and sharing of documents have also varied (in the table below) for different handover cases.

Table 10. Ways of storing and sharing data

Data storage & sharing
SharePoint workspace
Teams channel
OneDrive
PC / e-mail
Old database via Citrix
Lotus Notes

3.3 Handover process workshop Implementing

The workshop was arranged in the morning of March 14th2019. The author acted as a facilitator and made sure that all the participants were made aware of the process being mapped. The process definitions and limitations in the charter (appendix 3) were gone through together and agreed on. Before starting the mapping, it was also necessary to go through the mapping steps including the different abbreviations and metrics. There was a laid-back atmosphere at the workshop despite the video recording, which made it easier to discuss the process openly. It was an advantage to gather the group from employees that have worked together for a long time and know their field of task well.

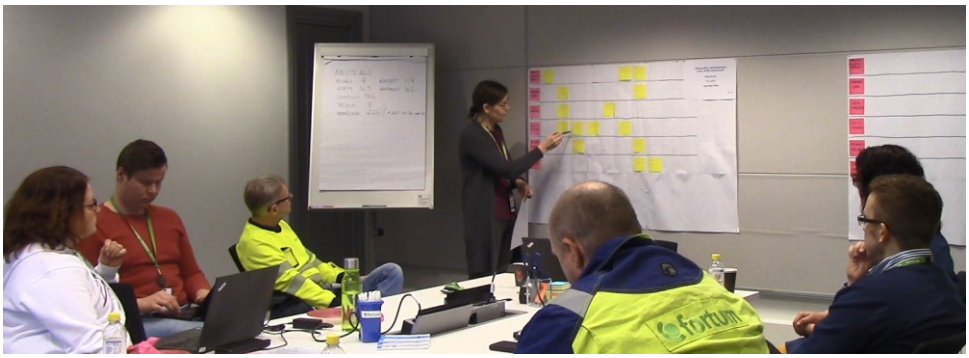

Figure 12. Laid-back atmosphere at the workshop

The workshop began with current state process mapping. Each predefined yellow post-it representing a task was talked through whether it was correctly placed and when applicable, the process time (PT) and lead time (LT) were placed on it. The company x waste solution implementation numbers were written on a flip board next to mapping wall in order to keep the numbers available, when thinking of each task. Also, the head number i.e. the number of employees for each task was written down in order to make the capacity of people doing the same tasks visible. When applicable, the amount of correct inputs (% C&A) was written down in the post-its. Some of the tasks did not get measurable metrics, since some of tasks were not time bound and some of the tasks involved lists, which were in principle taken in as being a hundred percent correct. When the first round was done, the second round was about numbering the steps. Parallel steps

were numbered with the same numbers, but with an additional letter a, b etc. The numbered steps from one to eight formed a critical path which was drawn to the map. Process times (PT) and lead times (LT) were now written under the swim lanes for the critical path and this gave the total process time of 111 hours and 34 days lead time. The third round was to go through the tasks one more time and define which tasks add value to the customer (VA), which tasks don't add value to the customer, but necessary for the process (N) and which tasks are waste, neither value adding nor necessary (without a label). The very last stage of mapping was defining the step that has the most potential for improvement. Step number one was unanimously named as the step which have both most potential for improvement and influence on the following steps i.e. the whole handover process. The final current state map in the following figure.

Figure 13. The workshop has finalized the map

The direct feedback from the workshop was, that even though the process itself was familiar, these metrics and the visual presentation provided new perspectives and more understanding. Especially the time metrics opened eyes to see how much time and manual work certain tasks require. Analyzing the choice of participants, the group size was good, and the atmosphere was immediate and open. All the SCM functions' knowledge was available in one room, which was a clear benefit. There was no need to leave questions unanswered or go to ask additional information from elsewhere. As a facilitator, the author learned a lot. Because the time was limited, the workshop had to be well prepared. The challenge as a facilitator, was to schedule the workshop so, that there was not too much to do and yet there was enough to do.

3.3.1 Handover process steps and observations

1. Hand out service configuration data/Specialist Service Configuration

The process was defined to be started when handover data was distributed to SCM function. This was the first step in the process and for this, no process time or lead time was defined. The data for handover was prepared prior to customer's approval and the approval acted as a trigger for the whole handover process. When the implementation data was approved by the customer, service configuration specialist transferred the finalized implementation data in several documents to SCM functions. In company x's case, the handover data was sent via e-mail either in document form or as a link to an internal SharePoint workspace. The workshop participants unanimously named the first step as having the most potential for improving and developing. After going through the process and all the different handover documents this step was the step, which was affecting the following steps the most and potentially would make the subsequent steps easier. This step was defined as value adding step to the customer. In this step service configuration interprets what customer wants and SCM order fulfilment translates it into a service.

2. Create at ERP system/masterdata specialist

Masterdata created the base data to ERP system and this was set as being the step two in the process. Based on the numbers in company x's case, including 163 contracts and 556 contract lines in the ERP system, it was possible to estimate the process time. If a masterdata specialist had no other tasks simultaneously and there was no waiting time for getting correct information, this case could be done in 32 hours. Lead time was set to ten working days in order to make sure that there were extra days for getting the missing or correcting the conflicting pricing data. Ten days is the same amount of working days that it was estimated in the real process of company x's case in autumn 2018. The amount of input data that was correct and didn't require additional work, was estimated to be 90%. This was due to unclarity of pricing related issues.

2a Reserve collection equipment/product coordinator
2b Reserve resources (permissions)/logistics coordinator

Two parallel tasks, 2a and 2b were started simultaneously. Product coordinator went through the final collection equipment list and made sure that everything was available at the equipment warehouse. This was just a short check and done just as the final list was made available. Therefore, no process time and lead time were defined for this task. Another parallel task was booking of resources by the logistics coordinator. This included booking of certain types of trucks as well as drivers and assisting crew for building the waste collection points. In this step coordinator also made sure that all the booked resources had the

permission to work at company x's site. Since this was similar to logistics coordinator's daily work and this was not in the critical path of process task flow, no process time or lead time was defined for this task.

3. Make export orders/Customer Service Advisor

The third step along the critical path was making of the export orders to ERP system for the collection equipment. In this step the company x's numbers to be considered were 226 pieces of collection equipment and altogether 86 export orders. The process time for this task was estimated to be 16 hours and the lead time planned for this step was 5 working days. The amount of correct input was not applicable at this task, since the customer service advisor relied completely on list that service configuration had made.

3a Make logistics service descriptions/Logistics procurement

A parallel step 3a was compiling of the logistics service descriptions and this step was coordinated by logistics procurement. This was an important step that needed to be done prior to day one of implementation of company x's waste service solution. However, this step was not a prerequisite for the next step in the process. Therefore, no process nor lead time was defined for this task.

4. Route the export orders/logistics coordinator

The fourth step was routing the collection equipment orders for fixed dates and for the right kind of trucks in seven different routes by a logistics coordinator. The estimated lead time for this task was five working days and the routing process time (PT) was estimated to be two hours. The limitation for routing orders and making the transport documents is that this cannot be done in advance. The routing always takes place the day before the collecting of the equipment for transporting. However, it was discussed that in a case like company x, this could be done as an exception for example during a weekend. That way it would not affect the daily routines of waste collection equipment warehouse. No parallel task we defined for the fourth step.

5. Collect and label collection equipment/Equipment warehouse

The fifth step took place in the waste collection equipment warehouse, which received the collection documents for different company x's routes. Each route had its own documents and instructions for collecting the equipment and relevant waste markings. At company x's case there were altogether 200 small collection equipment, 16 combination containers and 10 bulk containers. The estimation for process time (PT) was counted from the small collection equipment amount. The task included taking up the collection equipment and labelling it with one or two marking stickers. For

ID marked collection equipment, the ID needed to be written by hand to the collection document. If this all took approximately 10 minutes per equipment, the total process time (PT) for one person would be 33 hours and this is equal to approximately four working days of lead time (LT). In real life this collection is done by several employees simultaneously, so lead time (LT) for actual collecting was shorter. In order the totals to be comparable, this was counted as if one employee did all the work. This step was defined as value adding to the customers, since the customer is ready to pay for correctly marked and appropriate collection equipment.

6. Organize building of waste collection points/Specialist Service Configuration

The total amount of waste collection points at company x's site was 104. To organize the building of all the collection points the estimated process time (PT) was 24 hours and lead time (LT) three working days. These are equal amounts of time, since the implementation schedule needs to be planned well in advance. This was defined as a value adding step for the customer. The customer is ready to pay for the changing of waste operators in a controlled way in order to start a new contract period in waste management.

6a Deliver collection equipment/Driver

A parallel task 6a in the logistics the driver arrived at customer's site to deliver the collection equipment to waste collection points. This is a task done by subcontractor's employee, but still the activity is assigned and controlled by the logistics planning. This was also defined as a value adding step to the customer.

7. Record collection equipment to ERP system/Back office

The seventh step was the recording of company x's collection equipment in the ERP system. This was done by customer service advisor at back office and documents for recording came from drivers or logistics companies within one week of the activity at the latest. Most of the collection equipment have individual IDs, except for ordinary plastic bins. These recording in ERP system were all done manually, since collection equipment IDs are currently written by hand in the collection document. The process time (PT) for recording all the 226 pieces of collection equipment was estimated to be two hours. The lead time (LT) had to be set at 5 working days, since that is the timeframe given for delivering all the documents to back office. An interesting finding was the amount of correct and accurate inputs, which were estimated to be 95 per cent. The small amount of error comes from wrong written IDs or handwriting that is misread. Faulty ID or faulty previous recording may reveal that the collection equipment is currently recorded at some other customer's site. This means extra work taking the equipment off the other customer and

only after that it can be recorded to company x. Another time-consuming settling with company x's ID recording was, that the drivers didn't deliver right bulk containers with corresponding waybills. The drivers picked up the containers on their own without consulting the collection equipment warehouse. This caused confusion and therefore different types of containers were delivered, not clearly marked, and the matching of IDs had to be done afterwards.

7a Update handover data/Specialist Service Configuration

The little adjustments and additions that were noted during the implementation, needed to be done immediately after building the waste collection points. This completed the handover and ensured that service began as planned. This was a prerequisite step for 7b and 7c.

7b ERP system adjustments/Masterdata Specialist

Recording the changes that came up during the implementation.

7c Make extra export orders/Customer Service Advisor

Making additional collection equipment orders to complete the handover.

8. Invoice customer/Back office

The final step in the handover process was invoicing of the customer and this was done by a customer service advisor at the back office. The process time (PT) for invoicing the collection equipment transportation was estimated to be approximately two hours and the lead time (LT) two working days. This was due to missing information about the transport costs and checking of the prices. Percentage of inputs correct and accurate was estimated at 90%. In this connection it was discussed, that invoicing does not always receive the needed price lists or other instructions beforehand. Also, it is a recognized problem, that sales managers have difficulties in keeping the pricing up to date. In company x's case the difficulty arose from the fact, that the waste service implementation took place seven weeks before the waste service contract with price list attachment was signed. This meant that little adjustments to pricing were possible even after the implementation.

3.3.2 Document analysis – handover data

The objective of this part of workshop was to go through each SCM function and contemplate what is the data outside the ERP system, that each function needs when the first contact with company x takes place. The result of team's discussion was that there should be a common storing place for all the waste solution implementation data. For example, a SharePoint page, where all the SCM employees would have at least reading

rights. When data is stored in one place and in a standardized way, it would be easy to find. It was suggested that file name would be customer's name and the documents would have standard names. It was acknowledged that the handover documents describe only the situation in the beginning of the service. When the service has begun, changes take place continuously and the handover documents won't be updated.

The summary of waste service solution implementation of company x (appendix 2) was seen as a good tool in informing SCM functions. The summary document has been tested with other cases and it was distributed to all SCM team managers via e-mail. It was found out in the workshop, that this way it did not reach every employee. The distribution of the summary should be planned so that it reaches every SCM employee.

SCM internal service description of a customer's waste solution got more background information during the workshop. A few years ago, it was an incentive objective for customer service advisors to write a certain amount of internal service descriptions. The document included data that could be found in the ERP system and in the handover data, but it also included tacit knowledge that was not recorded anywhere else. This kind of document was not made in this company x's case. Masterdata made instructions for invoicing, after finalizing company x's contracts lines and price groups in the ERP system. This kind of instructions as well as the final price lists should be among the handover documents that are saved in a standardized way.

The vast amount of handover data and documents made it visible, that there is a demand for a tool that would help gathering and producing the handover data. Currently the same data is written several times in different places and by different employees. This is a good example of over processing.

3.4 **Summary of workshop findings**

Handover concerned all six different functions at SCM organization, and it took eight steps until each function had had the first contact with the company x. The total process times 111 hour (PT) and lead times 34 days (LT) were calculated for critical path's steps. A major customer's waste service solution implementation of this size is not routine work. The timetable for the process needs to be predetermined so that implementation occurs as agreed with the customer. In company x's case the timetable was fairly firm. This can be confirmed by counting the activity ratio. Activity ratio reflects the degree of flow in the process and it can be calculated with the following formula (Martin 2014, 90.)

$$\frac{\text{Total Process Time}}{\text{Total Lead Time}} \times 100 = \text{Activity Ratio}$$

$$\frac{111 \text{ hours}}{34 \times 8 \text{ hours}} \times 100 = 40{,}8\%$$

Figure 14. Activity ratio formula

After the workshop the author made the map in digital form for later use (the following figure, appendix 4).

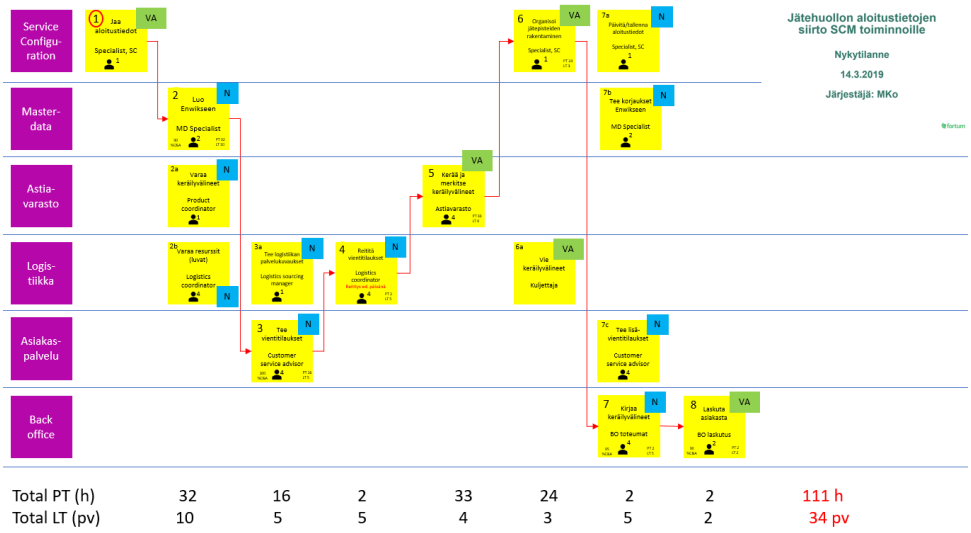

Figure 15. MBPM in digital form

The summary has been made in two parts: Metrics-based process mapping findings and handover document findings (In tables consequently).

Table 11. Metrics based process mapping findings

Workshop findings/MBPM
Step 1 has the most improvement potential
Process times ≥ 16 hours in four steps
%C&A <100% due to unclear pricing & handwritten equipment IDs
Bin collecting, labeling and ID writing could be done outside of warehouse hours
No unnecessary non-value adding steps were found, only VA and N
Reducing total process time (PT) and lead time (LT) possible

The first step, hand out service configuration data, was defined as affecting the following steps the most and therefore this step could potentially make the subsequent steps easier. In retrospect this was a predictable and obvious outcome, since interpretation of customer's service configuration defines what kind of service it translates to. When thinking of the company x's case in numbers, it was possible to estimate the process times for the

critical path steps. The mapping made it visual, that a lot of steps are labor-consuming. This can be used as a benchmark for the future projects. %C&As, the percentages of correct and accurate inputs to the step, were not applicable to all steps. Those steps that were under 100 % in accuracy were resulted in by two factor unclear customer pricing and handwritten collection equipment IDs and their interpretation. A good observation was done about collecting large amounts bins in equipment warehouse. This kind of major customers starting waste service can potentially mess up the daily routines at the warehouse. To avoid this the collecting could be done outside warehouse hours, for example during weekend. In a profitable, cost-effective business, it would be important to concentrate on steps, which add value to the customers. In the mapping there were found no unnecessary non-value adding steps, which would have been clearly waste. However, there we found 10 steps which were non-value adding, but necessary to the process (N) and 5 steps which were value-adding (VA). It becomes a tie, when looking at the step in the critical path. In the critical path there are 4 steps VA and 4 steps N. This mapping made the time management in the handover situation visible. Reducing total lead time (LT) in future cases would be possible by making tighter schedules for handover. At the workshop this was not seen as a sensible goal, since the same organization handles the daily routines and these handovers are extra work done beside routines. Process times (PT) should be examined for each step separately to determine what would be the best way to reduce it. An example of reducing both total PT and LT step 5 ID writing to collection document and step 7 ID recording to ERP system could be substituted by driver recording IDs and collection equipment quantities already at customer's site digitally. This would eliminate the handwriting mistakes and both the process and lead time would be shorter in the handover process.

Table 12. Handover document findings

Workshop findings/Handover documents
Common storing place needed, standardization
Summary document useful, distribution must be checked
SCM internal service description useful
A need for a tool for gathering and producing the handover data

Handover documents need standardization and a common storage place, where the structure and naming are uniform. That would enable anyone of SCM employees to finding missing details easily. Summary document received a good acceptance and it is worth developing further. The way of distributing the summary needs to be looked into, so that everyone at SCM has equal opportunity to hear about handovers and their details beforehand. SCM internal service description was seen a useful document. This document is also worth developing, since it records the tacit

knowledge, which is not available anywhere else. To prevent over processing of data, a handover data tool would be worth developing.

4 THE HANDOVER PROCESS IMPROVEMENTS

Going through the company x's handover process of implementing a waste service solution, studying Lean thinking, exploring Lean tools and facilitating a process mapping workshop has given the author a thorough insight of what are the factors influencing the handover from service configuration to SCM order fulfilment process. To make the handover process leaner, some improvements have been introduced, tested and further improved. Some of the ideas for improvement require investments and therefore these are only listed as suggested improvements. Summary of improvements is in the following table. Each improvement is explained in detail in the following chapters under headlines: introduced improvements and suggested improvements. Improvements from one to eight concentrate on standardizing and visualizing this first process step, handing out service configuration data. By adding work done in the first step, the following steps will have improved quality of input and scheduling the work for rest of the functions will ease. The ninth improvement would reduce work load at the collection equipment warehouse and it would eliminate the step, where the recording of data is done manually. Overall the improvements will have a influence on process time by reducing it.

Table 13. Summary of handover process improvements

Handover process improvements
1. Planner application to follow current and future handovers
2. Setting up Team/Channels for beginning service/customer
3. Service Congifuration workspace for uniform data storage
4. Standard handover document templates
5. Handover checklist
6. Customer price list matching with service
7. Suggested: Service Configuration communication board
8. Suggested: Service Configuration tool
9. Suggested: Digital collection equipment ID scanning by driver

4.1 Introduced improvements

All the introduced improvements were executed by utilizing existing Office365 tools. This was done, because these tools were easily available to every employee.

1. Planner

Service configuration team is involved in many projects simultaneously. Handovers are involved in each case proceeding to contract negotiations that result in a service contract, which has a set date for beginning the service. Handovers are also part of modifying and adjusting customers' services. How to make the workload visible? How to see which cases are going to be handed over to SCM in the next weeks and months? How to define the handover process timetables when simultaneous handovers are taking place? During the company x's handover, each simultaneous project was in single calendar markings indicating days that were reserved for example for preparing the handover data for company x's waste service solution. In May 2019 Service Configuration team was created at Office 365 Teams and Planner application was taken in use. The Planner was constructed so, that it includes the different stages of service configuration, handover being one of the stages. Each new task is established by customer name and under the appropriate stage. In addition to stage, tasks can be tagged with different colour codes and assigned to a team member. Team members can daily establish new task, move existing tasks from one stage to another and mark tasks ready. All tasks are discussed in a weekly team meeting to ensure that work is divided evenly and that the team is able to handle all the future work. Planner improves the handover process by making the workload visible. It assists in planning future handover timetables and in organizing simultaneous projects. The following table and figure show the overall layout of the introduced application for task in different stages in service configuration.

Table 14. Planner tasks' stages layout

Stage 1 Draft	Stage 2 Plan/Contract	Stage 3 Handover	Day1	Stage 4 Service begins	On hold
+	+	+	+	+	+
Customer A	Customer B	Customer C	Customer D	Customer E	Customer F
Customer G	Customer H	Customer I	Customer J	Customer K	Customer L

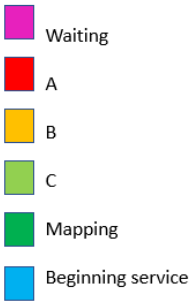

Figure 16. Color tags for tasks

It was argued by Medinilla (2014, 92-94) that this digital visual communication tool should not be used as only team communication tool, but rather this would be an add-on to a physical team board. More about the physical communication board in the suggested improvement. So far Planner has proved to be a decent tool to make the work load as well as work progress of service configuration team members visible.

2. Team/Channels

Company x's handover documents were stored in different places and some documents were sent via e-mail from one SCM function to another. There were difficulties in keeping up with the latest version of certain documents. Since spring 2019 Office 365 Teams and channels have been tested for waste service solution handovers. A team is established for a waste service solution implementation. Members are added to the team as more people get involved. Team's channels store the discussions, the latest versions of documents, meeting notes and schedules. When the handover is done, the team and its channels are no more needed. This improves the handover process by creating a space where all the members have the same data available. Everyone involved can join in discussion if a problem arises or a sudden change in plans occur. A short answer to a question or a brief statement of new plans are easily communicated to everyone and the project moves forward. Also, when the meeting notes are stored in the same place, it is easy to check what has been agreed on and to whom certain tasks are assigned to. This is a way of practising lean principle Jidoka, making the situation visual. When team is well organized, this enables visibility for advancing the project and reaching objectives. The next figure demonstrates an example of a team structure.

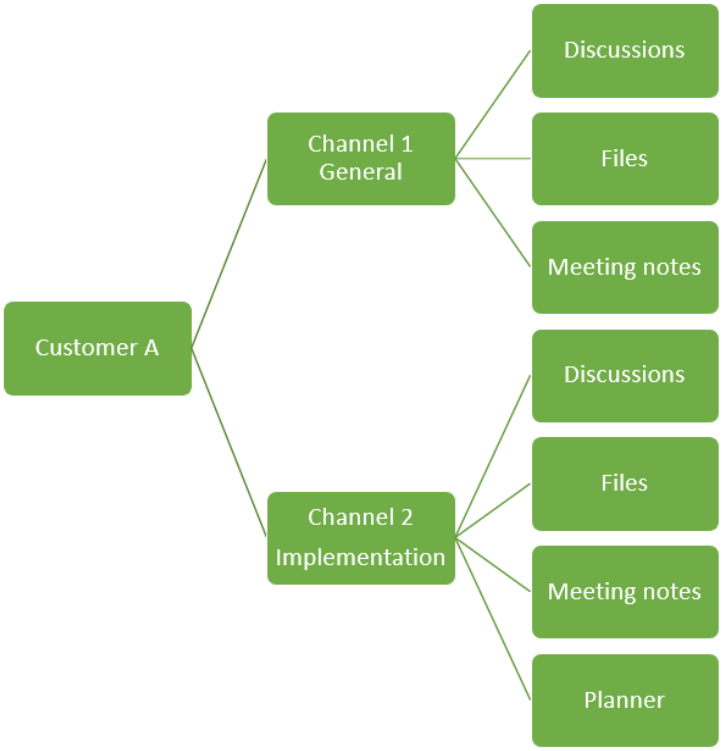

Figure 17. A team, 2 channels

This improvement has increased the visibility of handover process. A team is a tool that can be easily used and introduced to new members. Adding applications such as Planner will make dividing of tasks easy during the handover process. This is tool that will be developed further with each new handover case.

3. Service Configuration workspace

At the workshop the team discussed about the need for a common storage for documents concerning handover and customer's beginning service. A SharePoint workspace was created by the author for Service Configuration Finland. A SharePoint site provides a platform for storing documents. Owner of the site can define members, who will have either full rights to edit documents or only reading rights for browsing. In order to find information easily, the handover documents are stored in a standardized way in folders. Each handover case is found in a folder named after the company and if in several locations, the city it is located in. The structure for the stored handover data is in the next figure. All documents reflect the situation at the beginning of the customer's waste service solution. The red circled implementation documents go into details of how the implementation was done. This improves the handover process by creating a common storage to which the final versions of handover documents can be stored from the Teams site after the team's work is done. By uniform data structure and by using standard handover templates, the data can be easily searched for by all the employees at SCM functions.

This workspace utilizes the principles of Lean tool 5S – sort, simplify, scan, standardize, sustain. By sorting, in each handover case, the data produced is gone through by deciding which of the handover documents hold value after the service is implemented. All the documents that are not needed, won't be stored in SharePoint workspace. By simplifying, the documents, which hold value, are stored in consistently named files by uniform naming. By scanning, the workspace is kept organized all times by all the team members that have full editing rights for the workspace. Standardizing will make these three steps of sorting, simplifying and scanning a normal routine for going through the data collected and produced at Teams site during the handover. Sustaining this new way of storing the data is service configuration team's challenge ahead, which will require discipline. This improvement has provided a common storing place for handover data. In addition to handover data this workspace can store for example updated customer summaries and updated waste collection point maps.

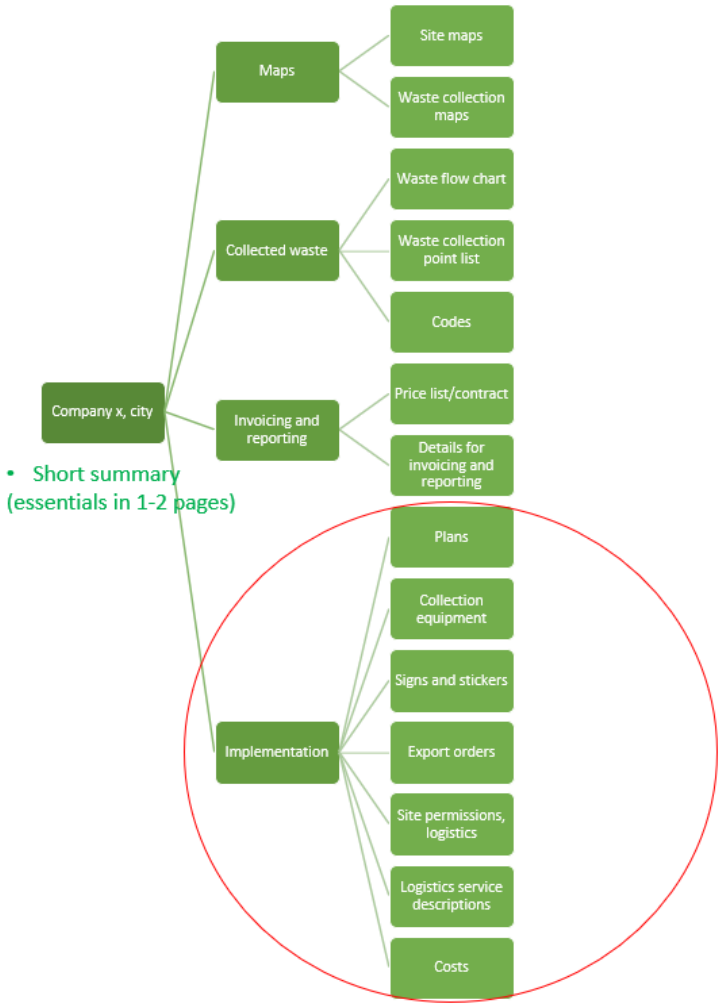

Figure 18. A uniform data structure

4. Standard handover document templates

The following handover document templates have been made and stored in Service Configuration SharePoint workspace and at the Service Configuration process Teams site (Appendix 5):

- Waste flow chart (both brief and extensive) (.xlsx)
- Waste collection point list (both brief and extensive) (.xlsx)
- Logistics service description (.docx)
- Summary (.pptx)

The templates have been created based on documents made for company x's waste service solution implementation. Case of company x was well representative of a major customer's waste service solution implementation, therefore it provided extensive amount of data and a valid set of documents and contents to be used for templates. The extensive versions of waste flow chart and waste collection point list were applied from an old service description template. At the workshop, the summary was introduced afterwards for company x. It was discovered to be a useful document to give the basic information at a glance. The distribution list of the summary needed elaboration, since at the workshop it was found out, that sending it to all SCM team managers didn't bring it to everyone's attention at SCM functions. In addition to team managers, the summary will now be sent also to invoicing, masterdata, logistics, customer service and back office general addresses.

These templates will be continuously revised and improved on. Pull-down menus for example for European Waste Code (EWC) numbers could be added and waste collection point names could be restricted by defining a maximum number of characters. These handover document templates improve the handover process by unifying the way the data is brought to SCM, especially masterdata specialist's work is facilitated with unified waste stream charts and waste collection point lists. The documents are used digitally and in paper. In a major customer's waste service solution implementation, it is an advantage for masterdata specialists if the documents are easily printable in paper. It will make the work easier for the masterdata specialist to record the contracts to ERP system. The template testing will continue, and new features will be added.

5. Handover checklist

To make the handover process proceed in a uniform way, a checklist was created. The checklist is meant to be used, when the customer has approved the waste service solution plan to be implemented. At that moment all the data for handover should be prepared and going through the checklist when the data is ready, will give a task list of things to be done and confirmed. The handover checklist is divided in three entities: Handover data, logistics related ERP system issues and general issues. Each

of these entities have a list of things to be checked. The checklist does not take into consideration the order of the tasks to be done, but an approximate timeline is attached to the checklist. The timeline example is based on the metrics-based process mapping of the handover process. The lead times defined to each task in the critical path of the process by different SCM functions define the timeline to be complied with a major customers waste service solution handover. It divides the 34 working days of the handover process to different SCM functions and it provides a timeline to count backwards from the day the service is set to begin. Based on this, a successful major customer's waste service solutions handover process data has to be ready six weeks before the implementation in order to get the customer's approval on time, so that the following handover process steps have sufficient time to complete their tasks concerning the implementation. Partly the timeline is also defined by the timetable for automatically created orders from the ERP system. Taking these logistics related dates into account, reduced the amount of manual work in the handover process. This checklist (Appendix 6) will improve the handover process, because simultaneous handovers are easier to plan and schedule with the checklist. Checklist also confirms that important issues are not skipped or forgotten. Checklist is utilized by saving it to Teams files sheet.

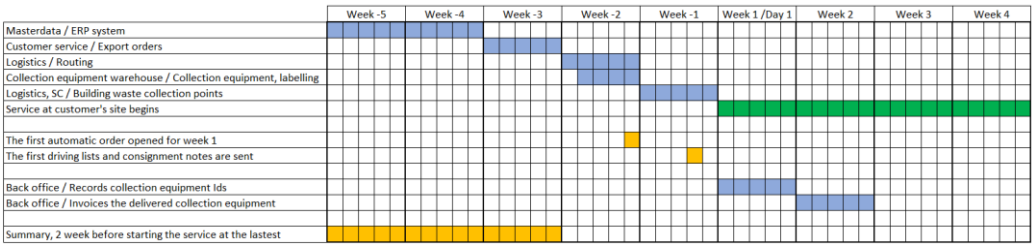

Figure 19. A suggestive timeline for handover process

6. Customer price list matching with planned service to be implemented

At the handover process workshop, the missing or unclear prices were brought up in two task steps. In step 2, where masterdata specialist creates contracts to ERP system, the percentage of input data being correct and accurate (%C&A) was estimated to be at about 90%. This was because price list did not include all the prices for the planned services. Some prices were also unclear and required additional information. In the eight step, where back office customer advisor invoices the customer, correct and accurate input was estimated at the same 90%. In addition to prices that were still under negotiation with the customer, while the first invoices were already created, there were missing costs for starting the service at the customer's site, i.e. the building of waste collection points and delivering the collection equipment to the customer's site.

A feature of matching service prices and customer prices is found in the extensive version of waste flow chart template. The template enables

recording of all the given prices for different waste fractions, collection equipment and type of pricing combinations. In case there is a need to check whether the subcontractor has provided us with the same prices, expenses of the equivalent service, this can be done in the following section of the pricing summary. Matching is a burdensome task but reveals the missing or unclear pricing and improves on the amount of correct and accurate input in the handover process. The controlling of costs of the waste service solution implementation and the pricing of implementing the service at customer's site don't have fixed practices. Therefore, invoicing the customer concerning the waste service implementation, is always done case-specifically. The final list of missing and unclear pricing is in every case received, when the masterdata specialist records the pricing and contract data to the ERP system. It functions as a final check of every price existing. Adding the matching of prices to the service planned to be implemented before handover to SCM, improves the handover process by increasing the percentage of correct and accurate input in both steps 2 and 8 of the handover process.

4.2 **Suggested improvements**

These suggested improvements require investments and apart from communication board, are not feasible to test with the existing ERP system. The author outlined the suggested improvements for future reference and considered the changes that these improvements would bring on the handover process.

7. Communication board for Service Configuration team

A physical communication board set up in service configuration team's room, would give further visibility of what are the daily tasks to be handled during the working week. By using the Planner application, the team sees the different customer projects and the stages that projects are in, but the actual tasks related to different stages are not visible. Also, it is only the team members that see the Planner tasks, no-one outside the team unless invited to be a member. The board would make the ongoing tasks and upcoming handovers visible also to each person coming into the room.

The structure of board could consist of boxes of different sizes and titles to name them. The tasks could be in color-coded post-it notes and the team member the task is assigned to could be marked with an avatar. The board would require constant updating and thus commitment from the team members. Since the board would follow the tasks on weekly basis, it would quickly show the increasing workload and the tasks that cannot be assigned to any of the team members. A suggestive form of board could be as in table below.

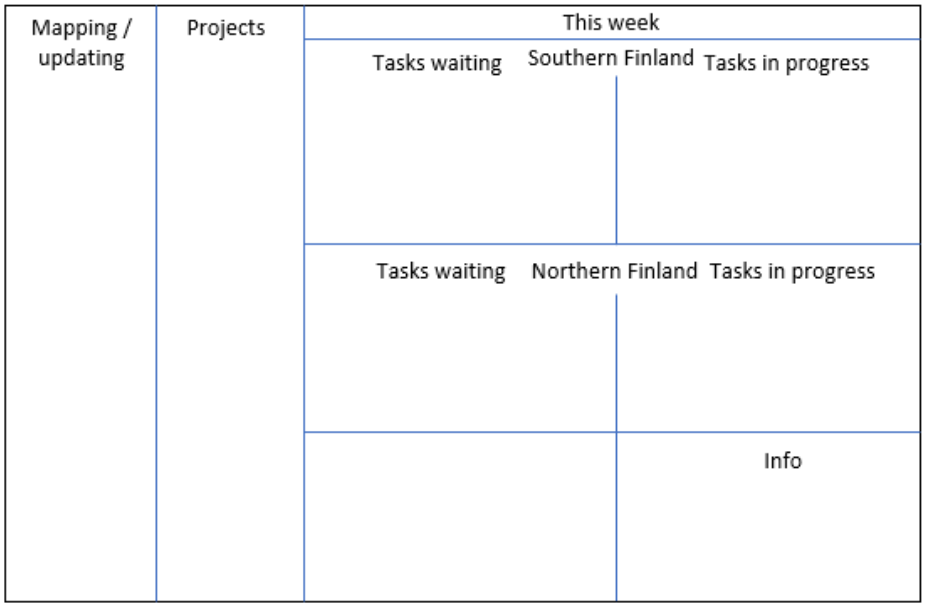

Figure 20. Suggestive structure of communication board

The communication board could even replace the Planner application and give the needed visibility to anyone following a certain service configuration project. Medinilla (2014, 92-94.) gave plenty of reasons for choosing the team board in chapter 2.3.1.

8. Service configuration tool

The document analysis and the handover workshop revealed, that data is over processed. When service configuration specialist collects and produces waste service solution implementation data, there are many different documents involved. These documents are not ready to be handed over as they are, but for example to give a summary list of all the collection equipment needed, the list needs to be made from the final version of waste collection point list. This means for example that an Excel sheet is produced by cross-checking and sorting data. This is time consuming, even though the data exists. Currently there is an existing mapping application, that could be developed further to serve service configuration and SCM functions. Current application features include lists of waste fractions, collection equipment type, quantity and color. The application allows numbering (maximum of 3 characters), naming and additional information of all the waste collection points at customers site. A waste collection point can be attached to a location in a map and pictures can be attached to each collection point data. As a result, the application can produce a waste collection point map, a thorough report of the mapping with pictures and waste collection points information and different kinds of Excel sheets summarizing the mapping data. These documents produced by the application are difficult to use, since the waste

collection equipment list doesn't cover all the existing equipment and the waste fraction naming is insufficient. In addition, the mapping report document needs to be heavily reworked before its layout is sensible.

The improved service configuration tool should have mobile application to be used at customer's site and it should include:

- Waste collection point numbering and naming according to an agreed standard
    - Waste collection points outdoors (additional information for gates, low access etc.)
    - Waste collection points indoors (additional information for lift, stairs, locked doors etc.)
    - Waste collection points that are only for internal use at customer's site
- Waste fraction naming matching the available selection, additional space for customer specific naming
- Waste collection equipment codes matching the available selection
- Waste collection equipment codes requiring ordering in advance
- Emptying rhythms matching the available selection
- Waste collection point location
    - On a downloaded map (.jpg, .pdf, .dwg)
    - On a Google map
    - With GPS coordinates

After the mapping the summaries needed for SCM are waste collection point listing, waste collection point map, waste stream chart, list of waste collection equipment to be rented and sold and list of export orders to be done for the implementation. The data needs to be reworked after the mapping tour at the customer's site. Especially waste stream chart needs additional information. This missing data could be integrated in the SC tool, so that a waste stream chart with full data could be produced. The additional data needed includes for example European Waste Codes (EWC), UN-numbers and packing group for hazardous waste, logistics group (packed, bulk, tank etc.), logistics partners, waste treatment facilities and waste treatment method. SC tool could be enhanced with pokayoke features to direct the users to fill in the necessary fields and to require certain data in a certain form. When choosing a certain waste fractions, the choice of collection equipment should be reduced to those that are applicable for the waste fraction. This would ensure a uniform and safe way of planning the customer's waste service. In order to further reduce the over processing of the data, the tool could be integrated to ERP system so, that all the data doesn't need to be rewritten or copy pasted manually. Generating the waste collection equipment export orders in the ERP system is also worth developing. Ideas for this in connection to equipment ID scanning in the 9th suggested improvement.

This tool would improve the handover process by standardizing the way the data is brought to SCM functions. The integration to ERP system would

reduce over processing the data and the tool could also function as a storage for all the data, so that there wouldn't be a need to store it anywhere else.

9. Digital collection equipment identification (ID) scanning by driver

In the handover workshop the team defined, which of the tasks were value adding to the customer. Many of the tasks were defined necessary, but non-value adding to the customer. One of these tasks was the recording of collection equipment IDs manually to ERP system in step seven by back office customer advisor. In this step it was defined that 95% percent of input was correct and accurate. The five percent consisted of unclear handwriting in the collection equipment list or in a consignment note. Furthermore, there were often found collection equipment IDs that were attached to another customer at the ERP system and those should not have been available to be delivered to another customer's site. This created additional work, since the collection equipment had to be released from another customer to be able to record it to the new customer. To reduce process time and false data in the handover process, this ID recording in the waste service solution implementation could be reconfigured. Collection equipment warehouse could handle the collecting of equipment with a list and do the required waste fraction markings beforehand. However, the ID recording to the customer's site would be done by the driver, when at the waste collection point. This would require a mobile application connected to the ERP system and it could allow the driver to choose the waste collection point and scan IDs of specified collection equipment to the waste collection point. The scanning of IDs would remove mistakes and it would eliminate the step seven of recording the IDs manually and move the task directly to step eight, invoicing the customer.

This improvement would both remove non-value adding work and reduce the process time in two steps in the handover process. The collection equipment warehouse would not need to record the IDs manually to collection equipment list and the back office customer advisor would not need to record the IDs manually to the ERP system.

5 CONCLUSIONS

There are several benefits in using Lean mapping tools for process mapping. The process mapping highlights the connections among activities, material and information flow creating the lead time for the process. Employees will understand the entire process, not just a single function that they perform. It also provides a means to identify and act on areas of value adding and non-value activities. (Myerson 2015, 286.) The handover process workshop for this thesis research used Company X as an

example case and made the process visual and easily understandable. The visual mapping enabled to make a foundation for improving the process. In retrospect, it was not a surprise to the author that step 1, the handing over of the implementation data by service configuration specialist was defined as the step with most improvement potential. The process is based on as correct input as possible, therefore all the data that is produced prior to handover, influences the following process steps. It should be service configuration team's responsibility to make sure that all the needed data is available, including customer price lists, invoicing details and reporting details by the time handover process begins.

Several improvements were introduced to the handover process based on the workshop findings. All the introduced improvements were realized with existing Office 365 tools. These improvements have increased visibility and defined the handover process standards in form of document templates, checklist, ways of working and data storing. Suggested improvements require investments and therefore they were only described as suggestive. A Lean organization is based on common values, which in Fortum are curiosity, responsibility, integrity and respect (Fortum, 2019). With the improved handover process the two principles Just-in-Time (creating and maintaining flow from function to function) and Jidoka (visual process, where employees know what is going on) can be practiced. The visibility of all the ongoing service configuration projects and their stages enables the planning and scheduling of handover tasks. By understanding the handover process and its steps, a standard method of doing the handover was produced. This standard way of doing the handover is aided with appropriate tools, which have been introduced to the service configuration team and also SCM employees involved in different customers' handovers. According to Hensley (2018, 50) Lean is about problem solving and learning. Continuous improvement is a typical way of working in a Lean organization, which means that the service configuration handover process will be developed continuously as new standards are tested and the standard ways of doing are further challenged.

How is the handover done at the moment? This question was answered as a result of the metrics-based process mapping workshop arranged in March 2019 for this thesis research. The produced current state process map provided understanding of how a major customer's handover was done and what could have been done differently to improve the handover. How to make the handover efficiently? How to develop the handover process and related tools? The efficiency is dependent on the quality of handover data, since the more data is wrong or missing the less correct and accurate is the input in handover process steps. Therefore, by investing more work in the first step of handover process, the more efficiently the handover can be done. Most of the improvements and tools were therefore introduced to this particular step that will ultimately influence all the following handover process steps. Efficiency for business

purposes means also, that the process emphasizes on the steps, which add value to the customer and the non-value adding steps are either eliminated or reduced. These definitions for each process step gave the direction on how to continue improving the process and its steps. To make a successful and efficient project handover from service configuration to SCM order fulfilment, standard handover documents and visual presentation of ongoing projects are needed. For a handover to be successful, it is important that handover plan is scheduled so, that each handover process step has got the needed data and available timeframe to do the work before handing it over to the next step.

For the author this has been a rewarding journey to learn what Lean thinking entails and how it can be successfully practised in an organization. This topic of handover process was motivating, because doing the handover to SCM functions has proved to be challenging. Especially interesting was to arrange a workshop with the colleagues, who actually participated in the handover that was chosen to be the case researched. It was an eye-opening moment at the process mapping workshop to see the amount of work that a major customer's waste service solution implementation brings on. The process itself proved to be a well-functioning process, so instead of making the future state mapping in order to change the whole process, this research concentrated on improving the current process. The timing for this research and the implemented improvements has been optimal, since service configuration department is being rearranged with added members during 2019. With standard document templates, visual presentation of on-going cases and the agreed places of working with and storing handover data, the continuous improvement is straightforward to set in motion. Each future handover will add the knowledge of a successful handover to SCM order fulfilment.

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