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Value Stream Mapping for Operational Excellence

How value stream mapping contributes to operational excellence in an ICT company - A case study at Swisscom

by

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Abstract

The purpose of this research was to do a case study of how value stream mapping (VSM) contributes to operational excellence within an ICT company. To illustrate this, a case study was conducted at Swisscom, a large Swiss telecommunications company. The motivation of the study was to contribute to research within the industry of information and communication technologies (ICT) and secondly, to highlight key aspects for successful application of VSM in a real life context. The research is based on a single case study of the VSM-processes conducted at Swisscom's team of Lean Management and Continuous Improvement Processes (LMI). The study uses triangulation and the findings are therefore based on observations of VSM processes, interviews with the LMI Lean managers and internal documents of Swisscom's methodology of VSM.

The study revealed four dominating themes that were present through all VSM stages. First of all, the study confirms the strength of VSM as a visualization tool. It also highlights the importance of enabling participant's ownership throughout the process. Furthermore, it highlights the integration of lean thinking throughout the organization and by this, challenge the concept of VSM being used as merely a tool. At last, LMI's continuous support and lean enabling function was visible throughout the whole case study and Swisscom's focus on encouraging continuous improvement throughout the organization.

The case study is limited in looking at a single case study within an ICT company. The authors therefore encourage future studies about the application of VSM within the ICT industry. Furthermore, due to the study's time constraints, the authors recommend long term studies to investigate the continuous improvement initiatives and its' organizational effects. The authors also suggest future studies about value stream as a mindset within the ICT industry.

Key words: value stream mapping, VSM, ICT, lean management, operational excellence, continuous improvement

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Now: Enjoy the read!

Lund, May 2017

Laura Christoffel & Sarah Axelsson

List of Key concepts and Abbreviations

Key concepts

Operational excellence:

Within this study, *operational excellence* implies to continuously strive for a customer-oriented focus and to improve operations/processes to be as simple and efficient as possible.

Operations:

Within this study, *operations* are defined as any activity and process conducted within an organization that relates to achieve and/or deliver a product or service.

Value creation:

Value creation within this study is any value adding activity within operations.

Abbreviations

| | |
|----------------------------|--|
| <i>Document Order form</i> | LMI's clarification of the VSM-order (see Appendix IV) |
| <i>Document PDCA</i> | LMI's document of PDCA experiment (see Appendix V) |
| <i>Document Process</i> | LMI's Process overview of VSM (see Appendix III) |
| <i>Document Shop floor</i> | LMI's document of the Shopfloor-board (see Appendix VI) |
| <i>Drumbeat</i> | Action phase for implementing new processes |
| <i>Future state</i> | Mapping the improved process without identified waste |
| <i>ICT</i> | Information and Communication Technologies |
| <i>KPI</i> | Key Performance Indicators |
| <i>Northern star</i> | The ideal state and guided vision when mapping the future state |
| <i>Observation CS</i> | Observation of a VSM-process at a current state |
| <i>Observation FS</i> | Observation of a VSM-process at a future state |
| <i>Observation CI</i> | Observation of a VSM-process in continuous improvement |
| <i>LMI</i> | Swisscom's team for Lean Management and Continuous Improvement Processes |
| <i>Ramp-up</i> | Create and agree upon the Northern star and finalize the future state |
| <i>Setup</i> | Preparation phase and mapping of the current state |
| <i>VSM</i> | Value stream mapping |
| <i>Waste</i> | Identification of non value-added activities |
| <i>VSM-coach</i> | The role of the Lean manager during the VSM processes |
| <i>VSM-owner</i> | The person/order-giver in charge of the order and the VSM process |

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1. Introduction

Organizations today need to respond to increasing global competition and therefore aim to improve their operations (Eker & Eker, 2016). Lean management is highlighted as one discipline that manages to respond continuously to new customer demands by both focusing on and improving their key processes (Bhasin, 2015). Within lean management, value stream mapping (VSM) is emphasized as a popular tool that visually shows the production flow and identifies improvement possibilities for future operations (Bhasin, 2015).

In the service industry, the practice of lean methodology is increasing to meet customer requirements and stay competitive (Vignesh, Suresh & Aramvalarthan, 2016). But different sectors have captured different amount of research and the lack of research within for example telecommunications emphasizes a need to further study the application within this sector (Hadid & Mansouri, 2014). Furthermore, although VSM's outlined success to facilitate improvements of processes, researchers highlight a need to continuously analyze key aspects to gain highest possible performance when practicing VSM within a real life context (Lasa, Laburo & de Castro Vila, 2008).

This thesis conducts a case study about how the process of VSM can contribute to operational excellence within a company in the industry of Information and Communication Technologies (ICT). To illustrate this, a case study is conducted at the telecommunications company Swisscom. The authors investigate the process of VSM by a triangulation approach and highlight key aspects in the VSM process, from the step of analyzing operations towards detecting operational improvements and supporting continuous improvements.

1.1 Background

Global competition underlines the importance for organizations to increasingly lower costs, become more flexible and focus on how to improve their operational processes (Eker & Eker, 2016). The last 20 years organizations have dramatically changed their measurement behavior and are today focusing on measuring instead of understanding how to extract value from the measurements (Neely & Bourne, 2000).

Turban, E. Aronson, J.E. Peng Liang, T. Sharda, R (2007) argue similarly, that managers today have become too focused on measuring organizational performance and as a result, are failing to analyze the outcome of the measurements and act on the data being collected. It is argued that the process of measuring performance is without value, if there is no action taken based on the performance data being collected (Turban et al, 2007). Many organizations focus on creating good measurement systems and as a result, they over measure and fail to act on the data (Neely & Bourne, 2000). Therefore, there is too much focus on how to measure, and little attention paid to how to act and make decisions based on the data being collected (Franco & Bourne, 2003).

The focus is now shifting towards how to extract value from the data being collected, and how it should assist in improving businesses (Franco & Bourne, 2003).

In operations management, lean is capturing a great part of research and implies how to utilize use of resources and doing more with less (Abdi, Shavarini & Hoseini, 2006). The lean philosophy is to simplify and standardize as much as possible (Womack, Jones & Roos, 2007) and provides organizations with a structured approach to change within business settings, by focusing on the simple idea of "eliminating waste" (Emiliani, 2000). In line with the argument about maximizing value from measurement (Neely & Bourne's, 2000), the lean philosophy emphasizes that it depends on *what* you measure, and not just having a cost-cutting approach (Womack, Jones & Roos, 2007). For example, measuring individual sales performance might not be the means and main indicator of a company's success (Womack, Jones & Roos, 2007). Singh et al. (2010) and Wan and Frank (2008) in Bhasin (2015), argue that today many businesses are linking performance measures to internal processes and neglecting to relate them to the customers' interests. Therefore, Bhasin (2008) argues that many organizations are measuring with little consideration to the measurements significance. Any organization that wishes to adapt to lean therefore needs to align measures that are value adding to the customers, as well as to the internal processes and culture in the organization (Bhasin, 2008).

1.2 Motivation of the study

The lean methodology within the service industry is increasing to meet customer demands (Vignesh, Suresh & Aramvalarthan, 2016). But, as highlighted by Hadid & Mansouri (2014), the lack of research emphasizes the need to further study the application of lean into service industries such as telecommunications. In this study, the authors investigate the use of one of the most popular lean tools, VSM, and its' application assisted by the team for *Lean Management and Continuous Improvement Processes* (LMI) at Swisscom, a major telecommunications provider in Switzerland.

Research also emphasizes the lack of study of the qualitative aspects in VSM (Alaya, 2016) and the importance to investigate the key factors of the VSM to gain highest possible performance (Lasa, Laburo & de Castro Vila, 2008). Therefore, this research does an in depth study of the main aspects in how VSM within an ICT company can contribute to operational excellence.

1.3 Scope of case study - LMI within Swisscom

Swisscom is a major telecommunications provider in Switzerland. At the end of 2015 Swisscom had approximately 21.000 employees (Swisscom annual report, 2016). Swisscom operates in several segments, from private consumers, to enterprise customers, wholesale, IT, Network and Innovation (Swisscom annual report, 2016).

Swisscom decided in the beginning of 2013 to work through a lean philosophy, which implies striving for constant improvement was to be an integrated part of running the business and the employee culture. To enable this, Swisscom established the team for Lean Management and Continuous Improvement Processes (LMI), which currently has 14 experts. LMI works as a centralized team, striving to enable operational excellence at Swisscom through lean and agile methods. (Interviews Lean managers Swisscom, 18 April 2017)

Operational excellence for Swisscom implies; keeping customer orientation as the most important value, inspire innovation in products and processes in an ever changing industry, and at the same time continuously improve their operational excellence by making things as simplified, sustained and efficient as possible (Swisscom 2016, Operational excellence for Team Leaders).

Within this, VSM is one of their main methods. The LMI team embraces all aspects of Swisscom operations, from business administrative processes to supply chain management. LMI both assists in current projects within the company as well as train the application of lean principles to be a part of the everyday business. (Interviews Lean managers Swisscom, 18 April 2017)

1.4 Introduction to Lean Management and VSM

The awareness of lean is increasing and lean management has done a shift from technical production system towards becoming a philosophy (Bhasin, 2015). A *lean* organization enables management to focus on customer value, and how to continuously find possibilities to increase it (Bhasin, 2015). VSM is probably the most used lean tool in organizations today with the following core goals; to visually map production flow, showing the process of current and future state to capture the need for improvements (Bhasin, 2015). VSM can be used in various ways, as a communication tool to deal with change processes or as a business planning activity (Rother & Shook, 2003). It takes a holistic perspective on the improvement process, instead of separately looking at different parts (Rother & Shook, 2003).

1.5 Purpose and research questions

The purpose of this research is to study how VSM contributes to operational excellence within an ICT company. Therefore, this research conducts a case study of how VSM enables improvements in Swisscom's operations. The study answers this by a triangulation approach and investigates the key aspects within the VSM process' different stages - from the process of analyzing operations towards detecting improvements and supporting continuous improvements. The study can therefore contribute to the lack of research about VSM in the ICT industry, and compare observed practices to existing research about VSM in the ICT/service industry. In addition, the findings are used to elaborate on how VSM adds value to Swisscom's operations.

To study this purpose, following research question has been developed:

How can VSM contribute to operational excellence within an ICT company?

To answer the main question, following three sub questions have been defined. The sub questions within the study are designed to capture the end-to-end aspects within a VSM process. The sub questions have been designed in this way in order to take in all aspects necessary to answer the main research question:

1. *What are the key aspects when analyzing operations within VSM?*
2. *How does VSM enable to detect and decide upon operational improvements?*
3. *What are the initiatives to support continuous improvements through VSM?*

2. Theoretical framework

A literature review serves several purposes - framing the context, outlining previous research, highlighting flaws and gaps and underlining what a specific research project will add to its' field (Easterby-Smith, Thorpe and Jackson, 2015). In Figure 1, the funnel strategy for the theoretical framework within this study is presented. Firstly, an overview of lean management is provided. Further on, the general idea of VSM is explained, and its' different elements and later on how it has been practiced in the ICT and service industry. Because ICT and telecommunications are sometimes included as well as excluded in the service industry, the authors will present VSM studies within both service industries and ICT/telecommunications. Thus, this knowledge frame serves as a context for VSM and lean management. Furthermore, it provides a solid basis for existing research, which is used to compare to observed processes in the case study.

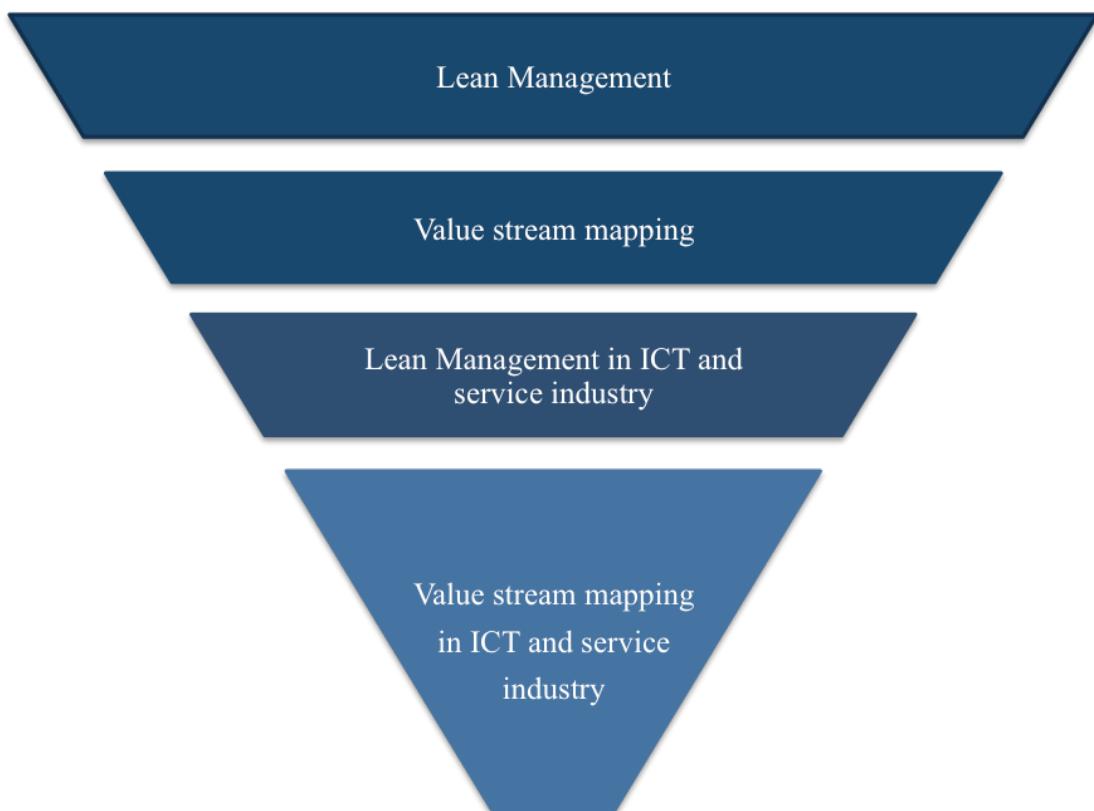


Figure 1. Funnel strategy for theoretical framework.

2.1 Lean Management

2.1.1 Overview of Lean Management

Lean management focuses on decreasing an organization's costs by eliminating waste, synchronize supporting functions and as a result, increase quality and customer fulfillment

(Bhasin, 2015). During recent years several tools and techniques have been developed to practice the methodology for reducing waste (Bhasin, 2015). Waste in this sense is defined as “every activity that adds cost but non-value added for the customer” (Chiarini, 2013, p. 17). In opposite to resource efficiency where focus is towards utilization of resources, lean management focuses on flow efficiency, i.e. how the customer or products flows through various steps (Modig and Åhlström, 2012). Womack & Jones (2010), the authors of the book “The Machine That Changed The World” that presented the Toyota’s way of practicing lean production, have defined lean thinking as following:

“...lean thinking is lean because it provides a way to do more and do more with less and less - less human effort, less equipment, less time and less space - while coming closer and closer to providing customers with exactly what they want.” (Womack & Jones, 2010, p. 15)

Further on, they have created five principles as the core of lean thinking (Womack & Jones. 2010). These are also highlighted in Figure 2.

1. *Identify Value* - specifying value is the most crucial starting point in lean thinking and implies that value in specific products and services meet customer’s needs at a specific time and price (Womack & Jones, 2010).
2. *Map the value stream* - identifying every part of the value stream of a product is an important action to find out which steps are providing value and which steps/additional steps are not providing value (Womack & Jones, 2010).
3. *Create Flow* - when value-creating steps have been identified, it’s crucial to make these steps flow through the value stream, by re-identifying the work of roles and functions as well as rethinking the lean strategy in the overall firm (Womack & Jones, 2010).
4. *Establish Pull* - when the flow is established, this enables the customer to pull the product from the organization instead of the organization pushing the product onto the customer (Womack & Jones, 2010).
5. *Seek Perfection* - these above four-mentioned principles are an ongoing process, which implies the idea to head for perfection (Womack & Jones, 2010). Within the aim for perfection, transparency becomes crucial since this enables all stakeholders to see everything in the process and by this, how to create value (Womack & Jones, 2010). Also, when employees get instant feedback on their development this empowers and encourages continuous improvements in the organization (Womack & Jones, 2010).

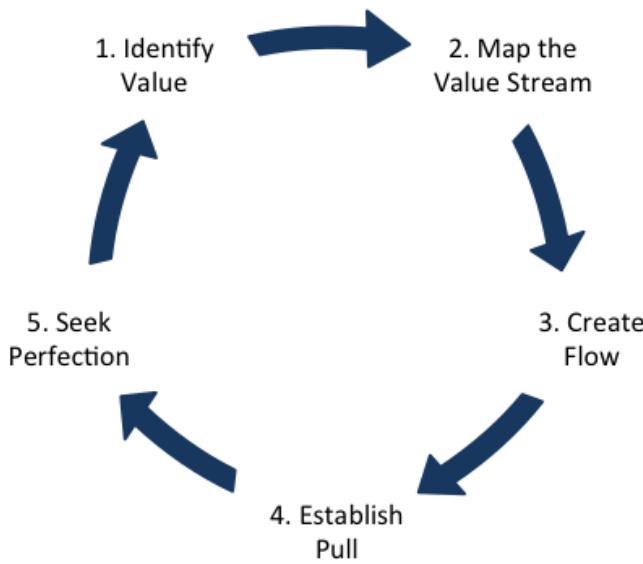


Figure 2. Five principles of Lean (The Lean Enterprise Institute, 2017)

Lean focuses on increasing customer value while using less resources and reducing waste that are non-added value for the customers (Bhasin, 2015). Furthermore, *the classification of seven relevant wastes* is the most famous method and was developed directly by Toyota (Chiarini, 2013). The seven wastes' concepts are:

1. *Overproduction* - producing products that exceed the demand, in other words - producing without customer order (Chiarini, 2013).
2. *Inventory* - product or raw material is placed within or outside the organization (Chiarini, 2013).
3. *Motion* - unnecessary movements for example, workers with lack of skills and activities that are being practiced isolated (Chiarini, 2013).
4. *Defectiveness* - for example when there is a defeat of customer revenue and products being returned (Chiarini, 2013).
5. *Transportation* - when you have irrelevant processes between products (Chiarini, 2013).
6. *Over Processing* - when there is processing beyond what is required from the customer (Chiarini, 2013).
7. *Waiting* - unnecessary waiting times before approaching a new activity, including machine operations and workers, is a result of for example unbalance between activities and lack of orders (Chiarini, 2013).

2.1.2 Lean as a philosophy

The core of the lean thinking implies generating value for customers while the organization is using less resources (Bhasin, 2015; Hines, Holweg & Rich, 2004). Put in another way, lean thinking is all activities that provide value and that customers are willing to pay for - the rest is waste (Chen & Meng, 2010). As a result of this, Bhasin (2015) underlines the importance to not view lean management as tools and techniques but instead focus on the philosophy thinking, that always emphasizes the link between reduced waste and value. Some critics have highlighted the lack of dealing with human aspects and variability within lean management (Bhasin, 2015). But, as Bhasin (2015) argues, it's crucial for organizations to look at lean management on both the strategic and operational level to grasp the purpose of the "lean thinking" and suitable tools and techniques to use.

Furthermore, Seth & Gupta (2005) underline that organizations today are recognizing the importance of becoming lean. But as a result, organizations are doing lean without becoming lean and by this, doing improvements without actually connecting the actions to the overall frameworks (Seth & Gupta, 2005). Therefore, as argued by the authors, all lean tools and concepts have to be used in a way that enables everyone to mutually work to improve the flow towards the customer (Seth & Gupta, 2005).

2.2 Value stream mapping (VSM)

2.2.1 Overview of VSM

VSM can be used in various ways, as a communication tool, to deal with change processes or as a business planning activity (Rother & Shook, 2003). This tool is probably the most applied in lean organizations today and its' core goal is to visually map production flow, showing the process of current and future state to capture the need for improvements (Bhasin, 2015). It takes a holistic perspective on the improvement process, instead of separately looking at different parts (Rother & Shook, 2003). It also looks at production flow, information flow as well as material flow to make improvements (Chen & Meng, 2010; Rother & Shook, 2003). For the organization, the VSM tool reveals where waste can be reduced and illustrate a roadmap for improvements (Bhasin, 2015). It is also said to be a paper and pencil tool, where you follow the product as it goes through the value stream (Rother & Shook, 2003). Within this, the aim is to question; "how can we flow information so that one process will make only what the next process needs when it needs it?" (Rother & Shook, 2003, p. 5). VSM can be applied from both a top-down and bottom up as well as from a strategic perspective with performance indicators (Chiarini, 2013).

2.2.2 Critical aspects within the application of VSM

Rother & Shook (2003) have developed a guide of a VSM process, a step-by-step approach based on the material as well as information flows used by Toyota. These steps are presented below and a similar step-to-step approach is found in Figure 3. Criticism have been directed to this step-by-step guide, saying that the approach of being a paper-and pencil-tool decreases the accuracy, the ability to handle multiple versions and that VSM is problematic to deal with the complexity within high-variety and low-volume organizations (Braglia, Frosolini & Zammori, 2009). Furthermore, the authors highlight the difficulty in using this approach when the processes are nonlinear but multiple flows that align (Braglia, Frosolini & Zammori, 2009).

At the same time, other authors highlight that the VSM's success is the ability to apply it, clearly show waste (Lasa, Laburo & de Castro Vila, 2008) and being able to see the whole value stream, which avoids local optimization (Alaya, 2016). Furthermore, VSM creates purposeful decisions by creating a common language of how to improve the value stream (McDonald, Van Aken & Rentes, 2002). Instead of criticizing the tool as being limited, some authors highlight personnel's lack of training in applying VSM (Lasa, Laburo & de Castro Vila, 2008) and the importance of VSM to be correctly applied under the right circumstances (Dal Forno, A.J. Pereira, A.F. Forcellini, F.A. Kipper, L.M., 2014).

In regards of continuous improvement through VSM, Gopal and Thakkar (2012) emphasize the importance of the organization not seeing the performance measures and metrics as a one-time activity, but an ongoing process that needs review. This should lead to a cooperative environment (Gopal and Thakkar, 2012) where job functions need to work closely together to achieve lean processes through VSM (Snyder, Paulson and McGrath, 2005). Damrath (2012) argues that the purpose of VSM is to create a mindset shift in employees' perspective and enable them to observe current processes focused on value and its' flow. Seth and Gupta (2005) highlight similarly, that VSM is able to link people, tools, metrics and reporting requirements to achieve lean enterprise. VSM enables clear communication about lean expectations within the organization, like between management and the shop floor units (Seth & Gupta, 2005). As a result, VSM can assist participants to understand and continuously improve how they view the lean concepts (Seth & Gupta, 2005).

2.2.3 Different elements in VSM

Following shows a step-by-step guide of VSM, developed by Rother & Shook (1999; 2003):

1. Selecting the product family:

VSM needs to focus and map the production flow for one specific product family, since customers are not interested in all the products - but care for specific ones (Rother & Shook, 2003).

2. The value-stream manager:

It's important to have one person leading the responsibility to understand the whole VSM for a production flow, to avoid several people isolated looking on specific parts of the process (Rother & Shook, 2003). This is also the reason why VSM should not be split up between different managers, but instead that someone in lead can see through boundaries and enable change (Rother & Shook, 2003).

3. Drawing the current state map

The aim when drawing the current state map is to do an analysis and clarify how the current state of the operations are (Rother & Shook, 1999). Information is gathered from the shopfloor to draw the production processes, which is crucial to develop a future state (Rother & Shook, 2003). From this, data is collected about cycle time, the changeover time, the number of people in the process, available working time per shift and machine uptime information (Rother & Shook, 2003, p. 20).

4. Drawing the future state map:

In the drawing of the future state, the focus is on the elimination of waste, mapping processes linked to the customers needs and creating a new state that soon can be ready for implementation (Rother & Shook, 1999). Future state ideas will arise when doing the current state map, as well as when drawing the future state map might reveal information that was overlooked in the current state map (Rother & Shook, 2003).

5. Implement the changes - achieving the future state

In the implementation phase, the importance is to enable a process by looking at value stream loops and value stream plan (Rother & Shook 1999). The value stream plan focus on measurable goals, time-plan, checkpoints with deadlines and enabling continuous flow (Rother & Shook, 1999, p. 98)

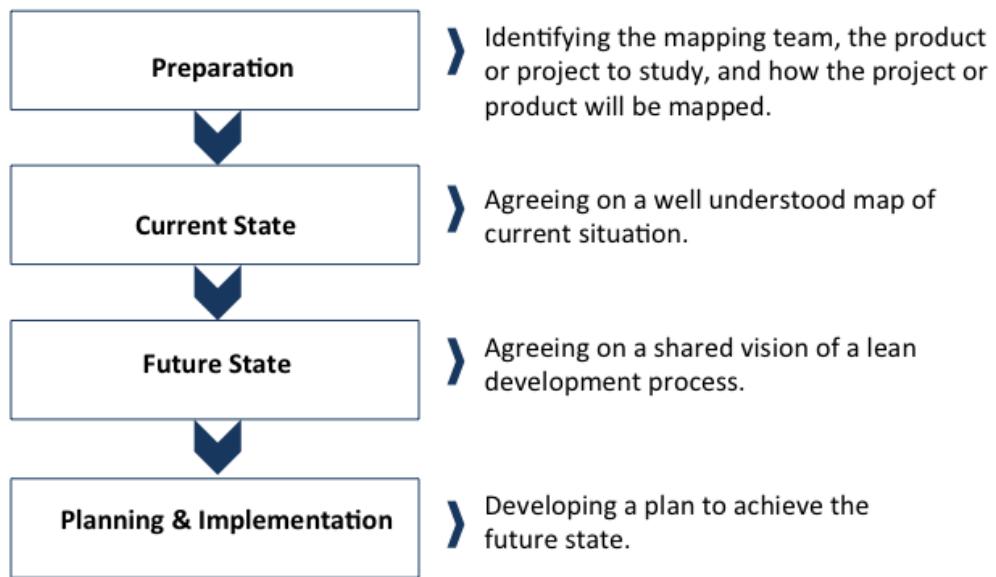


Figure 3. Overview of the different steps in the VSM-process (Locher, 2008, p.2).

2.3 Lean management in service industries and ICT

Lean management has moved beyond manufacturing into other sectors and businesses (Hines, Holweg & Rich, 2004) and aims to help organizations use it as a strategic tool to clearly see its' pitfalls (Bhasin, 2015). In comparison to lean manufacturing, lean service is a rather new concept (Hadid & Mansouri, 2014). After lean management's success in manufacturing, lean methodology is entering the service industry to enhance the services' efficiencies, meet customer requirements, stay ahead of their competitors (Vignesh, Suresh & Aramvalarthan, 2016) and to focus on the customer interaction (Portioli-Staudacher, 2014). Hadid & Mansouri (2014) presented in their literature review, that literature on lean service is most used within the health sector and office operations but less used in for example telecommunications (see Figure 2).

Suomalainen, Kuusela, Teppola & Huomo (2015) and Robertson & Jones (1999) have done studies about the application of lean with ICT companies. Suomalainen et al. (2015) studied and investigated the main challenges for ICT-companies within lean transformation. Firstly, strategy was challenging where its' execution is highly dependent on how management is committed and supported towards the employees (Suomalainen et al, 2015). Further on, following was emphasized as crucial - the importance to understand and define customer value, continuous learning and learning from mistakes, continuous communication at all levels in the organization, transparency through the operations and keeping people updated ongoing (Suomalainen et al, 2015). The most highlighted challenge were the employees' willingness to change their mindset and attitude (Suomalainen et al, 2015).

Robertson and Jones (1999) discussed in their paper about applying lean and agile concepts to British Telecommunications PLC, and that the lean concept allowed focus in optimizing processes holistically. In the telecommunications company it was necessary to look at end-to-end processes (Robertson and Jones, 1999). This therefore leads to breaking department barriers and including everyone affected by the process, in order to review the customer perspective in a transparent way (Robertson and Jones, 1999). Follow-up and double-checking procedures were therefore also reduced (Robertson and Jones, 1999).

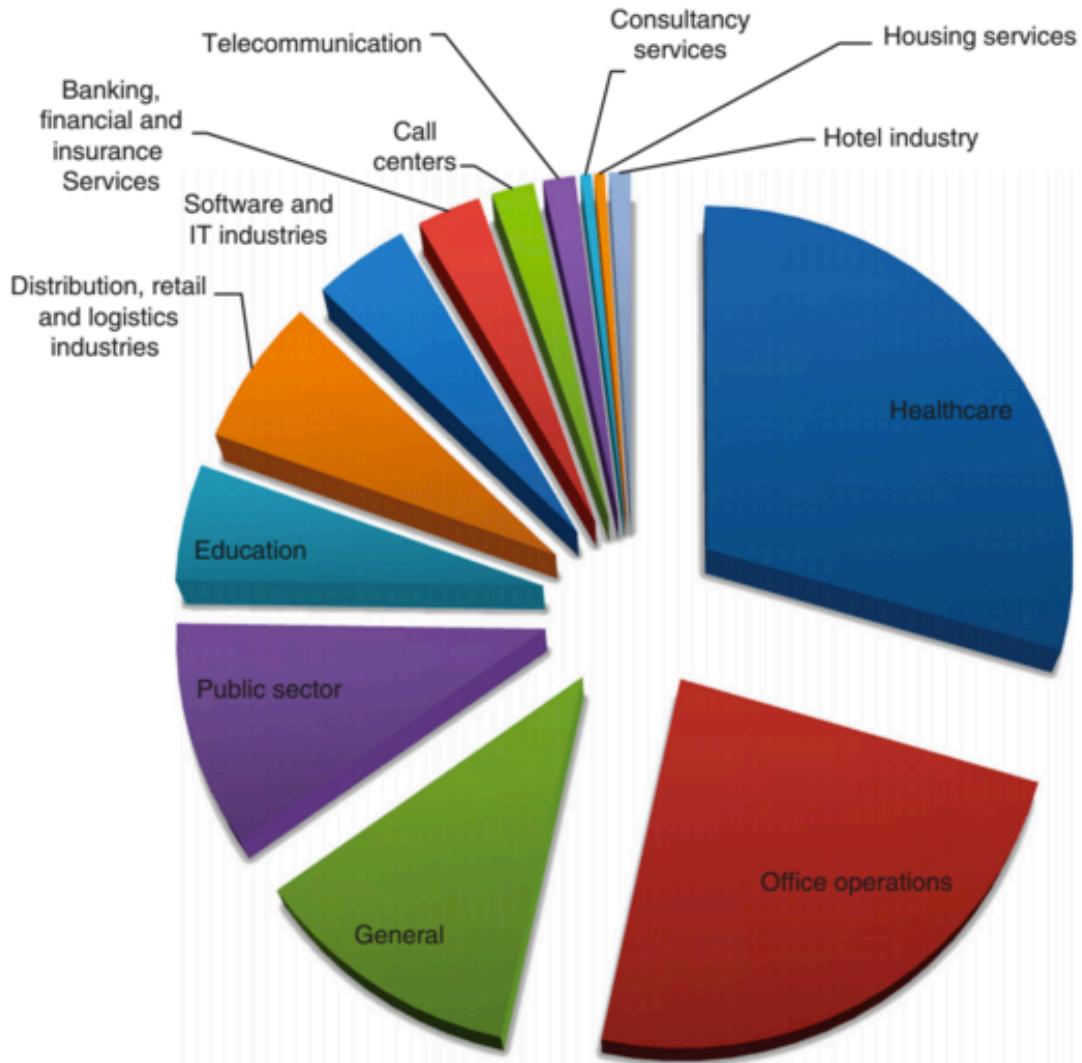


Figure 4. Classification of lean service literature per industry type, where telecommunications is highlighted as one area lacking in research (Hadid & Mansouri, 2014, p. 753, usage approval by authors).

2.4 VSM in service industries and ICT

Because ICT and telecommunications are sometimes included as well as excluded in the service industry, the authors will here present VSM studies within both service industries and ICT/telecommunications. Like Engelholm and Wiström (2012) emphasize when looking at similarities between IT and manufacturing industries, it can be argued that they are both process oriented. As Engelholm and Wiström (2012) state, IT value streams are both a service and an application that is offered to the customers. This paper suggests that in the case of Swisscom and the ICT industry, a similar definition can be made.

2.4.1 The process of analyzing operations within VSM

Shou, W., Wang, J., Wu, P., Wang, X., & Chong, H-H (2017) discuss VSM implementation in several industries and in this, they emphasize some key findings in their study of VSM in the service industry. Firstly, in the service sector the aim is to eliminate inappropriate procedures, errors, delays and increase satisfaction for the customer (Shou et al., 2017). Barber & Tietje (2008) underline the difference in mapping the sales process compared to manufacturing operations. They state that "*relationships, decisions, negotiations and conflict impact the activities and their pace compared to a manufacturing process...*" (Barber & Tietje, 2008, p. 157). In their study, they saw that the VSM enabled them to identify several types of wastes in sales and that many of the buyer's and seller's activities do not add value (Barber & Tietje, 2008).

Mujtaba, Feldt and Petersen (2010) conclude in their case study of VSM in Software development at Ericsson, that VSM was viewed by the participants as a great methodology to visualize and understand problems. Furthermore, VSM enabled them to identify improvements and create proposals for future solutions (Mujtaba, Feldt & Petersen, 2010). Paciarotti, Ciatteo & Giacchetta (2011) argue that VSM in the third sector (non-profit organization) enabled them to see differences between the theoretical delivery of service and the real way of practicing it. In their use of the current state map, they could illustrate the variations of operations, how phone calls were bypassed or forms were not updated on a regular basis (Paciarotti, Ciatteo & Giacchetta, 2011).

Kuiper, van de Hoef, Wesseling, Lameijer and Does (2016) found in their study of a financial service provider, that VSM helped them identify information and communication issues resulting in back-looping processes. The VSM proved that a lot of re-checking (back-looping) processes could be eliminated by $\frac{3}{4}$, and result in big annual savings (Kuiper et al 2016). Dahlman & Olsson (2014) studied the use of VSM in an ICT-company. In their study, they found that the VSM was successful in following up and finding bottlenecks, inconsistencies in the value stream (Dahlman & Olsson, 2014). Further on, they highlight that VSM showed a holistic view and enabled information sharing within the organization (Dahlman & Olsson, 2014).

Bin Ali, Petersen & de Franca (2014) did a VSM for the software engineering process at Ericsson, Sweden, and highlight the initiation and prerequisites to conduct a successful VSM process. In this, they highlight the importance of getting approval from relevant stakeholders, defining the purpose and the right people engaged in the process (Bin Ali, Peterson & de Franca, 2014). They highlight that the VSM-workshops enabled useful environment for discussions and multiple solutions (Bin Ali, Petersen & de Franca, 2014). The key contribution of the VSM was its' ability to successful illustrate waiting-times and variances in the processes (Bin Ali, Petersen & de Franca, 2014). Further on, they underline the importance to not be stuck in the VSM-terminology, let the practitioners be free in what notations they are comfortable with and in this way focus on creating a consensus on their current operations (Bin Ali, Petersen & de Franca, 2014).

In Khurum, Petersen & Gorshek's (2014) VSM case study within software development, they highlight following key aspects using workshops within VSM. The discussions were appreciated and participants were from different organizational units, that would otherwise not meet, but that are dependent on each other's knowledge (Khurum, Petersen & Gorshek, 2014). By this, the participants could have direct communication about what they knew about the process (Khurum, Petersen & Gorshek, 2014). The researchers also let the participants discuss the process in their own words, since the participants themselves highlighted that this would facilitate them to communicate ideas and improvements in easier ways (Khurum, Petersen & Gorshek, 2014). Further on, they highlight the findings of possibility to identify root causes looking at a holistic perspective and importance of written documentation of the specific goals of the activity (Khurum, Petersen & Gorshek, 2014).

In another recent study conducted by Bin Ali, Petersen and Schneider (2015), of Ericsson's software product development, their main lessons include following. Firstly, the maturity is a factor as people tend to fall back into old ways of working (i.e. the "the greenfield" way of thinking is not always possible) (Bin Ali, Petersen & Schneider, 2015). Another main lesson is that even in large processes, VSM could capture the current ways of working and analyze it and reach a future state map that the participants agreed upon (Bin Ali, Petersen & Schneider, 2015). At last, another main finding was that having diversity of participants represented from the process enables systematic end-to-end viewing and avoiding silo-vision and potential pitfalls to reach the objective (Bin Ali, Petersen and Schneider, 2015).

2.4.2 Detecting and deciding upon operational improvements within VSM

In the literature review of Shou et al. (2017) about VSM in several industries, they highlight that VSM in the service industry benefitted the process by improving the work efficiency and the value-added ratio. Looking at the techniques for future state improvement, the main focus is information transparency, having a proactive plan, improvement strategies for collaboration and restructuring the process (Shou et al, 2017). In the use of the VSM-tool in the services in the

third sector, the tool was successful in how it identified critical points in how to improve the value flow chain (Paciarotti, Ciatteo & Giacchetta, 2011). Dahlman & Olsson (2014) highlight in their study of software development within an ICT company that VSM, and creating the future state, was successful in highlighting improvements, provide a goal to strive for and useful when communicating about improvements to higher management. Bin Ali, Petersen & de Franca (2014, p. 58) highlight that successful factors in their application of VSM in software engineering, is for example “*... having realistic goals, executive support, sufficient resources, experienced and respected staff and involving developers as well as managers in the improvement initiative.*”

Khurum, Petersen & Gorshek (2014) emphasize that in their study the VSM enabled the two groups of participants to identify similar wastes and improvements. On the other hand, an issue was raised about oversimplification and the “black and white”-solutions (Khurum, Petersen & Gorshek, 2014). The authors highlight the importance to propose scenarios for the participants and focus on a realistic context in their developing of a future state map (Khurum, Petersen & Gorshek, 2014).

2.4.3 Establishing lean thinking and continuous improvements through VSM

Bin Ali, Petersen & de Franca (2014) highlight in their study of VSM in software development, VSM enabled the participants to see the realism of the suggested improvements and have a commitment for implementation. The authors discuss that the participants in VSM therefor can see the end-to-end perspective and in this way, understand the need to do a specific change (Bin Ali, Petersen & de Franca, 2014). In their study, the VSM Manager was crucial to, together with the developers, to negotiate a goal both being relevant and sufficient (Bin Ali, Petersen & de Franca, 2014).

In the case of the financial service provider, several initiatives were set in place to keep the processes from falling back into old ways (Kupier et al., 2016). Kupier et al (2016) highlight the most significant initiatives being following: Firstly, managers documenting the new processes so that employees are made aware and the managers can track possible irregularities (Kupier et al, 2016). Furthermore, feedback loops enabling chronic issues being treated directly at management level (Kupier et al, 2016). Third, each process element, responsibilities and roles were assigned (Kupier et al, 2016). Lastly, standardization of forms and procedures including checklists and having the team-managers sitting down and do check-in's on the processes and if they are being followed (Kupier et al, 2016). In the literature review of Shou et al. (2017) about VSM in several industries, the authors highlight that there is a gap of research about the critical success factors for VSM implementation in the service industry.

However, Womack (2011) in Damrath (2012) suggests three important elements that entail successful lean practices in the service industry; 1) One person responsible for the value stream

(value stream manager), overseeing the whole value stream flow and continuously improving processes for customer value; 2) the value stream managers attention should be towards continuously improving the processes, and not only focused on the outcome metrics as this will lead to only handling mistakes when they have already occurred; 3) in order for the value stream manager to continuously improve their value streams, PDCA cycles are suggested as ongoing experiments to test the current processes and detect improvements, leading to sustainable improvement processes. (Womack, 2011, in Damrath, 2012)

2.5 Chapter summary

This theoretical framework, as presented in Figure 1, provides a general overview of the core of lean thinking and it's relation to the lean tool VSM. It discusses critical factors within application of VSM and the tool's different steps. Furthermore, it specifically dives into lean within the ICT and service industry and the development within these areas. Lastly, it presents and highlights similar case studies' results of practicing the VSM in real life context within the ICT and service industry. Doing this, it explores the case studies' results in line with the research's main areas: analyzing operations, detecting and deciding upon operational improvements and continuous improvements.

3. Methodology

In following paragraphs, the approach to methodology is explained in terms of the research philosophy, research approach, the research design as well as chosen data collection methods. Figure 4, gives a brief overview of the chosen research process.

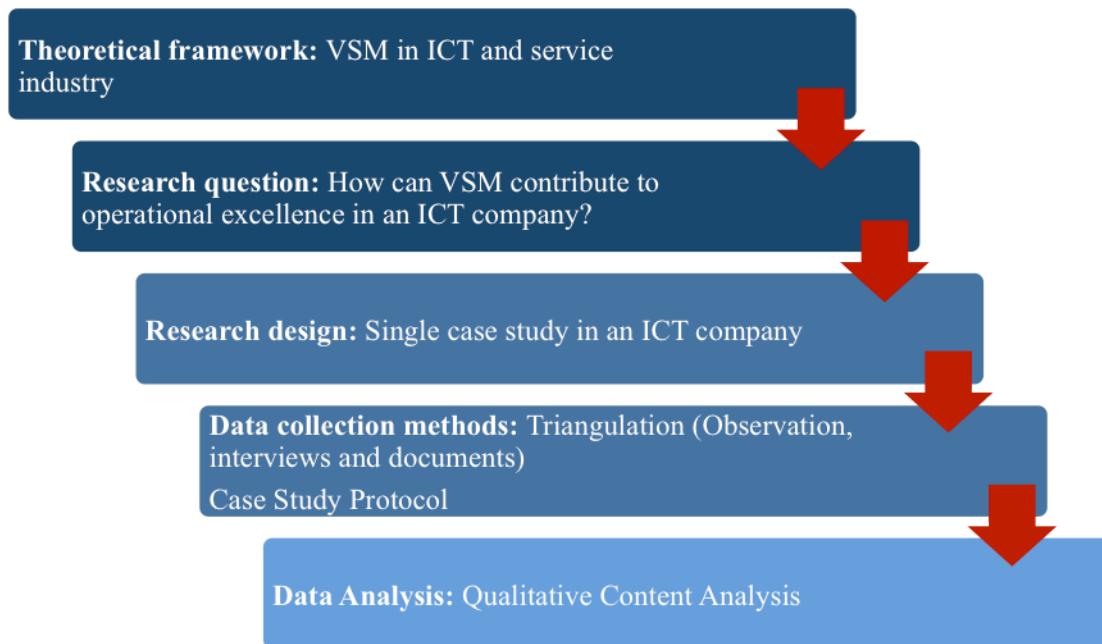


Figure 5. Brief overview of the study's research process and case study design.

3.1 Research philosophy and research approach

The study holds a social constructionist perspective, which in opposite to positivism incorporates the complexity of whole situations (Easterby-Smith, Thorpe & Jackson, 2015). Furthermore, the study embraces a relativist orientation, in opposite to a realist perspective, which is described as an interpretivist direction implying that there are multiple realities with multiple meanings and these findings will be dependent on the observer (Yin, 2014). Therefore, the data collected and derived from observations and interviews are highly dependent on the researchers' understanding of the findings. Due to the view of multiple realities, the constructionist approach emphasizes collecting diverse experiences from different sources, sometimes referred to as *triangulation* (Easterby-Smith, Thorpe & Jackson, 2015). To strengthen the findings in this case study, the research is using a triangulation approach to confirm similar findings with diverse data objectives. Furthermore, the thesis' approach on conducting a case study also underlines the study's aim of grasping the complexity of how VSM enables operational excellence within the different stages.

The research approach in this study is a combination of being *inductive* as well as *deductive*. This combination is argued by Saunders, Lewis & Thornhill (2012) to be the usual case in most research but emphasize that the study is mainly dominant in one of the two approaches. The dominant approach will be determined by the emphasis and the nature of the research (Saunders, Lewis & Thornhill, 2012). In this study, the research is mainly deductive. Deductive approach implies that the study is developed from prior research and the study aims to test this theory (Saunders, Lewis & Thornhill, 2012). In this research, prior research has provided us with a context and guided the formulation of research questions to study within the field. The inductive approach, on the other hand, investigates a phenomena, finds new patterns and themes (Saunders, Lewis & Thornhill, 2012). In this study, the aim is not to explicitly test theory but to also let new themes arise from the collected data. The research therefore also serves in an inductive direction, providing new concepts to previous research of VSM in the ICT and service industry.

3.2 Research design

In following paragraphs, this thesis' fundamental design elements are explained: the choice of case study, the single case study approach and the units of analysis.

3.2.1 The choice of case study

Case studies, despite being a challenging methodology approach, enables researchers to look into organizational and real-life characteristics (Yin, 2003). Therefore, the choice of case study within this study is sufficient since it enables the authors to study how VSM, in real life settings, supports operational excellence for the observed company. Furthermore, a case study is preferable when the research question aims to investigate the “how”, studying the operational links (Yin, 2014). A case study within this research enables, through a triangulation method, to study how VSM contributes to operational excellence within an ICT company.

3.2.2 Explanatory single case study

The choice of *a single case study* is suitable when the observed case is for example representative or typical (Yin, 2003). The observed operations are unique for Swisscom and their company. But the VSM as a tool is a highly popular lean tool within organizations practicing lean today (Bhasin, 2015). Thus, the study of how VSM contributes to operational excellence within an ICT company therefore represents a typical case and the findings presented can therefore be relevant for other ICT companies practicing lean. Furthermore, the aim is to gain an in depth understanding of the VSM process, by explaining *how* VSM contributes to operational excellence within Swisscom.

3.2.3 The units of analysis

The units of analysis imply defining what the case actually is and the relation directly to the

specific research questions (Yin, 2009). The study's different sub questions enable the authors to pinpoint the units of analysis. Therefore, this research studies firstly) the key aspects when analyzing operations in the VSM workshop, secondly) how VSM enables them to detect and decide upon operational improvements and lastly) their initiatives to support continuous improvements. As a result, the research's aim is not to study other lean management initiatives within Swisscom and the LMI team. The study excludes to look in depth of lean management and operational excellence in general, and strictly investigates how VSM is being used for operational excellence and the elements crucial for its success.

3.3 Validity (internal and external) and reliability

3.3.1 Construct validity - internal and external

Case study research *construct validity* by firstly) defining specific concepts and how they relate to the study and secondly) find and match operational measures to these concepts (Yin, 2014). In this thesis, definitions of the key concepts are defined (See List of Key concepts and Abbreviations). These key concepts have been redefined after conducting the case study, implying that the operational measures are also aligned with the vocabulary in the case study environment. Also, the chapter of "Case study context" provides the reader of a translation of how these key concepts are practiced within Swisscom. The validity is strengthened with the choice of triangulation approach, which enables similar phenomena to be studied from different sources (Yin, 2009). The approach of triangulation is explained further in the chapter *3.4.1 Case study design*.

As highlighted by Yin (2014), *internal validity* is problematic within explanatory case studies since researchers might neglect a third factor when trying to explain causal relationships between x and y. The analytic tactics for achieving this needs to be approached in the analytic stage, where for example pattern matching enables comparison of empirical data to the predicted pattern and if similar, this will be improving the internal validity of the case study (Yin, 2014). Within this thesis, pattern matching to the theoretical framework enables comparison to what has been researched before and how this relates to the specific case study within Swisscom.

In terms of *external validity*, single case studies are argued to have poor generalizability (Yin, 2014). On the other hand, a case study does not rely on statistical generalization but instead on *analytical generalization* (Yin, 2009). This implies that specific results can be used as a generalization within a broader theory, for example results from case studies about neighborhood change can be generalized to theories about transition after several replications (Yin, 2009). The findings in this case study, if replicated, can be generalized within the theory of VSM within the ICT industry.

3.3.2 Reliability

A case study with reliability enables future researchers to replicate the same case study and derive at the same conclusions (Yin, 2014). This puts emphasis on the researcher to document the procedures and for example in the situation of the case study, use a case study protocol (Yin, 2009). A case study protocol focuses on field procedures, sources for information and questions to guide the case study (Yin, 2003). To increase the possibility for future researcher to replicate this case study's procedure, a case study protocol has been constructed (see Appendix I). This protocol translates the thesis' sub questions into data collection objectives in the field. It highlights what units were explored and what data collection methods were used for what questions. As a result, this case study protocol creates transparency and enables both the reader and a future researcher to follow the case study's different steps.

3.4 Data collection

In this part, the case study design and choice of data collection methods are explained. In Appendix I, the reader can find an outlined Case Study Protocol that was used to guide the data collection. The formalia of this Case Study Protocol is derived from Yin (2003). Table 1, in chapter 4. *Findings & Analysis*, presents an overview of all collected data.

3.4.1 Case study design - the triangulation method approach

One great strength by choosing case study as the data collection approach is the ability to get many different sources of evidence (Yin, 2003). By using triangulation as the method approach the conclusion derived from the data will be more convincing (Yin, 2003). In this thesis, the findings are strengthened by using three different sources of evidence to answer the research questions: document collection, direct observation and interviews.

3.4.2 Organizational documents

Documents from LMI provide background information about the organization's VSM methodology and therefore their approach within lean and VSM. This allows the authors to compare documents about the VSM processes with the observations and interviews, and see how they align. The critical factors in this are to be observant that these documents are written for another purpose and audience and should therefore not be used as an "absolute truth" within a case study (Yin, 2014). Since this is a valid criticism, the triangulation approach is strengthening and supporting the findings, by comparing the documents to observations and interviews.

3.4.3 Direct observation

Direct observation enables the researcher to understand specific behaviors, environmental conditions and add additional information about a specific topic (Yin, 2003). In this study, direct observation is crucial to answer the research question on how Swisscom use VSM in their operational analysis, and how it aims to impact and improve their future operations. Direct

observation enable the authors to see the interactions between the participants, discussions taking part and study the process step by step. Direct observation has its weaknesses since observed actions might appear differently due to the fact that they are being observed (Yin, 2014). Although this weakness, ability to study interactions within VSM workshops were only possible through direct observation and not by solely focus on organizational documents or interviews alone.

3.4.4 Semi-structured interviews

The purpose with qualitative interviews is to understand the subject from the informant's own perspective (Kvale & Brinkmann, 2009). Having semi-structured interviews allow the interviews to be guided by a specific topic, while at the same time letting the informants highlight their own experience of the topic (Kvale & Brinkmann, 2009). The interviews within the case study enable the authors to get the informants' experience and perspectives on the VSM process.

In the interviews, asking open questions enables nuanced descriptions of the informants' view of the topic (Kvale & Brinkmann, 2009). Furthermore, open questions enable new and unexpected phenomena to arise (Kvale & Brinkmann, 2009). Therefore, the main question and the sub questions were the starting point in the interviews. This has enabled the informants to openly discuss their experience and view on the VSM process different stages. The interview guide served as a guideline throughout every interview. The interview guide has also been refined after have conducted the first interviews within the case study environment, making sure the questions are being comprehensible for the informants (See Appendix II, the interview guide)

3.4.5 Sampling strategy

The sampling strategy is non-probabilistic and purposive sampling. Purposive sampling enables the authors to choose interviewees according to a theoretical driven criteria, and by this choose which interviewees should be chosen and which interviewees should be rejected (Easterby-Smith, Thorpe & Jackson, 2015). In this study, the judgment criteria for interviewees in the case study field were following: *Lean managers in the LMI team conducting VSM workshops*. However, the bias in this strategy has to be taken into account (Easterby-Smith, Thorpe & Jackson, 2015).

In terms of chosen observations, the authors participated in three workshops that aligned with each of the three sub questions; mapping of the current state, mapping of the future state and planning meeting for continuous improvement. In terms of chosen documents, the authors got access to LMI's internal documents of VSM methodology as well as the specific documents for every workshop. The documents chosen are those that relate to explaining how Swisscom practice VSM in general. The documents related to the specific workshops are used by the authors to facilitate understanding of the workshops, but not presented in this paper due to company sensitive information.

3.5 Ethical considerations - informed consent and confidentiality

Ethical issues and considerations should be taken into account in all steps of a research, for example from designing interviews to the last part of reporting (Yin, 2003). To prepare for this, Swisscom and the authors signed an agreement about the collaboration, implying that all information that can be traced back to Swisscom is only to be published after consent with the company. As a result of this, sensitive findings of the research are disclosed to Swisscom and not the published paper, unless approved by Swisscom.

Informed consent implies describing the purpose of the study for the interviewees and the right to withdraw at any point (Yin, 2003). In every interview, the authors have repeated the purpose of the study, making sure all interviewees fully understood what their contribution would be part of, the recording of the interview and their right to terminate. Since Swisscom is foremost a German speaking company, the authors made sure the interviewees could choose to speak English or German depending on what was most comfortable for them. This was possible due to the fact that one of the authors is fluent in German.

Confidentiality needs to be clarified before the interview situation, making sure that the interviewees agree upon what will be published in the interview and ensuring their anonymity (Yin, 2003). Before every interview, the interviewees have been informed about the use of their answers in the final report and have had the choice to approve or disapprove.

3.6 Data Analysis - Qualitative Content Analysis

To conduct data analysis, the strategy of qualitative content analysis was chosen. This approach structures qualitative data by constructing a criteria list from pre-existing theory or research questions (Easterby-Smith, Thorpe & Jackson, 2015). It also enables quality in that sense that bias of the researcher is suppressed and the analysis is done in a systematic order (Bryman & Bell, 2015). As stated before, the research questions are answered by using a triangulation method. Using qualitative content analysis in case study research also strengthens the results, since triangulations takes part on two levels (Kohlbacher, 2006). First of all, by using several materials of evidence and second, by applying the method of content analysis which takes into account both qualitative and quantitative steps (Kohlbacher, 2006).

Within the content analysis, coding has been used to find themes that occur in the findings. Criteria for coding can emerge from research questions, pre-existing theory or the selected material (Easterby-Smith, Thorpe & Jackson, 2015). The criteria is derived from the sub questions, eg: 1) *what are the key aspects when analyzing operations in VSM?* 2) *How does VSM enable to detect and decide upon operational improvements?* and 3) *What are the initiatives to support continuous improvements?* Secondly, the criteria list has been developed with dominating findings/themes that arose from the analyzed material. See figure 6 for preparation

and process of coding steps in content analysis, also see Appendix VII for the coding scheme.

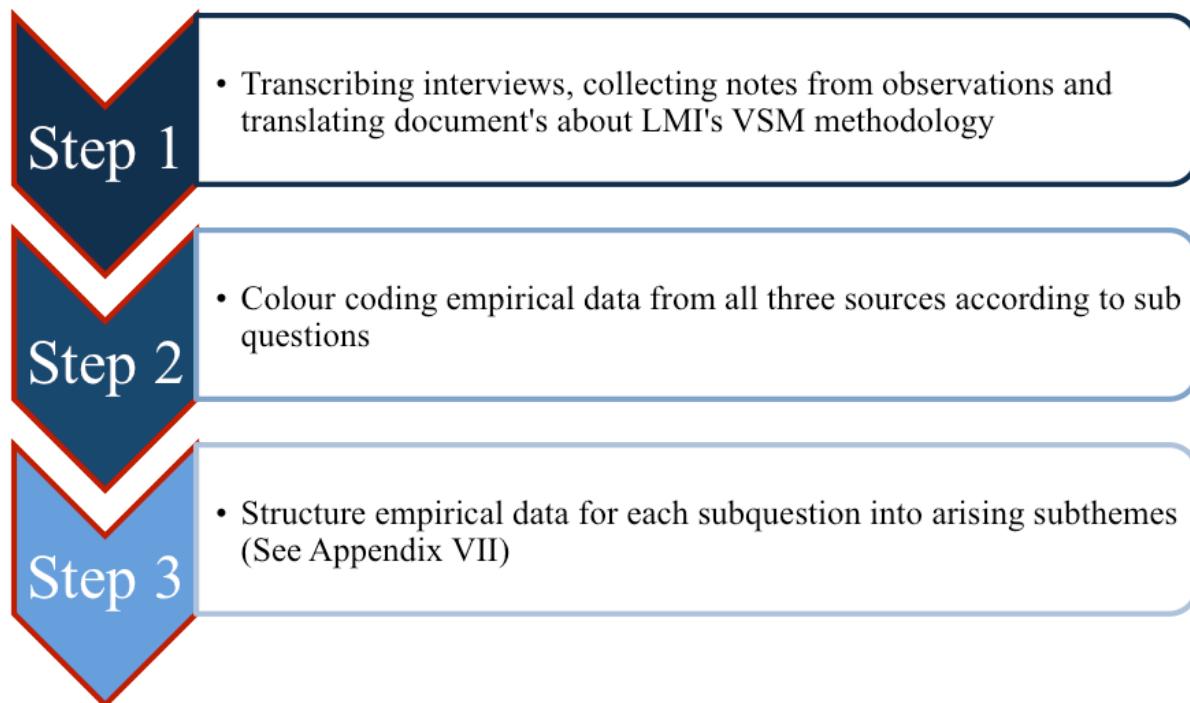


Figure 6. Preparation and process of coding steps in the content analysis.

3.7 Data Quality

Easterby-Smith, Thorpe & Jackson (2015) underline the importance of checking the collected data through several criteria to assess quality. The first aspect concerns the topic and its' *relevance and significance* (Easterby-Smith, Thorpe & Jackson, 2015). The research area of "VSM in a practiced setting" is highly studied in multiple sectors and industries. The relevance of this study increases since it's pinpointing VSM within the ICT industry, where considerably less research is covered. Another criteria of quality concerns the *rigourness*, and how suitable the concepts and data is for the study (Easterby-Smith, Thorpe & Jackson, 2015). Choice of case study enables in depth insights and data about contextual factors affecting VSM processes. However, a critical argument is that only a snapshot of their process and documents can be captured. The authors' lack of practical experience and use of the VSM might have affected their understanding of the process.

The criteria of *sincerity* imply the study's transparency to conduct a proper evaluation (Easterby-Smith, Thorpe & Jackson, 2015). Observations and interviews were affected by researchers' interpretation, as well as the translations from German to English. However, the case study protocol follows the triangulation approach, which enables the reader to follow the process of data collection and how different research questions relates to empirical data. Also, all interviews and observations have been transcribed to ensure that the majority of data can be derived strictly

as first-hand data. Furthermore, the triangulation approach enables the research questions to be explained using multiple sources and by this, increase *credibility* of the study. Therefore, the bias' problem with interviews can be checked through use of observations and documents. However, the dilemma to capture all details in observations can serve as a credibility problem.

3.8 Limitations

This paper excludes to discuss other operational analysis tools or approaches and do not further elaborate on concepts within lean and operational excellence. The theoretical framework used for the discussion has also been narrowed down to VSM within ICT and service industry, excluding health care sector. Shou et al (2017, p. 3909) highlight that VSM application in healthcare was separated from service sector in their study due to that fact that the management action within healthcare will be affected by “characteristic of healthcare”. Although healthcare can be included in the service sector, this study exclude it based on same reasons.

This paper also holds limitations in form of language barriers, as only one of the authors speaks German. Therefore as some of the observations were purely conducted in German, its interpretation is based on one author and the author's translation and interpretation of such. Interviews have all been conducted in English, and therefore hold higher validity, combined with the documents (although translated from German) that have been discussed with the informants in English. The validity in the interpretations of observations, combined with all other information derived from the case study, is heightened by the fact that the paper is approved and validated by the LMI team at Swisscom before being published.

3.9 Chapter summary

The methodology is primarily guided by the triangulation approach, using the observations, interviews and documents as a grounds for our analysis. The triangulation approach is also supporting the authors' validity and reliability in the research. The content analysis is the basis for a systematic approach to codify the findings and match with the research questions. Subthemes are allowing unexpected themes to be presented.

4. Case study context - VSM within Swisscom

In the following paragraphs, the process of practicing VSM within Swisscom is shortly presented. This is to explain the vocabulary, phases and steps, which facilitates the understanding of the coming analysis and discussions. The following paragraphs refer to LMI's documents of Swisscom's VSM methodology, interviews with Lean managers and to observations. This has been combined here as an introduction to the VSM processes at Swisscom.

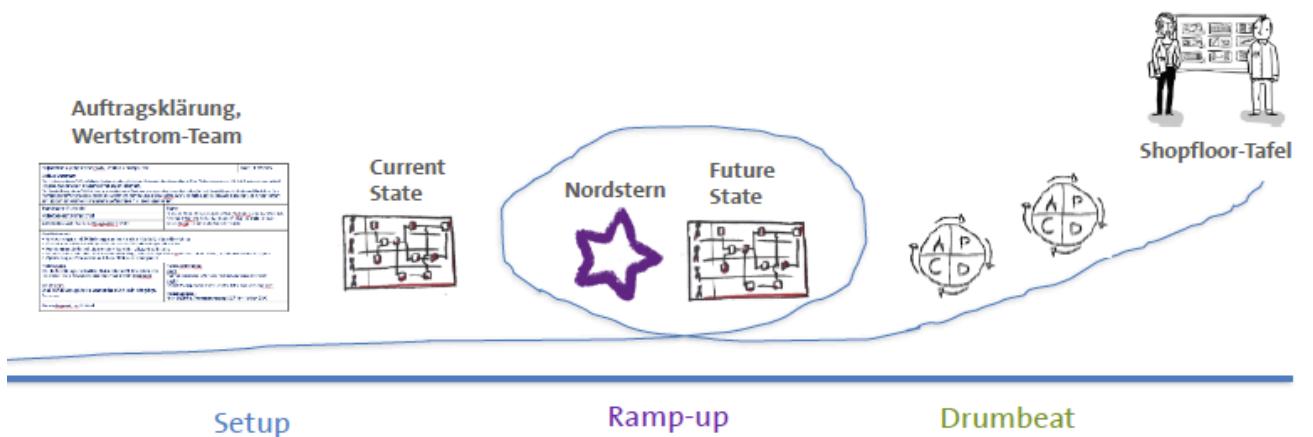


Figure 7. LMI's steps in a VSM-process (Swisscom, 2017, VSM presentation)

4.1 The Setup

When a department or manager wants to improve their processes, they firstly have to fill out a 'orderform'. This is an important step for the Lean managers to identify the issues within the current operations and processes, and what the manager wishes to achieve. Then a pre-analysis is conducted in order to estimate the potential. After the pre-analysis one of the Lean manager decides if VSM is the optimal tool to analyze and work with in the specific case. The manager who gave the 'order' becomes the VSM-owner. The VSM-owner then starts the process together with a VSM-coach, which is one of the Lean managers. The point of this is that the VSM-owner is to learn the concepts, and ideally be able to apply the concepts in the future on his/her own initiative. After deciding on using VSM, a detailed analysis is made where the departments affected by the process are identified and the participants for the VSM are decided. The goal is to have participants from each department in the same room when analyzing the value stream and identifying improvements to the process collectively. Once every participant is at the workshop, an activity-analysis is made to map the current state by mapping it on a 'swimlane chart' (pictured below). The current state visualizes the current processes and detects where the problem-zones are, which are symbolized as 'Kaizen' stars (marked red in picture). These are the areas identified as issues in the current state.



Figure 8. The current state map. Photo from observations. Blurred due to privacy agreement. (Blue: Departments, Yellow: Activities, Red: Identified issues ‘Kaizen-stars’, Green: Information needed for activity).

4.2 The Ramp-up

When the current state has been drawn and the Kaizen stars have been identified, the participants identify the Northern star (pictured below) based on the overall objectives set by the order form. Once the Northern star has been decided, Design principles (pictured below) to achieve the northern star are created. The Design principles should guide the participants when mapping the future state. When mapping the future state, it is highlighted that activities are no longer divided into the different departments, but rather into roles. Therefore on the swimlane chart, the roles are mapped (pictured below), and activities for each role are mapped accordingly to the ideal process. This is done to get the participants out of their department and into thinking collectively on role and activity identification. When mapping the current state, the participants are encouraged to leave the old ways and only focus on how the processes should be. Once the current state has been mapped, new measures for tracking progress are identified and new KPI’s are created to correlate with the new process.

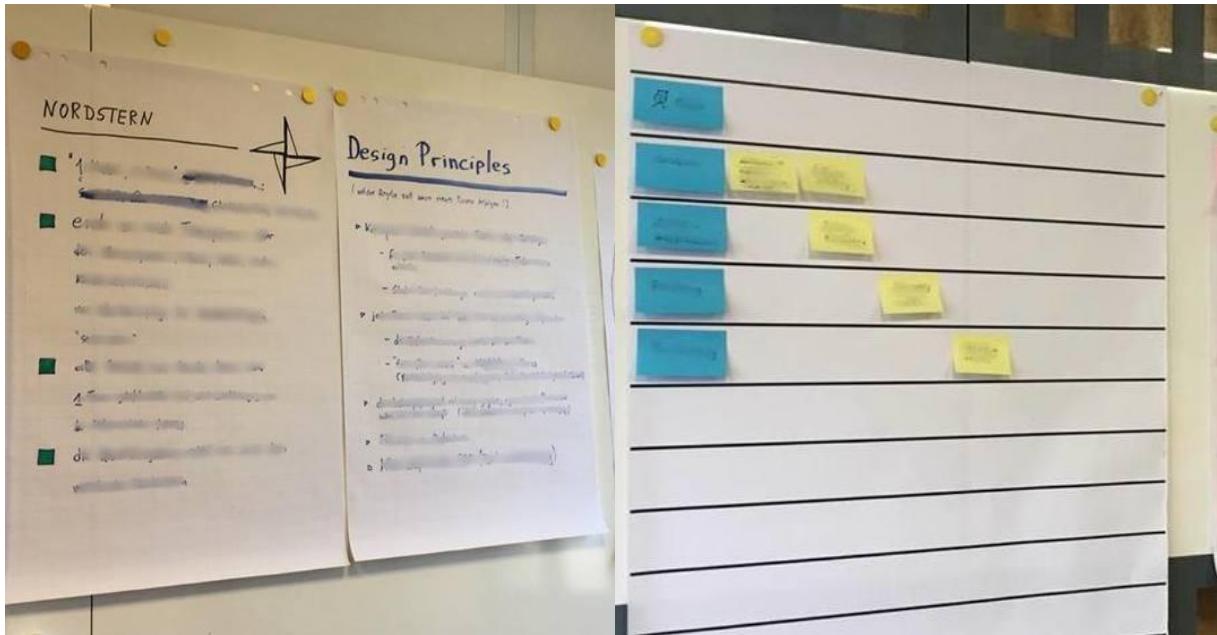


Figure 9. Northern star, Design Principles and a started (but not finished) future state map. Photos from observations. Blurring due to privacy agreement. (Blue: roles, Yellow: activities).

4.3 The Drumbeat

The Drumbeat phase means implementation time. This is the moment when the VSM-owner together with the VSM-coach is onboarding the affected departments/units. Usually a workshop is put into place to explain the new processes and the philosophy behind it, highlighting lean and the thinking of VSM. Within the workshop, the units work together to identify how they can impact the KPI's and what their role in the new process is. The PDCA (plan-do-check-act) exercises will be conducted once a week, with the VSM-owner and the unit to track if the process is working, and if there should be any adjustments or improvements. The PDCA allows for the employees in the units to affect the processes. The PDCA is also meant to keep the thinking of value stream alive after implementation, and assist in continuous improvements guided by the Northern star. The shop floor board, represents the processes and KPI's that are guiding the process, and which objectives need to be reached first. The VSM-coach is also tracking the progress of the PDCA cycles and assists when needed. The VSM-owner has to secure documentation of learnings of the process after the implementation. The learnings are emphasized as an important aspect in order to keep improving.

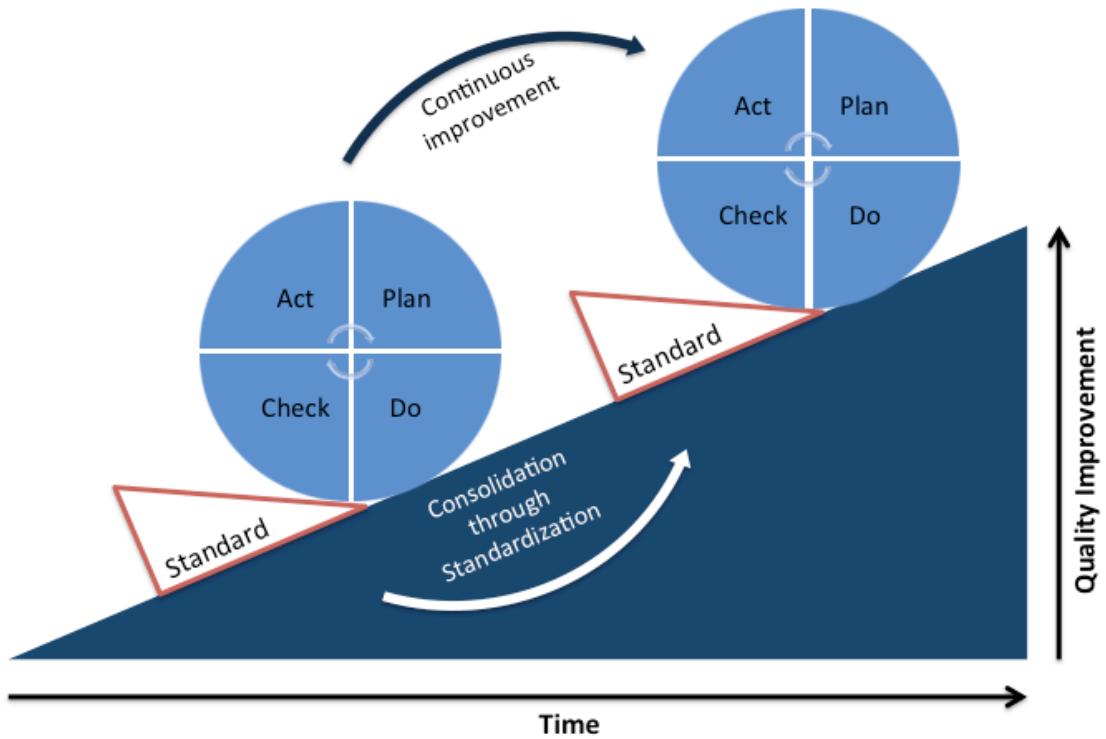


Figure 10. PDCA cycles. Modified - original by Johannes Vietze (2013).

4.4 Chapter summary

This chapter aims to frame the case study context and explain Swisscom's VSM methodology. In this, the VSM's phases of the Setup, the Ramp-up and the Drumbeat are presented to illustrate how the process of VSM is conducted and the specific vocabulary used within the workshops. This contextual illustration of VSM within Swisscom therefore facilitates an understanding to grasp the content in the upcoming analysis and discussion.

5. Findings & Analysis

In this section the authors present findings and analysis according to the sub questions. All the different data objectives are presented in the table below, together with abbreviations used in the following chapters.

| Type of data objective | Name/description | Abbreviations |
|----------------------------|---|---------------------|
| 1. Interviewee | Lean manager A | Lean manager A |
| 2. Interviewee | Lean manager B and VSM-coach in observation CI | Lean manager B |
| 3. Interviewee | Lean manager C | Lean manager C |
| 4. Interviewee | Lean manager D | Lean manager D |
| 5. Interviewee | Lean manager E and VSM-coach in observation FS | Lean manager E |
| 6. Observation | VSM-mapping of the current state | Observation CS |
| 7. Observation | VSM-mapping of the future state | Observation FS |
| 8. Observation | Preparation Drumbeat/ Continuous improvement | Observation CI |
| 9. Document (Appendix III) | LMI's schedule and procedure of the VSM-process (Internal document) | Document Process |
| 10. Document (Appendix IV) | LMI's clarification of the VSM-order (Internal document) | Document Order form |
| 11. Document (Appendix V) | LMI's PDCA Experiment (Internal document) | Document PDCA |
| 12. Document (Appendix VI) | LMI's Shop floor board (Internal document) | Document Shop floor |

Table 1. Overview of data objectives and analysis abbreviations

5.1 Key aspects when analyzing operations within VSM

This section presents findings about the key aspects when analyzing operations within the process of VSM.

5.1.1 Pre-analysis and clarification of the scope

Almost all of the Lean managers underline that clarifying the scope of proposal is crucial before entering the phase of current state.

“It is important to be clear about the scope of the project, because if the basis is not clear, you will never be able to have an outcome that will make anyone happy.” (Lean manager B)

This is also stated in the phase of “scoping”, where the clarification needs to be done before entering the preparation of the current state (Document Process). The clarification of scope is done in the document called “Assignment Clarification” (Document Order form). In this form, the current issues are outlined together with goals and focus of the specific value stream process (Document Order form). The Lean managers’ highlight that scoping and a pre-analysis implies defining “...which costs are involved and which people” (Lean manager A) and “defining the right roles” (Lean manager D). Another Lean manager also develops this further:

“Contractual clarification... clear definition of start and end point, goals to be targeted, constraints that must be taken into account and resources made available.” (Lean manager E).

Within this, a Lean manager highlights the importance to clarify and precise the wording, implying making sure that the scope is clear and if necessary, dive deeper into meaning and recharge words (Lean manager B). It’s also emphasized that the clarification of the scope is done together with the clients/teams, and making sure that “everyone have touched the process so that they have started from the same page.” (Lean manager B).

5.1.2 Transparency - in the mapping and between the participants/members

Transparency in terms of visualizing the process, aligning partners from different functions and get all the people in the same room is outlined as one key aspect when analyzing the operations.

“...making the process visible to the people involved and that they are able to identify if they are dealing with a Volvo or a Ferrari...” (Lean manager A).

Lean manager D highlights that VSM *demands* transparency, which is usually not the situation in the daily work. Transparency is a key ingredient in the VSM, since it enables everyone to understand the process (Lean manager E) and “*what you can not perceive, you can not change*” (Lean manager C). Furthermore, transparency *between* team members is another important aspect. This implies creating open discussions without blame (Lean manager A), get people in

one room and knowing what the other people are doing (Lean manager B). The transparency between members was also present in the observation of the current state (Observation CI), where the VSM-coach tells the team members that at this stage it's not important to map how the process should be, but how it is in the real situation. Also, before starting mapping the team members go through all the processes and measures to get everyone onboard and understand the current participants and their roles within the process (Observation CI).

"It is very important for aligning all of these people, as it leads to a common understanding and better comprehension of the domains and processes and knowledge" (Lean manager C).

5.1.3 Composition of participants and their ownership of the process

A third key aspect highlighted by the Lean managers is the presence and ownership of team members in and about the process. Firstly, the presence implies having the right people (Lean manager D), *"getting the value stream and experts in the same room"* (Lean manager C) and *"bringing the different competencies to the workshop is important, the people learn from each other"* (Lean manager A). This is also an outlined activity before preparing the current state, where the VSM-owner and VSM-coach decide who should participate in the team (Document Process).

Secondly, the Lean managers highlight the participant's ownership of the process by *"allowing them (team members) to identify what is just symptom treatment and what are root causes"* (Lean manager B) and *"letting the participants feel ownership of the process..."* (Lean manager A). In the observation CS, the participants lead the discussions and dictate the process, by explaining their activities and different information flows. The role of the VSM-coach in the observed process is to guide the team members so that steps will not be missed (Observation CS). In the observation, all team members are also asked directly by the VSM-coach if everyone understands the measures and activities correctly (Observation CS).

5.1.4 Treating root causes - not symptoms

A fourth key aspect when analyzing operations is the importance of looking at root causes, since this avoids symptoms treatments (Lean manager C). Another Lean manager develops this further by saying that usually the daily business life lacks time to focus on the root causes, the core issues, and instead the focus in daily operations becomes dealing with the symptoms (Lean manager D). Also, this is present in the observations. Once the process has been mapped from when the customer gives the order until the order is finalized, the identification of waste has begun (Observation CS). In this case, the waste identified is for example waiting time and unnecessary "backward processes" (Observation CS). Unnecessary "backward processes" are explained as activities that have to be re-done, communication issues or need for double checking (Observation CS).

5.1.5 Establishing a common direction - value-added activities

A fifth key aspect highlighted during the workshops and interviews is the team's ability to have a common direction when analyzing operations, which implies preparing the team for thinking in new ways and redefine their usual process in terms of value and value added activities. They emphasize when starting the process in the value stream, the starting point is the customer and the customer's desire and needs (Lean Manager A) and the customers' perspective and what creates value for them (Lean manager D). The Lean managers highlight that the VSM-coach's role is preparing the team, explaining the lean philosophy and challenge the team members' way of thinking and working (Lean manager A, B and E). The VSM-coach should assist and support the team in finding the gap between "where are we today" and "where will we be tomorrow" (Lean manager A). By asking these questions, the team members will discuss how they can achieve this and in this way know how they can start creating the Northern star and the Design Principles (Lean manager A). Lean manager B highlights similarly, that the VSM-coach has to challenge the team members in how they do their daily operations, to enable the participants to think about the way they work and the value it adds.

Further on, Lean manager E highlights that before tackling the value stream in the future state, it's crucial to prepare the team members. Also, in the observation of the future state, the lean philosophy is highlighted for the team members (Observation FS). In the mapping of the future state the VSM-coach tells the team to remember to follow the customer's journey through the process - and not looking at the resources needed in every unit (Observation FS). After this, the participants dictate the customer's journey from the first role to the next role (Observation FS).

5.2 Detecting and deciding upon operational improvements within VSM

This section presents findings of how VSM enables to detect and decide upon operational improvements.

5.2.1 Clarity and transparency

In the mapping of both the current and future state, the participants discuss and are transparent about their processes. In the next step, they agree upon how the current processes are and also the main issues (kaizen stars) (Observation CS and FS). In the observations of current state and future state, clarity and transparency in the process are therefore enabling the participants to collectively make decisions about operational improvements (Observation CS and FS). You need this transparency and common understanding to enable change (Lean manager A, B, C). Having a visualized map assists in clarifying current issues, and identifying the best possible outcome collectively by all participants affected by the value stream (Lean manager A, B, C).

When moving on from the current to the future state, the VSM-coach makes sure that there are no processes or activities that have been missed from the current state (Observation CS and FS).

The current state is summarized and the next steps are explained (Observation FS). The VSM-coach explains that the future state will not be divided by department, but by roles instead (Observation FS). As the VSM-coach explains, the process is supposed to symbolize the activities and roles needed for the customer to flow through the process (Observation FS). Doing this also enables the participants to come out of their silo-vision, collectively come up with the best flow-efficient process and afterwards divide the roles between the units (Lean manager B).

As explained in the case study context, the Northern Star together with its correlating Design Principles, are the guides for mapping the future state. In the observation, the VSM-coach explains that the process being designed should have a constant aim towards reaching the Northern star (Observation FS). To achieve the best flow-efficient process, the VSM-coach emphasizes the need to be aware of looping, meaning that activities going ‘backwards’ in the process should be eliminated (Observation FS). The VSM-coach also emphasizes the importance of the participants leaving the old processes; eliminate thinking; *this is how we have done* and rather think; *this is how we should or could do* (Observation FS). Lean manager C states;

“You draw the future state in a visionary way. It’s all about having a clear vision. Having clear goals and afterwards creating a strategy”.

5.2.2 “The neutral zone”

After having been at the workshops for a little while, it is clear that most participants attempt to think collectively, by agreeing on how the process should proceed, and not only focusing on their own role within it (Observation CS and FS). Lean manager C states: *“The value stream mapping helps lowering the resistance. Going from current state and identifying kaizen blitzes make the team see the problem”*. Lean manager C adds that it is about overriding personal goals and politics, and when the resistance has been lowered, the decisions made are usually with a better collective outcome.

Taking people out of their daily business and into these safe spaces assists in transparent processes (Lean manager D). The participants also realize what transparency can bring to operations and lowering the chance of making decisions based on personal goals (Lean manager C). Also, in the observations of current state and future state this is clear when it comes to the physical location. LMI hold workshops in their own locals, where participants are taken out of their daily business (Observation CS and FS). Further on, the mapping of the current and future state is done by starting with a blank sheet (Observation CS and FS).

“When building the future state, it is good to have a green field approach wherein you have a broad perspective and you are creative in design methods, thereby completely changing the perspective.” (Lean manager C).

5.2.3 Self-sufficient decision making

To facilitate decisions about operational improvement within VSM, all five Lean managers underline the importance of team members' mandate to change and make decisions by themselves. The team members' responsibility and mandate to change needs to be signed off before the process and therefore to enable the team to self-sufficiently make decisions in the right direction (Lean manager A; Document Order form). For the VSM-coach, he/she needs to coach the team to make decisions on their own based on facts and eliminations of waste (Lean manager B). VSM enables the team members to make decisions in a clear and objective way (Lean manager C). The process KPI's become non-threatening, since they are not decided by management but by the team members themselves (Lean manager D).

Also, in the observation of the future state the VSM-coach facilitates the discussions in the team, and lets the group discuss possible activities. When new ideas arise these are put on the so-called "parking-lot" (Observation FS). The "parking-lot" is a place between the map of the current and future state, to have a place to keep extra ideas written down on "post-its" when they arise and can be used further in the process (Observation CS and FS). The participants in the mapping of the future state decide that an extra role is needed, in order to take on a task that they can not agree on where to place (Observation FS). After a while the VSM-coach also asks the team members to discuss if the process being mapped so far, is aligned with Northern star and design principles. The Lean manager E and VSM-coach in observation FS also develop further about how to facilitate decision-making in the workshop.

"Open mind, willingness to work on flow efficiency, simple and clear business case, which involve stakeholders in the process accordingly" (Lean manager E).

5.3 Initiatives to support continuous improvement through VSM

This section highlights the work that is done within Swisscom to support the lean and VSM philosophy of continuous improvement within the drumbeat phase. It underlines the aspects that support continuous improvements and what initiatives are taken to strengthen it.

5.3.1 Treating root causes - not symptoms

A main aspect that is observed during the case study is how detailed processes are discussed between the participants, during the value stream workshops (Observation CS and FS). Lean manager D says, that due to detailed process analysis, they are able to treat root causes and not only symptoms. Lean manager B explains that reducing a process into small pieces also helps to connect the changes to correlating KPI's that will make sense for the given overall objective. Lean manager B also explains that having major change plans can make you lose track of progression. But, highlighted further by Lean manager B, breaking down processes instead

allows for detailed progression evaluation after implementation of new processes, and being able to step in if needed.

This is where PDCA-cycles are used to keep track of progression (Process document). Using the PDCA allows for the units involved in the new process to check-in and see if the new processes are progressing, if there is something that needs changing or that can be improved even further (Document PDCA & Document shop floor).

5.3.2 Enabling integrated lean thinking

Lean manager C, states that their function as internal consultants adds value to Swisscom's operations as they already have know-how of the business, and better can track the progress. He also adds "*the lean culture is an important aspect for the organization and its way of thinking..*" (Lean manager C). Lean manager C thereby explains that this allows the team to work on implementing the culture in an ongoing process. This plan for continuous improvement and integration of lean thinking is also outlined in the schedule of the process (Document Process). According to the description, the VSM-participants are to do a 30-minute shopfloor meeting every week to check the activities, track the KPI's, and decide for potential new activities (Document Process).

Lean manager D expresses that he views VSM as a philosophy, stating that when the value stream has been mapped - "*the value stream does not end here, it begins*" (Lean manager D). Lean manager D also explains how the internal function of LMI supports the philosophy development:

"This is where the difference of external and internal advisors shows. With external advisors, the process stops after implementation. With internal advisors you can track the continuous improvement and keep on encouraging them, and for the internal advisors to teach the thinking into different departments in the organization" (Lean manager D).

Lean manager B supports this by saying; "*. There is a mindset behind but it is also a cultural topic and a change topic, and that is something you should never forget*". Lean manager B at the same time expresses that growing together in this culture within the departments and organization is crucial. He also adds that being able to change the processes is the first step, and afterwards deciding on what KPI's should be used to track the progression is equally important, as having the wrong KPI's and therefore not matching performance can have an enormous negative impact on the company culture and work moral (Lean manager B). This is where VSM helps to get clarity of what needs to be done, and what measures are correlating to track progress (Lean manager B).

5.3.3 Onboarding units

Observing a drumbeat meeting allows the authors to see how onboarding the affected units of the process is planned (Observation CI). The VSM-owner and Lean manager B have a meeting, discussing how onboarding will be most successful, firstly by getting the team to understand what has been done, what are the reasons for the new process and how should it be approached. During the meeting, they discuss the kick-off day with the units involved (Observation CI). Firstly, the agenda for the onboarding will involve: what is next, the roles within the process, how was VSM used and the overall KPI board (shop floor board)(Observation CI). Then the units shall work in groups to discuss how they can impact those KPI's and together work in the same direction (Observation CI). Furthermore, the next step in the onboarding will be to focus on the short term deliverables and how these can be reached (Observation CI). In this meeting, the Lean manager explains that the reason for overall objectives being discussed first, is for the units to understand the long-term goals and therefore also better understand how to approach the short term deliverables (Observation CI).

Lean manager A says that the drumbeat phase is where you have to make sure not to loose track. He adds that bringing people into these units and involving them in reaching the set objectives is an approach to transfer the lean and VSM mindsets and encourage ownership of the new processes. Lean manager B supports this by saying that the biggest challenge in Swisscom is to start controlling and supporting the change. He adds that you have to be consistent in tracking the progress to also transfer the way of thinking into the affected units. Lean manager E expresses that this is where the training of the VSM-owner really comes into question, as it is the VSM-owner's responsibility to track and report progress. However, the VSM-coaches do follow up and assist in onboarding units continuously (Lean Manager B, C, E).

5.3.4 PDCA and participant ownership

Onboarding leads to the continuous improvement initiatives that are set in place to keep the participants and their units progressing. As stated above, the drumbeat phase where onboarding units are arranged is an important step to implement the culture and lean thinking. Lean manager C states that after implementation the PDCA cycles are important to track progression:

“You need to have this point of continuous improvement where the employees really bring in all the problems and the challenges they face together with some ideas of how to make it better”
(Lean manager C).

The difficulties within implementation lie within the departments' maturity towards the lean thinking (Lean manager A). Therefore the LMI team highlights the importance that management also acknowledges the need for the culture, and giving the departments and units time during the week to discuss their progress and possible changes that need to be done or developed (Lean manager B, D, A). *“You have to be tight on the set-up”* (Lean manager B). Getting the people

from the units into weekly settings of perhaps only half an hour of discussion is crucial for continuous improvement and participant ownership (Lean manager B). Looking at the PDCA and Shop floor documents shows that there are initiatives to track, report and replan the activities that are set in place to reach the objectives (Document PDCA and Document Shopfloor-board).

Simply because something has been implemented, does not mean that the change will happen nor that it will succeed (Lean manager B). If there is no track of progression, “*They will not change how they see the co-creational work and agile set-up. They will stay in their silo*” (Lean manager B). Lean manager D argues that when you are back in your daily business “*you are a hamster in a wheel, and you can't go out of the wheel.*” Therefore there must be a safe space wherein time is set aside for keeping up with the progression (Lean manager D).

PDCA cycles assist in keeping track of the implementation and to achieve this, you need to set a program for the progression plan (Lean Manager B, D, E). As Lean manager E expresses, the progression plan should clarify following points; 1. Who is doing something, 2. What is the next target, 3. When is the next target to be reached, 4. What are the overall objectives, 5. Schedule.

5.4 Chapter summary

This chapter presents the themes that arose from the coding of the empirical material within every sub question; key aspects when analyzing operations, how VSM enables to detect and decide upon operational improvements and initiatives to support continuous improvements. The empirical material consists of interviews, observations and documents and is referenced according to the abbreviations in Table 1. The empirical findings are presented and analyzed simultaneously, where the argumentation of the analysis varies between direct quotations and in-text references.

6. Discussion

The following chapter discusses how VSM contributes to operational excellence within Swisscom and how this relates to existing research of VSM in the field of the ICT and service industry. As structured above, the discussion is conducted in line with the chosen sub questions.

6.1 What are the key aspects when analyzing operations within VSM?

Following are highlighted as key aspects when analyzing operations in VSM: The pre-analysis and clarifying the scope of proposal, transparency about the process and between the members, the right team members' and their ownership of the process and the value-guided direction.

The Lean managers highlight the importance of *pre-analysis and clarifying the scope of proposal* before entering the current state. This is also stated in the documentation of the VSM process within Swisscom, where scoping and pre-analysis is the first step of the process. In addition, the Lean managers highlight that scoping needs to be done together with the clients/teams and has to make sure that everyone “is starting from the same page”. This is in line with Bin Ali, Petersen & de Franca’s (2014) case study where they highlight the initiation process where it’s crucial to define the purpose in the specific process, finding the right stakeholders and the right people involved in the process. Furthermore, even if pre-analysis and definition of purpose is highlighted as the initiating step in the VSM process, its implications for future process is not investigated deeper in the other case studies within the ICT and service industry. In this case study of the LMI team, pre-analysis and clarification of scope is however argued as a key prerequisite to prepare the entering and activity of analyzing operations in the current state.

Transparency is emphasized as a crucial aspect within analyzing operations for two reasons - the transparency of the actual process and the transparency between the participants during the mapping of the process. The Lean managers highlight that VSM, in opposite to the situation in daily operations, demands transparency and enables participants to understand the process, gain a common understanding and identify parts for improvements. The Lean managers highlight that this implies creating open discussions without blame, getting people in the same room and knowing what other people are doing. This is also present during the observations where the VSM-coach facilitates the discussions and argues for the participants to focus on the mapping of the real situation, and not “how it should be”. In terms of prior research, there are several studies in the ICT and service industry that highlight the VSM’s successfulness in how to visualize the current process (Bin Ali, Petersen & de Franca, 2014; Mujtaba, Feldt & Petersen, 2010; Piciarotti, Ciatteo & Giacchetta, 2011). Furthermore, the importance of transparency between participants in the workshop is similar to Khurum, Petersen & Gorshek’s (2014) emphasis on how to align participants from different units to share the knowledge about the process that they are mutually depending on. Also, case studies in the ICT and service industry highlight the

importance to open up for free vocabulary in the workshops to enable participants expressing ideas without being hindered by VSM terminology (Khurum, Petersen & Gorshek, 2014) and instead focus on creating a consensus between the members (Bin Ali, Petersen & de Franca, 2014). This study can clearly confirm transparency and visualization as crucial within the process of analyzing operations. Moreover, this study highlights how transparency has to be multifaceted in the VSM process when analyzing operations, by the ability to maintain transparency on the mapping sheet as well as in the room between the participants.

A third key aspect when analyzing operations is the presence of ***the right team members and their ownership of the process***. The Lean managers explain this as having the right people with diverse competencies in the workshop. Deciding on which participants should be part of the workshop is also documented as an activity in their preparation phase. The Lean managers emphasize the importance of participants' ownership of the process and allowing them to identify the root causes. This is also observed in the workshops where the team members dictate the process, hold the discussions and the VSM-coach focuses on guiding the team members to make sure no step is missed. Similar studies about VSM-workshops in the ICT and service industry highlight the importance of having the right people engaged in the process (Bin Ali, Peterson & de Franca, 2014) combining different participants with different knowledge (Khurum, Petersen & Gorshek, 2014) and the VSM-manager's job to negotiate a relevant goal with the participants (Bin Ali, Petersen & de Franca, 2014). But this study emphasizes specifically allowing and enabling participants' ownership of the process when analyzing operations. This implies not only combining different competencies, but also empowering the participants to lead the VSM-process. This case study underlines the interaction aspect between the VSM-coach and the participants, enabling a workshop that allows and encourages shared ownership of the process.

The last key aspect in the VSM when analyzing operations is the team's ability to think and rethink their process in terms of ***value and value added activities***. The Lean managers highlight that this implies starting with the customer and customer's desires and needs, where the VSM-coach's role becomes crucial to prepare the team for the *lean philosophy*, challenge their thinking and support the team in always imagining the customer's journey. The *value added*-guideline was also emphasized in the workshop, where the VSM-coach encourages the participants not to focus on resources in the specific processes - but to follow the customer's journey from one role to the other. The identification of value is the core of VSM (Rother & Shook, 2003) and this is also highlighted as a crucial factor in other VSM case studies within the ICT and service industry (Barber & Tietje, 2008; Bin Ali, Petersen & de Franca 2014; Dahlman & Olsson, 2014; Paciarotti, Ciatteo & Giacchetta, 2011). But, as highlighted within this study, the value added guideline puts emphasis on the role of the VSM-coach. Since the VSM-coach is acting as the expert of lean thinking in the workshop, this highlights the importance to get the participants to understand the lean philosophy and to always redefine their thinking in terms of

value and value added activities. Although mapping the value stream is the purpose of the tool, this case study highlights the importance of transferring the lean thinking and supporting the participants to think in terms of value and value added activities. It therefore highlights the critical factors in how to enable change through the tool, and not critical factors of the tool per se.

6.2 How does VSM enable to detect and decide upon operational improvements?

The following are identified as key aspects of how VSM enables to detect and decide upon operational improvements: The transparency and visualization, the neutral zone and self-sufficient decision making among participants.

In the case study of Swisscom, VSM enables decision making about operational improvements by the participants' *transparency and visualization* about their operations. In the observations, this transparency and visualization of the process allows participants to understand the current processes and by this, assisting the participants to determine the main issues. This is also highlighted by the Lean managers, who argue that the visualization assists in clarifying issues and further on, identifying the best possible outcome. By the guidance of the VSM-coach and the way they should visualize the customer's journey through the process, the participants are able to collectively come up with the most optimal flow efficient process. Bin Ali, Petersen & de Franca (2014) highlight similar findings in their case study, stating that VSM enables participants to see the end-to-end perspective and in that way, how to facilitate a specific change. Furthermore, other studies highlight the importance of information transparency to enable change (Khurum, Petersen & Gorshek, 2014; Shou et al, 2017). The transparency and visualization of the process is therefore confirmed, as similar to other studies, to be a key aspect in VSM when both analyzing operations as well as taking the next step of deciding upon operational improvements.

During the mapping it becomes clear that the VSM process enables them to firstly) understand the whole value stream, and secondly) to think holistically about the future process. The Lean managers explain that it is highly due to the VSM, but also the fact of being taken out of your usual setting and into a *neutral zone*. It is also emphasized by a Lean manager, that having to override personal goals and politics lowers resistance and enables a better collective outcome. Starting from a blank page (the swimlane charts) and being able to set-up a process for the future state, encourages letting go of what *was* and focusing on what *should/could* be. Although prior research in the ICT and service industry emphasizes the importance of adjusting vocabulary to not hinder participants' expression (Khurum, Petersen & Gorshek, 2014) and focus on creating a consensus between the members (Bin Ali, Petersen & de Franca, 2014), the importance of the actual place and distance from daily operations is not highlighted as explicit as it is in the case study of Swisscom.

In the Swisscom case study, the Lean Managers' and observations suggests ***self-sufficient decision making*** as it is the participants dictating the future state of the processes. Combined with the overall objective, it is the participant's task to identify how it can be reached in the most flow efficient way. This is also the case in Bin Ali, Petersen and de Franca (2014); Khurum, Petersen and Gorshek (2014); Mujtaba, Feldt and Petersen's (2010) that they view VSM as an enabler for the participants to come up with suggested improvements. The Swisscom case study highlights that having everyone in the room, breaks down silo vision and encourages reaching goals in an objective way. Since the participants are also deciding on their own correlating KPI's to track the progress, the KPI's are considered non-threatening as they are established by the participants themselves, and not dictated by higher management.

6.3 What are the initiatives to support continuous improvement through VSM?

The key aspects to support continuous improvements include: treating root causes and not symptoms treatment, enabling lean thinking throughout the organization, onboarding affected units and PDCA cycles to keep track of progression.

The case study highlights the importance of VSM breaking down processes into small pieces, enabling ***treating root causes and not symptoms treatment***. To be able to break down the processes, it is clear in the case study that the right participants need to be present. This is also highlighted in other studies as an important factor when conducting VSM. Having the right participants in the room is crucial for not overlooking or missing certain processes, aligning people in defining the purpose and present multiple solutions in a holistic way (Bin Ali, Peterson & de Franca, 2014; Khurum, Petersen & Gorshek, 2014)

In the case study of Swisscom, it is however highlighted that the right participants need to be present, to be able to treat root causes. Treating root causes is important for continuous improvement initiatives, as a Lean manager explains that breaking down processes allows for detailed progression tracking after implementation and assist in identifying issues before they evolve. The correlation of the right participants and root cause treatment for facilitating continuous improvement initiatives have not been highlighted in previous studies.

In the case study, it is clear that VSM is, and perhaps mostly, seen as a mindset enabler by the Lean managers, ***enabling lean thinking*** throughout the organization. VSM has in prior studies not been highlighted as a lean mindset enabler. But within this case study, a Lean manager highlights that VSM is more a philosophy since the value stream itself does not simply stop after implementation like many other tools do - it starts. Therefore, the mapping is the tool and the value stream is the mindset. The efforts of implementing a lean mindset within Swisscom and using the principles of the value stream is done in form of the PDCA cycles. In this, the departments affected by the processes work to continuously improve the value stream, and

therefore encouraging a continuous focus on the value stream and fostering a correlating mindset.

Onboarding the affected units of the process is highlighted as a highly important factor in the case study. A Lean manager highlights that if the Lean manager and VSM-owner do not onboard the employees in the units in a proper way, the new processes will likely not succeed. Therefore getting everyone on board is of great importance. As explained by the Lean managers, within the onboarding the main reasons and philosophy behind the new processes are explained to the affected units. However, the most important aspect is involving the units in how the objectives can be reached, and that they understand their role in the new process and their effect on the objectives. Therefore, the aim for the Lean manager and VSM-owner is to transfer the lean and VSM mindset into the units and encourage ownership of the processes. Prior research shows that there are difficulties with implementing the improved processes, as people tend to fall back into old ways of working (Bin Ali, Petersen & Schneider, 2015). Previous studies in ICT and service industry highlight that VSM allows for the participants to see their processes and create an understanding for a future direction (Bin Ali, Petersen and Schneider, 2015; Bin Ali, Petersen and de Franca, 2014; Dahlman and Olsson, 2014; Mujtaba, Feldt and Petersen, 2010). However, there are lack of explanations as to how this visualization is transferred into the affected units of the processes, and how to get the employees onboard to support the development.

In this case study of Swisscom, ***PDCA cycles are used as initiatives to keep and track progression.*** Standardization, role assignment, checklists and progression documentation is highlighted by Kupier et al (2016), in the case of the financial service provider as initiatives to keep track of progression. The role of the VSM-owner being responsible for tracking progress is highlighted by most authors (Bin Ali, Petersen and de Franca, 2014; Damrath, 2012; Kupier, 2016). The VSM-owner is also seen as the responsible party within the case study of Swisscom, and like in the case of financial service provider mentioned above, highly similar initiatives are put into place. In the case of Swisscom, these initiatives are explained more implicit and in further detail. In this, the PDCA cycles are meant to unite the employees from the units around the shop floor board. This enables employees to discuss and be involved in the progression and allow for possible changes or further improvements. The informants from the case study also highlight the importance of involving management in this way of thinking and the importance of management seeing the investment of giving employees time to engage in the weekly 30 minutes PDCA meetings.

6.4 Dominant themes throughout the case study

In the findings of the three sub questions, there are four overall key aspects that are present throughout the process of VSM at Swisscom – from analyzing operations towards deciding upon operational improvements and supporting continuous improvements. These themes can therefore

be argued as main elements in how VSM contributes to operational excellence within the case study of Swisscom.

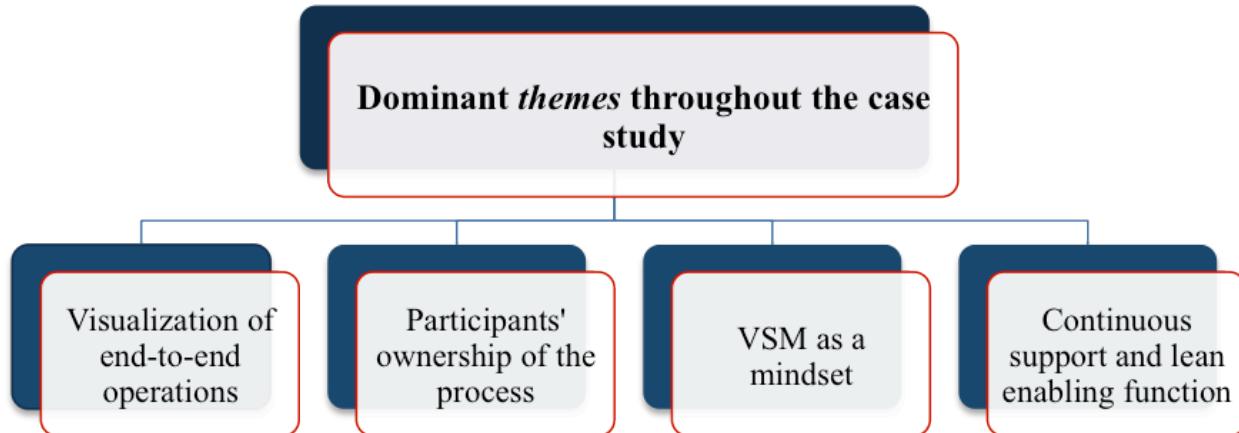


Figure 11. Dominant themes throughout the case study and in the findings of the three sub questions.

1. Visualization of the end-to-end operations - *the strength of the mapping tool*

VSM proves to visibly clarify the processes for all participants during the workshop. Within the step of analyzing operations, the visualization of the operations for all the participants in the room enabled them to identify the process and see the core issues (kaizen stars). Furthermore, this visualization and transparency about processes is crucial when detecting and deciding upon operational improvements. The visualization enables participants to identify root causes and have detailed progression tracking, which facilitates PDCA-cycles after implementation. As stated earlier, previous research about VSM in the ICT and service industry highlight the VSM's successfulness in visualizing the current processes (Bin Ali, Petersen & de Franca, 2014; Mujtaba, Feldt & Petersen, 2010; Piciarotti, Ciatteo & Giacchetta, 2011) and enable change (Bin Ali, Petersen & de Franca, 2014). This case study clearly confirms the visualization through VSM as being a key strength of the mapping tool throughout the different stages.

2. Participants' ownership of the process - *dictating the change*

Through all the stages, and as observed in observations, the participants are the driving force when mapping the value stream. It's also highlighted, in the "Document Order form" and by Lean managers, that the composition of participants and their mandate to change needs to be signed off and prepared before entering the VSM workshops. Participants' ownership of the process, as emphasized by the Lean managers, implies giving them mandate to identify the root causes and allowing them to decide upon operational improvements. Furthermore, to support continuous improvement, the participants are also setting their own KPI's to track that the overall objective of the new operations can be reached. To enable this ownership, the VSM-coach's role is focusing on guiding the value-directed thinking, transferring the lean thinking and allowing participants' decision making. In opposite to previous studies in the ICT and service

industry, this study explicit highlights the importance of the *ownership*, the holistic idea that participants need to own and lead the process from beginning of the process towards implementation of their new processes and correlating KPI's to enable change.

3. VSM as a mindset - enabling lean thinking throughout the organization

The LMI team works to transfer the lean thinking into the units by letting the employees in the units participate in defining possible further improvements through the PDCA cycles. VSM encourages everyone to simplify anything that can be simplified. Being a participant of designing the process encourages them to apply the design principles when they are back in their departments and are implementing the processes into their units. Therefore, the mapping is the tool and LMI's way of working enables the value stream to be a mindset that facilitates lean operations in the future. Prior research in the ICT and service industry has not highlighted the value stream as an enabler of lean thinking to the extent as presented in this case.

4. Continuous support and lean enabling function - LMI's enabling of lean management within Swisscom

As observed in the case study, LMI as a centralized team within Swisscom encourages and develops the lean principles. It enables Swisscom to keep track of the progress after VSM workshops are finished. Furthermore, it enables the LMI team, together with the VSM-owners, to reevaluate if the implemented processes need to be redefined before new potential issues evolve into bigger issues. This is a main difference from comparing to the theoretical framework within ICT and service industries, where it is not stated that the researched companies have a centralized team dealing with lean processes on a daily basis. The risk of the whole organization falling back into their old ways of working can therefore be argued as minimized within Swisscom.

7. Conclusion

This case study aimed to gain an in depth understanding of how VSM can contribute to operational excellence in an ICT company. As stated before, in this study *operational excellence* implies to continuously strive for a customer-oriented focus and to improve operations/processes to be as simple and efficient as possible. To answer this question, a case study was conducted at Swisscom. The three sub questions allowed the authors to investigate VSM's different stages and how these specific findings provided an answer for the overall purpose and main research question. The triangulation approach enabled the findings to be supported from multiple empirical sources and therefore, increasing the validity of the findings.

First of all, the key aspects when analyzing operations show the importance of pre-analysis and clarification of scope, transparency by visualizing the operations as well as enabling transparency within the discussions between the participants. Furthermore, the key aspects also include enabling participants' ownership of the process and redefinition of processes in terms of value added focus. In terms of detecting and deciding upon operational improvements, the case study shows that the visualization of the operations enables participants to identify improvement areas. Furthermore, it's crucial for the participants to be taken out of their daily operations to deal with these improvements within "a neutral zone", implying letting go of what was and focusing on what should be. Lastly, participants need to have the mandate from the beginning to dictate the change and identify own KPI's to track the progress.

The last sub question highlighted initiatives to support continuous improvements. Within this, findings show that it is important to focus on the root causes instead of symptoms treatment by breaking down processes, which allows for detailed progression tracking. Furthermore, the Lean managers try to integrate the lean mindset to facilitate the continuous improvements and by this, enabling a value stream *mindset*. Another initiative includes onboarding units to be able to transfer the lean thinking into the daily operations. Continuous improvements are also facilitated by PDCA-cycles to keep and track progression of the new processes.

The findings reveal four dominant themes that are present through all VSM stages and can therefore be argued as main elements to contribute to operational excellence: the visualization of end-to-end operations, participants' ownership of the process, integrating VSM as a mindset and the continuous support and lean enabling function within Swisscom.

Prior research within the ICT and service industry does not highlight enabling the lean thinking and getting the organization aligned through VSM. In the case study of Swisscom it was clear that the mapping is the tool and LMI's way of working enables the value stream to be a mindset that facilitates lean operations in the future. There is also lack of previous studies within ICT and

service industry that highlight progression tracking efforts like PDCA cycles, and the decision making aspects of VSM. As seen in the case study, the decision-making and ownership of processes is taken down to the shop floor level. For example, participants have mandate to change throughout the mapping and PDCA cycles encourage shop floor employees to participate in improving the process and take ownership of the processes and results.

Breaking down processes not only allows identifying root causes to enable sustainable improvements. It also allows, as expressed by the Lean managers, the identification of correlating KPI's that will correspond with the overall objective. As stated previously, organizations' highly struggle with over-measuring performance (Turban et al, 2007). The VSM approach within Swisscom therefore serve as an example of how combining the right measurements to the overall objective minimizes the risk of over-measuring and instead - only having measures that are adding value to the overall objective.

7.1 Theoretical contribution and practical implications

In terms of theoretical contribution, the case study confirms previous studies' argumentation of the VSM's strength of being a visualization tool. In this case study, the *visualization of end-to-end operations* was highlighted as a key aspect to enable change from mapping of current state towards improved future state. Furthermore, this case study highlights the importance of enabling participant's ownership in terms of mandate to change with support from VSM-coach. In addition, this case study underline initiatives of continuous improvement through VSM and within this, provide several examples of how to integrate and follow-up on new routines within the affected units.

This case study highlights several findings that have relevance in a practical VSM setting within other ICT companies. It highlights the importance of having the right people, clarifying the scope with the participants and enabling their ownership throughout the process. Furthermore, the highlight of how Swisscom integrated lean thinking within their VSM processes can challenge the use of VSM as a tool and the importance of using it as an enabler for continuous improvements. The continuous support and lean enabling function that LMI serves within Swisscom can also provide an example as for how VSM can contribute to operational excellence in the long-term perspective. Investing in lean experts within the organization can act as a support to continuous improvements.

7.2 Limitations and future research

This case study was limited in looking at a single case study within an ICT company. To be able to create potential further generalizability the authors therefore encourage future studies about the application of VSM within the ICT industry. The theoretical framework presented in this paper suggests that VSM as a tool creates opportunity for continuous improvements but few

studies present *how* to track progression and work with continuous improvement initiatives. This study has revealed a practice within Swisscom that could serve as an example of how continuous improvements could be practiced within companies in not only the ICT industry, but in other industries as well. Due to this research being a single case study, the authors therefore encourage future in depth studies of how continuous improvements are practiced within the ICT industry. The authors also suggest further research about the correlation of continuous improvement initiatives like the PDCA cycles combined with VSM and if the PDCA cycles contribute to employees' ability to take enhanced ownership of their work.

This study highlights the dominant theme of LMI being a continuous support and lean enabling function. It is suggested that future research is done to evaluate the success of lean implementation in companies with or without a centralized team working with lean, and the effects thereof. The study was also limited in terms of informants, since it interviewed the Lean managers and not the participants within a VSM workshop. This was due to time constraints of the case study, and time constraints from the participants in the workshop. A suggestion for future research is to create in depth studies of how participants in VSM workshops perceive the mapping and view the effect on their new ways of working. Another aspect highlighted during the case study are the soft elements of VSM as a philosophy, and how it can contribute to support and enable a value stream mindset. Therefore, the authors encourage future studies that focus on the area of the value stream as a mindset within the ICT as well as any given industry.

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APPENDIX I. The Case Study Protocol (Formalia by Yin, 2003)

The choice of Yin's (2003) case study protocol is due to Yin's prominent position within the case method literature (Easterby-Smith, Thorpe & Jackson, 2015).

Overview of the case study project:

The purpose of this research is to do a case study of how VSM contribute to operational excellence within an ICT company. To illustrate this, a case study is conducted at Swisscom.

The study answers this by a triangulation approach and investigate the key aspects within the VSM process' different stages - from the process of analyzing operations towards detecting improvements and supporting continuous improvements.

Field procedures:

- Documentation of VSM processes at Swisscom
- Direct observation of VSM processes
- Interviews with Lean managers in charge of VSM processes

Case study questions: **How is VSM contributing to operational excellence within Swisscom?**

1. What are the key aspects when analyzing operations in VSM?

- Sources:
 - Analysis of the documents about LMI's methodology of VSM.
 - Observations of VSM-processes (current state, future state, continuous improvement)
 - Interviews with LMI's Lean managers

2. How does VSM enable to detect and decide upon operational improvements?

- Sources:
 - Observations of VSM-processes (current state, future state, continuous improvement)
 - Interviews with LMI's Lean managers
 - Analysis of the documents about LMI's methodology of VSM.

3. What are the initiatives to support continuous improvements?

- Sources:
 - Observations of VSM-processes (current state, future state, continuous improvement)
 - Interviews with LMI's Lean managers
 - Analysis of the documents about LMI's methodology of VSM.

Interview questions:

(See Interview guide in Appendix II)

APPENDIX II. INTERVIEW GUIDE

Information points before every interview:

- Purpose of the study, confidentiality and right to terminate
- Recording of the interview and ability to talk in any language comfortable (English or German)

Interview guide:

1. How can value stream mapping as a performance analysis tool be used to facilitate business improvements?
2. What are the key processes when analyzing operations in value stream mapping?
 - a. What factors are you analyzing? Why do you analyze these factors?
 - b. What do you specifically look at when analyzing these operational factors?
 - c. Describe how you analyze operational factors during value stream mapping.
 - d. How does value stream mapping as a tool enable you to analyze these operational factors?
3. What steps in the value stream mapping include decision making about business improvements?
 - a. When in the process of value stream mapping do you make decisions about business improvements?
 - b. How do you go from the step of analyzing operations to making decisions about business improvements?
 - c. What do you specifically look at when making decisions about business improvements?
 - d. What is important to enable decision making about business improvements in value stream mapping?
 - e. Describe the process of how you make decisions about value stream mapping.
 - f. How does value stream mapping as a tool enable you to make decisions about business improvements?
4. How do these steps secure an improved future performance?
 - a. How does value stream mapping as a tool enable you to implement your decisions?
 - b. How do you implement the decisions about business improvements?
 - c. How do you secure that all aspects for improvement have been explored?
 - d. Are there any challenges you might face implementing the improvements? - if not, why? If yes, what kind?
 - e. How do you handle potential challenges? Or how are the decisions communicated/argued for?
5. Is there anything else you want to add?

APPENDIX III - PROCESS OVERVIEW OF VSM

Translated version of LMI's internal document.

| Set-up (4 weeks) | | | Ramp-up (4 weeks) | | | (12-18 m) | | Reflection |
|------------------|--------------------------|--------------------------|--------------------------|-----------------------|--|--------------------------|-------------------------|----------------------------|
| Duration | Participants | Output | Steps | | | | | |
| 0.5 days | VSM owner, Improve coach | VSM owner, Improve coach | VSM owner, Improve coach | Current state start | Current state, Gemba, "the real place" | Finalizing current state | Decide on Northern Star | Shop floor meeting |
| 0.5 days | VSM owner, Improve coach | VSM owner, Improve coach | VSM owner, Improve coach | Suggest current state | People and processes on site | Current state created | Define the ideal state | 2. RIW 3. RIW x. RIW |

APPENDIX IV - ORDER (ASSIGNMENT) FORM 1 & 2.

Translated version of LMI's internal document.

Clarify the assignment with the assignment giver

Auftrag mit Auftragsgeber klären (Seite 1)

Inhalt, Personen, Ziele Content, Persons, Goals

| | |
|---|---|
| Projektname: Project name | |
| Produkt / Leistung: Product or service | |
| Problem / Thema Problem/ Theme | |
| Sponsor: | Verantwortliche/r: Responsable/s |
| Stakeholder: | Team: Team |
| Kunde: Client | |
| Improve Coach: Improve coach/ lean coach | |
| Ziel: Goal | Fokus: Fokus Kein Fokus: Non focus |
| Datum/Ort: Date/ Place | Commitment: |

Clarify the assignment with the assignment giver

Auftrag mit Auftragsgeber klären (Seite 2)

Potential, Ressourceneinsatz, Zeitplan Potential, Needed resources, Timeline

| | |
|--|---|
| Mögliche Lösung & Potential: Possible Solution & Potential | Ressourcen CLK-LMI: Resources from LMI |
| | Ressourcen AG: Resources from Company (general) |
| | Direkte Kosten: Direct Cost |
| Bemerkungen: Remarks | Projekt Kadenz: Project Cadence |

The timeline diagram illustrates the project phases and their duration relative to time t . The phases are represented by colored bars: a red bar for 'Set up', a blue bar for 'Ramp up', and a green bar for 'Drum Beat'. A long blue line at the bottom represents the progression of time, labeled with the letter t at its end.

PDCA Experiment

APPENDIX V - PDCA EXPERIMENT

Translated version of LMI's internal document.

| Problem | Issue |
|--|---|
| PLAN 1. Hintergrund & Problem beschreiben (Faust im Sack) | |
| Background and Issue defining | |
| Aktuelle Situation erfassen (Gemba) Capture of the current situation | |
| PLAN 2. Nächster Zielzustand (NZZ) Next Target State | |
| PLAN 3. Ursachenanalyse (Fischgräten) Cause Analysis | <p>5x Warum 5x Why</p>  |
| ACT. Erkenntnisse Findings | <p>CHECK. Wirkung tracken Track Effect</p> <p>Reflection</p> |
| Root Cause | Neue Standards New Standards |
| (Mensch) (Methode) (Maschine/Systeme) (Problem) | Neue Hindernisse New Challenges |

Das Poster Themenschwerpunkt (TSP)

Focus Points - Shop Floor board

| Probleme in Bearbeitung | | Focus Points | | ThemenSchwerpunkt / Owner | |
|--|--|--|--|--|--|
| priorisiert, konfliktfrei, kleine Anzahl Issues In Process | | Ein "guter" Titel verfärbt das Problem und dessen Tiefwirkung in einem Satz. | | alleine Beitrag an den Wertstroms.» | |
| We have this problem, therefore this happens | «Wir haben dieses Problem, daher geschieht jenes.» | «Wir haben dieses Problem, daher geschieht jenes.» | «Wir haben dieses Problem, daher geschieht jenes.» | «Wir haben dieses Problem, daher geschieht jenes.» | «Wir haben dieses Problem, daher geschieht jenes.» |
| Sammler To be processed | «Wir haben dieses Problem, daher geschieht jenes.» | «Wir haben dieses Problem, daher geschieht jenes.» | «Wir haben dieses Problem, daher geschieht jenes.» | «Wir haben dieses Problem, daher geschieht jenes.» | «Wir haben dieses Problem, daher geschieht jenes.» |
| PDCA-Experimente. im Wochentakt vorantreiben, mit Coaching-Kata | PDCA Experiments / weekly | Wirkung: Effects | Armaturen, Kennzahlen Key Figures | | |
| <p>A3 Problemlösungs Blatt [«PDCA-experiment»]</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> | <p>A3 Problemlösungs Blatt [«PDCA-experiment»]</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> | <p>A3 Problemlösungs Blatt [«PDCA-experiment»]</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> | <p>A3 Problemlösungs Blatt [«PDCA-experiment»]</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> <p>Was ist das Problem? (Problemstatement) Was ist der Vorschlag? (Vorschlag) Was ist die Lösung? (Lösung) Was ist der Nutzen? (Nutzen)</p> | <p>Wirkung: Effects</p> <p>Armaturen, Kennzahlen Key Figures</p> | |

APPENDIX VII – THE CODING SCHEME

| THE CODING SCHEME | |
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| 1. What are the key aspects when analyzing operations? | 1.1 Pre-analysis and scoping 1.2 Transparency and visualization 1.3 Composition of participants and ownership of the process 1.4 Treating root causes not symptoms 1.5 Common direction - value-added activities |
| 2. How does VSM enable to detect and decide upon operational improvements? | 2.1 Clarity and transparency of the process 2.2 “The neutral zone” 2.3 Self-sufficient decision making |
| 3. What are the initiatives to support continuous improvements? | 3.1 Root causes - not symptoms treatment 3.2 Integrated lean thinking “VSM as a mindset” 3.3 Onboarding units |