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Value Stream Mapping at Sahlgrenska University Hospital

Understanding and Improving the Coordination Process of Breast Cancer Surgeries

Master's Thesis in the Master's Programmes Supply Chain Management and Quality and Operations Management

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CHALMERS UNIVERSITY OF TECHNOLOGY
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Abstract

Sahlgrenska University Hospital (SU) is one of Sweden's largest hospitals with a wide range of specialist treatments and research. Within the scope of surgery there are three primary care units, with one of them being Surgery Unit 33 (the surgery department). At the surgery department, patients diagnosed with breast cancer, malignant melanoma, endocrine disease or obesity are treated, with the largest share of them being breast cancer patients. At the surgery department, around 900 surgeries of breast cancer surgeries are performed each year. The need for breast cancer surgeries has grown throughout the years and combined with a broader range of surgical options and constrained resources it has become challenging to coordinate them. The surgery coordinators responsible for breast cancer surgeries have developed their own solutions over the years to handle the coordination process, which has made the process dependent on a person. In addition to that, the work environment has become stressful and there is a consensus regarding the need to gain an overview of the coordination process, identify potential problems and find ways to improve the process. The purpose of this thesis was thus *to understand and document how the coordination process of breast cancer surgeries works today and develop improvements that can decrease the problems the process currently is faced with.*

To gain an overview of the process, a Value Stream Mapping was conducted where a current state map provided a visualization of the work flow along with detailed description for each step. In order to understand where potential problems arise with the process, this current state was analysed. The identified problem areas were divided into three areas; internal disturbances, external disturbances and uncertainties. Internal disturbances refer to the problems arising in the coordination process itself and hinders the steps described in the current state. External disturbances relate to the many different interruptions and issues that hinders the coordinators in their daily work. Uncertainties concerns the factors that affects the planning on a higher level and longer time horizon.

In the development of improvement suggestions for the process, a future state map was developed. This map included a visualization of how the coordination process could flow and was followed by an elaboration on general improvements. In order to improve the process, main changes included the removal of the frequent controls of journals for defects which is not the coordinators responsibility, removal of unnecessary inventory steps creating motion and a proposal on a new way to coordinate patients by merging two activities when possible. Other general improvements for instance included to implement Poka-yoke to reduce defects and visualize information to reduce questions.

There are multiple changes needed to make the coordination process more efficient. It should be noted that it is not enough to only improve the coordination process, but also a need to take on a long-term strategic approach when investigating how resources such as operating rooms should be allocated. Many factors and processes are connected and will be affected if one process is changed. Thus, change might be needed in several different processes in order to achieve long term differences. Crucial in order to achieve this is to communicate within the department and hospital wide, as well as striving to continuously improve the processes.

Keywords: Value Stream Mapping, Healthcare Improvement, Surgery Coordination Process, Lean, Current State, Future State, Healthcare Planning

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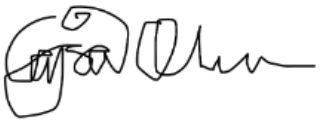

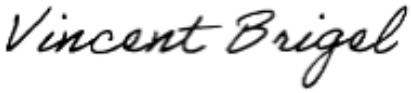

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Table of Content

List of Figures

List of Tables

Terminology

Coordination process/surgery coordination process: Aims at the administrative process of coordinating the surgery of a breast cancer patient. Also denoted surgery coordination process.

Coordinators/surgery coordinators: The staff members responsible for the coordination process. Aims specifically at the coordinators responsible for breast cancer surgery coordination in this thesis.

Fully investigated patient: A patient that has gone through all the necessary tests and meetings connected to referral letters that are needed before a surgery can be performed on that patient.

Invitation letter: A letter sent to a patient with the date and time of their surgery and instructions for preparation, which can be seen in Appendix D.

Journal: Folder containing a wide variety of material regarding a patient's diagnosis and upcoming surgery. Not to be confused with general journal notes made throughout the treatment process.

Letter of referral: The recommendation of a medical or paramedical professional. If you get a referral to ophthalmology, for example, you are being sent to the eye doctor. Referral can refer both to the act of sending you to another doctor or therapist, and to the actual paper authorizing your visit.

Orbit, Melior, Elvis and Operett: IT systems used for registration and documentation of surgeries and patient information.

Registration form: Paper form filled in when a patient is registered for surgery, containing information regarding for instance the diagnosis, type of surgery, estimated time. Seen in Appendix B.

SVF (Standardiserat vårdförlopp): SVF is a standardized way to treat patients in an early stage of their cancer diagnosis and contains a time limit of how long it should take from the cancer being detected to the first surgery being scheduled and finished. Each cancer diagnosis has its own SVF and the time it should take for breast cancer is 28 days. Appendix F shows the SVF for breast cancer patients.

The surgery department: The department, Surgery Unit 33, at Sahlgrenska University Hospital which was studied during this thesis.

1. Introduction

Sahlgrenska University Hospital (SU) is one of Sweden's largest hospitals with a wide range of specialist treatments and research. With 1 950 beds available, the hospital is the county hospital for inhabitants from the Gothenburg area as well as other parts of Västra Götalandsregionen (VGR).

Within the scope of surgery there are three primary care units, with one of them being Surgery Unit 33 (the surgery department). At the surgery department, patients diagnosed with breast cancer, malignant melanoma, endocrine disease or obesity are treated, with the largest share of them being breast cancer patients. Breast cancer has become the most common cancer disease among women in Sweden, with approximately 20 women falling ill each day across the country (Cancerfonden, 2016). Each person becoming a patient at SU will meet a surgeon at the surgery department. During this meeting, information about the breast cancer diagnosis is given, a treatment plan is set and a preliminary week for surgery is registered on a registration sheet. The registration sheet is then used by two surgery coordinators at the surgery department to coordinate the surgery by registering the patients in IT systems, assign a suitable surgeon, an operating room, complement with information and send out a letter of invitation to the patients with information regarding their surgery.

With more cases being detected early and treated thanks to new technology, the number of patients with a breast cancer diagnosis and in need of a surgery have increased as an effect. Simultaneously, an increased number of actors are involved in the treatment of a patient, such as different medical specialists, caretakers, interpreters and social support providers. Due to new treatment options, the treatment process has also become more complex, with a wide variety of alternatives and options for patients. Some patients may also have other another diagnosis simultaneously, adding further difficulties to the treatment process.

Consequently, the workload in the coordination process of surgeries has grown, with the coordinators at the surgery department having a difficult time handling the process. Due to the situation described above, there is a large number of actors that needs to be coordinated and factors to be taken into consideration when coordinating surgeries. With large amount of paperwork, different IT systems that lacks integration, as well as frequent disturbances during the working day, their tasks have become difficult and resulted in a stressful work environment. Many of the steps in the process have been developed by the coordinators themselves with little involvement from management, which have resulted in a process that is not formalized, resulting in a lack of overview of the process. In addition, some of the steps are inefficient as they require frequent double-checking in order to avoid errors. Hence, the time it takes to coordinate a surgery has increased.

With surgeries simultaneously being affected by several other factors, such as access to different operating rooms and surgeons' schedules as well as their areas of specialization, the task of coordinating surgeries becomes person-dependent and reliant on the coordinators' personal knowledge and experience. In addition to that, there will be an implementation of a new IT system, called Orbit, for coordinating surgeries which has increased the need to gain an overview of the coordination process. Considering that the coordinators are soon to retire,

the knowledge needs to be documented to reduce risks such as errors in the work tasks and to ensure quality in the future.

1.1 Purpose and Research Questions

The purpose of this thesis is *to understand and document how the coordination process of breast cancer surgeries works today and develop improvements that can decrease the problems the process currently is faced with*. This purpose can be divided into three main research questions.

Firstly, there is currently little documentation of the coordination process, and the knowledge possessed by the coordinators has not been formalized. As a consequence, there is a need for providing a map of the current state of the process, with a clear description for each step. Thus, research question one is:

What does the coordination process look like?

Secondly, the process has its challenges in terms of efficiency due to many of the parameters to consider, disturbances and increase in number of patients, hence making the work environment stressful for the coordinators. Therefore, it is crucial to properly identify problem areas that are disturbing the coordination of the surgery process. Consequently, research question two is:

What problems does the coordination process have?

Thirdly, when knowing what the process looks like and what the problems areas are, an improvement suggestion of a new coordination process should be created. The aim is to provide the coordinators with solutions that will address the problem areas, making it more efficient and decrease the stress and workload on the coordinators. Hence, research question three is:

What improvements can be made to the current coordination process to decrease the identified problems?

1.2 Scope and Limitations

This thesis will focus on mapping the current process, identify problems and generate suggestions on how to improve the coordination process. The thesis will not include an implementation plan. This is due to the difficulties in overviewing available resources, budget constraints and political aspects that exists due to the public funding of healthcare in Sweden. Instead the focus will be to provide the surgery department with a list of improvement suggestions that can be used in the near future as well as on a longer time horizon.

The mapping will start from the point where the patient is assigned surgical treatment at a Multidisciplinary Conference (MDC) and finish when the journal is completed by the medical secretaries and delivered to the cashier desk. The mapping will not consider re-operations due to the small volume of such surgeries.

Due to the complexity of healthcare and of cancer treatments, the improvements will not include any suggestions regarding the medical aspects and will thus be limited to administrative and logistical aspects.

2. Theoretical Framework

This chapter provides the theoretical framework on which the work process, the analysis and developed recommendations have been based. The chapter covers three theoretical sections: Healthcare Organizations, Lean, and Value Stream Mapping (VSM). The chapter is then concluded by the presentation of a Conceptual Framework, where the theory has been organized and contribution to different parts of this thesis are described and visualized.

2.1 Healthcare Organizations

This section contains a general description of healthcare organizations and its challenges, an elaboration of the Swedish healthcare system, as well as an introduction of the need for healthcare improvements. The intention is to provide an overview of healthcare organizations and the challenges they are faced with so that a contextual understanding of such organizations can be achieved. This is crucial in order to be able to categorize the different stakeholders that exist within the healthcare sector and understand what type of customers that eventually uses the output of the coordination process at SU. The introduction to healthcare improvement serves to create a basic understanding of how industrial improvement concepts and theories have been applied to a healthcare setting. This is eventually used as a motivation of why such concepts, in this case Lean, can be used to improve the coordination process at SU.

2.1.1 Organizational Challenges in Healthcare

Healthcare is one of the most complex systems in a society due to the existence of several stakeholders according to Glouberman and Mintzberg (2001). The stakeholders in a healthcare organization can be categorized into four different worlds, seen in Figure 1, with each world having a different purpose at the hospital. Some stakeholders manage their businesses downstream in the system, meaning that the focus is on the individual treatment of a patient. Upstream management includes stakeholders that control funds, establish policies and handle insurance companies et cetera. Moreover, management can be practiced inside a unit or institution, while outside management means that those involved are independent and not bound to a specific institution. The complexity Glouberman and Mintzberg (2001) describes is represented by these four worlds and within each quadrant there is a different view on how healthcare organizations should be built and treat patients.

Cure (doctors) and *care* (nurses) both focus on the patient treatment downstream, but the doctors are not bound to a specific hierarchy compared to nurses, that are only one of many departments that provide basic care. *Control* (managers and administrators) are responsible for the organization but do not have any direct involvement to patient care and treatment. *Community* (trustees*)* are outside the organization with no responsibility for the patient care and treatment, therefore being both upstream and outside. This is not one organization but four different ones with their own agendas and structures which can create friction when trying to drive implementation (Nilsen, 2010).

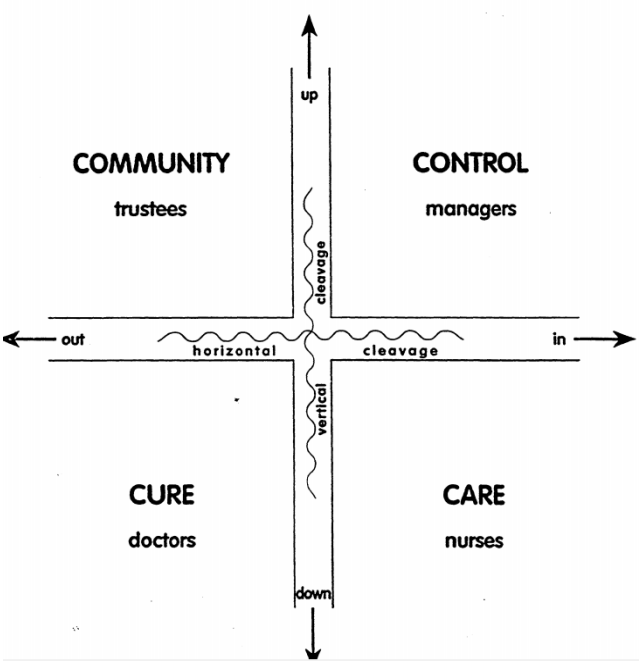

Figure 1 *- The four worlds by Glouberman and Mintzberg (2001).*

Moreover, a growing problem with modern healthcare organizations is the creation of new departments within a hospital (Nilsson, 2007). On one hand, the increase in medical knowledge is a good thing since it provides better treatment to diseases, therefore motivating creation of new departments. On the other hand, this means that there are more departments within a hospital that set their own agenda and create a local structure that may not consider the whole system. To conclude, on a general level there is a complexity with the four different worlds and on an organizational level there are difficulties with different departments not working together.

Driving change in healthcare is not without friction due to the different goals and objectives set by the departments and stakeholders. This section highlights the main stakeholders, presented as the four worlds, and is a good starting point when establishing where and what data has to be collected at SU. This section shows that the data collection should not only by centered around the surgery coordinators, but also the staff members who uses the output as well as management. Therefore, it is important to identify and interview all of the stakeholders connected to the coordination process to ensure that no important details are left out. Interviewing several stakeholders is also a good way to increase engagement among the staff members and the willingness to change since they have been a part of the process and thus affected the results.

2.1.2 Swedish Healthcare System

The Swedish healthcare system is one of the global leaders within providing high quality outcomes in terms of medical results (Sanandaji, 2012). Despite this, Lifvergren (2013) summarizes that the Swedish healthcare system have shortcomings regarding productivity, efficiency, integrated care and patient safety. Simultaneously, the demands on quality care keep on increasing along with a growing as well as ageing population that requires additional healthcare resources (Sanandaji, 2012). Consequently, Swedish healthcare is facing a

challenge in how to continue delivering safe and high-quality care while also dealing with this system pressure along with increasing costs due to the variety of new treatment options (Lifvergren, 2013). This creates a need to ensure that the available resources are used and improve the areas of shortcomings of the healthcare system through improvement efforts within for instance quality and management (Lifvergren, 2013).

While technological development is seen as one crucial part of the improvement efforts, it is highlighted by Sanandaji (2012) that finding new ways to work and improve existing operations and processes should be seen as equally important. As described by Lord and Smith (2014) healthcare processes are often subject to ambiguity regarding how tasks should be performed and contain solutions and methods that have been developed locally. Designing solutions on an individual basis results in wide variations in how processes are shaped throughout healthcare system, which becomes a source of potential errors and reduced patient safety due to a poor system set-up (Lord and Smith, 2014). The healthcare system further adds difficulties to the processes due to the need of coordinating multiple departments, which require individuals to not only perform their tasks well but also perform them successfully in collaboration with other departments (Spear, 2005). This further opens up for potential errors and problems, which tends to be solved by being worked around, instead of addressing the root causes and operational problems that could cause the issues presented (Spear, 2005). Throughout the years, healthcare improvement has grown as a research area that, by applying for instance quality improvement science to a healthcare setting, seeks to provide solutions through a wide range of theoretical models and suggestions regarding how the healthcare sector should address the many challenges it is facing (Lifvergren, 2013).

As stated in the introduction of this thesis, the coordination process at the surgery department has been subject to individually designed solutions. Thus, the statements by Lord and Smith (2014) are also applicable in this context, which speaks for the importance of identifying potential problems with the coordination process and determine where potential errors might occur. In order to do so, there is a need to carefully observe the coordination process and do a mapping of such to make it possible to locate problems and determine the root causes of those. With it being stated that healthcare improvement involves finding new ways to work with existing processes and operations, the coordination process would typically qualify for being a potential area to direct such improvement efforts towards.

2.1.3 Healthcare Improvement

When investigating the improvement methodologies used within healthcare, Singh and Lillrank (2015) describes how many of the used methodologies have their origin in the manufacturing industry. However, it is also stated that such methodologies require additional adjustments when applied in a healthcare context in order to be useful in such a setting (Singh and Lillrank, 2015). Some of the most common industrial methodologies that have been applied to healthcare are the Plan-Do-Study-Act (PDSA) cycle, Statistical Process Control, Six Sigma, Lean and Theory of Constraints (Boaden et al., 2008). As seen in Figure 2, the focus of the different methodologies shifts between concepts relating to process view, variation, flow and customer focus. While all of the methodologies or approaches take on a process view, SPC and Six Sigma focuses more on variation, and Theory of Constraints (ToC) on flow. Lean on the other hand has waste reduction as a focus that includes both variation and flow. In addition to these methodologies, Boaden et al. (2008) also brought up

Total Quality Management (TQM) and Business Process Re-engineering as strategic approaches but stated that they include tools from the methodologies in Figure 2, thus not reviewing them in detail individually.

<table>
<tr><th></th><th>Process view</th><th>Variation</th><th>Flow</th><th>Customer focus</th></tr>
<tr><td>PDSA</td><td rowspan="5">All approaches assume there is a process focus, although some regard it as more fundamental than others</td><td colspan="3">All these themes may be important, depending on the answer to the first question from the model for improvement and the change concepts derived as a result of considering thethird question</td></tr>
<tr><td>SPC</td><td>Main focus</td><td></td><td>Leads to definition of control limits for process</td></tr>
<tr><td>Six Sigma</td><td>Main focus</td><td></td><td>The driver for definition of what needs to be improved</td></tr>
<tr><td>Lean</td><td colspan="2">Reducing waste, which may be related to variation and/or flow, is the focus. Flow tends to be emphasised more (Seddon 2005b)</td><td>Leads to the definition of value which determines where improvement is focused</td></tr>
<tr><td>ToC</td><td></td><td>Main focus</td><td>Leads to the definition of performance measures and targets for improvement</td></tr>
</table>

***Figure 2** - Relationship between methodologies and different concepts (Broaden et al., 2008 pp. 114).*

When seeking to select an approach among the methodologies presented, Lean is viewed as the most appropriate of those in Figure 2. With the workload of the surgery coordinators being seen as high, finding ways to reduce the stress and make the process flow smoother is important. With the broad range of surgeries, studies and constrains, there is also variation, making it important to focus both on that and flow. With Lean being the methodology focusing on both, through the reduction of waste, this speaks for the suitability of the methodology. In addition, the department has a history of working with for instance continuous improvement and other Lean tools, which further speaks for the suitability of Lean in this context.

2.2 Lean

This section contains an introduction to Lean in healthcare, a description of the philosophy, tools used in Lean and an elaboration of how Lean can be used in an office environment. The objective behind this section is to introduce Lean, to explore its applicability as an improvement methodology for this project and describe the tools that can be used as improvements for the coordination process. Since the coordination process takes place in a healthcare organization it is important to describe how Lean can be used in such a context and in what ways this has been done previously. As the coordination process is of an administrative kind, it is also important to understand how Lean can be used in an office environment in addition to the healthcare setting.

2.2.1 Lean in Healthcare

With increasing healthcare costs, improvement methodologies such as Lean production have to be used to address the inefficiencies in healthcare delivery (Kim et al., 2006) and to increase the quality (Drotz and Poksinska, 2014). Many authors state that Lean can be implemented in healthcare and achieve the same success as in manufacturing (Kim et al., 2006; Drotz and Poksinska, 2014) since the tools are not only applicable in manufacturing (Manos et al., 2006).

Central within Lean is to understand what value is for the customer and identify which activities that create this value for them (Drotz and Poksinska, 2014). However, since healthcare organizations have many stakeholders with different needs (Glouberman and Mintzberg, 2001) as well as with several supporting processes such as radiology, pathology, coordination et cetera assisting the treatment process (Jones, 2006), defining that value can be more challenging in a healthcare setting than in a classic manufacturing context. Singh and Lillrank (2015) describes the differences between those settings by exemplifying how value definition in manufacturing is quite easy to identify, since processes that contribute towards completion of the end product tends to fall under the category of value adding. The end customer focus mainly on the outcomes, and not on how the product is actually manufactured. On the other hand, Singh and Lillrank (2015) describes how healthcare is more challenging, since value can be created both by what is done and how it is done in the process of care, which makes internal process efficiency as well as quality assurance relevant. In addition to that, it is not always obvious which steps that contributes to a certain outcome, since it for instance is unknown if a second opinion or additional x-ray eventually will contribute to a better health outcome until afterwards (Singh and Lillrank, 2015).

The focus in healthcare should be on doing the right things rather than being efficient (Al-Balushi et al., 2014). Any activity not providing value to the need of the customer should be considered waste and removed and Al-Balushi et al. (2014) suggest VSM as a tool for doing this (Drotz and Poksinska, 2014).

Jones (2006) provide some basic Lean tools that can be used in healthcare, see Figure 3, and continues that the focus of healthcare historically has been on the patient and doctor interaction and not considered the rest of the journey such as the waiting list, sitting in queues et cetera. However, when the introduction of patient choice in the UK was made, which means that the patients could choose which hospital to go to, more focus was put on reducing the non-value adding steps by looking at the support processes which contain a lot of waste, which was successful (Jones, 2006).

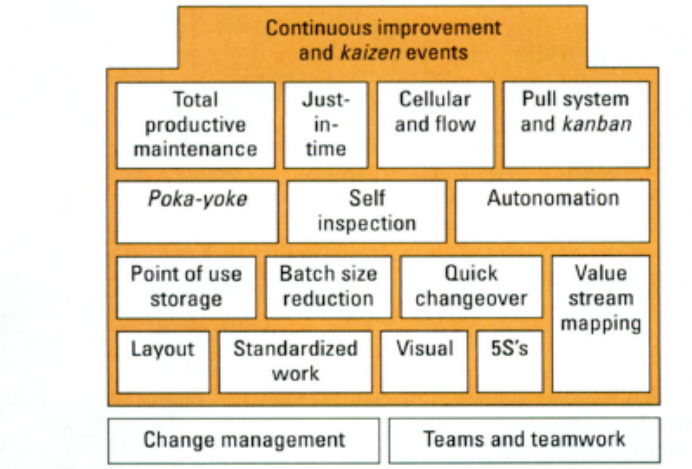

Figure 3 *- The building blocks in Lean healthcare (Jones, 2006).*

An example where Lean was successful in healthcare is the Virginia Mason Medical Centre that managed to achieve improvement in both variation and flow through waste elimination using Lean methodology and tools (Bush, 2007). For instance, Bush (2007) describes how waste was identified in terms of unnecessary copying of forms and reports that seldom was used, multiple recording and logging of data, error fixing in documentation and several other areas relating to information processing. Some of the process improvements performed at the Medical Centre included order entry by portable wireless computers, computerized clinical order entry and visually controlled restocking systems (Bush, 2007). Results achieved through the improvements were positive in a wide range of areas, such as reduction in the turnaround time for reporting test results and average waiting time from diagnosis to initiation of treatment.

Mayday Healthcare NHS Trust sterile service improvement work regarding smoothing of capacity and demand is another example of how Lean tools helped improving operations (Westwood, Moore and Cooke, 2007). Through identification of value streams, specification of value and focus on process flows, the availability of sterile packs was secured, and the sterile service flow improved, making it possible to carry out theater lists to plan (Westwood, Moore and Cooke, 2007). Swedish examples of Lean improvements are presented in a study by Poksinska et al. (2017) where the healthcare providers used VSM to eliminate waste from processes. Mapping was conducted over patient flow as well as staff and information flow, ultimately resulting in increased patient throughput, decreased stress and improved staff satisfaction. However, there were no results of increased patient satisfaction, but the Lean tools contributed to a more efficient and more timely healthcare (Poksinska et al., 2017).

Lean can be adapted to a healthcare context, which is demonstrated in the cases above. The surgery department has experience working with improvement projects and Lean concepts. The most valuable tool for this thesis to use is VSM, since it answers the first research question, “What does the process look like?”. Information on the current process steps has to be collected for a VSM to be established. This information can be obtained through interviews and observations.

2.2.2 Lean Philosophy and Tools

Lean can be seen as a philosophy based on the principles of the Toyota Production System (Womack and Jones, 1996). The key principle of Lean is to improve current daily activities by eliminating waste to get a more efficient process (Slack et al., 2016) or as Dennis (2016) define Lean, doing more with less while achieving customer satisfaction.

As seen in Figure 4, the 14 principles developed in the Toyota Production System on the right side of the figure can be summarized into four P's: philosophy, process, people and partners and problem solving. Philosophy is the core of the company where all decisions should be made according to a strategy, regardless of what it might affect in short-term. A clear philosophy will help to realize the business goals set within the company (Liker, 2004). The next level is the process level, where the goal is to eliminate waste by creating a list of all the activities in a process and evaluate which ones that contribute by adding value. This level also represents the main purpose of Lean as introduced in the first paragraph, to remove waste, and is where most Lean companies are. The last two levels, people and partners and problem solving is about challenging and empowering the staff to improve the working environment, learn new things and grow. It is important to always strive for improvement to keep the customer satisfied and therefore fostering a culture of continuous improvement is crucial. To summarize, the 4 P model represent the core of Lean philosophy, to eliminate waste, involve everyone and always improve (Slack et al., 2016).

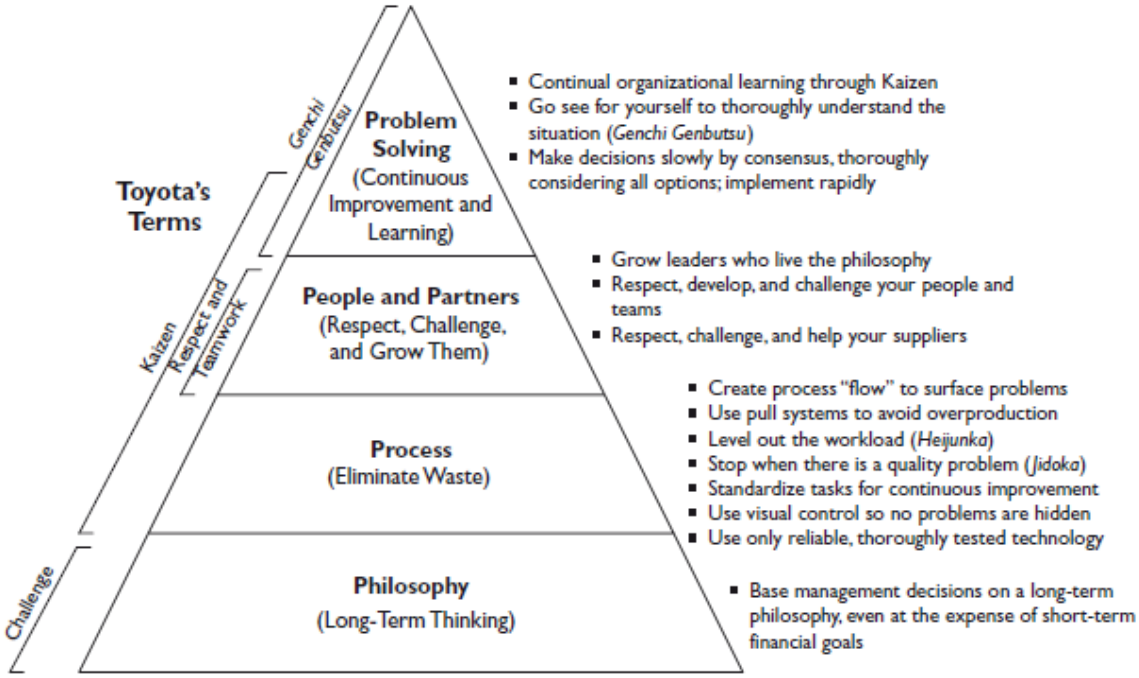

Figure 4 *- Toyota's 14 principles divided into four different P's. (Dennis, 2016).*

Lean is mainly used in manufacturing, but the rules of Lean can be applied universally with the challenge of translating them in special cases (Dennis, 2016). Slack et al. (2016) see no obstacles in using Lean in service operations and Keyte and Locher (2004) have found two types of actions involved when delivering a service or creating a product (Keyte and Locher, 2004). These are:

1) Activities that create value as perceived by the customer.

2) Activities that create no value as perceived by the customer but cannot be removed since it supports other needs of the company.

Commonly, the majority of the work in an office falls into the second type (Keyte and Locher, 2004). These activities cannot be removed since they are crucial for other parts of the business to function properly. In order to remove these, the business has to be rebuilt so there are only activities that create value for the customer. This is why it is important for office members to understand the flow of the product and/or information which is possible by doing a VSM, introduced in detail in *2.3 Value stream mapping*. VSM shows which activities are crucial for value creation and which ones are waste (Keyte and Locher, 2004). When the value stream map has been established, a common thing is to address all the waste activities simultaneously which can be both time and resource consuming. A more effective way is to use the value stream map to focus on the major critical areas first and later dig deeper into optimization less significant areas.

Lean's focus is on removing waste and there are seven types of waste that exists according to Slack et al. (2016). Keyte and Locher (2004) adds one additional waste category which address the waste of not using the capacity of the staffs' creativity and skills. To conclude, the eight waste categories that can be identified are:

1) Over-production: Producing more than needed by the next process.
2) Inventory: A quantity of some kind, for example journals.
3) Waiting time: Waiting for information on others before task can be continued.
4) Extra processing: Re-entering data, extra copies
5) Defectives: Fixing an error causing a quality issue.
6) Excess motion: Walking to the printer or other offices.
7) Transportation: Movement of paperwork.
8) Underutilized people: People are not using their creativity and skills.

(Slack et al., 2016; Keyte and Locher, 2004)

Besides VSM, the Lean methodology have developed many tools and practices that, if implemented correctly, can address many of the waste categories identified above, thus reduce the cost and lead time. The relevant tools for the master thesis will be introduced in detail below.

Standardized Work

According to Dennis (2016) the purpose of standardized work is to create a baseline for the process so that improvement areas can be identified since there is always something that can be improved in a process. The pros of standardized work are many. For example, it provides process stability which means that things can be repeated and people are getting more skilled in doing their task everyday which increase the productivity. A standardized process can also implement Poka-yoke, introduced later in this section. A useful concept when talking about standardized work is takt time which states how frequent one product has to be produced and finalized each time unit. Dennis (2016) define takt time as:

$$(required)\ takt\ time = \frac{daily\ operating\ time}{required\ quantity\ per\ day}$$

If the current takt time is longer than the needed takt time, delays in orders are highly likely. On the other hand, if the current takt time is smaller than the needed there will also be waste created through over-production.

5S's

The 5S's is a methodology to organize work areas by ensuring that an office is clean, standardized and items are easy to find (Slack et al., 2016). The purpose is to eliminate waste related to searching for an item or information when knowing where everything is. The 5S's are:

1) Sort: Throw away unnecessary items and papers and only keep what is needed.
2) Straighten: Position the most common items used daily so they are reachable within an arm's length when needed.
3) Shine: Keep the office clean.
4) Standardize: Keep the items at the same position at all times.
5) Sustain: Be committed to keep the standards and feel pride over the work.

(Slack et al., 2016)

Jidoka

Jidoka is about pausing the current task an individual is doing to find out why a defect has occurred (Dennis, 2016). Sometimes defects are created in a process and it is up the individual to pause, contain and identify the source of the defect so countermeasures can be taken in the future. Jidoka is about ensuring that quality issues are taken seriously and handled straight away to prevent them from happening in the future. These preventive activities can for example be Poka-yoke which will be introduced in the next paragraph.

Poka-yoke

Poka-yoke is about preventing an error from occurring by making something fail-safe (Slack, Brandon-Jones and Johnston, 2016). In manufacturing, this can be achieved by designing a product that can only be assembled in one way so the operator has no choice but to do the same assembly for each product. In healthcare, it can be possible to use checklists that has to be filled in before an activity is completed. This action guarantees that everything has been checked before sending the patient back home.

Kaizen

Kaizen is not about change, it is about changing for the better (Graban and Swartz, 2014). Kaizen often starts with small changes and follows a scientific method called Plan-Do-Study-Act (PDSA). Plan is about understanding a situation, finding the root cause to a problem and develop a change and understand the effects of the change. Do is about testing the change before launching it full on. In study, the data gathered from do is analysed and evaluated and either confirms or rejects the hypothesis in the planning phase. When the analysis is done one has to act on the results and decide to launch the change, adapt or do something else. PDSA is iterative. Once a change has been implemented, hence a new standard has been set, improvements can now be made on the new standards (Graban and Swartz, 2014).

For Kaizen to work well, there needs to be a culture of continuous improvement where the staff are encouraged to build improvements. In Kaizen, no idea is too small and the staff are encouraged to react and follow-up the root cause when defect have been detected.

Visual Workplace
A visual workplace system is about setting up signs, floor painting, colour coding, signs et cetera to provide the staff and patients a systematic way to track and find the place and/or item they are looking for. It is useful to provide information and guidance to both staff and patients (Manos et al., 2006).

As some of the steps in the coordination process are inefficient, identifying and removing waste is crucial to improve the situation. Keyte and Locher (2004) waste categories are appropriate to use for this purpose. Furthermore, standardizing work, Jidoka, Poka-yoke and Kaizen are other tools and concepts that can be used to address the issues that the surgery coordinators are faced with. Data needed is a detailed description on the coordination process. Regarding the use of the takt time, data on the number of surgeries performed during a year and the operating time is needed.

2.2.3 Lean in Offices

Lean is not only an improvement methodology that can be used in manufacturing. Association for Manufacturing Excellence (2007) presents several case studies were Lean has been translated to be used in offices too. A company called The Antioch Company had several problems with repeated wastes in their offices and decided to create a Lean Office Department to handle this. The Antioch Company mapped their processes with the VSM technique, formed routines and successfully implemented Lean concepts into their offices. The program, which was developed and driven by employees, gave many positive outcomes. Some examples are standardized work, increased awareness of the process and value, reduced paperwork, streamline, customer focus, improved communication, reduced lead time and reduced rework. The process mapping at the office started with gathering of interview data for the current state and later this data was used to map the current state. Each task was later determined to be value-adding or non-value adding. After this an analysis was conducted, which was followed by a future state of improvements.

Association for Manufacturing Excellence (2007) presents questions that can indicate if Lean is needed and should be implemented in an office. If the answer is yes to the first six questions, Lean should be implemented. If the answer is no the last five questions, Lean should also be implemented.

A yes to one or more of these questions indicate that Lean should be implemented in the office.

1) Is overtime common?
2) Is rework a fact of life?
3) Do employees spend a lot of time compiling, copying, and filing paperwork?
4) Is there more than one way to perform a task? Is one way better than another?
5) Do employees spend time searching for files, messages, or packages?
6) Has the company grown without changing processes?

A no to one or more of these questions indicate that Lean should be implemented in the office.

7) Do you have standardized procedures?
8) Do you implement best practices?

9) Does every process have an owner?
10) Do employees understand how their role affects a process?
11) Do people communicate the right information at the right time to the right people?

However, it is not easy to implement Lean in an office. Common issue known is for example the knowledge of the employees. In an office, productivity and efficiency are two terms that may be vague compared to the assembly staff working with the terms every day. Additionally, office staff are not directly connected to cost of a product and therefore staff may not understand if their work is efficient or not. But in fact, Association for Manufacturing Excellence (2007) state that the office is where most of the opportunities are and working with Lean in an office will have a positive effect on waste, thus the cost. Other issues trying to implement Lean into an office can be lack of cooperation between departments, lack of directive from management, and belief that Lean does not work in an office and culture.

Since the process of coordinating surgeries is performed in an office, it is relevant to see if Lean is suitable in an office environment. To see if Lean is useful in the coordinators' office the questions provided by Manufacturing Excellence (2007) should be used. Questions one to five are good questions to include in interviews and to have in mind when observing the environment the coordinators are working in. Furthermore, question seven and eleven are relevant too look at and determine if Lean is a possibility.

2.3 Value Stream Mapping

This section provides a description of the technique VSM in terms of the different steps used in the mapping of a current state and the development of a future state, along with a description of VSM in healthcare and offices as well as the challenges and problems behind the technique. Since VSM is viewed as an appropriate technique to use for mapping and improvement of the coordination process, the objective of this section is to provide a detailed description of the technique and clarify what adjustments that are necessary in making it appropriate for an administrative process in a healthcare setting. Another objective behind this section is to clarify that VSM is indeed an appropriate technique for mapping the coordination process. Additionally, in order to create transparency regarding the drawbacks and motivate some of the delimitations behind VSM, the challenges and problems also needs to be clearly described.

2.3.1 Value Stream Mapping Background

VSM is a technique for process mapping used within Lean where the objective is to visualize processes and understand where value is created as well as where waste arise (ACT Academy, 2017). With this visualization, it should be possible for different stakeholders to help improving the process by creating plans for eliminating sources of waste as well as to gain a joint logical understanding of how a certain process flows and how communication occurs within it (Nash and Poling, 2008). The difference between VSM and a conventional process map is that VSM gathers and displays a broader range of information (ACT Academy, 2017).

In VSM, the process is documented both by drawing of a current state map and a future state map (Nash and Poling, 2008). The current state map is a description of the existing process which should serve as a baseline when developing any future improvements. For improvements, the future state map should represent a vision of how the process should flow when improvements have been implemented. The steps of VSM are illustrated in Figure 5 and will be described in detail in this chapter. VSM of administrative and healthcare processes are mentioned and commented on in particular in some of the sections, due to its relevance in the context of the coordination process discussed in this report.

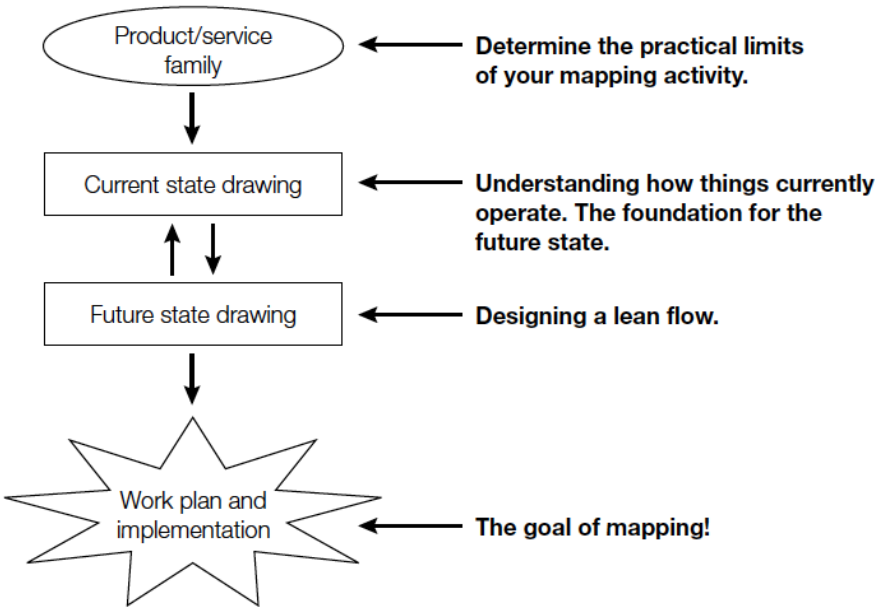

Figure 5 *- Steps for mapping a value stream (Keyte and Locher, 2004).*

2.3.2 Current State

The intention of a current state map within VSM is that it will be a snapshot of time, that makes it simple to see how the process flows and explain both what employees do, how they do it and how interaction happens between process steps (Nash and Poling, 2008). In the development of the current state map, Nash and Poling (2008) highlights how strong observational skills are required, and that walking the process step by step is crucial in order to understand how the process is actually functioning instead of basing this on employees' opinions and guesses during interviews.

In the process of completing a current state map, Keyte and Locher (2004, pp. 23) suggests following six steps:

1) Document customer information and need.
2) Identify main processes (in order).
3) Select process metrics.
4) Perform value stream walk-through and fill in data boxes, including inventory and resident technology.
5) Establish how each process prioritizes work.
6) Calculate system summary metrics, such as lead time versus process time, first-pass yield, cost, and/or other value stream summary measures.

The initial steps of a VSM and current state map development includes defining customer requirements (Rother and Shook, 2003). If failing to define these properly, there is a risk that eventual improvement fails to provide the customer with what is actually needed (Rother and Shook, 2003). It is also crucial to simultaneously determine the scope of the mapping and which product or service family that should be mapped (Nash and Poling, 2008).

Secondly, icons used for the mapping needs to be selected. Some of the most common icons used within VSM are shown in Figure 6. Many of the icons used are adopted for a manufacturing context. For instance, process boxes are used to describe a process where material is flowing and in a production setting, this can for instance be represented by assembly, pre-manufacturing and mounting (Medbo, 2018). In an administrative context, process boxes can instead represent activities such as order entering, invoicing, schedule creation and fabrication (Keyte and Locher, 2004, pp. 17).

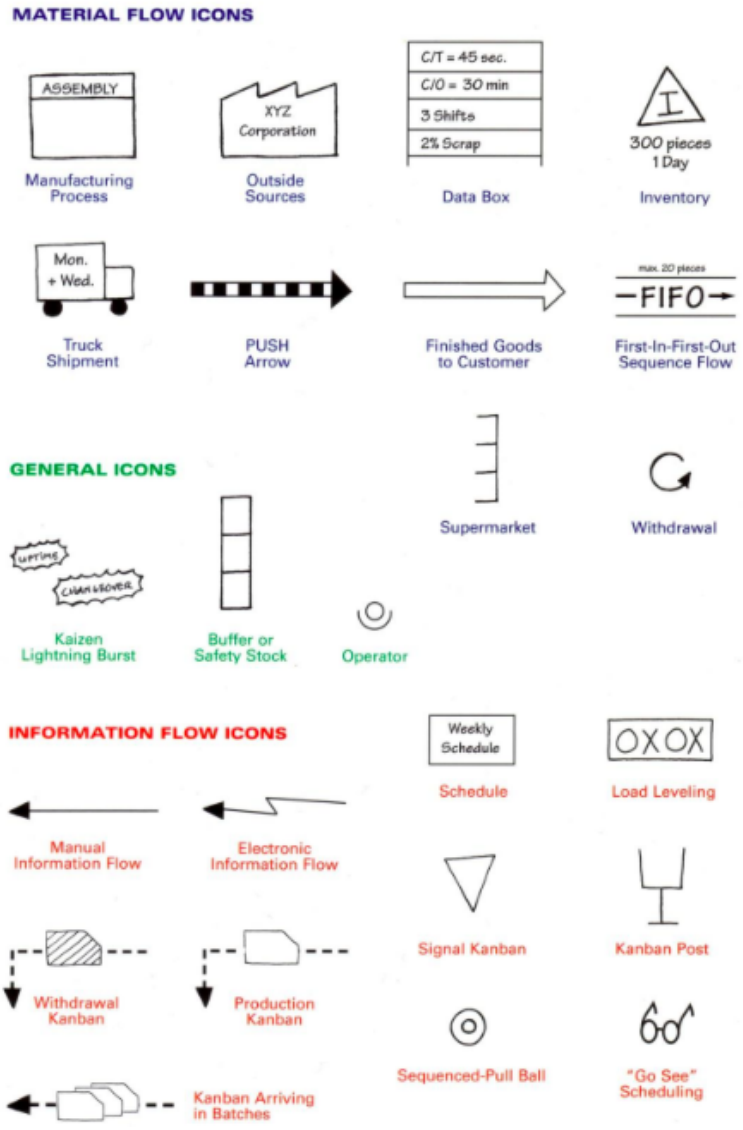

Figure 6 *- Common icons used within VSM (Medbo, 2018).*

In the mapping, Rother and Shook (2003) describes how it is important to walk along the entire flow, both upstream and downstream in order to understand the sequences as well as

the flow, while also having the same members performing the mapping to understand the whole flow. While doing this walk along the flow, the main processes should typically be identified, focusing on the main activities needed to be able to process a product or information (Keyte and Locher, 2004). Along with description of the main processes, data needs to be collected to help identify process issues (Keyte and Locher, 2004). In Table 1, some of the common metrics within VSM are listed and described. For administrative processes, determining the appropriate measures can be more challenging than for manufacturing processes due to the lack of standard metrics that enhances cost, service and quality of such processes (Keyte and Locher, 2004, pp 30-35). However, collecting data regarding things such as typical batch sizes, demand rate, percentage complete and accurate, time, inventory and information technology used can be a good starting point for administrative processes as well as manufacturing processes (Keyte and Locher, 2004, pp. 30-35). Data should be recorded in a data box presented below for instance a process box icon or an inventory icon in the current state map (Rother and Shook, 2003).

Table 1 *- Common measurements within Lean and VSM (Rother and Shook, 2003).*

Measurements	Description
Cycle Time	Time needed to complete one process or cycle for a piece.
Value-Creating Time	The share out of the total time that contributes towards transforming the product into what the customer is willing to pay for.
Lead Time	The total time needed for a piece to move from start to finish through a process or value stream.

In a current state map, both the material flow and the information flow should be included. While the material flow covers the creation of the output, the information flow represent communication with different IT systems to assist in the creation of the output.

With an identified need to formalize and create an overview of the coordination process, the creation of a current state map could fulfil that need, both in terms of making it easy to see how the process flow and by providing a baseline for eventual future improvements. In order to create a current state map, it thus becomes necessary to conduct observations at both the coordinators' office as well as in the steps before and after the coordination process has been completed. Information regarding IT systems also needs to be collected in order to be able to map both the material and the information flow. Process metrics also need to be selected as well as the icons used in the map.

2.3.3 Future State

The future state map serves the purpose of visualizing a suggestion of a future value stream where the waste within the flow that was illustrated in the current state map has been eliminated (Rother and Shook, 2003). As seen previously in Figure 5, the arrows between the current state and future state goes both ways. This is due to the fact that ideas regarding the future state tends to arise during the current state mapping as well (Rother and Shook, 2003). The objective in the development of the future state should be to achieve a Lean process, which according to ACT Academy (2017) has the characteristics of a continuous flow, following takt time. A continuous flow includes movement between the steps of a process without delays, but when this is not possible the other option should be to have a pull driven flow or follow the principles of first-in-first-out (FIFO) (ACT Academy, 2017).

In the development of a future state, Keyte and Locher (2004, pp. 68) states that there are seven crucial questions that needs to be answered when designing a future state for office processes:

1) What does the customer really need?
2) How often will we check our performance to customer needs?
3) Which steps create value and which steps are waste?
4) How can we flow work with fewer interruptions?
5) How do we control work between interruptions, and how will work be triggered and prioritized?
6) How will we level the workload and/or different activities?
7) What process improvements will be necessary?

Keyte and Locher (2004, pp. 69) describes how these questions are connected to the key concepts within Lean management, such as the different types of waste. ACT Academy (2017) suggests dividing steps into non-value adding, value adding and necessary but non-value adding when seeking to identify waste in the development of the future state. Necessary steps are steps that do not add any value but still are required, such as transport. Medbo (2018) describes how Lean tools such as 5S, can be used when developing improvement suggestions for the future state. In addition to that, Keyte and Locher (2004) mentions that standardized work tasks, visual controls and quality at the source are some tools that can be used to make process improvements that are necessary to achieve the future state. Many of these concepts, as well as tools to make improvements when identifying sources of waste, are described in detail in *section 2.2.2* and will thus not be dealt with explicitly in this section.

When discussing customer needs, as mentioned in question one above, Rother and Shook (2003) suggests using takt time, further described in *section 2.2.2*, as one of the measures for determining the state of the process and current working time available in relation to the need of the customers. In addition to measuring needs, Keyte and Locher (2004) mentions that the recipients of the process output should be defined as well as specifications regarding quality requirements on the output and deadlines regarding when it should be delivered. While manufacturing process often have specified the expected levels of quality, administrative processes tend to have less specified requirements regarding such (Keyte and Locher, 2004).

The future state map itself should be complemented with a plan for achieving the future state in order for it to provide a real opportunity for change of a process. In addition to the future

state map, detailed process-level maps or layouts along with a value stream plan is typically needed in terms of documentation when seeking to achieve a future state (Rother and Shook, 2003). In the value stream plan, it should be stated an exact plan for implementation with deadlines and step-by-step description, complemented with measurable goals and checkpoints with deadlines and reviewers (Rother and Shook, 2003).

Since the purpose of the thesis includes finding ways to improve the process, a future state map could be a way of identifying, communicating and visualizing such improvements. In order to develop a future state, it is crucial to collect data in terms of improvement suggestions as well as regarding problems with the coordination process from employees. In order to develop improvement suggestions, there is a need for tools, where those presented under the section concerning Lean provides an appropriate theoretical ground due to the focus on waste reduction. With VSM being a technique used within Lean, the usage of other tools from the same methodology ensures that the tools are appropriate and carries the same focus as that of VSM. In addition, a current state map is of course needed as a baseline for the improvements.

2.3.4 Value Stream Mapping in Healthcare and Offices

As described by Shou et al. (2017) VSM is one of the most common Lean tools to be used within the healthcare sector. The primary workflows where VSM is applied in healthcare are patient treatment process or administrative process, where administrative processes for instance could involve delivery of information or materials while patient flows could involve efficiency regarding the patient's way through the hospital (Shou et al., 2017). For administrative processes, the review conducted by Shou et al. (2017) found that the main benefits achieved from VSM was a reduction in employees' overtime in 41% of the cases and a reduction of customer complaints in 35% of the cases. The same review also concluded that quantitative analysis highlighted a high level of improvements regarding the service level.

When looking at administrative processes, or office processes as it is described by for instance Locher and Keyte (2004), there are some major differences between that and mapping of a production environment. For offices, the material flow will include the flow of data which can either be electronically transferred or on paper, while the information flow still includes the mechanisms that initiates the next task that occurs in production systems (Locher and Keyte, 2004). However, the structure of office processes tends to be looser and include several value streams which tends to make such processes more complex to map (Locher and Keyte, 2004). Despite the difficulties, office VSM is used by companies to for instance improve handling of paperwork and information, changing information systems and improve coordination (Locher and Keyte, 2004).

Other major differences between a VSM in a classical manufacturing process and that of a healthcare environment is that while manufacturing tends to be linear and move in the same direction, healthcare processes tend to flow in parallel or reverse directions (Larson, 2014). Challenges also arise in terms of defining who the customer is, since that could be seen as either the patient, the care provider, the payer or the community, which results in difficulties in defining value in certain parts of the VSM (Larson, 2014). In terms of identifying waste and delays, there often has to be a greater reliance on information systems within a healthcare

setting to visualize the value streams, due to the fact that there rarely are customer returns or excess inventory seen in such a system in the same way as in manufacturing (Larson, 2014).

With the coordination process taking place in a healthcare setting, but simultaneously being of an administrative kind, VSM seems to be appropriate due to its many application examples in both of those settings. With the statement by Shou et al. (2017) regarding VSM being applied to administrative processes within healthcare, the suitability of doing a VSM of the coordination process is viewed upon as high. It is however clear that there are challenges in defining customers as well as their perception of value, which requires interviews to be conducted with multiple stakeholders. Consideration also needs to be taken to the looser structured, described by Locher and Keyte (2004), which can make the coordination process complex to map. In addition, it becomes clear that information systems will likely be of high importance when seeking information as well as for finding quantitative data regarding for instance the number of surgeries in need of coordination during a year.

2.3.5 Challenges and Problems

As described by Forno et al. (2014), VSM can be an important tool, but if failing to apply it correctly, it can easily result in misinterpretations and difficulties in actually identifying the sources of waste. For instance, the authors describe how processes with little stability that are subject to change from a day-to-day basis are difficult to present in an accurate way in a current state map since the real situation will be difficult to visualize through VSM in such a case. In addition to that, inadequate data is mentioned as another source of challenges within VSM where failure in measuring data can result in inconsistencies and a false representation of how processes actually perform (Forno et al., 2014).

2.4 Conceptual Framework

In this section, the areas where the theoretical framework from this chapter can be used in the master thesis will be described through the presentation of a conceptual framework. By doing so, the objective is to explain where the theoretical models and concepts can be applied and what data is needed in order to do so. Figure 7 provides a visualization of where the different theoretical sections can be used to answer the research questions within the thesis.

From the theoretical framework, it can be established that VSM can be used as the main technique in this thesis. VSM can help answering all of the research questions to different extent, and in combination with usage of other Lean tools as well as the contextual understanding achieved from the section on healthcare organizations, the theoretical sections all contribute towards fulfilling the purpose of this thesis. By doing a VSM instead of for instance a simpler process mapping, the benefits of having a broader range of information as well as identification of value adding steps in a more thorough way can be realized. VSM has also been successfully applied in a healthcare setting as well as office environments, further motivating the selection of this technique in this case. In terms of data needed in order to use the theoretical models, this is presented in Figure 7 and described briefly below, but how the collection eventually is performed is further elaborated on in *3. Methodology*.

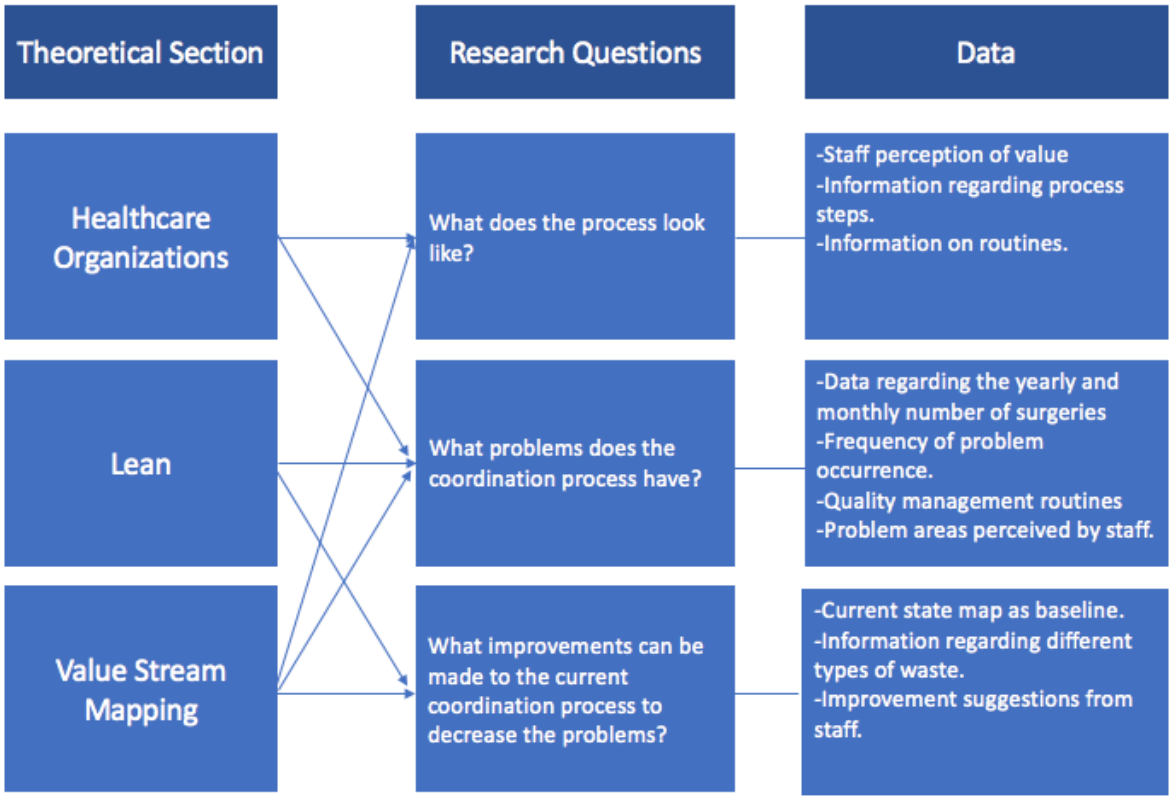

Figure 7 *- Conceptual framework describing the usage of the models and concepts introduced in the theoretical framework.*

With the first research question of the thesis being connected to understanding and documenting how the coordination process works, VSM is an appropriate technique for doing such a documentation and provide an overview of the process. As described in the section concerning organizational challenges, value definition among multiple stakeholders provides a challenge and requires interviews to be performed with several stakeholders regarding their perception of for instance value adding elements in the coordination process. In addition to interviews where information regarding the process is collected, careful observations of the coordination process also needs to be conducted. The six steps for completing a current state map, recommended by Keyte and Locher (2004), should be followed when creating the map, along with the icons commonly used within VSM. Crucial data that needs to be collected includes information regarding the process steps as well as regarding the daily work routines. The section on healthcare organizations can be used as a way of defining the stakeholders in the process, through categorization according to Glouberman and Mintzberg's (2001) model of the four worlds within healthcare.

To answer the research question regarding problems with the coordination process, the section of healthcare organizations can be used to understand potential problems relating to for instance individually developed solutions. The section regarding Lean contributes by categorizing potential wastes, which makes it crucial to collect data and information regarding routines that exists in terms of for instance quality management as well as the number of surgeries performed over the year. It is important to also collect information from staff regarding which problem areas they identify in relation to the coordination.

Through the future state map included within the VSM technique, suggestions of improvements to the coordination process will be provided, which contributes towards answering the third research question. In order to develop improvement suggestions, VSM can be combined with other tools within Lean, such as Kaizen and Visual Workspace, depending on the type of problems that are identified. Lean itself is viewed as an appropriate improvement methodology or philosophy due to its previous application in healthcare as well as the wide range of tools and techniques within Lean that can be helpful in the development of improvement suggestions. Instead of mixing tools and techniques from for instance TQM, Six Sigma and Lean, it is viewed as more structured to use one single improvement methodology by keeping a focus mainly on Lean tools.

3. Methodology

This chapter presents the research strategy that has been used during the development of the master thesis. The chapter consists of three parts: The research strategy, an explanation of the different tools used, and a discussion regarding the validity and reliability of the work.

3.1 Research Strategy

The research strategy in this master thesis was abductive and contained mainly qualitative data from interviews, observations and a workshop. Blomkvist and Hallin (2014) describes abductive as matching academic theory to a real-life observation deviation. The empirics affect the type of literature that is studied, thus the literature affects the understanding of the empirics.

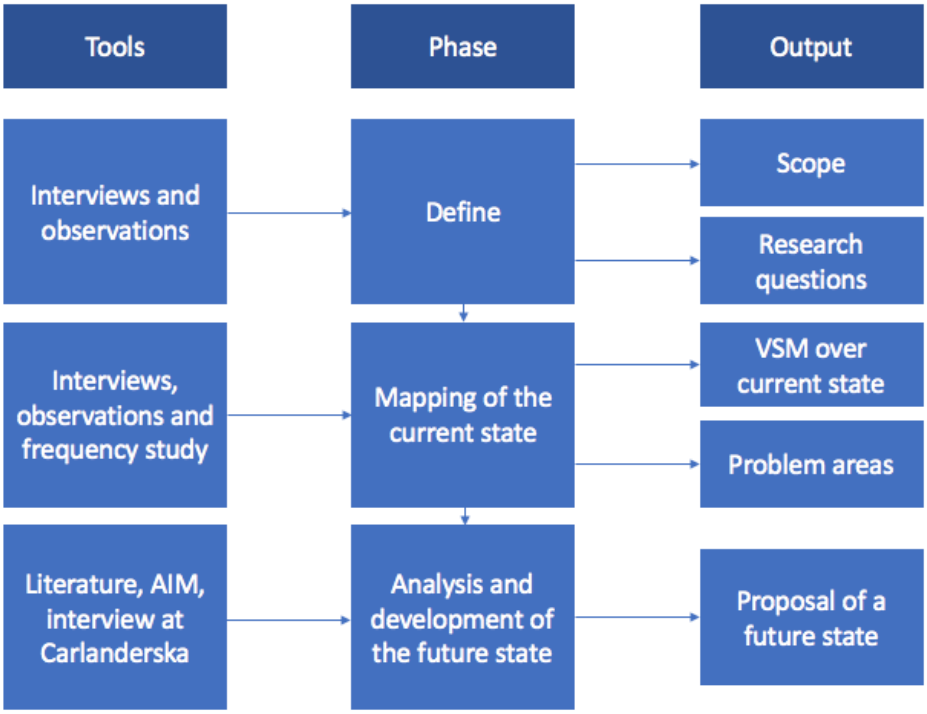

***Figure** 8 - An overview of the work process for this master thesis.*

Figure 8 presents the research strategy for this master thesis by dividing it into three phases: define, mapping of the current state, and analysis and development of the future state. The purpose of the define phase was to gain knowledge about the stakeholders by doing three semi-structured interviews with the coordinators and the care unit director, as well as doing observations in the coordinators' office to understand the work environment. By doing this, the master thesis scope and the research questions were easier to establish and not only based on intuition.

When the research questions and scope had been established, the next step was to map the process of the surgery administrative process in detail. Interviews, observations and frequency studies were the main methods of use to collect data for the creation of a VSM.

The output of the final phase, the analysis and development of the future state, was a value stream map of a potential future state. A future state map is a way to develop a common vision of how a service line should operate and how a process can be redefined to fulfil its purpose (Keyte and Locher, 2004). In the design of a future state map, a review of the current state map, along with reflections from the analysis were used along with a set of questions regarding an intended future state. These questions concerned Lean concepts such as waste, flow, pull, levelling, and management timeframe or pitch and examples of questions are "Which steps generates value and which creates waste" and "How will interruptions in the work flow be controlled?" (Keyte and Locher, 2004). The outcome was a proposal of a future state along with solution to many stated problem areas. The improvement suggestions were partly developed through interviews, an AIM workshop and with inspiration from the literature. The literature played a key role in addressing the problem areas that were identified in the current state map and description.

3.2 Elaboration on Used Tools

In this section, the different tools used for data collection during the master thesis are presented. The purpose is to answer why each tool was chosen and what, when and how it was used.

3.2.1 Literature Review

As part of the aim of this thesis was to provide an academic perspective to the organizational issue at SU, the main focus of the literature review was to find tools and theories that had the potential to address the problem areas in the coordination process. The literature was also used to develop the framework for the research strategy and provided assistance during the different phases of the work. Literature was also used to discuss the validity and reliability of the report.

Electronic databases at Chalmers University of Technology and Google Scholar were used to find literature. Key words relevant to the scope of the master thesis such as value-stream mapping, process flow mapping, Total Quality Management, healthcare improvement, Lean healthcare and healthcare coordination management were used. The literature came mainly from academic books and articles from various publishers. Only literature from credible and quality ensured sources was used which guarantees reliability according to Blomkvist and Hallin (2014). To ensure this, the literature was reviewed by the following criteria: authenticity, vicinity and representativeness, for example by looking at the publishers' specifications for an article to be published and the number of citations. Furthermore, since the literature review contains theory relevant for the purpose of the master thesis, it can be considered to be valid (Blomkvist and Hallin, 2014). In chapter *2. Theoretical Framework* three literature sections were presented: Healthcare organizations, Lean and VSM. This literature has been chosen to support and solve the research questions and was discussed and motivated further in the last part of that chapter, *2.4 Conceptual Framework*.

3.2.2 Observations

Observation is a technique that is used to identify and record behaviour (Bryman and Bell, 2015). Specifically, the type of observations made in the define phase were unstructured,

meaning that the aim was to gather as much details as possible on the behaviour of the coordinators. A strength with observations is that it can capture details that are usually forgotten to be mentioned in an interview. An explanation of this is that some details seem so obvious that people becomes unaware of them, but they are still crucial to identify since they have an impact on the situation (Bergman and Klefsjö, 2010).

The purpose of the observations was to gain a deeper understanding of the situation in the coordination process and not only rely on the spoken words of the coordinators. Observations included to understand and learn the work process that the coordinators are doing, identify problem areas and ask unstructured questions to make clarifications about the work as well as understand the medical treatments given.

The observations were conducted during two to three days per week for a five-week period in the office of the coordinators. The master thesis members sat there for whole days and took notes each time a disturbance occurred as well studied the details of the coordination process as a part of the VSM. These observations gave much data which later lead to the creation of Appendix A, which was used to complement the initial data collection. Moreover, questions were asked about the work they were doing and what they experienced to be a problem. The notes were later transferred and summarized to one document and categorized into different problem areas presented in *4. Current state* together with findings from interviews and the affinity-interrelationship method. In addition to the observations of the coordinators' daily work tasks, observations were conducted at an SVF-coordinator's office during two days in order to gain deeper understanding of the full treatment of breast cancer and the terminology used for different types of diagnoses and studies.

3.2.3 Semi-structured Interviews

A semi-structured interview has a set of specific questions asked by the interviewer, but with possibility to elaborate on interesting things that might come up during the interview (Bryman and Bell, 2015). The purpose of the semi-structured interviews was to collect data on the process to be able to map the current state as accurate as possible as well as understand the issues that the coordinators were facing. In order to gain insights regarding the coordination process from different perspectives, the objective was to interview several different stakeholders connected to the process, listed in Table 2. The list was developed in cooperation with the care unit director, who possess detailed knowledge regarding the staffing situation and their daily tasks.

Before each interview the purpose of the master thesis and the interview was given to assist the interviewee in understanding the objective of the interview. A semi-structured interview form was constructed prior to all interviews.

The interviews were conducted by both group members with one being the interviewer and the other group member taking notes. The notes were taken on a computer and the focus of the note-taking was on writing down the non-confidential parts of the respondents answers as exact as possible in order to avoid distorting respondents' answers and by doing so introduce errors in those (Bryman and Bell, 2015). No recording of the answers was done due to patient confidentiality.

After each interview, all the notes taken were summarized to gain a clear overview and make it easier to go back to the data when analysing it. The interview data was also anonymized and after each interview the group reviewed the answers to see if improvements could be made to the interview questions or process.

Table 2 *– Number of conducted interviews and roles of interviewees.*

Person	Role	Date of interview	Duration of interview
A	Surgery Coordinator I	13/02/18	1 hour
B	Surgery Coordinator II	13/02/18	1 hour
C	Care Unit Director	16/02/18	1 hour
D	Head of Surgery	15/03/18	1,5 hours
E	SVF Coordinator	16/02/18	2 hours
F	Surgeon	16/03/18	1 hour
G	Substitute Surgery Coordinator	12/03/18	0,5 hour
H	Specialist nurse responsible for cooperation with Carlanderska	16/03/18	0,5 hour
I	Medical Secretary I	19/03/18	1 hour
J	Medical Secretary II	19/03/18	0,5 hour
K	Coordinator at Carlanderska I	21/03/18	1 hour
L	Coordinator at Carlanderska II	21/03/18	0,5 hour
M	Surgery coordinator for Endocrine patients	02/04/18	1 hour

3.2.4 Affinity-Interrelationship Method

The affinity-interrelationship method (AIM) is a method used to identify problems on a high level and is based on two management tools: the affinity diagram and the interrelationship diagram (Alänge, 2009). Alänge (2009) describes AIM as an appropriate tool to receive quality of qualitative data by applying a step-by-step approach to categorize the existing problems.

The purpose of AIM was to define problem areas together with the coordinators. It was conducted at the surgery department with both coordinators and the care unit director, with one of the group members of the master thesis as a participant and the other as a moderator of the session. Therefore, the AIM session captured perspectives from several stakeholders and the purpose with this was to guarantee that as many issues as possible were brought up and none were missed.

It took two hours to finish the AIM session and follow the ten steps given by Alänge (2009). Step one is to ask the group a question to answer. The question asked was ‘What issues do you have related to the coordination process work today?”. The following steps, in short, included to do an individual brainstorming on post-it’s for each issue the person comes up

with, and then later to discuss and categorize all the post-it's into bigger problem areas. This data is presented in *4. Current state*.

3.2.5 Frequency Study

The purpose of the frequency study was to gather quantitative data that could be used in the VSM as well as strengthen some of the claims given from interviews. The data was collected through a data collection sheet, Appendix A, where the coordinators made a mark each time a disturbance issue occurred in a category. There was also a data sheet for some of the metrics that was needed in the VSM, for example the number of journals created, the number of patients registered each day and week et cetera. Establishing metrics in the VSM was important to ensure that things can be measured and used as a point of comparison in the future to see if an edit in the value stream is resulting in any improvements. Some of the data was shared by the central logistics office at Sahlgrenska and from the coordinators directly.

3.2.6 Interviews at Carlanderska

During the interviews with the coordinators, it was discovered that some of the breast cancer patients are directed to a private hospital named Carlanderska for surgery. Apparently Carlanderska is using an IT system called Orbit which SU is about to implement as well. Since Carlanderska had already made this implementation it was of interest to learn about their implementation and use of the IT system and how they work with coordination of patients. Therefore, an interview with the surgery coordinators at Carlanderska was scheduled and conducted.

3.3 Methodology Discussion

The purpose of this section is to describe the efforts done during this master thesis to make the research transparent and increase the replicability. The goal is to provide transparency in some of the weaknesses in the selected strategy and the tools used.

The strength of qualitative research is that it seeks to understand why something is happening, (Denzin and Lincoln, 2000), useful when data are not in the form of numbers (Punch, 2005) and theory needs to be created (Bryman and Bell, 2015). However, common critiques against qualitative research is that it is subjective, difficult to replicate, hard to generalize due to the specific nature of the scope and lack transparency in how the research was done (Bryman and Bell, 2015).

To increase the trustworthiness of the master thesis, these issues have been taken in to account. To avoid subjectivity, the group members have tried to interview staff from several different roles and relationship to the coordination process. By doing so, data can either be confirmed or disregarded by others if proven to be inaccurate. As an example of trying to establish objectivity, the group members asked the coordinators to measure each time an issue occurred to get a number that indicate the frequency of how often an issue appears. This also provides an opportunity for comparison in the future so improvements can be made and avoid a feeling that 'something is annoying' to be the only point of data for an issue. A third action taken to avoid subjectivity was too use different methods to collect data: interviews, observations, frequency studies and AIM. Data detected in all of the methods was confirmed

to be of high reliability, while data that could only be found in one or two would be questioned and sometimes disregarded by the group members due to lack of significant evidence of being a real issue and hard to quantify.

Regarding the generalization, it can be partly correct that this specific research context is difficult to transfer to a general knowledge that can be used in other industries. However, considering the size of the healthcare industry in Sweden both locally and nationally, it can still be considered to be applicable and used within this industry since a lot of public healthcare organizations are built in a similar structure. Locally, the care unit director has already confirmed the identified problem areas to exist in other departments at SU as well.

Finally, validity refers to relevance and for a research to be valid (Harboe, 2013). Validity is created by having a relevant literature review and have a research strategy that contributes to increase the validity. The chosen research strategy in this master thesis does this by having empirics that affect the literature, thus the literature affecting the analysis of the empirics as well as helping to set a final scope of the research questions. The interview questions created were thoroughly compared to the research questions to ensure that data would help in answering the research questions.

Reliability refers to data trustworthiness (Harboe, 2013). As explained, to avoid subjectivity several actions were taken. Furthermore, all data was questioned by the group members before adding it to the analysis and if uncertainties came up, clarifications from the staff was requested. If the clarifications did not satisfy the group members doubts, the data was disregarded. Furthermore, quantitative data collection was made to ensure that the thesis was not only driven by qualitative data, but with quantitative data as well as input to the analysis and recommendations.

4. Current State

This chapter consists of four sections. Firstly, there will be a contextual description of the coordinators' work tasks, the inputs, outputs and objectives of the process. Secondly, the current state map produced in the VSM will be presented along with detailed descriptions of each step of the coordination process. Thirdly, there will be a problem description of the challenges that the current state is faced with. Finally, the last part contains a description of the coordination process at the private hospital Carlanderska and the implementation of the IT system Orbit that recently was performed there. The findings presented are based on conducted interviews as well as observations.

4.1 Context and Objectives of the Coordination Process

This section of the chapter aims at providing an understanding of what the coordinators' primary work tasks are and the context in which they work in. In addition to that, inputs and outputs to the coordination process will be defined in order to provide a specification of what the process needs to achieve.

Currently, there are two people working with the coordination of breast cancer surgeries. One of them is working full time and the other is working half time. They are also responsible for coordinating surgeries of malign melanoma patients as well as perfusion patients, but since that is outside the scope of this master thesis, tasks regarding that type of planning will not be described further. Their office is located in the hallway at the surgery department, closely to the reception room hallway where surgeons meet patients that will be signed up for surgery.

Breast cancer surgery is the most common type of cancer surgery at Sahlgrenska, with a high number of patients being diagnosed each year. Figure 9 shows that 890 breast cancer surgeries were performed at SU during 2017. The monthly number remains at a level of minimum approximately 70 surgeries, with the exception of December where only 54 surgeries were performed. Peaks in the numbers occurred in May with 89 surgeries and August with 88 surgeries.

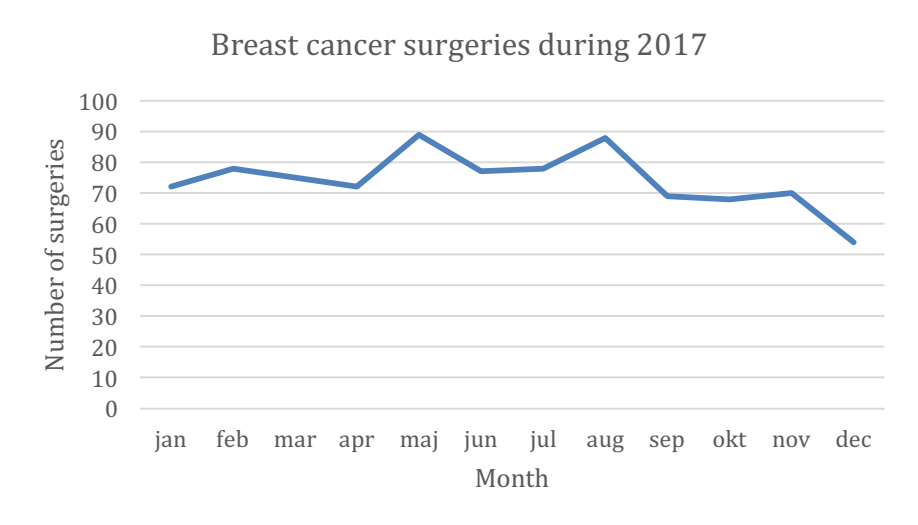

Figure 9 *– Number of breast cancer surgeries during a year.*

The daily number of surgeries that needs to be coordinated varies depending on the availability of operating rooms as well as the time required to perform each surgery. When one operating room is available between two and three surgeries are typically performed in each room during the day. These numbers are viewed upon as important input to the process since it equals the amount of surgeries that the coordinators need to be able to handle when planning the weekly schedules, in other words the capacity of how many surgeries that can be performed each week. The input that then initiates the process of coordination will be the surgery registration form, which states the type of breast cancer surgery that will be performed, and thus needs to be coordinated. This form is submitted by the surgeon that has given the patient notice regarding his or her condition, and the date on this registration form becomes the time where a surgery is put up on a waiting list by the coordinators. The registration form consequently becomes the first product in focus for the VSM, since the submission of this form initiates the process and is present through the administration process, where it is complemented and put into a journal, all the way to the operating room where the journal is put when the surgery eventually is to be performed. The input described above is representative for the majority of cases.

Sometimes a tumour is identified to be acute and needs to be operated immediately to avoid a fatal outcome for the patient. In these cases, the patient instead becomes registered over a phone call from the SVF-coordinator responsible for register all breast cancer patients. The SVF-coordinator making the call to the coordinators does this to reduce the lead time to surgery instead of going through a surgeon on a patient notice meeting which can take additional weeks. SVF is a standardized way to treat patients in an early stage of their cancer diagnosis and contains a time limit of how long it should take from the cancer being detected to the first surgery being scheduled and finished. Each cancer diagnosis has its own SVF and the time it should take for breast cancer is 28 days. Appendix F shows the SVF for breast cancer. The master thesis does not take these patients in to consideration since they constitute a small number of the total volume of breast cancer surgeries.

With regard to output of the coordination process, this can be divided into three different parts: (1) a journal used before, during and after the surgery, (2) a detailed daily schedule and (3) an invitation letter. The coordinators compile the journal when they gather information that will be used in the surgery and during sign-in as well as by administrative personnel that registers costs. It contains responses from different medical consultants, journal notes, medical lists and other information that varies depending on the type of breast cancer surgery that is performed. The daily schedule is the set schedule for surgeries during one particular day. That schedule contains detailed descriptions of each surgery and allocated time slots for tests and sign in procedures. This schedule is used by the surgery department and the one that is sent away from the coordinators at the end of the coordinating process, along with the journals that belong with the surgeries listed in the daily schedule. The invitation letter contains the information about when and where the surgery will take place as well as information regarding how the patient should prepare and is sent out daily.

The output is used by the surgeons and nurses. The surgeons read the medical information as preparation for a surgery while the nurses use it for control and to check that everything is there. The requirements on the output are the same for both professions, that the journal has

all the relevant medical and research information attached so the surgery can start immediately.

4.2 Current State Map and Description

In this section, a current state map is presented. This map will be followed by a detailed description of each step. In VSM, the current state map is an essential part for providing a baseline and mutual understanding of the current process. This baseline then serves as a starting point for identifying problems with the current state, and then present potential improvements to the process through a future state map and description of such. There is currently a lack of overview of how the coordination process actually is performed. Much of the knowledge regarding each step of the process has become dependent of individual knowledge, making coordination person dependent and vulnerable if anyone among the coordinators cannot perform the work tasks as planned. Thus, a visualization of the current state of coordination process also serves an important part in creating an understanding of how the process works for the surgery department.

The mapping and description will start at the multidisciplinary conference where a suggestion of surgical treatment is agreed upon and be concluded at the point where the journal is delivered to the cashier desk by the medical secretaries. The current state is illustrated in Figure 10. As seen in the figure, some of the steps are marked with a number, which indicates where in the process this can be found. Each of these steps are described in detail below.

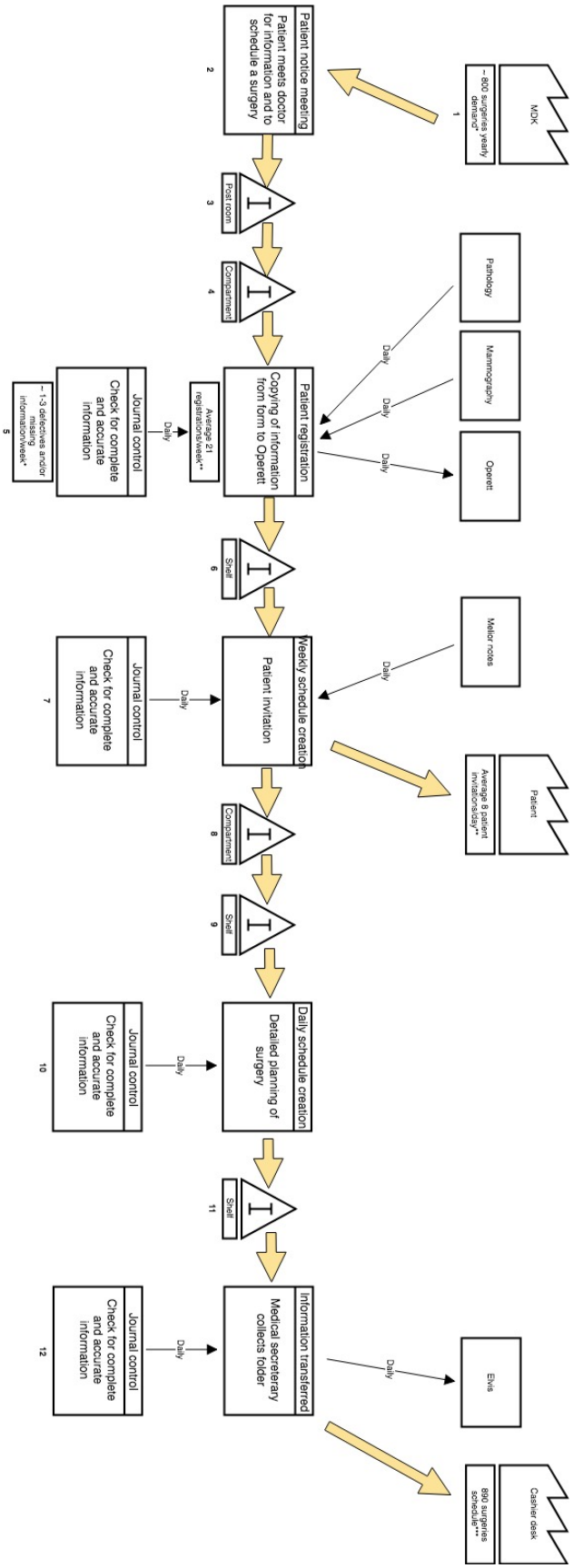

Figure 10 *– The current state map of the coordination process.*

**Based on interviews ** Measured from the frequency study, see Appendix A. ***Based on statistics given from the central logistics office at SU.*

1. MDK – Multidisciplinary conference
During the conference a cross-functional team consisting of a varying number of surgeons, a SVF coordinator, contact nurses, pathologists/cytologist, radiologist and oncologists meet to discuss patients that have been diagnosed with different stages and types of breast cancer. This is the point where it is decided if a patient will need a surgical treatment and/or other type of treatments such as cytotoxic or radiation therapy. If surgery is the case, it will be discussed which kind of procedure that the conference agree upon is the most appropriate. For instance, it is decided if a mastectomy is needed or if breast-conserving is appropriate and if the patient need sentinel lymph node biopsy or axillary lymph node dissection. The decision is made based upon the different test results and x-rays. This conference takes place on Tuesdays and Thursdays. For patients that will have surgery, a patient notice meeting is set up. In cases where surgery is not chosen as a treatment method, the patients exit the process after the MDK process step and is taken over by another department at the hospital or declared free of disease.

2. Patient notice meeting
A surgeon and a nurse meet with the patient to give notice regarding that a surgery will be necessary in order to treat the breast cancer. The recommendations that were developed during the Multidisciplinary conference are presented to the patient. Together with the patient, the surgeon develops a decision regarding the type of surgery that will be performed. During this meeting, a surgery registration form is filled in, which states the type of surgery that is agreed upon. This form can be seen in Appendix B. In the form, a preliminary week for surgery is stated, which is also written on another preliminary schedule for the week, that is kept in connection to the meeting rooms. This schedule can be seen in Appendix C. The registration of the patient in this surgery form is the input for the coordinators.

3. Registration form submitted to post room
When completed, the registration form is submitted to a compartment in the post room by the surgeon or the nurse attending the patient notice meeting.

4. Registration form put in compartment in the coordinators' office
The coordinators empty the compartment in the post room daily and takes the submitted registration forms to their office. In the office, the forms are put in a compartment next to the door.

5. Registration form information transferred into Operett
The form is collected from the compartment and the information needed to register the surgery is transferred into an IT system named Operett. A preliminary date during the previously agreed upon week for the surgery is set as well as a date from which the patient entered the waiting list for surgery. The waiting list date is primarily used to follow the SVF, while the preliminary surgery date is used by the coordinators to gain an overview of a potential schedule. While doing the registration it is also noted what kind of special needs a patient might have, such as a need for an interpreter, check-ups the day before surgery et cetera. In this step, the first check and complementation towards a complete journal is initiated. The registration form is complemented with medical information, such as mammography results and pathology answers. Thus, the information folder that is created by adding this information is henceforth referred to as the journal.

There are cases when there is information missing from for example pathology which triggers a journal control throughout the coordination process. As can be seen in the current state map, this process step is occurring three times for some of the journals before the journal is picked up by the medical secretary. Beside checking if the information is available and attached to the journal, the coordinators also check if the information is accurate.

Figure 11 and 12 shows the number of surgeries that are registered each day during the time period January 1 to March 23, 2018 and summarize each week. As can be seen in Figure 11, the number of surgeries registered per day varies a lot from day to day. An extreme is both day six and day 31 where twelve respectively thirteen registrations were made, hence creating more work for the surgery coordinators these days compared to other days. The number of surgeries registered per week is a bit more stable but still with variation from week to week.

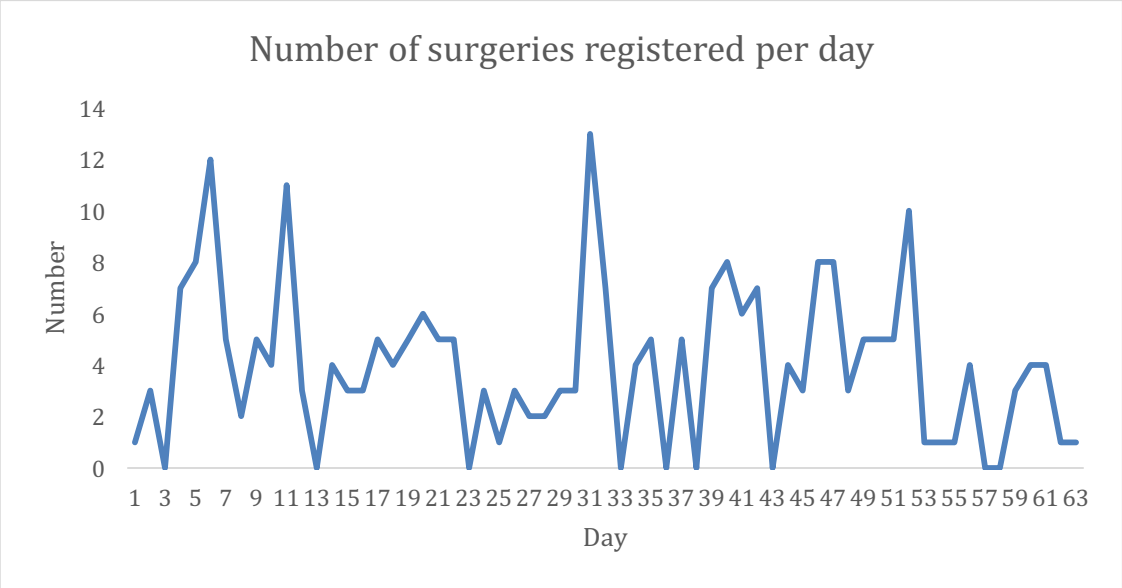

Figure 11 *– The number of surgeries registered per day between January to March 2018.*

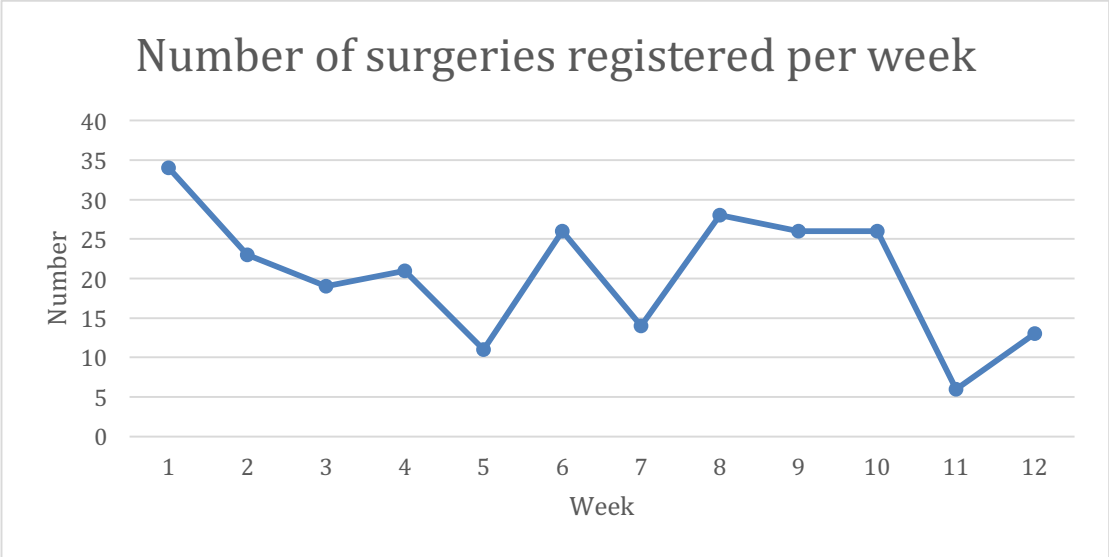

Figure 12 *– The number of surgeries registered per week between January to March 2018.*

6. Journal put in a plastic folder
After the information has been transferred and the registration form complemented with additional information, the journal is put in a plastic folder that is marked with the preliminary week of surgery. These folders are placed on a shelf sorted in chronological order.

7. Creation of a preliminary weekly planning
Approximately one week before preliminary week of surgery a weekly plan is decided upon. The folder marked with that week's number is collected from the shelf and the journals in that folder are each matched with a set date in the schedule for surgery for that week. The schedule currently used is based on the number of available operating rooms and can be seen in Appendix D. The schedule, which is written by hand, contains each patient's name as well as personal identity number. However, not all available operating rooms are filled during the preliminary weekly planning. Since the process needs to be able to handle acute breast cancer patients and re-surgeries some capacity is saved as a buffer. This spare capacity is later filled during the detailed planning of each day if it has not been filled before by the mentioned cases.

When the date is set, an invitation is sent to each patient. This invitation contains information regarding time for sign-in, usually occurring the day before surgery, medical appointments after sign-in, as well as instructions about showering and eating before surgery. The invitation is further sometimes complemented with attachments containing detailed information about for instance patients that are taking heart medicine or has diabetes. The invitation is put in the mail immediately after it has been printed and put in an envelope. However, in cases when a patient is planned for a surgery on short notice, the information in the letter will not reach the patient in time. Instead the patient gets a phone call or is alerted at the patient notice meeting immediately from the coordinators with all the crucial information needed. Table 3 shows the number of invitations sent to patients over a week, as well as how many in each category. The majority of the patient invitations are from letters and these are usually produced during the first days of the week. During the end of the week there can be an increase in the number of short notice invitations. This usually occurs when the surgery coordinators did not successfully fill the schedule for the upcoming week and last-minute alterations has to be done.

Table 3 *– Number of different invitations to patients distributed over a week.*

Sending of invitation to patient	Monday	Tuesday	Wednesday	Thursday	Friday	Total
Letter	9	10	6	6	1	**32**
Telephone (short notice)	0	4	0	1	0	**5**
KM (short notice)	0	0	0	2	1	**3**
Total	**9**	**14**	**6**	**9**	**2**	**40**

When the invitation has been sent, this is noted in a calendar, referred to as a time book, that the coordinators keep on their desk. In the time book, the patient's name and social security number is noted once again along with a number stating the number of days remaining until the surgery from the date when the invitation has been sent. The patient invitation can be seen in Appendix E. At this point the journal is checked again for errors, as well as complemented

with information such as Melior notes if these have arrived, referenced as journal control in the current state map.

8. Journal put in compartment between desks
After the invitation has been sent, the journal is put in a compartment that is located between the coordinators' desks.

9. Journals relocated
As the week of surgery approaches, the journals are moved to another compartment on a shelf. They are not moved until the compartment is becoming less full. The decision is based upon how far ahead in the planning the coordinators currently are. In the compartment, the journals are sorted in chronological order based on the date of surgery. They are kept there until approximately two days before the surgery.

10. Detailed planning of daily schedule
Two days before the surgery, a daily schedule is produced. Since the date has been set already when doing the preliminary weekly planning, the major steps mainly include moving of the patients to specific time slots in Operett and assigning an exact operating room for the surgery.

Considerations that are taken during the assigning of an operating room includes what type of equipment that is needed for the surgery depending on the type of treatment, if research will be conducted so special considerations has to be taken and for certain time slots the patient needs to be able to leave the hospital quite shortly after the surgery. Furthermore, the time it takes to finish the surgery is dependent on the surgeon. It can be a problem if a surgeon takes longer time to perform the surgery and occupy the operating room longer than necessary and thus hinder new surgeries to be conducted. Other considerations, as examples, could be that a patient should be sent home the same day and then is assigned a time slot in the morning, so the surgery will finish in time for recovery to be possible before going home.

When the schedule for the day is set and printed it is put in the front of a folder together with all the journals for the patients that are scheduled for surgery during that day. Simultaneously, different lab tests as well as time slots for indication and sentinel node are assigned if applicable. Time slots for sign-in are also checked and registered in an Excel sheet.

In this planning, each journal is checked again to ensure that the information is complete and consistent, regarding for instance which breast that the surgery will be performed on. Even though the surgery is two days away, a majority of the patient will arrive for their sign-in the day after this step has been completed.

11. Daily schedule and journals put on shelf in folder
When the schedule for the day has been finalized, all of the journals and the schedule are collected in one folder. A rubber band is put around this folder to show that it has been finalized and is ready to be collected. Later, one of the medical secretaries will come and collect the folder from the coordinators' office.

12. Information added to journals and transferred to IT systems
After collecting the folder containing the daily schedule and the journals, the medical secretary adds additional information to each journal. Information added is, if needed, an anaesthesiology journal, letter of referral for blood tests of different kinds, name tags and marked bracelets for the patient, as well as a cancer registration form. In addition to this, the information is transferred to IT systems. The patient is registered in the IT system Elvis under the right category for cost and payment determination. A re-visit is scheduled for when the patient should return for a check-up after surgery. During all of this, the medical secretary marks that the information has been added and transferred on the surgery schedule to ensure that all of these steps have been performed.

When the journals are complete, and everything registered, the journals are carried back down to the cashier desk at the reception where it will be kept until it will be used before a surgery.

4.3 Problem Areas

With the current state map aiming at providing an overview of how the coordination process should work, there are also several different factors that have come to make the process work differently from what the current state suggests. To understand these issues and identify potential problems in the coordination process, this section will elaborate on the many challenges that the current state is facing. These challenges can be sorted into three problem areas: **internal disturbances**, **external disturbances** and **uncertainties**. To gain an overview of the areas and the subgroups belong to each, these have been illustrated in Figure 13. Each problem area and its subgroups will be described in detail below.

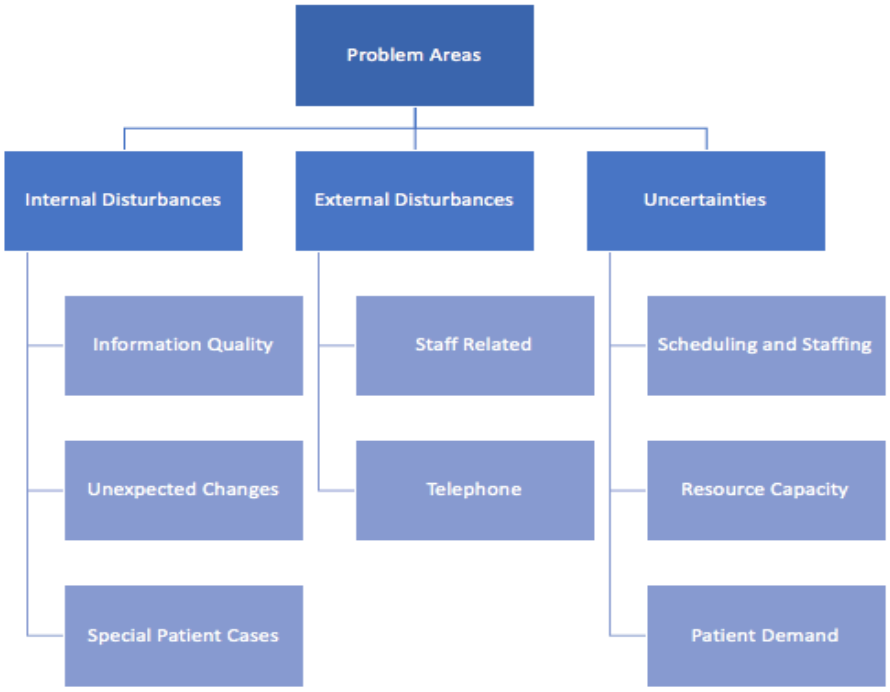

Figure 13 *– Identified problem areas for the coordination process along with subgroups within each area.*

4.3.1 Internal Disturbances

Internal disturbances refer to the problems arising in the coordination process itself and hinders the steps described in the current state. The internal disturbances have been divided into the subgroups: **information quality, unexpected changes** and **special patient cases**.

Information Quality

A large share of the time spent on coordinating the surgeries is dedicated to different types of quality controls regarding information, both in terms of making sure that it is accurate, as well as complementing missing information. This is primarily done by controlling the papers in the journal towards each other as well as towards material in IT systems. In the current state map, this activity is marked as journal control and is performed during multiple steps in the current process. In terms of accuracy, a potential source of errors is that the wrong side is described in different documents regarding which breast the surgery should be performed on. This information is thus both double and triple checked by the coordinators. It is also verified that the same surgeon is assigned to perform the surgery in both the papers in the journal as well as the IT system, which is not always accurate.

With regard to the case of missing information, such problems can arise at different stages of the current process depending on the type of information. When transferring the registration form, it can be discovered that a patient is not fully investigated. This means that not all tests and consultancy sessions have been completed, and thus a surgery cannot be scheduled and coordinated immediately if a time slot opens up. The instructions for the surgeons is that no patients should be registered for surgery unless they have been fully investigated, but this still occurs on occasion. A reason mentioned behind this way of registering surgeries is that for time periods when the waiting times are longer, around eight to nine weeks compared to the normal two to four weeks, it was a way of ensuring that time consuming tests do not put a patient to far down the waiting list. Other types of information that can be missing are test results, journal notes that have not yet been transferred into IT systems, incomplete medical lists or information from patients regarding their personal health.

When information is missing, the coordinators note that on a check-list attached to the journal and then controls information that currently is in the journal and verifies that it is accurate, but then perform another control of the journal when the date of surgery is approaching. In case information is either missing or inaccurate, the coordinators search through IT systems as well as make calls to collect the missing information. This is a time-consuming work task and an obstacle when doing both preliminary weekly schedules and daily schedules since inaccurate or missing information potentially will hinder the surgery and potentially force rescheduling. Despite doing frequent controls of the journals, there is currently no routine for following up how inaccuracies were caused and why information was missing, so there is no quantitative estimation of how often this occurs.

Lastly, apart from controlling the information, there are issues regarding the information accessibility and the IT systems in use. Currently, seven different IT systems are used in the coordination process. Several of the systems are not integrated with each other, so when documents are transferred between systems they are printed from one system and then

scanned and added to another. This process is quite time consuming. Simultaneously, not all staff members have access to the same systems, which makes this process necessary at the current state. For instance, it will be difficult to verify and collect information from the systems at the time of surgery, which is used as motivation for adding all the information that might be needed to the journal during the coordination process. Additionally, access to the weekly schedules for surgery have been partly limited to the coordinators since it is only available in full in paper format, as seen in Appendix D. This is also the case for a lot of the documentation since the journals that have been complemented with information are in paper format as well. Thus, the complete journal is only accessible in its paper form, and not through a single IT system. The information is however accessible through the different systems, but not for all of the staff and accessing it is, as mentioned earlier, time consuming.

Unexpected Changes

The coordination process is often faced with unexpected changes that makes it necessary to do alterations in the produced schedules or perform controls of such. Some of these unexpected changes are necessary, which primarily concerns surgeries that has to be scheduled with short notice due to the severity of the breast cancer diagnosis. To be able to handle that type of short notice surgeries, it is necessary to leave empty slots in the preliminary weekly schedule, but it should be noted that this is not seen as a problem since it is a necessity from a medical perspective. Late cancellations of a surgery can also be a type of necessary change since sudden illness or medications that have not been mentioned earlier by the patient could make anaesthetization impossible. However, the possibility to make unexpected changes has resulted in the occurrence of doing so in other ways as well.

Currently, the coordinators make an attempt to assign the surgeon who have met the patient to his or her surgery. This cannot always be achieved and is largely dependent on if that surgeon is doing surgeries during the week when the patient preliminary will have his or her surgery. However, the attempt of achieving this is challenged due to late changes in the surgeons' schedule. When this has occurred previously, the coordinators have been notified via email, but this is no longer the case. Since there is no notification, the coordinators now control that the surgeon that will perform the surgery is the same as the one noted in the invitation that is sent to the patient. It should also be noted that change of surgeon can occur due to the surgeon becoming ill, but this seldom results in cancellation of the surgery but notification of this change to the patient is still necessary.

The number of available operating rooms can change unexpectedly. There is a long-term planning, further discussed in the section regarding uncertainties, but short-term changes created additional issues for the coordinators. For instance, during the beginning of spring an operating room was added but then removed again shortly afterwards. There were also discussions regarding usage of external operating rooms at a second private actor, apart from the current operating rooms at Carlanderska, but those plans were eventually also discarded.

Special Patient Cases

While the general trends within surgery speaks for a movement towards standardized procedures, breast cancer surgeries have instead become more specialized with a wide range of treatment options and possibilities to adjust the surgery for each individual. Even though it is difficult to determine if this is necessary and if the coordination process should be able to handle this situation on a long-time horizon, the consequence has been that there are many

special patient cases with certain details that are taken into consideration when coordinating the surgery. These special cases concern direct reconstruction patients, study patients and patients with particular requests. While factors such as medical condition are clearly needed to take into consideration, these factors and their level of importance are more difficult to determine and are thus brought up in this section.

Direct reconstruction is a type of breast cancer surgery where an implant is used to immediately replace the loss of breast at the same time as a mastectomy is performed. Currently, space is allocated specifically for this type of surgery in the schedule. Reasons mentioned for this allocation is that coordination with the plastic surgery department is necessary since a plastic surgeon needs to be present at the time of surgery, and that an operation room for direct reconstruction is only available on Thursdays. Consequently, the allocated space in the schedule is kept available until approximately one week before when the weekly schedule is determined in more detail. In case there are no direct reconstructions, the time slot will then be allocated to another surgery.

Study patients are patients that are participating in certain types of studies currently performed at the surgery department. For these studies, there are limitations to which surgeon that can perform the surgery, which operating room that can be used, and during what time of the day. Currently, there are four studies that affect how the participants can be scheduled: SentiNot, SentiDose, Senomac and the MALT-study. While some surgeons take their own work schedule into consideration when recommending patients to participate in studies since it affects the possible time slots when a surgery can be scheduled, others do not do that. It also occurs that participants in studies change their mind about participating after a surgery has been scheduled, which potentially results in changes of operating room and surgeon, but in general no changes are made regarding the date of surgery.

In terms of particular requests from patients, these primarily concerns either requests regarding not having surgery during certain dates or requesting being called with short notice if a time slot opens up. Quite frequently, patients request not to have surgery during certain weeks due to their work hours, vacation or other personal reasons. If this information is not known when coordinating the surgery, cancellation and rearrangement of the schedule can become necessary if the patient reaches out and requires a change. For short notice requests, it means that the patient has agreed to be called in on short notice if a time slot opens up in the schedule. This is stated by a notice on the registration form and is done if for instance there are late cancellations or if empty slots for direct reconstruction is not filled the week before. However, coordinating short notice surgeries is challenging for the coordinators. Since the invitation containing date and time for surgery will not be able to reach the patient with mail the patient needs to be contacted by telephone. Not all patients will agree to come in on short notice, despite agreeing to it earlier, since it is common that they have changed their mind and focused on the preliminary date set at the notice meeting with the surgeon instead. There can also be obstacles in terms of missing information regarding the patient or medical needs, such as preoperative cytostatic or blood thinning medication, that makes a patient inappropriate to schedule on short notice, despite the patient having agreed to being called on short notice. If a patient agrees to be scheduled with short notice, all the information concerning the surgery will be given via telephone, which sometimes results in misunderstandings and make additional phone calls necessary to clarify the information.

4.3.2 External Disturbances

External disturbances relate to the many interruptions and issues that hinders the coordinators in their daily work and have been divided into two subgroups: **Staff related disturbances** and **telephone disturbances.** The external disturbances are not primarily related to the process of coordinating the surgeries itself, but rather concerns the general work environment and the consequences this cause on how the tasks are performed. Examples of these issues are that one loses focus which takes a long time to regain or that confusion occurs so the work that was done before the interruption is forgotten and a new task is started. Table 4 shows the frequency of common disturbances which are elaborated on below. The largest disturbance factor is questions that the staff has regarding the surgery planning, followed by 'other' questions. Other questions can for example be questions about patient information such as address or phone number. The number of disturbances each day differ a lot from only eight on Friday up to over 30 on Wednesday and Thursday. And as Table 4 shows, during this week Monday, Wednesday and Thursday can be considered to be days when it is very stressful to work with coordination tasks due to the constant flow of interruptions. However, many of the questions regarding the surgery coordination are usually necessary to ask but should be asked during a time span instead of interrupting during the day.

Table 4 *– Collected data over disturbances during a week.*

What?	Monday	Tuesday	Wednesday	Thursday	Friday	Total
Staff have a question regarding the surgery planning	9	9	7	16	4	**45**
Staff have an 'other' question	3	5	9	5	2	**24**
Telephone disturbance from staff/other functions at the hospital	1	0	7	3	1	**12**
Telephone call within the time slots	5	0	8	1	0	**14**
Telephone disturbance patients outside the time slots	0	0	1	0	1	**2**
Need to ask staff due to lack of information	3	0	0	8	0	**11**
Total	**21**	**14**	**32**	**33**	**8**	**108**

Staff Related Disturbances

The most common staff related disturbances are connected to questions that the staff have regarding a patient or the schedule. Questions regarding the patient are usually about the diagnosis, address or other pieces of information that the staff wants to know. Another issue occurs during the patient notice meeting. When the surgeons are supposed to register the patient on the registration form, sometimes the surgeon or a nurse instead walk to the coordinators office and ask directly for the availability to schedule the patient on another day not given on the registration form. In the majority of these cases, this is not helpful and only interrupts the coordinators since the availability of surgeries are the ones given out and are up on the preliminary schedule available for the surgeons. However, this schedule can be difficult to interpret for the surgeons and is not always updated.

Another issue is the lack of overview of the surgery schedule among the staff. The coordinators are the only one with a complete overview and therefore the most qualified to answer questions regarding the schedule. Therefore, nurses, surgeons, other coordinators,

hospital departments reach out to the coordinators to ask questions regarding the schedule and constantly interrupt the work.

Interruptions also comes from the resident physicians that usually enters the room and ask questions regarding where the surgery they will observe during training will take place. These are questions that not really should be answered by the coordinators since it is not their responsibility to take care of the resident physicians. This is an example of an extra work task that the coordinators take on themselves. Another example of an extra work task occurs when a patient is not fully investigated and therefore should not have been registered for a surgery. Usually the coordinators try to fix this problem by looking for the information needed, which is a responsibility that lies on the nurses and surgeons to do.

Telephone Related Disturbances

The telephone in the coordinators' office is an important tool used for the coordination work. Mainly since the coordinators usually need to call the patient to make an appointment for a surgery and sometimes to collect extra information from either a patient or another department at the hospital before scheduling a surgery. However, the telephone is also a source of noise that disturbs the daily work that the coordinators are doing. Since the coordinators are working with many departments on the hospital such as pathology and mammography they can also expect to be interrupted by these departments answering questions and/or get stuck in telephone queues when they need to reach them. This communication is crucial to find out information about a patient since the coordinators cannot access this information on their own.

Phone calls from patients can concern questions regarding when their surgery is to be scheduled since these patients need this information to plan their week or to be able to mentally prepare for the surgery. Furthermore, some patients are worried about the surgery and needs to be calmed down, something that can be very time consuming since the coordinators cannot really end this type of call quickly, since it is a part of the well-being of the patient.

Each patient at the surgery department gets a contact nurse to ask questions regarding the diagnosis, surgery, treatment and other issues. However, if the nurse is unavailable to answer due to an ongoing surgery as an example, the patients instead tends to call the coordinators with these questions. There are also calls from patients who wants to ask questions about the research that will be conducted during the surgery. An issue is that some patients do not understand the research presented during the patient notice meeting and then start to ask questions over the phone.

Finally, the coordinators also have a fixed time slot from 10 a.m. to 12 a.m. every day where patients can call them regarding surgery planning questions. Some days there are no patient phone calls made, while other days the phone can be overloaded with patient questions. This variation in phone calls can cause frustration the days when the phone is overwhelmed, taking time from doing the actual planning which causes delays in the process and stress for the coordinators. Furthermore, the time slot between 10 a.m. to 12 a.m. seems to be the time of day when the coordinators are doing the most crucial part of their work, when quality needs to be high and work free from interruptions and therefore additionally increase the stress.

4.3.3 Uncertainties

Uncertainties concerns the factors that affect the planning on a higher level and longer time horizon. These exists outside the coordinators' process, but affect them in many ways, and are thus crucial to highlight. The uncertainties are divided into the following subgroups: **Scheduling and staffing**, **resource capacity**, and **patient demand**.

Scheduling and Staffing
When planning a surgery, the coordinators have to take several aspects into consideration. One of these aspects is which surgeon to assign to a surgery. Choosing the right surgeon is difficult since not all surgeons are suitable for all the surgeries due to several parameters. Examples of parameters are experience, lead time for a surgery and if research is to be conducted. Furthermore, due to the inconsistency in the schedule of the surgeons, each week will look different with few possibilities to standardize. There are various reasons for the inconsistencies in the schedule of a surgeon, but a common issue is that surgeons disappear on conferences and/or take holiday as compensation for night shifts at the acute hospital unit. Consequently, this means that the coordinators do not know when the surgeons will work which is making the matching of a patient and surgeon difficult. In addition, it also becomes challenging to assign the surgery to the same surgeon that the patient met during the patient notice meeting.

Resource Capacity
Capacity can refer to the amount of available operating rooms where breast cancer patients can be operated in. All available operating rooms have different capabilities and specifications that needs to be met during surgery, therefore this adds an additional dimension of complexity when planning for a surgery. This becomes an issue when the operating room capacity, the number of rooms available, changes from week to week which creates uncertainties when doing the planning. Sometimes the surgery department has three to four available rooms every day which can change to between two and three the week after. Sometimes these changes occur on short notice and create a lot of additional work for the coordinators when they suddenly need to find and plan for additional patients. This work consists of calling to various departments at the hospital to be able to get all the information and coordination done to schedule a surgery on short notice due to the change in capacity which is time-consuming and stressful.

Hence, if the capacity is lowered fewer surgeries are possible to do during that week which increase the waiting list time and, consequently, increase the workload on the coordinators other weeks when more surgeries need to be coordinated. Hence, the coordinators work is unevenly balanced from week to week which affects the work environment.

Other capacity uncertainties the coordinators need to consider are related to other departments at the hospital. The pathology department is currently short-staffed and do not work after a specific time during the day. This means that even though resources are available at the surgery department, a surgery cannot be performed during the late part of the day since the pathology department is closed. Therefore, the surgery needs to be rescheduled earlier so the sample can be sent to pathology for analysis after the surgery is finished.

Patient Demand
On a high level, a problem is the number of surgeries that SU should perform during a year in relation to the available capacity. The demand for breast cancer surgeries is currently fluctuating around 900 surgeries. If the demand goes up, then the capacity of operation rooms should increase as well. This is not always the case, since flexibility in terms of capacity is limited, which creates longer waiting time for the patient to get a surgery and higher workload for the entire hospital, where many of the resources already are constrained or used to an as high extent as possible.

Another problem with patients and capacity is that there are seasons when patients arrive to the hospital. Usually during the summer, additional operating room capacity is freed and there are more possibilities to do surgeries. However, the mammography screenings are usually conducted after the summer, which means that the women detected to have breast cancer arrive as patient's late autumn when the capacity is lower compared to the summer. This is a decision made by the surgery department as a consequence of not being able to perform surgeries during the summer months, due to for instance lower staffing levels, which results in a large peak in the number of patients that seeks care at the end of summer. As a result, this peak tends to be decreased by adding more operating rooms and increase the number of surgeries during that time of the year instead.

4.4 Findings from Carlanderska

Carlanderska currently has an established cooperation with Sahlgrenska for certain surgical procedures, where simpler breast cancer surgeries are included in that cooperation. In addition to that, Carlanderska has recently made an implementation of the IT system Orbit, which Sahlgrenska is planning to implement in the upcoming months. Consequently, an interview with the central coordinators at Carlanderska was conducted with the objective to gain understanding within two different areas. Firstly, the objective was to understand how the cooperation with coordinators from Sahlgrenska works and secondly what the effects from the usage of Orbit has been so far and what learnings there have been from the implementation procedure. The intention is to eventually use these findings in the improvement suggestion regarding the coordination process at Sahlgrenska.

4.4.1 Coordination Process at Carlanderska

Carlanderska is a private hospital located in Gothenburg with seven different operating rooms, where approximately 30-35 surgeries are performed in total each day. The surgeries performed typically involves simpler and non-urgent surgeries of patients that otherwise would be faced with long waiting times when turning to public healthcare due to prioritization of more severely ill patients. At Carlanderska, each department has their own local surgery coordinator. In addition to that, there are two central coordinators with an overall responsibility for surgery planning and coordination. The central coordinators meet with the local coordinators each week and goes through the upcoming schedules and determines if any planned surgery needs to be changed, adjusted or added in case of available time slots. Priority for the coordinators is to fill the available time slots to ensure that the operating rooms are used to the fullest extent possible.

As for the operating rooms, it is possible to perform most of the different procedures in a section of new operating rooms. By ensuring that procedures can be performed in multiple different operating rooms the hope is that movement of equipment can be minimized, since that can cause damages to sensitive types of equipment. In the older operating rooms, it is not possible to do all sorts of procedures, which also applies to one of the new rooms which is specially dedicated to robotic surgery, so then it is attempted to always place that kind of surgeries in those rooms.

Surgeries start at 8.00 a.m. each day and cannot be performed during hours outside the normal opening time, which makes scheduling accurately of high importance for the coordinators. In order to keep down surgery times, Carlanderska has performed frequent improvement efforts and lowered the switching times between surgeries by for instance making cleaning of the rooms more efficient. The time consumption of each surgery is based on the average time that type of procedure has taken for the operating surgeon during the last five times he or she performed it. Cancellations of surgeries is not common at Carlanderska, and mainly occurs in case a patient falls ill or feels that he or she no longer need the surgery. It should be noted that most of the surgeries are minor ones with patients that for instance has no need for intense care or an extended hospital care afterwards, since such surgeries are not performed at Carlanderska.

4.4.2 Cooperation with Sahlgrenska

In the agreement with Sahlgrenska there should be around ten time slots, equalling ten surgeries, in operating rooms available for Sahlgrenska to use during each week. The surgeries are performed by surgeons from Sahlgrenska, but with the rest of the surgery team being staffed by Carlanderska. In general, it is required that patients that will be having surgery at Carlanderska instead of Sahlgrenska is of good health, which limits the surgeries that are performed on breast cancer patient to for instant prophylactic procedures where the patient has no other health issues. Patients always comes to Carlanderska for a sign in procedure and additional information before the surgery, which is said to be appreciated by the patients.

In terms of cooperation with Sahlgrenska, there is no integration between different IT systems used, thus requiring most of the information material to be transferred by scanning of paper. The material needed at Carlanderska includes information regarding: Operation codes, diagnose codes, operator, antibiotics, inpatient care or day-care. Consulting regarding anaesthesia is made at Carlanderska during the same day as the surgery by one of the anaesthesiologists that are present during surgery. Updated journal notes as well as a patient that has been well-informed regarding having a surgery at Carlanderska instead of Sahlgrenska is also viewed as important by the coordinators at Carlanderska.

Some of the problems with the cooperation sometimes includes communication between the patient, Sahlgrenska and Carlanderska. Since the surgeon normally works at Sahlgrenska, but the patient often contacts Carlanderska with questions, such questions might be difficult to answer. It can also be challenging to find surgeons from Sahlgrenska that are willing to perform surgeries as Carlanderska instead, which sometimes results in clash of cultures between how surgeries are prepared. For instance, surgeons from Sahlgrenska might have different expectations regarding which equipment that should be available in the operating

rooms. It is difficult to ensure that information regarding the patient is available both at Sahlgrenska and Carlanderska since the information material needs to be transferred between the two hospitals due to the lack of integration between for instance the IT systems.

4.4.3 Orbit Implementation

Orbit has been used at Carlanderska since January 27, 2018. The central coordinators that were interviewed have been involved in the implementation as well as the development of the system to a large extent. This involvement has for instance included how Orbit should be shaped in order to best meet the needs at Carlanderska and which functions that should be included. Basically, the interviewed coordinators have shaped several different functions in Orbit from scratch by combining their own improvement ideas and experience with functionalities from the old IT system.

After the Orbit implementation, much of the paperwork has disappeared or been reduced to a very large extent. Instead of for instance using IT systems such as Melior for journal keeping, the number of IT systems used at Carlanderska has been reduced to two, where Orbit is the system that will be used to the largest extent and contain most of the relevant information for Carlanderska's daily operations. The amount of telephone calls regarding information has also decreased after the implementation since Orbit allows both the local and central coordinators to gain the same overview over the upcoming surgeries. For instance, it is possible to view all tests that have been ordered for a patient as well as making a note when the tests have arrived. Lists for instruments and equipment are also automatically produced when a surgery is coordinated in the system and can be complemented by surgeons themselves to ensure that personalized requests are also registered for their individual profile in Orbit.

Since there is a large amount of information regarding the different types of surgeries in Orbit, the implementation has included transfer and creation of information from old systems. For instance, the central coordinators have created cards for each type of surgery, which then has required alterations after Orbit has been implemented, since certain complements were discovered to be necessary.

Other changes to the coordination process as a result of the Orbit implementation has been that surgeons do the surgery registration directly in Orbit instead of using a registration form on paper. Thus, the need to transfer information from paper forms into the system has disappeared to a large extent. Positive aspect of this has been that the risk of making errors when transferring information has decreased, which according to the central coordinators was seen as an important improvement in patient safety. Some of the argument against this change was that some of the surgeons believed that registration in Orbit would be more time consuming. However, it was discovered that the differences in time was quite small since Orbit for instance eventually adjusted orders of lists and type of surgery according to frequency of such, thus shortening the time needed to complete the registration.

An important factor in the success of the implementation was deemed to be support from management. This support was for instance helpful in convincing other staff member of the importance of a new system and when changing work routines and clarifying responsibilities regarding how the system should be used. For instance, this was important when determining

who should be responsible for filling out information about the different surgeries. Another success factor is the fact that a large amount of alterations was done to the original version of Orbit. There were a lot of focus put on making Orbit work for Carlanderska in particular and not settle with only basic functionalities. This has resulted in an IT system that can be used hospital wide and with functionalities that supports the daily operations at the hospital and are adjusted for that particular context. Lastly, integration of the functions was also emphasized, so that Orbit can be used as a complete solution at the hospital, and not just as an additional system that overlaps and fails to actually substitute any other of the existing systems.

5. Development of a Proposed Future State

In this section, a proposal of a future state for the coordination process is developed and presented along with a range of improvement suggestions both for the process and the general work environment for the coordinators. While the current state is used to document the current performance in an organization, the future state is an opportunity to make changes that helps an organization to reach the objectives. Keyte and Locher (2004) have seven questions, presented in the theoretical framework, that can be used to evaluate the current state and to form a future state. The questions are:

1) What does the customer really need?
2) How often will we check our performance to customer needs?
3) Which steps create value and which steps generate waste?
4) How can we flow work with fewer interruptions?
5) How do we control work between interruptions, and how will work be triggered and prioritized?
6) How will we level the workload and/or different activities?
7) What process improvements will be necessary?

These questions have been used for the development of the future state proposal and have been analysed and answered in the sections 5.1 to 5.7. In the last section, 5.8, a proposal of a future state is presented through a future state map with description of the steps in the map along with a summary of the improvements suggested to reach this future state.

5.1 Finding the Customer Needs

Since question three will examine what process steps in the current state that generates value so the first thing to do is to understand what value is in the context of the breast cancer surgery department. Glouberman and Mintzberg (2001) have identified four stakeholders in the healthcare organization: doctors, nurses, managers and trustees. Each stakeholder has its own needs and view on what value is for them and are affected by the output from the process in different ways. In relation to the coordination process, three out of four stakeholders can be identified to use the output from the coordination process. Doctors and nurses are the stakeholders that directly treat and take care of the patient and are highly involved in using the produced output. Managers is the third stakeholder and include control functions such as the administrative staff that take cares of the journal after it leaves the coordinators' office to the cashier desk, step twelve in the current state map. The administrative staff ensure that the daily operations work and that all crucial information regarding the patient is registered and trackable in various IT systems. Besides the three identified stakeholders, patients who need treatment is another stakeholder that is present in relation the coordination process, that can be seen as a fifth stakeholder in addition to those presented by Glouberman and Mintzberg (2001).

The output from the coordination process is as identified in the current state three entities: an invitation letter to a patient for a surgery, a daily schedule with details and a journal with patient information. No stakeholder uses all three outputs from the process. Each stakeholder uses the output different and therefore has its own needs for the output. Consequently, it is

crucial to understand what creates value for each stakeholder since the needs are different. All of the outputs are required to be finalized at least two days before the surgery occurs and therefore the output is required to be produced continuously.

What the output is used for differs between each stakeholder. Both the surgeons and nurses use the patient journal to prepare before a surgery. The surgeons use the journal to prepare for the surgery, for example deciding final treatment method and check if the information is accurate. The nurses use the journal to prepare various materials prior to the surgery. From interviews, value for both the surgeons and nurses is to have accurate information. Moreover, it is important that all the information related to the patient is in the journal. For example, if a patient is scheduled for a research surgery, then all the research papers needs to be there. Additionally, it is crucial that indication papers, showing the location of the tumour, and the x-ray pictures and the PD-remiss is in the operating room. The daily schedule is used by the surgeons on the Monday meeting to check if every detail looks accurate for each patient and discuss treatment type a final time and if the preparations are going as planned.

The administration staff use the daily schedule to register additional data about patients in a system called Melior, the medical record system. Furthermore, the administrative staff register the patient in Elvis which has to be done in order for the unit to get paid for treating the patient. Some additional information and papers has to be added to the medical journal which the administration staff does. Value for the administrative staff are that all the tests are already requested and that all the journal papers are present which is not always the case due to too much work at the coordinators office. When this occurs, time has to be put aside by the administrative staff on ordering a test and/or complementing the journal with information that should have been there.

The patient receives the invitation letter with information regarding the planned time for surgery and how the patient should prepare, for example by showering with a specific shampoo. This letter is a crucial part of the communication to the patient and value for the patient is that the information is clear, easy to read and that the information is complete. According to interviews with both the coordinators and nurses, there are cases when the patient, as an example, has taken a drug that is forbidden to be present in the body during the surgery. This is something that could be avoided by providing complete information in the letter since not all the information transferred orally during the patient notice meeting is remembered.

To conclude, the three outputs from the process are used for different purposes by the stakeholders. However, the desired values on the outputs are quite similar for all, which includes that the information in the journal is accurate and everything is ready for surgery, for example that a test is ordered. However, due to uneven workload and disturbances, elaborated on in 5.6, sometimes the coordinators have to put a lot of time on fixing problems or making alterations due to unexpected changes, resulting in that some basic criteria such as ordering a test or putting in all the information is forgotten and affects the output quality. Worth mentioning is that quality is not a common issue and that the coordinators often deliver outputs of high quality.

5.2 Measuring Performance

Keyte and Locher (2004) highlight the importance of measuring the output to see if it lives up to the specifications set by the stakeholders. These specifications are presented in 5.1 as value to the stakeholder. Measuring is key to identify abnormalities that hinders the output to deliver on the specifications. Measuring also enables the process owners to act and take action to prevent these abnormalities from occurring again (Keyte and Locher, 2004). This is aligned with the Lean principles Jidoka and Kaizen, to seek out why a problem occurs and prevent it from happening again (Graban and Swartz, 2014; Dennis, 2016). For this reason, measuring performance should be standard and established for all outputs and stakeholders. The benefit, besides being a basis for improvement detection, is that the coordinators can learn new things about their stakeholders and therefore adapt the process to deliver on the requirements that the stakeholders have on output from the process.

Furthermore, there are many recurrent disturbances during a day, as described in *4.3.2 External Disturbances*, which indirectly affect the work. As an example, when being interrupted, the surgery coordinators could become confused regarding what they were working on, and when trying to regain that focus details can be forgotten, such as scheduling a test. This is why it can be a good idea to continue measuring the frequency of these issues to see how large impact these actually have, as has been done within this project, which can provide both an incentive and motivation to act on the problem.

There have been no signs during the observations nor the interviews that the coordinators are working with routines to measure and act on issues that occurs within the process. On one hand, the coordinators usually have ideas of how problems can be solved, but on the other hand these ideas seem to be kept within the office and not communicated to managers. This can be considered to be the eight of the waste principles, underutilized people, according to Keyte and Locher (2004) and is something that should be handled. What the underlying reason might be for not communicating and implementing ideas is not clear. Failing to measure the frequency of problems and especially how it may affect the stakeholders can be an explanation for not acting, since there is no realization of how large the impact is. This is why a short frequency study was done during this project. However, one hypothesis to avoid this from proceeding and to start capturing these ideas could be to empower the coordinators to start measuring performance and act on issues, come up with solutions and get responsibility and encouragement from management to improve. The staff has to be responsible in the improvement process to make improvements happening (Graban and Swartz, 2014). How often the coordinators should measure is not easy to predict but since the process and the environment around is changing slowly twice per year can be a good starting point.

5.3 Identification of Waste and Value-adding Activities in the Current State

In the current state map, there are twelve identified steps, along with some side activities performed at several different occasions in relation to the different steps, such as control of journals. In Table 5, these steps are presented along with identification of them as either value adding, non-value adding but necessary or waste with regards to what the stakeholders

demand in section 5.1. The eight types of waste described by Keyte and Locher (2004) have been used when defining the type of waste. In some of the steps there are value adding dimensions as well as waste dimensions. With the multiple stakeholders described in 5.1, it is crucial to look at value from all of the different perspective presented. However, the customers' needs seem to have quite little to do with some of the steps that are performed during the coordination process, and first and foremost concern the quality of the outputs that are produced. Thus, there are several steps where waste can be identified, but with some value adding dimensions as well. A short motivation behind each categorization of waste, value or non-value adding but necessary will be presented in the table and then be elaborated on further in the sections below.

For both step one and two, the value adding is clear from the fact that both steps are judged as highly necessary due to the decision making that occurs. Without them occurring, it would be difficult to determine the type of surgery and treatment, since it both has to be recommended by participants during the MDK and then approved from the patient during the notice meeting. The creation of the registration form also falls under the category of value adding due to the need to document the decisions made during the first steps. However, when processing the information on the registration form, there is copying and transferring from paper into IT systems during step five, which can be categorized as waste within the category of extra processing. This could be avoided by adding the information directly into Operett, or Orbit eventually, during the creation of the registration form, thus eliminating the extra processing as well as the need to store the registration form in step three and four. Further benefits of registering the information directly into Operett or Orbit are that the amount of papers in the coordinators office would be reduced.

Out of the non-value adding steps, several involve different forms of transportation of the journals. This goes in line with the statement from ACT Academy (2017) which suggests that transportation is a common form non-value adding, but necessary, activities within manufacturing as well as offices. The fact that information currently not is collected and summarized in any type of IT system makes the transportation of the journals necessary, but if an IT solution would be available the classification would be changed to waste in the form of transportation and excess motion.

The preliminary planning in step seven is one of the steps that contains both value adding dimensions and dimensions of waste. It does provide value in terms that it enables a certain overview of the upcoming weeks, as well as assigning a preliminary date. However, since the preliminary planning mainly is visible for the coordinators themselves and consequently not used by any of the customers of the process, the purpose of producing this preliminary plan becomes rather unclear. Since parts of the preliminary planning, such as information collection will have to be repeated in the detailed planning during step ten, a certain amount of waste through waiting time for information and extra processing through re-entering of data occurs in the step.

Step nine and eleven are more examples of necessary storing but with no value adding. If the process design would be different, these activities can be considered to be inventory waste and removed. Step eight is an unnecessary step in the process today and can be considered waste since it does not add any value, nor is necessary for the process.

The planning in step ten is the activity which creates most value today. Step ten provides a complete schedule with details regarding time slots, surgeons, operating rooms et cetera and is basically the schedule that will be used by all the stakeholders after leaving the office. The administrative staff, a medical secretary, takes the schedule and journals in step twelve where additional value adding activities are performed, such as adding final information.

Table 5 *- Identification of waste or value in each of the steps in the current state map.*

Step (for detailed description, see chapter 4.2)	Value or Waste (with defined type of waste)	Motivation behind decision
1. MDK – Multidisciplinary conference	Value	Necessary for decision making.
2. Patient Notice Meeting	Value	Necessary for decision making.
3. Registration form submitted to post room	Waste (Extra motion and transport)	Can be delivered to the office directly.
4. Registration form put in compartment in the coordinators' office	Non-value adding but necessary	Form has to be stored before processed in step 5.
5. Registration form information transferred into Operett	Waste (Extra processing)	Copying of information from registration form to IT system.
6. Journal put in a plastic folder	Non-value adding but necessary	Needs to be stored before processed further.
7. Creation of a preliminary weekly planning.	Combination of waste and value	Provides a valuable overview of the upcoming weeks and the invitation to patient is created and sent out here, but lacks usage for involved people. Value adding dimension includes the invitation that is sent to the patient during this step.
8. Journal put in compartment between desks	Waste (Motion)	Can be delivered to step 9 directly. Only triggers extra motion and takes up space additional space.
9. Journals relocated	Non-value adding but necessary	Needs to be stored before processed further.
10. Detailed planning of daily schedule	Value	Provides an important detailed planning over the upcoming days used by nurses, surgeons and administrative staff to plan.
11. Journals put on shelf in folder	Non-value adding but necessary	Needs to be stored before processed further.
12. Information added to journals and transferred IT systems	Value	Journal is complemented with final information from administrative staff and is now ready to be used in a surgery by nurses and surgeons.
Side activities		
Journal control	Value and waste (overproduction and extra waiting) combined	Value adding for patient safety. Over-production and waiting time through all the extra controls and complementation of missing information.

The journal controls are crucial from a patient safety perspective in order to ensure a complete and accurate collection of information. However, through the way this control is performed currently, it is subject to waste in multiple different categories, such as defectives, extra-processing, waiting time and over-production. Defectives occur from missing or inaccurate information that needs to be complemented by contacting involved personnel, thus also creating waste in form of waiting time for the information that has been discovered defective. The over-production takes its form through the extensiveness of the controls. Since it is performed in relation to multiple steps throughout the process, journals are both double- and tripled-checked, but with no systematic follow up of how and when defectives do occur.

5.4. Eliminating Interruptions in the Workflow

As seen in the current state map, there are multiple interruptions in the coordination process. Batch processing is common, from the reason that the initial registration with assignment of a preliminary date of surgery is being separated from the preliminary planning and detailed planning. Thus, there are multiple inventory steps and stocks of journals being kept between the different planning activities and steps causing interruptions in the flow. The process steps from creating the registration form until the journals are collected from the medical secretaries becomes long and divide the completion of a journal into an unnecessary number of steps and processing by not completing a journal in fewer steps. Thus, shortening the planning procedure would be an important action towards decreasing the interruptions in the flow. This could be achieved by a detailed planning of each surgery being performed immediately in relation to the step when the invitation letter is sent.

The motivation behind this reduction of steps is that the journal control should be completed at that stage and that the patient indeed should be ready for surgery when the invitation letter is sent, since the date then is changed from preliminary to set. Waiting with doing final controls of the journals and booking time slots for tests and reception visits creates additional steps and rework later in the process. Completing these in an earlier stage would save time and has a large potential to reduce the time required to complete the coordination of a surgery, as well as move towards a more continuous flow for the process. With the huge amount of constraints and considerations that are taken currently, it is easy to defend the decision of postponing some steps of the coordination but doing so will not be sustainable long term. Instead, an active work towards decreasing the number of considerations needs to be driven both by the coordinators by them providing insight and expert knowledge of the current process, but also by management to keep it on a strategic system level, which is discussed further in *6. Discussion*.

In addition to interruptions in the coordination process itself, there are also the external disturbances that concerns the identified areas of staff related disturbances and telephone related disturbances. As described in *4.3 Problem areas*, these disturbances cause interruptions that makes re-work necessary as well as reduction of the patient safety through the increase in the risk of errors. Much of the direct questions from staff concerns scheduling and planning, where a large share of the information should be available through for instance IT systems. However, with little overview of the coordination process for staff members, an increased level of visualization could help with these issues. As described by Manos et al.

(2006) different kinds of visualization could provide a systematic way for staff members to find information regarding for instance schedules. In addition to this, it was also suggested during interviews that time slots for questions from staff or alternatively hours where the coordinators ask for no disturbance by for instance using door signs was brought up as suggestions of also making the work flow with fewer interruptions. Furthermore, it is suggested to move the patient time slots from the morning to the afternoon when less critical work is done. This can reduce the risk of making errors and overall improve the efficiency since the coordinators can finish the most crucial part of the coordination tasks undisturbed.

5.5 Controlling the Work Between the Interruptions

The system used to register a patient today is similar to what Keyte and Locher (2004) refer to as a push system, where the surgeons register a patient for surgery which then is delivered to the coordinators office. This triggers a work activity where the coordinators have to register these patients before continuing to work with the regular scheduling activities. Furthermore, there is a risk of a patient being registered without being a fully investigated patient which triggers a lot of extra work for the coordinators. This is something that should be solved in order to avoid the coordinators to be overwhelmed with work.

If a specification for registration which ensures that patients are fully investigated before being put up for a surgery is created, and in combination with surgeons registering patients directly into Orbit, only patients that are ready for a surgery is listed and can be pulled out of the system. The coordinators can then choose the patients in a pace that suits them without being disturbed with new registration forms and questions each morning, since the list in Orbit will be under their control. Keyte and Locher (2004) describes this as a pull-system, so instead of being overwhelmed with patients, where some patients trigger extra work, the coordinators can now pick which patient to schedule next and know that all the information needed is there.

5.6. Levelling of Workload and Different Activities

When looking at the surgeries that need to be coordinated throughout the year, there are mainly peaks arising before or after the summer and winter holidays, due to closure of either screening or decrease in the number of surgeries that are performed during the holidays. Thus, the coordinators are not faced with monthly peaks, but rather two major peaks per year. In addition to that, there are weekly and daily variations that rather concerns the detailed planning and the need to for instance coordinate surgeries occurring in the beginning of the week before the previous weekend. In order to balance the workload and activities there is two perspectives that needs to be taken into consideration; a yearly perspective and a weekly or daily perspective.

The weekly or daily perspective has direct connections to the work routines and processes the coordinators uses. By currently leaving some time slots open the workload consequently increases when these slots remain empty and eventually need to be filled by calling in other patients on short notice. While the slots for urgent surgeries fill a purpose, these are not coordinated, but instead filled by the SVF coordinator, and should thus not be something that is dealt with explicitly by the coordinators. Instead, focus should be on completing the coordination of each surgery to an as large extent as possible upon registration, as described

in section 5.4. By doing so, the work peaks before weekends or extra time required to eventually fill empty slots can be decreased, making the week and days more levelled. Of course, there might be difficulties and restrictions in when certain tasks can be performed, but through a Kaizen philosophy, it should constantly be attempted to decrease such restrictions and work on eliminating bottlenecks in the coordination.

On a yearly perspective, the balancing is more on a management level and concerns resource allocation. With a baseline of around 70 surgeries being performed each month, but with variations occurring where the number reaches almost 90 surgeries, certain flexibility in the coordination process is required. Thus, there is a need to ensure that there are available operating rooms allocated over the year to handle the number of surgeries required each month. This might seem like a basic statement, but especially for the peaks before and after the holidays this cannot be stressed enough. In order to meet the goals of initiating treatment within 28 days from the initiation of SVF, extra allocation of resources during these peaks needs to be planned in advance in order not to first create queues that cause the resources in terms of available surgery slots to be severely constrained. However, the problems regarding resource constraints are difficult to grasp and deal with and will therefore primarily be presented in *6. Discussion*.

Takt time can be used to give an indication on how long a coordination process of one surgery should take, from the point of registration to when the journal is collected by the medical secretary. Takt time is a good parameter to use to detect deviation in the process and to understand how much time it should take to produce one unit of output. If the time would deviate from the required takt time, actions have to be taken. If the time is longer than the required takt, delays are likely, and the likeliness of overtime and high workload will increase. If the takt time is lower than the required, the coordinators might work faster than necessary which can, as an example, be a result of stress and increase the risk of defects being created. Therefore, takt time is a useful parameter to detect if something is affecting the current process and actions can be taken immediately before growing into a larger problem, for instance the coordinators getting burned out due to unbalanced workload.

An estimation of the takt time has been calculated to give an example, see Table 6. The variables are number of working hours per week based on the number of working hours both coordinators put on coordinating breast cancer patients, which is assumed to be 40 hours per week. The number of surgeries is approximately 900 per year and the number of weeks the coordinators work during a year is 46 with regard to vacation and other reasons. Therefore, a takt time of 2,04 hours for completing the coordination of a patient, from registration to having completed the detailed planning, should be kept in order to manage the process with the current amount of time available in relation to the quantity of surgeries.

Table 6 – *Variable data and estimated takt time.*

Variable	
Number of working hours per week	40
Number of surgeries	900
Number of weeks	46
Takt time	**2,04**

5.7 Further Process Improvements

The control of journals in terms of information accuracy and availability that is performed by the coordinators as well as medical secretaries during the coordination process is said to be important. The motivation behind the extensive amount of controls is patient safety and the importance of an error free environment when the surgeries eventually are performed. This strive towards an error free environment goes well in line with the vision described by Slack et al. (2016) of Lean in terms of reducing quality issues and improve the processes so that for instance waste in terms of errors is reduced. However, while extensive controls indeed are performed, there is no systematic way of working with reducing eventual errors in terms of missing or inaccurate information and improve the quality in general. Thus, process improvement is needed for the journal control.

Process improvement regarding journal controls should be initiated through implementation of Jidoka tools, which as Dennis (2016) describes, includes pausing the work when errors occur and find the source of the problem. By combining this with a Kaizen way of working, where errors and their sources are documented, the coordinators as well as management should be involved in developing changes that can make the process more error safe. Poka-yoke and making certain steps fail safe (Slack et al., 2016) could be example of how the process can be improved through for instance making it impossible to fill in certain forms in IT systems without having matching information in fields or submitting a registration form without steps being completed. Keeping statistics over errors and follow up eventual missing or inaccurate information is an important step towards going from a reactive way of fixing quality issues towards acting in a proactive way regarding quality and patient safety. For instance, it should also be attempted to implement procedures for how registration forms for patients that have not been fully evaluated, and thus should not be registered for surgery, should be handled. Sending registrations for such patients causes the workload to go up for the coordinators, and the lack of formal procedures for how such registration forms should be sent back and followed up make it difficult to handle the occurrence of such currently. Moreover, avoiding doing the journal controls continuously throughout the process would make the process much more efficient.

In order to be able to reduce the number of steps in the coordination process, the IT system support needs to be developed, along with investments in equipment supporting the usage of such systems. Copying information between papers as well as through scanning between systems is not a sustainable way of managing the coordination, and efforts needs to be made to reduce this type of activities. Additional education regarding system usage and how functionalities can help to simplify administration is one important part of this. As for the upcoming Orbit implementation, lessons from the Carlanderska case should be used, such as the need to adjust the system according to needs and spend time on developing the solutions in the implementation phase. Spending time on creating functions initially can help reducing the wastes in terms of extra processing, transportation through movement of paperwork and defectives (Keyte and Locher, 2004) on a longer time horizon. In order to realize the benefits of for instance being able to do the surgery registration form directly in the system, investment in equipment will also be necessary. For instance, portable wireless computers are needed as in the case described by Bush (2007) regarding process improvement, so that the surgeon can fill out the surgery registration in the system during the patient notice meeting. If such equipment is not provided, it will not be possible to remove the extra processing through

copying of registration forms, which then cannot help in increasing the patient safety by reducing the information transferring. Using Orbit can reduce the amount of paperwork in the office as well as reduce the number of questions that the staff have to the coordinators.

Process improvement relating to the office environment itself are also necessary. The current amount of papers makes waste occur through extra processing from not finding material as well as keeping large inventory of journals (Keyte and Locher, 2004). 5S could be used to throw away unnecessary items, work on positioning and standardizing where everything is kept (Slack et al., 2016) to give a few examples. Visualizing the workplace (Manos et al., 2006) should also be included in addition to 5S through for instance putting up the surgeons' schedules, surgery time slots et cetera in places where staff can access this type of information easily. This should help reducing the amount of interruptions relating to questions from staff by making sure that information is available for them in different places. In relation to these improvements a relocation of the coordinators' office should also be considered. The current location makes it very easy for all staff members to interrupt with questions and moving the office to for instance the administrative department where the surgeons also have their office could improve this situation.

5.8 Proposal of a Future State

In the previous section in this chapter a wide range of changes and improvements of the coordination process have been presented. Some of them concerns changes in the process and its steps themselves while others concern the surrounding environment and additional changes that are necessary in order to achieve the improvements. Thus, the future state map and a description of changes regarding each of the steps in the map will be presented firstly, which primarily relates to process changes. Secondly, the rest of the suggested changes will be presented and their impacts summarized.

5.8.1 Future State Map and Description

The future state map, Figure 14, has been developed with the current state map as a baseline. Consequently, the mapping and description of changes from the current state will start at the multidisciplinary conference where a suggestion of surgical treatment is agreed upon and finish at the point where the medical secretaries hand over the journal to the cashier desk.

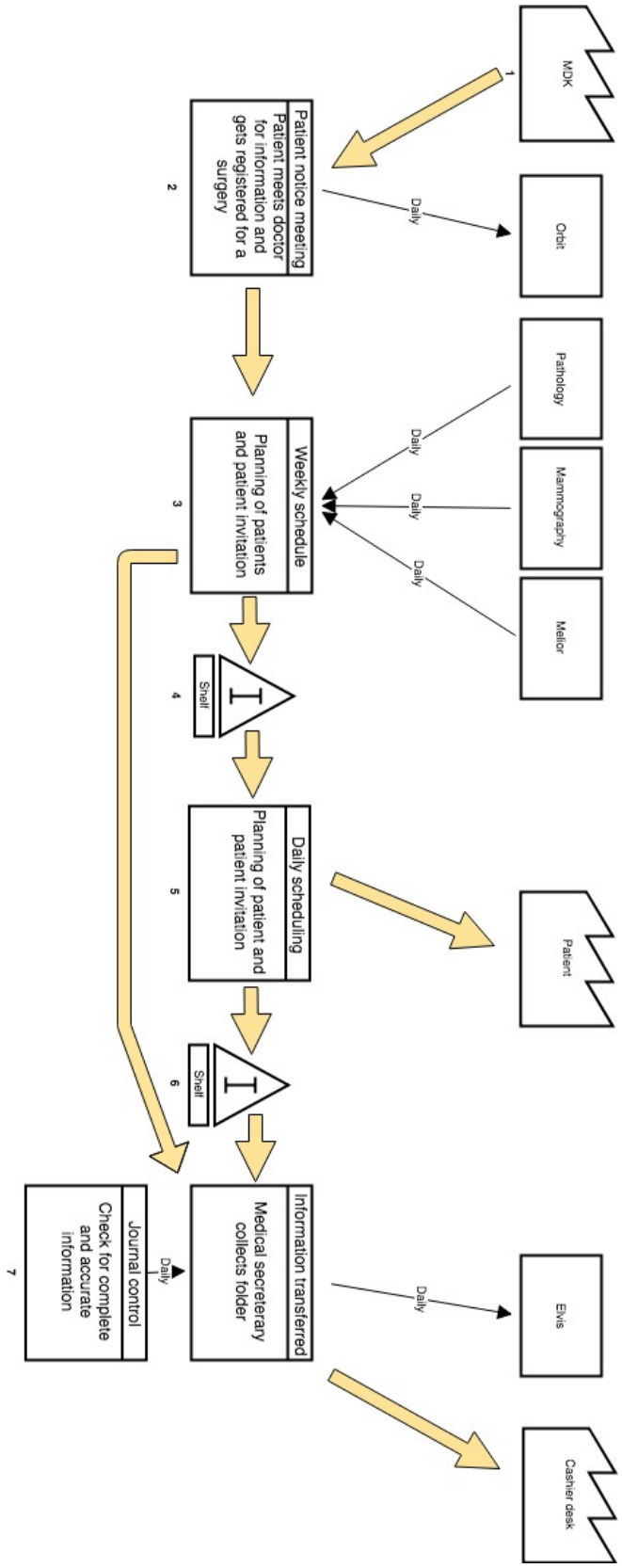

Figure 14 *- The future state map for the coordination process.*

1. Multidisciplinary Conference
The multidisciplinary conferences should proceed as in the current state without any alterations. Since the conference primarily concern medical aspects of the coordination process it is outside the scope of the thesis to suggest any improvements regarding such.

2. Patient notice meeting
During the patient notice meeting, the changes will concern how the registration form for patients in need of surgical treatment is filled out. Instead of doing this on paper, thus creating the need to copy the information and transfer it into the IT system Operett, the registration form should be filled in directly in the IT system. With Orbit being implemented at Sahlgrenska from the middle of May, this will be done in Orbit instead of Operett. The responsibility of filling out the form will be put entirely on the surgeon who fills out the registration in Orbit. In addition, it is recommended that the registration function Orbit is customized so that it for instance is impossible to create a registration for patients that have not been fully investigated as well as leaving fields with crucial information blank. Potential effects from this change will be an increased patient safety, since the risk of misinterpreting any information in the previous paper registration form when copying and transferring it disappears. The time spent on collecting missing information will also be decreased for the coordinators, as well as the time they spend on copying information.

4. Weekly schedule
This step has had quite limited value adding dimensions in the current state, and mainly contributed by providing the coordinators with overview of the upcoming weeks and by providing a basis for the detailed planning. The important output in this stage is the letter of invitation sent to the patient. The optimal solution would likely be to avoid doing mainly preliminary planning in this step, and instead complete the planning for each surgery immediately through a detailed daily planning being done instantly. However, this would only be possible if there was more flexibility in terms of operating room availability and all surgeries being possible to perform in all of the rooms. This is not the case, and thus this preliminary planning through weekly schedules is still needed in the future state. However, the strive should be to complete the journals in this stage and reduce the number of factors that are taken into consideration when determining which surgeries that should be performed during a day. When the coordinators send the invitation letter in this step, all of the tests and appointments that are needed for the surgery to be performed should now be ordered simultaneously so that the journal is completed to the best extent possible at the time, represented by the arrow going directly to step seven in Figure 14. A change that will affect the way of working will also be the possibility for the coordinators to pull registered surgeries from Orbit instead of assigning each surgery with a preliminary date when they transfer the information into Operett, hopefully making the creation of schedules easier. In addition to that, the coordinators need to work in collaboration with either the Head of Surgery or the surgeon currently responsible for helping with the coordination to do evaluations during the year regarding the factors taken into consideration and work on eliminating some of those obstacles.

5. Journals put in folders
Similar to the current state map, each journal will be put in folders sorted by the day of surgery. A future ambition should be to reduce the amount of papers in the office and aim at

printing the complete journals closer to when the medical secretary comes to collect them and instead keep all of the information in Orbit until that time.

6. Daily scheduling
The daily schedule, where the last alterations are made and detailed schedule over the upcoming day is set, is still needed in this future state. It is important that the amount of time spent on journal controls in terms of information accuracy is reduced in this step so that focus is on verifying that no information is missing and that the parts where the coordinators have responsibility, such as for reserving time slots, are completed. The time spent on journal controls in the current state has grown to an amount which is not sustainable, and even if it can be argued that patient safety is increased it is also outside of the coordinators' responsibility to ensure that the medical information stated is accurate.

7. Journals put on shelf and collected by medical secretary
Besides eventually delaying the printing of the information kept in the journal, as described under step five, there is no need for any major changes to this step.

8. Information transferred
The transferring of information made by the medical secretaries will not be changed apart from an increased focus on quality and following up on errors. Since the coordinators should decrease the time spent on journal controls it is important that there still a formal control at the medical secretaries' office. This can include routines, such as sheets that can be filled out where errors are noted, to ensure that this is done thoroughly at one step in the coordination process. By keeping notes of type and number of errors, awareness regarding potential quality problems is increased and root causes of such can be identified and eliminated. However, there should still be no control of medical accuracy of information since that is not under the responsibility of the medical secretaries either.

9. Journals delivered to cashier desk
There will be no changes regarding this step since it is deemed necessary in order to relocate the journals to the right location.

5.8.2 Additional Changes and Improvements

With the future state map and the steps described in relation to that, the coordination process of one surgery should hopefully have decreased lead time and fewer interruptions in the flow. Consequently, with reduced journal controls and elimination of some of the copying between paper and IT systems, the workload of the coordinators should decrease. In that case, it is also important to use that time for continuous improvement work and for instance improvements of Orbit in relation to the implementation. In addition to the changes relating to the process, there are other improvements and changes needed in relation to other things than the coordination process itself. These changes have been described earlier in this chapter but have been summarized below in Table 7 in order to provide an overview.

***Table 7** - A summary of the recommendations given in section 5.4-5.7.*

Recommendation	Explanation	Impact
Understand the stakeholder needs	Healthcare is a dynamic environment. Have a dialogue with the stakeholders to always deliver what they need.	The process can adapt and deliver to changing stakeholders needs.
Measure and analyse data	Start measuring problem areas such as unexpected changes as well as other relevant parameters such the time needed to coordinate one surgery. Important to allocate time for analysing this data on a regular basis.	Problems can be detected, are quantified and can be prioritized. Can measure before and after an improvement to see the impact of the change.
Make information available	Put up information, such as schedules over the upcoming surgeries, in the hallway.	Decrease the amount of questions and interruptions from staff members and increase their understanding and insight of the process.
Visualize the schedule	Put up the surgery schedule for everyone to see on it systems and/or in the hallway.	Decrease the amount of questions and interruptions from staff members.
Time slots for staff questions	Establish time slots when staff can ask questions.	The coordinators are not constantly interrupted during a day.
Move the patient telephone slot	Move from the morning to afternoon.	Avoid having patients disturbing during the most critical work tasks that is being done every morning. Reduce risk of errors and make the work more efficient.
Set routines for surgery registration	Develop clear guidelines regarding what information that needs to be available for a patient to be registered, and what it means when a patient is fully examined.	Coordinators can focus on their work tasks and avoid working with information search on patients.
Finalize the planning for some patients immediately.	Some patients should be coordinated in detail when possible when doing the weekly schedule.	The flexibility is lowered but it saves coordination time overall and allows focus on coordinating more complex surgeries.
Assign extra resources during seasonal peaks	Assign resources when more patients are expected to be in need of surgery by planning on both a month and yearly basis.	Waiting times are not going up. Coordinators can act in a proactive way to avoid getting overwhelmed with work.

Implement Poka-yoke	Making it impossible to fill in certain forms in IT systems without having matching information in fields or submitting a registration form without steps being completed	Avoid getting patients not ready for surgery registered. Reduce the amount of errors from start. Going from reactive to proactive.
Root-cause analysis	Establish a culture to find the root cause for a defect.	Solving the right issue. Hinder the issue from reoccurring in the future.
Allocate time for Orbit education	Allow the coordinators more time to understand Orbit and to see its full potential so improvements can be made.	The learning curve will be quicker.
Adapt Orbit to the needs of the surgery department	Give the coordinators time to improve Orbit by letting them meet Orbit programmers.	Orbit can be adapted to their specific needs and reduce e.g. the amount of papers used in the department if all the information is digitized.
Use portable wireless computers	The surgeon can fill out the surgery registration in the system during the patient notice meeting.	Decrease the time needed to copy information from paper to IT systems by making it possible to fill in the forms directly in the system.
Relocate the office	Relocate the coordinators' office, as a suggestion, the administrative department could be a better location.	Interruptions from staff will decrease. Will work closer to other administrative units that they work closely with.

6. Discussion

The discussion is divided into two parts. The first part consists of general reflections about the results and observations during the thesis. The second part contains a SWOT-analysis of the master thesis to highlight some of the pros and cons of it.

6.1 Insights from the Work Process

The purpose of the thesis was *to understand and document how the coordination process of breast cancer surgeries works today and develop improvements that can decrease the problems the process currently is faced with*. The current state chapter provides a process map over how the coordination process works today and has the benefit of providing an overview of the process. This makes it easier for staff to understand how things work. For instance, newly hired staff can faster understand the process steps by looking at the visualization or management can easily get an overview and understand the process, hence relate to the work the coordinators are doing. Therefore, it can be concluded that the process is documented and can provide a deeper understanding as the first part of the purpose highlight. The recommendations given in Table 7 are mainly focusing on mitigating the effects of the problem areas consisting of internal and external disturbances. For instance, making information available, visualize the schedule and create time slots for staff questions can be considered easy to implement and immediately decrease the problems with external disturbances. Other recommendations, such as relocating the office, setting routines for surgery registration and assigning extra resources during seasonal peaks takes longer time to implement but will also address the disturbances if implemented successfully. Therefore, it can be concluded that the second part of the purpose is fulfilled with reservation for the last problem area, uncertainties.

Of the three areas identified in *4.3 Problem Areas*, uncertainties is the problem area where solutions are more difficult to establish since these issues needs to be handled on a strategic level. When planning resource capacity in relation to patient demand, the surgery department has to cooperate with many other departments at the hospital, all in need of for instance operating rooms and time slots for tests and medical consultants. Since these departments have their own agendas they may not always work efficient together with the surgery department, and therefore creating issues. An example of this is the closing of the pathology department two hours earlier than the surgery department, which hinders the surgery department from doing certain surgeries the last two hours since they need to send samples of the removed tumour to the pathology immediately in order to run tests. However, due to these departments being independent, it is difficult to establish any suggestion of changes concerning it on an operational level. This has to be handled on a strategic level, where it should be obvious that these types of mismatches need to be removed. A belief is that by initiating communication regarding these issues on a management level, long-term strategic solutions can be possible but also short-term operational changes. The impression today is however unfortunately that each department is focused on their own operations and forget that improvements should also be applied, developed and shared all over the hospital. Thus, working towards finding ways to eventually implement best practice from different departments over the entire hospital is something that could be an important step in improving the operations on a system wide level at Sahlgrenska.

Another issue is the variation in availability of operating rooms that changes from week to week, sometimes on short notice. Even though there is a baseline with available operating rooms that remains rather stable, additional rooms can be added and then later removed on quite short notice. Some weeks there are four operating rooms available per day, but this can change to two per day on quite short notice due to unexpected changes. The problem is that each time this occurs it triggers a process where the coordinators have to put in additional time to call various functions at the hospital and do extra coordination work to be able to assign a patient to an operating room on short notice. Or in the case when an operating room is removed, a patient has to be rescheduled. Hence, all the effort put into scheduling or rescheduling a patient to an operating room on short notice makes it more difficult to handle the regular tasks that the coordinators have to do. This also implies that the schedule that is developed by the coordinators contains variations each week which is making the current process difficult to standardize. These time consuming extra activities could be solved by having an increased number of fixed operating rooms available during the year, which would reduce the uncertainty when planning and reduce the time spent on rescheduling and scheduling patients with short notice.

An issue that could occur by having a fixed capacity is that there will be a mismatch between the number of surgeries needed and the number of surgeries that are possible due to the capacity of the operating rooms. Usually the demand for surgeries increase after the summer due to mammography screening being done during late summer, creating a peak in demand for surgeries. This, in combination with a previously fixed capacity after the summer makes it difficult to meet the rising demand, which results in an increase in waiting time after the summer. However, this can be solved either by from start deciding a proactive capacity strategy over the year instead of changing it from week to week in a reactionary way and/or examine if it possible through a dialogue within the unit to see if the mammography screening can be spread out more evenly over the year. This could for example be an old decision that is not relevant anymore and therefore currently causing more problems than it is solving.

Regarding old decisions that are not relevant anymore, it seems to be a common problem that has been brought up during interviews with both surgeons, nurses and the central logistics department at SU. The problem is that there is little time and incentive for communication between different staff roles and departments around the hospital. A concrete example from this thesis is that it is believed that direct reconstruction surgeries in cooperation with the plastic surgery department only can be done on Thursdays, but actually the case seems to be that they could do that kind of surgeries four days a week. It was only in the past that surgeries were possible on a Thursday. Thus, allocating more time for communication between various departments with the goal of discussing issues and improvements, would unleash motivation and energy to act and create solutions to those limitations.

Furthermore, it is obvious that the staff at the hospital feel that many things are problematic. However, there is no way to measure the issues that are present. There needs to be a culture where an observation of an issue is measured to see how large the problem actually might be. An example is the frequency study that was made during this thesis to either confirm or reject if an issue mentioned verbally was significant. If one gets disturbed 30 times per day, then obviously something has to be done compared to if it was discovered to be only two times per

day. Numbers helps to visualize, prioritize and motivate actions to be taken regarding a situation. Not only should the culture be to always improve, but to measure and compare as well.

Lastly, a general improvement not necessarily related to the coordination process, concerns the overall philosophy and approach regarding the coordination process. A more continuous view towards improvement and learning in terms of problem solving regarding how coordination is performed and the considerations and restrictions relating to that is important to adopt. Instead of working with customizing the coordination of each surgery and make adoptions that increase the complexity of the process, the standard process needs to be simplified. Even though it sometimes is argued that standardization might not be appropriate for healthcare, a volume of around 900 surgeries per year cannot be handled in a customized way by the coordinators in a sustainable manner. There needs to be a certain level of standardization for the simpler surgeries, thus opening up for customization for the cases where this instead really is necessary. Thus, an extensive review of all the current restrictions needs to be performed, in attempt to identify potential bottlenecks in the process. By doing so, it becomes possible to take on a system perspective and for instance look over the opening hours at departments where labs are tested if these indeed turn out to restrict the surgeries that can be performed during certain hours. All of this should revolve around an attempt to limit the ideas regarding which constrains that are truly necessary and limit the considerations so that the available operating rooms can be used to the fullest extent possible. With this being said to be the top priority among the majority of the interviewees during this thesis, the strive needs to be directed towards a fulfilment of such goals.

6.2 SWOT

The purpose of the SWOT analysis is to provide insights of the strengths and weaknesses of the thesis. Furthermore, the section seeks to explore some of the opportunities that the surgery department has as a result of this thesis and some of the threats that may hinder these opportunities from being realized.

Strengths
The thesis has used established literature and tools that have been proven to work well in a healthcare context. The goal of the thesis is not to fully enforce an implementation of all the solutions, rather to provide important insights in the benefits of working differently and which tools that can be used to do this. Hopefully, the solutions enable a discussion that will trigger a motivation to change, try the solutions provided and find other ways to further improve in the future.

Another strength is the transformation from words to numbers. In the beginning of the thesis it was common to hear that “something was a huge problem” or “last week was very hectic due to the extensive amount of phone calls”. However, it was difficult to understand the quantity of the problem and therefore a frequency survey was established to make sense of what these words actually meant. By quantifying for example the number of interruptions from different sources, an incentive has been created to actually act on the problem, which works as a motivation to improve the working environment. The thesis provides many insights in how the coordinators can work proactively to avoid problems and disturbances from occurring again instead of acting reactive and not solving the problems.

Weaknesses
One of the strengths presented is that both qualitative and quantitative data have been collected. However, the data should be complemented by doing further data collection, spanning over a longer period than a week. Collecting more data means that the numbers could be statistically significant, which means that the numbers will represent the reality more accurately. This can then help to highlight what problems that have the most impact and work as a basis for prioritization. In addition, the data collection for the current state map posed a challenge due to the difficulties in measuring time spent on journals. Frequent interruptions, large variations in the time spent, as well as the mixture of work tasks performed while handling a journal made it hard to capture any relevant data regarding time. However, with quality and accuracy being the most important dimension for the outputs, the possibility of collecting data regarding such compensates the lack of data regarding time to a quite large extent.

An issue that can be a weakness if not mentioned is the use of one particular theory. Even though Lean is an established philosophy with several tools, proven to have positive outcomes on various companies, it can also limit the thinking and there may be more possible solutions that can be applied. However, since the goal is to provide insights on how problems can be solved, a discussion is still triggered and may be beneficial.

A weakness in this thesis is the lack of consideration to implementation and change management theory. It is easier in theory than in reality to implement new ways of working in an organization depending on various factors such as resources available, culture to change, knowledge about the organization and much more. However, the surgery department has a history of success with improvement projects and with a culture among the staff that change is good and always should be on the agenda, which decreases the risk of failing with an eventual implementation. What can be a weakness is the limited knowledge of the thesis members regarding the treatment processes and additional relevant knowledge related to the healthcare organization that hinders some of the solutions to be implemented at all.

Opportunities
One of the major opportunities from this thesis is to learn from the interviews done at Carlanderska. Carlanderska has successfully implemented and adapted the IT system Orbit to fulfil many of the needs of the hospital. This was possible by having several workshops with different departments so everything could be aligned and all the information gathered at one place and in one system. There is nothing that stops the surgery department from achieving some of these benefits as well. There is a limitation that many of the present systems still have to be used due to the dependency of other departments' IT systems. However, internally Orbit can be a system where much information can be gathered and accessed by everyone. For example, patient data, surgery date and a schedule for all surgeries which is requested by both surgeons and nurses and is currently not possible to access. Orbit can make this easier by simultaneously reduce the amount of paperwork and questions if the time is given to implement it well. Orbit training and workshops should be established and given to everyone to enable a cross-functional cooperation to come up with a IT system that solves problems and avoid local adaptations.

Another major opportunity is to use this thesis as a dialogue starter for discussing future improvements. There could be cases where some of the suggestions are impossible to implement due to different limitations. However, the suggestions still provide insights of a possible future state that can be reached in the future, but with the possibility to start doing small changes now.

Threats

The first identified threat is the lack of resources given to learning and developing the new IT system Orbit. Orbit, as mentioned, has some great potential but resources in terms of releasing staff from the daily tasks to learn Orbit and participate in workshops have to be given. This can be a problem due to staff shortage and/or other reasons. However, the surgery department is good at providing improvement hours and these could be allocated to Orbit.

A second threat can be the limitation to implement some suggestions due to resource constraints from management or unwillingness from other departments to change since these units have their own strategy and agenda. This can affect the motivation for the staff to implement the solutions provided in this thesis and therefore push the staff back to working as usual.

7. Conclusion

The purpose of the report was *to understand and document how the coordination process of breast cancer surgeries works today and develop improvements that can decrease the problems the process currently is faced with*. The research strategy was abductive, matching academic theory to a real-life observation of the coordination process at SU. The tools chosen in the methodology, for example interviews, AIM and observations, were all chosen with the purpose to help defining the scope and establish a clear goal with the master thesis and assist in forming and answering the research questions. Frequency studies were used to quantify some of the issues that were stated as problems by the coordinators. However, the frequency studies could have been more extensive to ensure significance. It is recommended that the coordinators take the opportunity to continue to measure to determine how large of an impact a specific issue has.

The conceptual framework developed in 3.4 shows how theory helped answering the research questions. Healthcare organization theory helped to define the stakeholders related to the coordination process and a suitable way to improve the situation. VSM helped to create a current state and to highlight issues present in it and develop a future state, while Lean assisted in categorizing the issues in different types of waste and develop solutions to them.

Research question one, "*What does the coordination process look like?*", is answered in *4.2 Current State Map and Description* with a figure over the process steps in the coordination process. The coordination process consists of twelve main steps. Parallel with the creation of the process map, the second research question was answered, "*What problems does the coordination process have?*", in *4.3 Problem areas*. Three main categories of problems have been identified in relation to the coordination process. Internal disturbances refer to the problems arising in the coordination process itself and hinders the steps described in the current state. The internal disturbances have been divided into the subgroups: information quality, unexpected changes and special patient cases. External disturbances relate to the many different interruptions and issues that disturbs the coordinators in their daily work and have been divided into two subgroups: staff related disturbances and telephone disturbances. Uncertainties concern the factors that affects the planning on a higher level and longer time horizon. These exists outside the coordination process, but affect it in many ways, and are thus crucial to highlight. These have been divided into three subgroups: staff and scheduling, resource capacity and patient demand.

The final research question, "*What improvements can be made to the current coordination process to decrease the problems?*", is answered in *5. Development of a Proposed Future State,* beginning with an analysis of the current state and ending with a recommendation in *5.8 Proposal of a Future State.* The first part in 5.8 presents a process map over a future state, Figure 14, that is believed to be more efficient than the current state map. This is achieved by relieving much of the workload that the coordinators are facing today by removing some work tasks that are redundant and/or non-value adding. The second part presents Table 7 that summarizes recommendations that are not purely related to a process change. These recommendations span from small changes, such as spreading information to the hallway, to larger changes such as implementing new ways to measure and identify problems in the work to foster a culture of continuous improvements.

By addressing issues related to the process through the new design as well as improving the external work conditions by reducing the amount of interruptions during a day, much of the stress that the coordinators are feeling should be reduced if the recommendations are implemented. However, not all recommendations will be easy to implement since these suggestions need support from management. For example, establishing a capacity strategy or giving more resources for Orbit implementation requires extensive involvement from management compared to the removal of an inventory slot in the current state. An important learning for future improvement efforts is to be more data driven when an issue is identified to make it easier to understand the size of the problem and to motivate why change is needed.

There are many questions that came up during the work with this project. An interesting idea is the possibility to, as mentioned, develop a strategy for capacity that is set in the beginning of each year to avoid changes from week to week. Currently, given from a meeting with the central logistics office, it is unclear who carries the mandate to make decisions regarding capacity planning, but for instance this could be the hospital director. This is a problem since a hospital director typically has many other issues to handle and therefore capacity strategy is not prioritized to the extent it should be. SU is in the process of recruiting an operative director that would have the mandate to do this in the future and therefore this could be an interesting idea of future research.

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Appendix A – The Data Collection Sheet

	Dag 1	Dag 2	Dag 3	Dag 4	Dag 5
Operationsanmälningar					
Antal					
Felaktig information					
Information saknas					
Veckofolder					
Antal +1 vecka					
Antal +2 veckor					
Antal +3 veckor					
Antal +4 veckor					
Kallelser					
Antal skickade					
Fack mellan skrivbord					
Antal journaler					
Fack på hyllan					
Antal journaler					
Veckoplanering					
Antal kort varsel					
Dagsplanering					
Information saknas					
Information felaktig					
Journaler till sekreterare					
Antal					
Frekvensstudie av störningar					
Personal har operationsplaneringsfråga					
Personal har övrig fråga					
Telefonavbrott från annan del av sjukhus					
Telefonavbrott från patient innanför patienttid					
Telefonavbrott från patient utanför patienttid					

Appendix B – The Surgery Registration Form

Sahlgrenska Universitetssjukhuset **BRÖSTCENTRUM**

Namn:

OPERATIONSANMÄLAN

Personnr:

Prio ☐ SVF ☐ 1 ☐ 2 ☐ 3

Kort varsel, mobil nr _____

Prel op tid _____ ☐ Ej lämplig för dagkirurgi ☐ Dagkirurgi SU/Mölndal

Diagnos

☐ C50.9 Bröstcancer ☐ D05.9 Cancer in situ ☐ D24.9 Benign tumör i bröstkörtel

☐ D48.6 Oklar tumör i bröst ☐ Z40.0 Ärftlighet för bröstcancer

☐ C43.9 Malignt melanom i huden

☐ C77.3 Lymfkörtelmetastas i axillen ☐ C77.4 Lymfkörtelmetastas i ljumsken

☐ Annan diagnoskod _____

Ingrepp	Kroppsdel	Sida	Kod

Hjärt- och lungstatus utförd ☐ Ja

Foto pre op ☐ Nej ☐ Ja

Uppskattad OP tid: _____ **min**

Indikering ☐ Nej ☐ Ja

SN lymfscintigrafi ☐ Nej ☐ Ja

SN Snabbsvar ☐ Nej ☐ Ja

Infektionsprofylax ☐ Nej ☐ Ja, inj Ekvacillin 2gx1 iv engångsdos ☐ Ja,_____

Trombosprofylax ☐ Nej ☐ Ja, inj Fragmin 5000E sc kl 20, op dagen i 5 dagar

☐ Start dagen innan

☐ _____

Studiepatient ☐ Nej ☐ Ja, _____

Pre operativ utredning ☐ Nej ☐ Ja, _____

☐ Ja, _____

Seponera läkemedel ☐ Nej ☐ Ja, _____ i _____ dagar

Tolk ☐ Nej ☐ Ja, språk _____

MRSA ☐ Nej ☐ Ja, (Land/År) _____

Annat ☐ Nej ☐ Ja, _____

Namn: **Datum:**

www.sahlgrenska.se

VÄSTRA GÖTALANDSREGIONEN
SAHLGRENSKA UNIVERSITETSSJUKHUSET

Sahlgrenska Universitetssjukhuset
413 45 Göteborg
TELEFON växel 031-342 00 00

Operationskoder

Bröst

HAC20 Mastektomi

HAC22 Mastektomi + axillutrymning (MRM)

HAB40 Partiell mastektomi

HAB00 Extirpation av förändring i bröst

Onkoplastik

HAD30 Samtidig reduktionsplastik

ZZR70 Samtidig omformningsplastik (t.ex. Roundblock, Grisotti)

HAE10 Samtidigt volymsubstitution med lambå

HAC20 Samtidigt kontralateral mastektomi utan rekonstruktion (profylaktiskt ingrepp)

HAD40 Mastopexi

HAD50 Ta bort bröstprotes

HAD55/57 Kapselklyvning/excision

HAC10 Subkutant mastektomi med bevarad mamill

HAC15 Subkutant mastektomi med excision av mamill

ZZS50 Inläggning av vävnadsexpander

Lymfkörtlar

PJA10 Sentinel node biopsi

PJD52 Axillutrymning

PJD55 Inguinal utrymning

PJD54 Iliacal utrymning

Melanom

QBE10 Utvidgad excision på bålen

QCE10 Utvidgad excision på övre extremitet

QDE10 Utvidgad excision på nedre extremitet

PBW99 Brachial ILP

PDW99 Iliacal ILP

PEW99 Femoral ILP

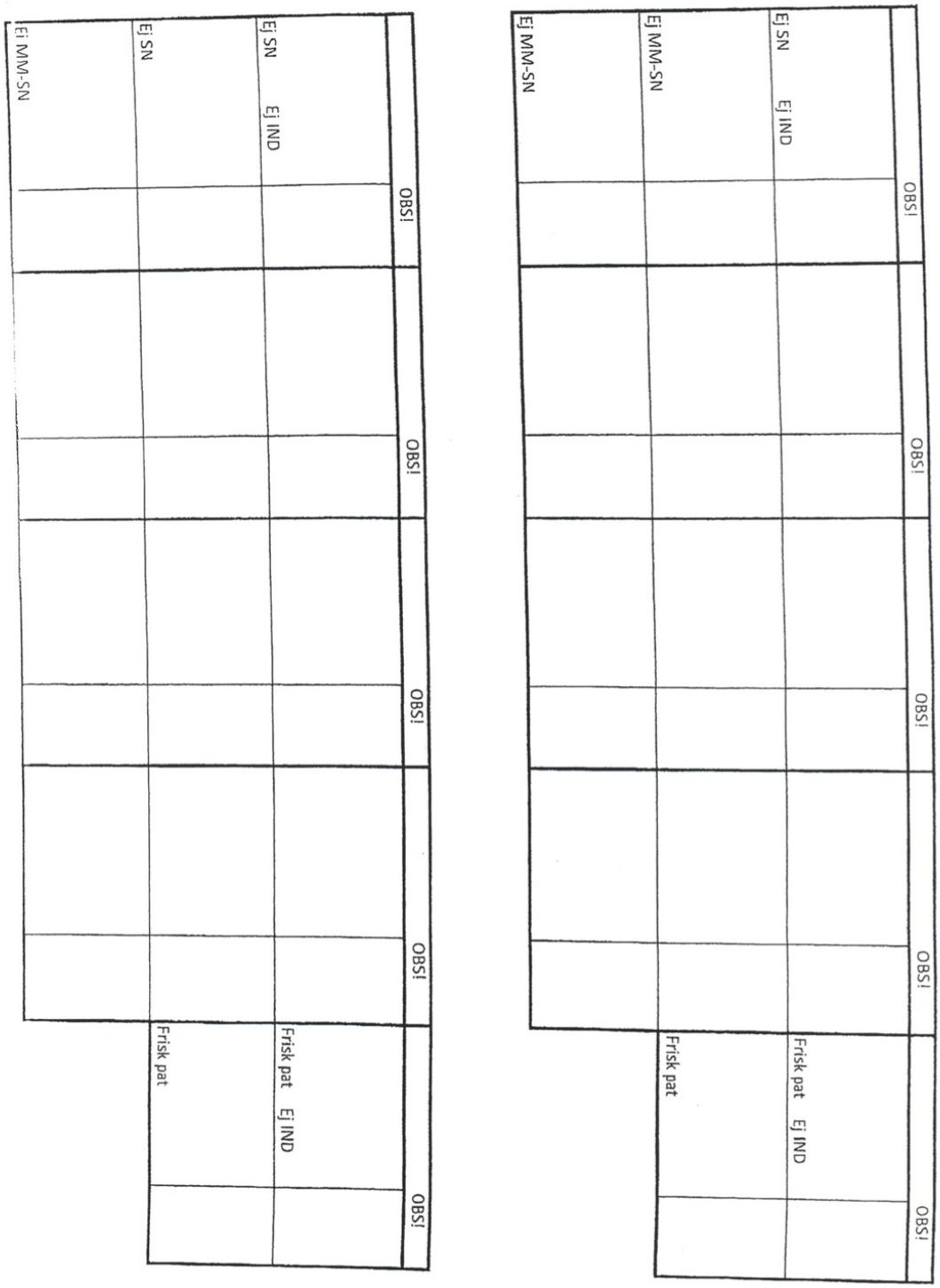
Appendix C – Preliminary Schedule for Surgery

	PAT ID	INGREPP	OBS!/ÖVRIGT	Anm läk	opdag
1			Ej IND ej SN		
2			Ej IND ej SN		
3			Ej IND ej SN		
4			Frisk! Ej IND ej MM-SN		
5			Frisk! Ej IND ej MM-SN		
6					
7					
8					
9					
10					
11					
12					
13					
14					

MAX 6 MM-SN

V 13 26/3 – 29/3

Appendix D – The Weekly Schedule



Appendix E – The Patient Invitation for Surgery

Kirurgimottagning
Blå stråket 5, uppgång E, vån 2
Sahlgrenska sjukhuset
www.sahlgrenska.se

[<Personnummer>]

Kallelse

[<Datum-kort>]

[<Namn>] [
[<Gatuadress>]
[<C/o adress>][<C/o postnummer>]

[<Postnummer>] [<Postadress>]

Välkommen till kirurgmottagningen/bröstteamet, Sahlgrenska sjukhuset
för inskrivningsbesök [<Inläggningsdatum-kort>]

Operationen kommer att äga rum [<Operationsdatum-kort>]

För vägbeskrivningar vg. se informationstavla i huvudentrén.
Inskrivningsdagen [<Inläggningsdatum-kort>]:
Klockan 7.30 börjar du med att gå till mammografiavdelningen för insättande av trådmarkering via stick. Blå stråket **3**, vån 2 (**ingång utifrån**, mellan huvudentrén och akutmottagningen).

När markeringen på mammografiavdelningen är klar går du direkt för blodprovstagning.
Provtagningscentralen ligger i entréplan, Blå stråket **5,** huvudentrén.
Du behöver EJ vara svältande inför provtagningen. Ät frukost som vanligt.
När blodprovstagningen är klar går du direkt till **kirurgmottagningen**, Blå stråket **5**, uppgång E, vån 2.

Inskrivningen kan ta nästan hela dagen i anspråk (beroende på vilken operation som ska göras).
När du är klar med inskrivning och ev. förberedelser får du gå hem och återkomma på operationsdagens morgon. Du kommer överens med inskrivande sköterska om hur dags du ska komma.

OBS!
Tag med fotolegitimation.
Tag med aktuell medicinlista och aktuella läkemedel (avdelningen har ett begränsat läkemedelsförråd).
Det är viktigt att du EJ rakar vid operationsområdet tex. armhåla/ljumske en vecka före operation.
DUSCH innan operation, vg se bifogad duschinformation.

Står du på blodförtunnande läkemedel såsom Waran, tag snarast kontakt med ansvarig läkare alt AK-mottagning för ändrad ordination inför operationen.

Önskas tolk vid inskrivningen, tag snarast kontakt med undertecknad.

Om tiden för inskrivning/operation inte skulle passa var vänlig meddela detta snarast på telefon 031 - 342 1676.
Telefontid måndag - torsdag, mellan klockan 10.00 - 12.00

Om akuta situationer uppkommer kan vi bli tvungna att skjuta upp din operation med kort varsel.

Med vänlig hälsning
Ingrid Bourgström
Koordinator/Leg Sjuksköterska

SAHLGRENSKA UNIVERSITETSSJUKHUSET

BESÖKSADRESS: Kirurgimottagnig
Blå stråket 5, vån 2, Sahlgrenska sjukhuset
POSTADRESS: Sahlgrenska Universitetssjukhuset,
Kirurgimottagning, 413 45 Göteborg
TELEFON: Vx: 031-342 00 00

Appendix F – The SVF for Breast Cancer