Rationalisation within a healthcare context: Application of the concept Theory of Constraints within a minor healthcare department

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Rationalisation within a healthcare context: Application of the concept ToC in a minor healthcare department

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Effektivisering inom sjukvården: Applicering av konceptet ToC i en mindre sjukhusavdelning
av
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Abstract

The demand for healthcare services is currently growing worldwide with an ever increasing pace. Healthcare institutions need to adapt to the changing demographics in order to satisfy the demand. Meanwhile, many hospitals and care units have limited economic means to find appropriate solutions. A concept from the manufacturing industry that is considered to fulfill these criteria’s is called Theory of Constraints (ToC). This concept is focusing on streamlining processes by coordinating the activities and ensuring an efficient stream the production flow. This study has investigated the ability of the concept to support medical and administration staff in the department’s overall objective to decrease overall lead time.

The investigation has been realized by conducting a case study at one of the largest emergency hospitals in Stockholm, Sweden. The hospital is one of the leading hospitals within Swedish medicine and receives and treats over 300000 patients annually. The case design consisted of three methods all linked to qualitative data collection, the three methods consisted of interviews, observations and shadowing.

The results suggest that the application of ToC revealed little resistance to change among the participants. The concept was able to identify and resolve minor constraints in the case setting; the department of obstetrics and gynecology and also display promising characteristics in terms of solving more complex and intricate constraints. ToC as a concept were able to identify constraints in a healthcare department with a simple yet apparent cause and effect linkage. Finally, the findings indicate that ToC complements the concept of working with Continuous Improvements (CI) within the healthcare.

The conclusions from this study have implications both in a theoretical perspective and a practical perspective. The findings provide additional empirical data to a field that is currently dominated by theories. In a practical aspect, the results of this study provides hospitals insights of ToC, a potentially valuable tool to improve efficiency and decrease lead times while working long-term towards an approach with CI.

Key-words: Continuous Improvements, Rationalization in healthcare, Resistance to change, Theory of Constraints
Sammanfattning


Utredningen har genomförts praktiskt genom en fältstudie på ett av Stockholms största sjukhus. Sjukhuset är ett av de ledande inom svensk medicin och tar emot och behandlar uppemot 300 000 patienter årligen. Fältstudiens utformning bygger på tre metoder, intervjuer, skuggningar och observationer vilket alla är sammankopplade med kvalitativa datainsamling.

Resultaten indikerar att tillämpandet av konceptet ToC har påvisat litet förändringsmotstånd av de som har deltagit i förändringsarbetet samt att konceptet har haft förmågan att identifiera och lösa mindre restriktioner inom sjukhusavdelningen för Obstetrik och Gynekologi. Detta har i huvudsak gjorts genom att kartlägga olika aktiviteter med en tydlig orsak och verkan samband. Utöver detta så har konceptet initialt påvisat intressanta framsteg för att eventuellt lösa mer komplexa restriktioner som begränsar produktionsflödet i en sjukhusmiljö. Vidare så framgår det att konceptet ToC i viss utsträckning kompletterar filosofin att arbeta med kontinuerliga förbättringar (Continuous Improvements/CI).

Slutsatserna för denna studie har implikationer för både ett teoretiskt och praktiskt perspektiv. Utifrån ett teoretiskt perspektiv, så förser resultaten från studien med ytterligare empiriska data i ett område som för närvarande är uppbyggt av teori och litteratur. Utifrån en praktisk synvinkel ger resultaten för denna studie sjukhus och vårdinstitutioner värdefulla insikter om konceptet ToC, ett potentiellt värdefullt verktyg för att förbättra effektiviteten och minska ledtider samtidigt som det stödjer ett långsiktigt arbete med kontinuerliga förbättringar.

Nyckelord: Ständiga förbättringar (Continuous Improvements), Rationalisering inom sjukvård, Förändringsmotstånd, Theory of Constraints
Foreword
This master thesis has been conducted at the department of Industrial Engineering and Management at KTH, The Royal Institute of Technology in Stockholm, Sweden. This report is the final product of a 30 credit academic course at KTH. The report was written during the spring of 2016.

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Stockholm, August 2016

Johan Chen
Abbreviations
ToC - Theory of Constraints
CI - Continuous Improvements
WIP - Work in progress
CSF - Critical success factors
CIF - Clinical Innovation Fellowships
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1. Introduction

In this first chapter the background will be presented to the study and also the problem formulation, purpose and aim. Finally, research questions and delimitations will be discussed within this chapter.

The healthcare industry is an essential integral for the society to promote long-term growth and development. Currently, there is a worldwide trend where the population is growing and the life expectancy is increasing. In the perspective of the healthcare industry, this changeover has increased the overall demand for healthcare services. For the future, it is inevitable that the healthcare system needs to be continuously evaluated and improved in order to accommodate the increased number of patients. Currently, many hospitals have very limited resources for their daily production (Appelbaum & Wohl, 2000). This has led to the fact where the majority of the healthcare industry is constantly targeting to reduce costs and increase their financial resources. However, the hospitals main priority is to always strive for the highest level of patient satisfaction (Cardoen et al., 2010). This balancing act is a continuous conundrum for healthcare organizations (Bourdais et al., 2003).

The operation stage is considered to be one of the largest cost and revenue epicenter in the healthcare organization (Healthcare Financial Management Association, 2003; Macario et al., 1995), thus it has a notable impact on the performance of the healthcare organization as a whole. Therefore, utilizing the appointed resources for the healthcare industry becomes more and more important. Finding new ways to manage this operational and financial dilemma has thus far found limited solutions. This issue within the healthcare industry has been encountered in other industries, among them is the manufacturing industry. The manufacturing industry is one of the most competitive, optimizing costs while maintaining production output is a scenario that is shared with the healthcare industry.

One of many successful concepts implemented in the manufacturing industry, is Theory of Constraints (ToC). The concept has recently gained a lot of interest. Studies has been conducted across industries (Reid, 2007; Schragenheim & Dettmer, 2001; Lummus et al., 2006; Lubish et al., 2005) where positive indications have been observed. In brief, the concept combines a systematic overview of a specific process and aims to optimize it by locating constraints. These constraints are considered as activities or areas of a process which causes inefficiency and consumes unnecessary amounts of resources. Thus, the process of locating and eliminating constraints should in theory (Goldratt, 1990) generate an efficient process with equal or higher output utilizing small resources to achieve noticeable results.

An application of ToC in a healthcare context given the similar industry characteristics with the manufacturing industry is therefore very interesting. Closely linked with ToC is a concept called Continuous Improvements (CI) which specifies a framework for the organization to efficiently improve processes. CI and ToC are two concepts from the manufacturing industry both targeting to rationalize processes in an organization (Reid, 2007). Since neither concept has been studied deeply in the healthcare context there is consequently a need for supplementary empirical studies.

1.1 Problem Formulation

The department of Obstetrics and Gynecology, from here on the healthcare department will refer to the department of Obstetrics and Gynecology, in a large emergency hospital in Stockholm has expressed a need for improving their surgery scheduling process. This process is considered as one of the core processes within the department where internal information
flows regarding surgery scheduling. Thus, the healthcare department wants to investigate the conditions for efficient rationalization within the healthcare department. In what ways an application of ToC may complement the rationalization of the surgery scheduling process; what is the current status of the surgery scheduling process and what inefficiencies that could be detected. Secondly, the department wants to assess the ToC and in what ways it may benefit the department in a long-term perspective in terms of working with CI.

1.2 Purpose and goal
The purpose of this study is to investigate how the concept of ToC may complement and contribute to rationalization within the healthcare sector. More specifically, the purpose is to address the gaps that currently exist within the concept of ToC and provide insights of how and in what ways ToC may complement managers driving rationalization within the healthcare sector.

The goal of this study is to help the healthcare department to reach their objective of becoming an efficient department with a focused and sustainable strategy for rationalization. Thus, they would like to be remodeled into an efficient subset of a healthcare organization that encourages continuous improvement within the department.

1.3 Research questions
The purpose will be fulfilled through answering following main research question:

**MRQ**: What are the managerial implications of applying ToC in a healthcare department’s surgery scheduling process?

In the interest of answering the main research question, three sub-questions have been formulated:

**SQ1**: What types of inefficiencies have been identified in minor healthcare department using the concept of ToC?
- How can the identified constraints be validated?
- What are the identified drawbacks when applying of ToC?

**SQ2**: What is the perception of rationalization in regards to applying ToC within the minor healthcare department and what are the challenges?

**SQ3**: In what ways could ToC create an efficient way to work in the healthcare department?

1.4 Delimitations
The emergency hospital where the case study was conducted at consists of over 70 departments and clinics. The thesis was restricted to look solely into one department, the healthcare department and the operative staff groups of surgery coordinators, physicians and anesthetic staff. Within the department there are multiple inter-departmental functions, for example the surgery scheduling process is an inter-departmental function. In an inter-departmental function, each function could be further divided into several sub-functions. To provide a thorough analysis of each inter-departmental function and its sub-functions would not be possible given the limited time frame.

A delimitation of the study was a limited collection of data from the physicians, nurses and the administrative personnel of the department. Thus, in this study (due to time constraints) only key staff members from the department were selected for interviews, shadowing and
observations. Thus, the results only reflect what the staff members that were participating in interviews and by default should not generalize for the whole department’s physicians and nurses. However, the effect of this delimitation is slightly reduced, since applying ToC should be done with a top-down approach (Goldratt, 1990). Therefore, chiefs and other head responsible for the production of the healthcare department are the only relevant to participate in an application of ToC. Nonetheless it would be interesting to evaluate other staff members in the department without responsibilities. But due to time constraints and limitations of this project, this has not been included.

A limitation of this study that is coupled with the application of ToC was the set-up of a certain activities in the process of surgery scheduling. As the researcher’s knowledge of the surgery scheduling process and the healthcare industry in general was limited, the optimization of the surgery scheduling process was practically done solely on recommendations from the physicians and surgery coordinators (administrative staff members that are responsible for the surgery schedule). Thus, there are possibly a more efficient set-up for the activities in the process, but on the other hand the physicians and surgery coordinators do have more than 20 years of working experience regarding the set-up of a surgery schedule.

1.5 Thesis outline
The entire thesis consists of eight chapters. The content in each chapter is briefly summarized in this thesis outline.

Chapter 2 – Literature review
The literature review chapter presents findings in previously published work within the theoretical field of the study. This is done in order to give a relevant background and to answer the main research question and its sub-questions. In detail this section is written in order to get an overview and understanding of the concept of ToC and the relation to the manufacturing industry and how it in previous applications of the concept has complemented rationalization.

Chapter 3 – Methodology
The methodology chapter presents the chosen research design and the methods for data collection. The methods for data collection are then discussed along with the method and approach for analyzing the collected empirical data. Lastly, a discussion of the study’s reliability, validity and generalizability and other limitations are conducted at end of the chapter.

Chapter 4 – Empirical setting
The empirical setting chapter presents a thorough description of the case setting where the study was conducted. This has been done in order for the reader to get an overview and understanding for the context. The background, organizational setting and the surgery scheduling process is explained and lastly a discussion of the limitations and impact the empirical setting had on the study.

Chapter 5 – Results
The result chapter presents the overall findings from the study. The collected data that consists of three different sources are presented and sorted into themes in which they appeared relevant. A summary of the overall findings from the study are included at the end of the chapter.

Chapter 6 – Analysis and discussion
The analysis and discussion chapter presents a thorough discussion and analysis of the collected data from the study. The overall findings are compared and evaluated against previous findings from the theoretical framework. In detail, the overall findings that were
sorted into themes in the previous chapter are then adapted in order to answer the main research question and its sub-questions.

**Chapter 7 – Conclusions**
The conclusions chapter presents overall findings from the study in a summarized format in order to answer the research questions. This chapter also addresses the study’s research contribution.

**Chapter 8 – Future work**
The future work chapter presents the recommendations for future research.
2. Literature Review

The literature review presents contemporary research and studies from relevant fields in order to provide an understanding to the theoretical background which the study was based on.

![Diagram](image.png)

Figure 1. The theoretical framework visualizing the relationship between the three concepts and the healthcare context used in this thesis

2.1 Introduction

The theoretical framework presented in this chapter is used as a foundation and reference when analyzing the results and establishing the conclusions in this study. The research questions acknowledge three major areas, rationalization and optimization of processes, CI and the concept ToC; all of which are established in a healthcare context. In figure 1 above, the theoretical framework is apportioned in regard to these three areas and also apportioned into separate chapters in the literature review. The relationship between the three concepts is the application of the concept ToC in a healthcare context. The application of ToC is seen as the overall theme and the remaining two topics (rationalization of processes and CI) are to be seen as complements to the main topic.

2.2 Rationalization of healthcare industry processes

Rationalization as a topic has recently gained interest in many industries. As companies grow larger and enters new markets, it has become more and more important to improve and rationalize the processes within an organization. The main objective for the majority of the companies and organization that implements rationalizing efforts has been to increase the level of production and lowering costs (Esain et al., 2008). Rationalizing an organization’s processes is by definition, a cost efficient way to increase the levels of production without the necessity to make large investments (Goldratt et al., The goal: a process of ongoing improvement, 1992).

The manufacturing industry is one market where rationalization of an organization’s processes is already integrated (Jackson et al., 2011). In fact, the majority of concepts for
rationalization and improvement originates from the manufacturing industry; concepts such as Lean Production (Womack & Jones, 1994; Liker, 2005), Six Sigma (Smith, 1993) and Total Quality Management (Deming, 1982) are a couple of concepts with specific visions and applications for rationalization and CI. The approach for rationalization has already achieved large success in the manufacturing sector and the spoken effect of the concepts are spreading (Frazier & Reyes, 2000).

In recent times, the healthcare industry is one of the industries where manufacturing rationalization concepts have grown in terms of interest. Multiple studies have been conducted regarding rationalization and in particular the application of Lean philosophy (Esain et al., 2008; Kuo et al., 2011; Machado & Leitner, 2010). However, the results from the studies have not been unanimously positive. In fact, many studies express concerns about applying concepts from external contexts. They also question the ability to transfer and align the main assumptions from the native context to the destined context (Radnor et al., 2012). In a few cases the application of Lean has been negative (Sjöberg & Lindblad, 2014; Radnor et al., 2012). Despite concerns of compatibility of applying a concept in a new context, the motivation remains strong. Esain et al. (2008) emphasizes that the main reason the hospitals push for these concepts is the desire and desperation to improve certain processes.

In general, rationalization efforts within the healthcare industry have been overlooked in the past (Wehrens & Bal, 2012). The healthcare industry’s current approach to rationalization is characterized with limited resources in both time and effort (Radnor et al., 2012). Jack et al. (2009) strongly advise a change to the current approach for rationalization in the healthcare industry. If the rationalization efforts are carefully planned in terms of time and resources it will be difficult to provide sustainable solutions. Thus, the healthcare industry need to understand the importance of rationalization in order to find sustainable ways for efficient rationalization.

Dent & Goldberg (1999) argues that the need for rationalization projects should be the main motivation for implementing rationalizing efforts. In this way, the rationalization project has the most potential to provide success. Jack & Powers (2009) agrees with Dent & Goldberg (1999)’s views and adds that certain market characteristics such as the ambition to increase profit creates a natural drive and ambition towards rationalization efforts. The drive to increase profit or the impression of need for rationalization is not shared within the healthcare industry. In comparison to the manufacturing industry, the incentives for the employees to drive rationalization projects are not supported in the healthcare industry to the same extent as it is in other industries (Springer, 1999; Bone, 2002). Furthermore, the first priority within the healthcare context is to ensure the function of certain processes within the hospital or healthcare unit (Källberg, 2013). Thus resources and focus is directed towards maintenance instead of improvement. The drive and ambition for change and rationalization within the healthcare context is not supported until there are signs of major inefficiency, for example when the capacity is not sufficient.

Recently a series of studies have been conducted in the field of healthcare rationalization. Marklund & Eriksson (2014), Carayon et al. (2015) and Studer (2014) have conducted studies in increasing the performance of specific processes within the healthcare industry. These studies shared the same purpose, to improve the current working procedures and increase the performance of daily routines. When implementing various support systems (Carayon, 2015; Studer, 2014; Tapsell & Law, 1998) new technology has been added to the healthcare context. These studies indicated that the case settings for the studies were slow to adapt to new
technology and features. As a conclusion, a clear overall plan for the problem formulation and the contribution is important for a successful rationalization project within a healthcare context (Berglund & Danielsson, 2015; Carayon, 2015).

There is as a result a conundrum of finding the right rationale for implementing rationalization concepts despite the evident need for rationalization in the healthcare industry. It is similar to what previous studies have shown, important to align the objectives and reasons for rationalization projects before an implementation (Radnor et al., 2012).

2.3 Resistance to change in healthcare industries
Change projects typically create significant transformations in an organization. According to Kotter (1996), change projects almost always encounters resistance among staff members in an organization. Rationalization projects are a type of change projects that often also encounters resistance to change (Miller, 2004). Therefore, a major success factor for a rationalization project is to find ways to neutralize the resistance to change (Pettigrew et al., 1992; Springer, 1999; Schragheim & Dettmer, 2001). Several researchers have previously studied the effects of resistance to change while implementing new rationalization projects, a common conclusion has been that success of a certain project to some extent corresponds to the success of managing the resistance to change (Källberg, 2013; Kershaw, 2000; Lummus et al., 2006). Thus, before initiating rationalization projects, it is important to consider the features of the proposed change (Källberg, 2013; Tapsell & Law, 1998).

Organizations regardless of industry or background are under influence by internal and external forces. The internal and external forces add complexity when making decisions for a change (rationalization project). The forces in favor and against change could be analyzed utilizing a framework originally developed by Kurt Lewin and later adapted by Burnes (2004). Burnes (2004) states three major forces favoring organizational change (Burnes, 2004, s. 985):

- A sufficient amount dissatisfaction with the current status in regard to the performance in profit, quality or other relevant categories
- A strong aspiration exists to move towards a more desirable state
- There is an appealing strategy to reach the desired state

The conditions originally invented by Lewin but further developed by Burnes (2004) are complemented by Mabin & Davis (2003) which argues for the importance of the employees and their opinions and thoughts for the proposed change. A well-thought strategy and an apparent cause for the proposed change have been observed as enabling factors for a rationalization project (Mabin & Davies, 2003; Miller, 2004; Källberg, 2013). The importance of focusing on the employee links well with creating an environment which embraces change (Pettigrew et al., 1992).

More recent studies within the same field validates the conclusions from Pettigrew et al. (1992), Källberg (2013) concludes that establishing a culture of change is a way of increasing the likelihood for a successful rationalization project. Embracing and facilitating change is a sense of commitment from the whole organization, in Källberg’s study from 2013 concerning change processes within the healthcare industry, the hospitals that would not commit time and resources to a rationalization project was a major factor for whether or not the project would be successful. The correlation between commitment for a project and eventual failure has been indicated strong (Källberg, 2013).
Combining the two perspectives of change management, overcoming resistance and creating an environment for embracing change ahead of implementing rationalization projects (Kotter, 1996) appears to be two important perspectives.

### 2.3.1 Identified key factors for neutralizing resistance to change

Recent research studying the perception of change within the healthcare industry concludes that more change projects fail than succeed (Esin et al., 2008). Appelbaum & Wohl (2000) suggests that poorly adapted strategies for change projects in the healthcare could be one of the main reasons. Fryer et al. (2007) observed in their study on several healthcare units that it exists a non-coherent view on change for managers and employees. While managers might expect enthusiasm and positive reactions to a certain change project, the employees tend to view change as a disruptive and encroaching event. The authors suggest that this situation is becoming more and more common.

Already in the early 70s it was observed that inefficient communication is a critical reason why change projects fail (Lawrence, 1969). Efficient communication is therefore considered as a key factor for a successful change project (Kotter, 1996; Dent & Goldberg, 1999). In a non-transparent organization employees may have to interpret vague and limited information and fill in the gaps with their own beliefs (Appelbaum & Wohl, 2000). This is one of many factors that potentially could increase the resistance to change.

Dent & Goldberg (1999) and Kettinger & Grover (1995) suggests that deep involvement of the employees in a change project would facilitate an application/implementation of a proposed change. However, due to recent studies in this topic, change leaders should remain cautious for allowing excessive participation as it may ultimately decrease the efficiency when implementing changes (Källberg, 2013).

### 2.4 Translation of management models and methods

Most management models and methods are developed from the characteristics of an industry or market. The methods and models are generally designed to target issues and problems within that industry or market, for example, Lean production (Womack & Jones, 1994) was developed in the manufacturing industry targeting to increase output given limited resource. A specific management model or concept may not be successful in all context (Jackson et al., 2011). The rule of thumb for success when applying models and methods from one context into another lies in the success of translating the main features and assumptions into the new context (Trägårdh & Lindberg, 2004). Translating a main feature or assumption boils down to Employee manipulation as Latour (1998) phrases it, plays an interesting role for effective translation of models and methods. Employee manipulation is according to Latour (1998) a way to inform and adjust a model or method into fulfilling the needs and requests for the desired state after the change. Morris & Lancaster (2006) builds on the thoughts of employee manipulation by suggesting an alternation in strategy for translation. They suggest using strategies to create and display the current need for applying the models or methods. In this way it will spur the desire to apply it.

In conclusion, one of the most important aspects that enables a successful translation is to disengage distinctive features which are not applicable when applying it into a new context (Trägårdh & Lindberg, 2004). In order to understand which features to disengage, the managers will need to understand the needs for the designated context. This intervention is what Morris & Lancaster (2006) refers to as an essential and in most cases also a pivotal
component for change leaders when trying to efficiently communicate the proposed concept to their employees. An efficient strategy start of from the knowledge of the employees current beliefs and identified problematic areas within an organization (Latour, 1987; Morris & Lancaster, 2006).

2.5 Continuous Improvements

In this section, there is a discussion about different objectives for why organizations implement the concept CI. Originally CI as a concept was first established in the manufacturing industry by William Deming which described the concept as “Improvement initiatives that increase success and reduce failures” (Bhuiyan & Baghel, 2005). In recent times the concept has spread to other industries and contexts where applications have been carried out. This aspect of the origin of the concept will also be discussed. Following, the concept of CI is defined by considering the several distinct definitions that have emerged through previous research within the field. Additionally, the core features of CI are described. This has been done in order to gain full comprehension of CI and thus understand why specific prerequisites are required for an organization to gain success from applying the concept of CI.

2.5.1 Defining CI

Deming’s definition of CI which was described explicitly by Bhuiyan & Bagel, on the other hand there is a definition by Jamtvedt et al. (2006) describing the concept as an “on-going development of products, services or processes through internal initiatives for improvement”.

A third definition of CI is “a collection of working methods that team-leaders may use in order to improve the working procedures and increase the current efficiency in the organization” (Ramström & Stridh, 2008). As the quick overview of the several definitions of CI suggest that there is more than one way to define the concept. One possible explanation to the numerous definitions of CI appears to be different contexts where different definitions have been made to target the specific problem (Bhuiyan & Baghel, 2005). Thus, definitions may be business oriented, for the purpose of rationalizing an organization or a tool of education for the employees (Ramström & Stridh, 2008).

A potential drawback identified by Fryer et al. (2007) for the previous definitions is the lack of employee involvement. Fryer et al. (2007) argues that the exclusion employee involvement may severely affect the reception of the concept among the employees. This type of reasoning is aligned with the findings from Appelbaum & Wohl (1997), which suggested that rationalization projects within a healthcare setting, in general can be perceived as an encroaching event by the employees. Anchoring the concept among the employees might increase the possibility of a successful application. Therefore, the Fryer et al. (2007) argue for a broader definition:

“CI is where all members of the organization work together on an ongoing basis improving processes and reducing errors to improve overall performance for the customer.” (Fryer et al., 2007)

This definition explicitly emphasizes not only the team leaders and managers but the employees as well. As the study will take place in a healthcare context, this definition will be used onwards when discussing CI.
2.5.2 Motives for CI
In the manufacturing industry which is a part of the private sector, one of the main motivations to implement CI was to improve cost control and reliability (Terziovski & Sohal, 2000). Among other organizations within the private sector, the main motivation is to improve customer satisfaction as increasing the number of satisfied customer will increase profit (Fryer et al., 2007). The previous example displays contrasts in motivation for applying CI across the industries. Hence, finding the correct motivation for application has shown important in previous studies.

Studies that investigated the effects of CI in the healthcare industry has found that nurses are in a key position for a potential rationalization project (Pillay, 2009). Given their pivotal role, it is of high relevance to consider motivational factors when applying concepts such as CI.

Motivation for applying CI or other types of improvement models in a healthcare context is very different. One attractive factor for public hospitals is to alleviate the high work load using limited amount of resources to accomplish it (Machado & Leitner, 2010). Another motivational factor is to increase employee commitment (Fryer et al., 2007). Staff members are generally interested to give feedback and evaluations for processes and important functions, thus the nurses and doctors wants to be noticed for their job (Jamtvedt et al., 2006).

In general, the objective to apply CI from an administrative perspective has been found similar in many industries (among them the healthcare industry), to improve internal processes (Walley et al., 2006).

2.5.3 Success factors for CI
Critical success factors (CSFs) for working with CI vary considering the industry surveyed, within a certain industry or context there are CSFs that are considered more important than others in terms of achieving potential success. The identified success factors in the original context of CI, the manufacturing industry, differs compared to the public sector. The main differences concerns perspectives of the processes and employee empowerment. Important CSFs among the manufacturing organizations have been identified as concentrating on training and learning (Fryer et al., 2007). Learning new technology and implementing new innovations has been identified as important features in the manufacturing industry (Schragenheim & Dettmer, 2001). Whereas in the public sector the industry characteristics are different and are more focused on processes. The healthcare industry (regardless if it is private or public owned) main objective is to provide healthcare services (Lubitsh et al., 2005; Wickizer, 1991). Focus on processes and employee empowerment thus tends to be highly valued factors.

2.6 ToC
ToC is a management concept which views a manageable system as being limited to producing larger output by internal or external constraints in the defined system. The constraints in the manufacturing industry are often referred to as a bottlenecks (Simatupang et al., 2004; Rahman, 1998).

ToC takes a scientific approach towards improvements. The concept builds on the premise that every advanced system, for example processes in production, can be further broken down into several activities. There entire system is often limited by a single activity, that constraint activity is thus “the weakest link in the chain” (Goldratt M. E., 1990; Rahman, 1998).
The improvement method ToC was designed to, similar to many other improvement methods such as Lean, Six Sigma and TQM (Total Quality Management), to provide tools to achieve the ultimate goal – to make a profit in both short- and long term. The only real distinction compared to other improvement methods is the inherent focus on finding constraints in order to improve the throughput of the current system. The priority in ToC is always the identified constraint. In environments where there is a present need for improvement, the ToC may offer tools for fast improvement using its highly focused methodology (Goldratt et al., 1992; Simatupang et al., 2004)

The relationship between ToC and CI is that ToC embodies the main assumptions of CI suggesting improvements by utilizing a systematic approach which consists of five focusing steps (Lubitsh et al., 2005; Goldratt et al., 1992)

2.6.1 The five focusing steps

The core features of the concept ToC are the five focusing steps in which the system is analyzed and identified constraints are addressed and confronted. In figure 1 below, is a general description of the five focusing steps used in ToC.

1. Identify the system's constraint(s).
2. Decide how to exploit the system's constraint(s).
3. Subordinate everything else to the above decision(s).
4. Elevate the system's constraint(s).
5. Notice! If in the previous steps a constraint has been broken, go back to step 1, but do not allow inertia to cause a system's constraint (Goldratt, 1990).
1. **Identify**
   The first step is to find out the activity in the system that acts as a constraint. In detail one will need to identify the system source that is hindering an increase in performance of the system in comparison to its goal. Although there could exist two or more activities identified as constraints, it is usually only one single activity that acts as the main limitation or restraining factor. One possible approach to help determine the system’s constraint is to answer the question (Scheinkopf, 1999, p.17): “What, if only the system had more of it, would enable it to increase its rate of goal attainment?” In general,

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**Key terms in ToC (Goldratt, 1990; Reid, 2007; Lubitsh et al., 2005):**

- **Throughput**: The rate at which the system generates ‘goal units’ (NB: in healthcare the goal is not, as in business, simply to make money but to provide affordable, high-quality and timely care)
- **Investment**: All the money currently tied up in the system
- **Operating Expenses**: All the money the organization spends in generating goal units

The five focusing steps will be investigated in detail, as a step by step analysis will be conducted below:
constraints could either be internal when the capacity of a certain physical resource is insufficient or inefficient organizational work routines or policies. External constraints could be limited market demand for the organization’s products or services (Mabin & Davies, 2003). Planning and implementing strategies to surpass these limitations is the key to improve the system’s performance.

2. **Exploit**
   The second step aims to maximize the operational efficiency of the constraining resource in its existing configuration in the system. Specifically, the organization needs to evaluate the constraining activity and eliminate all non-value adding sub-activities and other wastes that create inefficiency (Goldratt et al., The goal: a process of ongoing improvement, 1992). Managers may exploit the constraint by securing the constraint activity to minimize or rather eliminate the downtime of the activity in order to make the activity as effective as possible.

   In the action of exploiting the constraint activity it is more likely to involve changes in the organizational working routines and policies that are currently used to handle the constraining aspect rather than implementing changes that require substantial monetary expenditures (Reid, 2007). Furthermore, exploitation in the constraining activity will most likely discover “hidden capacity” that may increase the throughput to increase without added expenses (Schragenheim & Dettmer, 2001). Exploiting the constraint activity alone may improve the system’s capacity constraint by 10-20 percent, e.g. improving the throughput amount by equal amount (Reid, 2007). Even though it is possible but highly unlikely Reid (2007) states that the identified constraint from step 1 may be improved sufficiently without the need for following through with the remaining steps and skip to step 5 and evaluate the new constraint of the system.

3. **Subordinate**
   In step 3 the focus is on the non-constraining activities (including resources) in the system so that their behavior is synchronized with and linked with strategy implemented to manage the constraint (Goldratt et al., The goal: a process of ongoing improvement, 1992). Although this step is theoretically the easiest, it is among the five focusing steps the hardest to fulfill (Rahman, 1998). In most cases it requires a shift in managerial thinking. For example, reevaluating the roles among various managerial staff within the organization might render staff members and their role within system as redundant in the light of the identified constraint’s activity. In reality, the subordination of non-constraints helps the managers to focus redirect the personnel utilizing their capabilities to support performance enhancement in the constraint. As in step number 2, this step contains changes in procedures and policies and can be implemented without significant monetary outlays (Simatupang et al., 2004).

   One approach to subordination is to coordinate the upstream non-constraint’s activities and resources in a certain way that the constraint will eliminate waiting time (Reid, 2007). According to the already stated definition about constraint and non-constraint activities, the non-constraint activities should be able to produce at a higher rate compared to the constraint and as a result produce buffers or excess work-in-process. This buffer ensures that the constraint will always be productive despite any fluctuations and/or temporary disruptions that may prevent upstream activities from functioning.
Repeatedly, if the constraint is fully relieved and functioning in accordance to preset goals and in smooth cooperation with upstream and downstream activities in the system, one may skip the step number 4 and proceed to the final step. Often, management will proceed to step number 4 (Reid, 2007).

4. **Elevate**
   The fourth step is to improve the performance of a constraint activity (Goldratt et al., The goal: a process of ongoing improvement, 1992). According to Reid (2007) and Rahman (1998) this step may be achieved by simply increasing the capacity of the constraints’ resources. While step 2 and 3 might not need significant monetary investments in order to tackle the identified constraint, this step will in most cases require monetary investments. For example, appropriate activities might be to recruit specific personnel skills, equipment or other types of physical resources to increase a constraint’s capabilities. If the identified constraint is external, for example decreasing market demand, other types of efforts such as new marketing strategies to elevate the capabilities of a certain constraint.

Many experienced ToC advisors (for instance, (Fox, 1984; Schragenheim & Dettmer, 2001; Simatupang et al., 2004)) recommend a thorough situational analysis before reaching the decision to invest in any strategies to remediate an identified constraint. The main reason for the proposed analysis is the fact that solving a constraint, new constraints will appear which could be even more difficult and/or costly to alleviate compared to the current. Therefore, in order to ensure the location of the constraint to as cost-efficient as possible, some firms are nowadays specifying their system’s constraint in a location that is easily manageable and cost-efficient according to the firm’s overall objectives and goals (Rahman, 1998). In this scenario, it is argued that it could be beneficial to increase the capacity of non-constraint activities in order to meet growing market demand before expanding the capacity of the constraining activity (Mabin & Davies, 2003)

5. **Prevent Inertia**
   Step number five, preventing inertia implies evaluating the new system setup and examine if the changes made in order to alleviate the identified constraint are adequate (Goldratt et al., The goal: a process of ongoing improvement, 1992). This is essentially important to the policy changes made in step 2 and 3 and to investigate the appropriateness. In other words, it is important to thoroughly scrutinize the improvements for the current constraint (Reid, 2007; Lubitsh et al., 2005). In brief, the five-step focusing method is a “system-based method for structuring managerial decision making within a continuous improvement framework” (Reid, 2007; Simatupang et al., 2004).

### 2.6.2 ToC in the perspective of CI
ToC as a concept has the goal of streamlining the processes where the concept is applied upon, this approach has a tendency of becoming a “quick fix” and in general a short term solution to decrease lead times (Reid, 2007). Rahman (1998) complements the thoughts of Reid (2007) by claiming the feasibility of ToC complementing the approach of CI (CI) is dependent on the initial set up and also the overall objective with ToC. Mainly, ToC needs to be set up for a long-term perspective in order to complement CI in an effective way. The effectiveness of ToC complementing CI is also dependent on the interval of conducting process analyses where the entire process is investigated and the activities are timed. The whole process is relatively time-consuming and there are question marks as whether or not ToC is feasible in a sustainable tool when working with CI. One of the criteria for a tool in CI is the importance of
short iteration cycles, if an iteration cycle is very time-consuming or require heavy capital investments it would not qualify as a feasible tool for supporting the approach of CI (Fryer et al., 2007).

2.6.3 Description of constraints
Rahman (1998) and Reid (2007) discovered that internal constraints can be further categorized in physical or policy related constraints and external constraints could be divided into market related or supplier related.

Constraints categories:
- Physical – In general concerns equipment, but may be additionally tangible items, such as deficiency in material, lack of people, or lack of space.
- Policy – May occur when rules are enforced that restrain a company’s operational capabilities or inflicts deficiency in flexibility towards achieving the overall organizational goal. Could be informal (for example descriptions to new employees as “how to conduct business”).
- Paradigm - Profoundly embedded beliefs or habits. For example, the belief that “we must always strive to maintain a specific cycle time on the equipment to lower the manufacturing cost per piece”. Familiar to the policy constraint.
- Market - Appears when production capacity surpasses sales (the production throughput exceeds market demand).
- Supplier – such constraints appear when an external source of an essential input such as material of equipment related becomes restricted (Reid, 2007). May occur when there is an absence of proficient suppliers to meet the system’s need or when policies or other regulations affect the choice of certain suppliers.

The different categories of constraints are adapted from Rahman (1998) and Reid (2007).

2.6.4 Success factors for ToC
During the short lifespan of the concept for ToC (developed originally by Goldratt (1990)), multiple implementations have been carried out. ToC has been applied in multiple studies evaluating the effects and a lot of research data has been added to the research field of ToC. Many studies have reports substantial improvement in performance (Mabin & Balderstone, 1999) as measured in amplified throughput and reductions in lead times, inventories and various costs. The concept has mainly been achieved success in production settings such as shop floor e.g. (Cox & Spencer, 1998) (Krausert, 1998) (Frazier & Reyes, 2000) and manufacturing support services (Kayton et al., 1997).

The improvement method from the manufacturing industry has spread to other industries and has gained interest in multiple contexts (Reid, 2007). One major success factor identified by Lubitsh et al. (2005) is if the process or work procedures where concept reassembles the predictability of a conventional production process (Lubitsh et al., 2005). The more complex a process is, the more difficult it would be to apply the concept. Lubitsh et al. (2005) applied the concept in a surgery department and concluded that the complications of determining an exact time for a specific surgery made it very difficult to realize positive effects when applying ToC to a surgery process. The unpredictability of each activity made it very difficult to determine if the time elapsed was due to normal variation or actual inefficiency. The authors suggest a careful consideration to which process that is suitable for application.
Another success factor is if the ability to customize and adapt the concept to reflect the local department’s needs and objectives is high the application is more likely to succeed (Simatupang et al., 2004). Aligning the objectives of the department with the objectives of ToC is very important to sort out before an actual application (Lubitsh et al., 2005).

Overall, in order to increase the probability of a successful application of ToC in a healthcare context Lubitsh et al. (2005) suggest to continuously evaluate and discuss the application among relevant staff members when applying the concept. Arranging regular meetings where staff members are able to discuss different perspectives and reasons to the findings from the application of ToC was found important for sustaining reliable and long-term results (Pettigrew et al., 1992; Lubitsh et al., 2005). In particular, appointing a ToC coordinator was found to be successful for ensuring a steady progression when applying the concept of ToC.

2.7 Summary of Literature Review
The research questions in this study displays three major areas; Rationalization processes, CI and an application of the concept ToC. The relationship between the three major concepts is that the application of ToC is seen as the overall theme and the other two concepts are sub-concepts complementing this theme.

Currently, as the demographics for societies are changing around the world, as the healthcare industry has thus far struggled to keep pace with the increase in demand, there is a constant search for sustainable solutions. The topic of applying improvement models and methods from the manufacturing industry has been increasing in interest with numerous studies being conducted (Rahman, 1998; Reid, 2007; Simatupang et al., 2004; Schragenheim & Dettmer, 2001). This approach of applying such improvement models and methods has previously achieved large success given limited overall resources. This approach has appeared to be attractive to the healthcare industry as the characteristics of the industry reassembles the characteristics of the manufacturing industry (Reid, 2007; Radnor et al., 2012; Mabin & Davies, 2003; Källberg, 2013). A few studies have been conducted of the improvement models and methods, especially Lean Production has gained attention where multiple studies have been conducted, however, as Radnor et al. (2012) and Wehrens (2012) concludes, an application of Lean Production within a healthcare context has been indicated to be less efficient than in the manufacturing industry. Instead, a few studies have indicated that other improvement methods may be suitable for the healthcare industry, two of them are called ToC (Reid, 2007; Lubitsh et al., 2005; Kershaw, 2000; Simatupang et al., 2004) and CI (Fryer et al., 2007; Ahlström, 2014; Terziovski & Sohal, 2000), albeit both are similar to Lean Production, have in previous research shown indications of success and improvement.
3. Methodology
This chapter describes the research methodology used in this study. A case study has been chosen as the primary research method. In detail, the case study as a research method was entirely qualitative, consisting of empirical collection of interviews, non-participant observations and shadowing. In this section each research method is defined in detail, following a description and lastly argued and rationalized by discussing benefits and weaknesses and by comparing relevant alternatives to the research methods utilized in this particular study.

3.1 Choice of Methodological Approach
The main purpose of this study has been to provide additional empirical data in an application of the concept of ToC in a healthcare context. A decision has been made to opt for a qualitative research design rather than a quantitative design. The main reason is due to the fact that qualitative research may offer an in-depth understanding for the context since the objective is to identify implications of applying the concept of ToC in a healthcare context (Kawulich, 2005; Collis & Hussey, 2013). The concept has previously been applied in various industries, previous applications will also be considered while discussing the empirical findings in the healthcare department.

The focus of the study has been towards interactions and events related to applying the concept of ToC. Therefore, a case study as a methodological approach is an approach which appears to be suitable according to Yin (2003). The author elaborates on the fact that case studies are designed to evaluate a specific phenomenon within a real-life context when the borders between the phenomena and the analyzed context are not evident (Yin, 2003). In this case, the studied phenomenon is the implications of applying ToC in a healthcare context.

The data collection of the study was restricted to the healthcare department of Ob/Gyn. Initial pre-study data collection were participating in department meetings, conducting interviews in different areas and within different inter-departmental functions in order to get an understanding of the dynamics of the healthcare department. The main data collection, included observations, shadowing, interviews and reading historical data over previous rationalization projects. The difference between observations and shadowing is that shadowing is a more focused observation and entails following a key staff members during a longer time frame than a normal observation. All data collection methods aimed to provide a sufficient and detailed view of the healthcare department and ultimately offer a more coherent and comprehensive interpretation of the studied phenomena.

3.2 Methodological Implementation
All interview questions have been developed given the data gathered from the previous observations. The choice of constructing the interview questions based on prior observations aimed to enhance the understanding for a certain behavior, perceptions and the interactions among inter-departmental functions. The collected data was then summarized and assembled into categories of similarities and differences. It was then linked with previous research in order to create applicable solutions. This step was considered to be an important step when discussing the potential solutions for alleviating constraints in the healthcare department.
Written documents of previous rationalizations projects offered guidance when keeping track of previous efforts and events that were important for the overall understanding of the healthcare department.

In addition, the environment which was studied was out of the researcher’s control, which is a condition when conducting experiments (Yin, 2003). Alternatives to case studies could have been to perform action research (Collis & Hussey, 2013), although one pre-requisite is that action research require a longer timeframe for research and implementation, which would not have been feasible during this set-up for a Master thesis where the time schedule was limited.

3.3 Research Design
For a study to be successful, it is important that the research design is well-documented (Yin, 2003). The problem-formulation and research questions which are essential for the study, was revised continuously during the whole study while new data from studied literature or gathered empirical data changes was made to accommodate new insights.

During the progress of the thesis, an iterative method was utilized. The problem formulation, purpose and research question were created in the beginning of the study to form the foundation of the research. The problem formulation was influenced by the chief physicians and personnel from the health department. Also, initially unstructured interviews and observations were carried out within the health department to gain insights of which topics/subjects that could be relevant to study. This created a foundation (problem formulation, purpose, research questions) which was then used as guidelines for what type of information that needed to be gathered. In the literature review, these types of insights were used. The empirical data consisted of an application phase and an evaluation phase of the improvement method ToC, within these two phases, there were additional interviews, observations and initially shadowing conducted. The empirical data obtained could then confirm possible gaps previously identified in the literature review. This process gave the benefit of continuous development in the research question, purpose and problem formulation.
3.3.1 Interviews

One of the main methods for data collection was interviews. In figure 2, there is an illustration of the timeline for the different interview stages and the content for each stage. Interviews were conducted with key managers and other staff members in each of the inter-departmental functions. This was done to obtain a holistic view of the department. Since the focus was to investigate implications and challenges on one single process in the department, the surgery scheduling process, employees who were not directly involved in the process were excluded. This exclusion was made with the objective to increase the validity of the collected data regarding the specific process and minimize influence from the performance of other similar processes in the department.

Within the implementation phase and evaluation phase of the improvement method, another main method for gathering data for the analysis was a utilization of semi-structured interviews, a part of the qualitative data collection. The main objective for the interviews was to recognize the reasons for why and what thoughts, feelings or desires a certain interviewee had (Collis & Hussey, 2013).

In this particular study, the interviews had the objective to understand the current situation of surgery scheduling as a process and to utilize interviews as a method to evaluate the implementation of ToC.
The semi-structured interviews had open ended questions and circumstantial questions to facilitate personal responses from an interviewee (Collis & Hussey, 2013). Every conducted interview was also recorded and transcribed after receiving permissions from the interviewees. This allowed a deeper analysis of interview data. Every interview was held at the hospital but occasionally at different departments, the lengths of the interviews varied from 30 minutes up to a whole day, in those cases observations were incorporated.

The continuous data collection for following through all five focusing steps in the improvement method of ToC has been strengthened through multiple interviews with medical and administrative staff. Since the majority of interviews were conducted with staff members in chief positions the responses added valuable and beneficial insights and experience of before and after an application.

### 3.3.2 Three Stages of Interviews

The overall structure of the process of interviews with key personnel within the healthcare department has been divided into three separate phases, where the first one is about debriefing with the medical and administrative staff, their view of the current situation and description of the process of surgery scheduling. In detail, every staff member would also state their position and head responsibilities in the surgery scheduling process.

In the second phase, the interviews concerned the application of ToC regarding working routines and work tasks. The second round of interviews were combined with observations to obtain a deeper understanding of the context and the interrelations that could not have been detected through ordinary interviews (McDonald, 2005).

In the final and third stage of interviews, the main purpose was to follow up the result of the application of the improvement method of ToC. A subset of this purpose was to receive feedback from the department of positive and negatives related to the application and also details connected to the process of identifying constraints.
This text contains a table summarizing the interviews and observations conducted with medical and administrative staff at a large emergency hospital in Stockholm. The interviews were conducted in three stages: first stage, second stage, and third stage. The tables show the departments and positions of the interviewed staff members.

### Table 1. Summary of interviews conducted with medical and administrative staff at a large emergency hospital in Stockholm

All interviewees in the table above have participated in all of the three stages of interviews; in total 24 interviews, 8 semi-structured interviews have been held (first stage) and the remaining 16 interviews for stage two and three were structured in order to evaluate the effects of the application.

#### 3.3.3 Participant Observations

Observations was another method used in order to gain more insight and add empirical data to the study. It is of specific benefit when you have questions of an exploratory nature e.g. how or what people do and what presence of routine work and management have in an organization (Blomkvist & Hallin, 2015). The role as an observer involves things that occur in a particular context, questioning people, listen and process what is being said during a specific period of time (Kawulich, 2005). In order to ensure a suitable implementation of the concept ToC in the healthcare department, the participant observation was a chosen as a complementary method as there was a large proportion of case specific elements that needed to be evaluated. In total six observations were conducted, one observation with each employee from the list below.

### Table 2. Summary of observations conducted with medical and administrative staff at a large emergency hospital in Stockholm

The participant method was utilized in two stages, the first as a surveying method to grasp the case specific context and then during the whole implementation process. An important element to the implementation of the concept ToC, is to accurately identify a system’s main constraint (Krausert, 1998; Lubitsh et al., 2005; Reid, 2007). The method of participant observation may benefit the process of finding the constraint, by actively observing and documenting the actions, behaviors and what happens at every activity in the surgery scheduling process. The researcher is by that matter receptive towards new experiences and
actions which may not be revealed in an interview concerning the same topic (Becker & Geer, 1957)

3.3.4 Shadowing
Shadowing as a methodology is less common and not as frequently used as for example observations, which is very similar to shadowing. In short, shadowing is a research method that involves a researcher following a member of the organization during an extensive period of time (McDonald, 2005). Throughout the time of shadowing, when the researcher asks questions it will prompt direct answers or so called “running commentary” from the person being shadowed, thus helping the researcher to gain clarification or reveal hidden purposes for doing things in a specific way. At the end of a shadow session, the researcher should have gained a detailed and comprehensive set of empirical data which yields a holistic picture and role specification of the person being shadowed (McDonald, 2005). These data can then be analyzed in the same way as qualitative data.
This approach was especially beneficial for analyzing the specific activities in the process of surgery scheduling as the activities are context specific and being carried out by different employees with or without medical background. In the table below are the individuals within the healthcare department with which shadowing were used as a qualitative data collection method. In total seven shadowing sessions were conducted, one with each employee from the list below.

An important limitation when utilizing shadowing as a data collection method is the influence/effect of the Hawthorne effect (Adair, 1984). This effect is where people potentially may improve their behavior under the influence of an external participator. It may therefore have an impact of what is being observed from the observer’s perspective. Ultimately, it may affect the validity of the collected data.

<table>
<thead>
<tr>
<th>DEPARTMENT/DIVISION</th>
<th>POSITION</th>
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<tbody>
<tr>
<td>THE HEALTHCARE DEPARTMENT</td>
<td>Chief of surgery</td>
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<td></td>
<td>Surgery coordinator</td>
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<td>Chief nurse</td>
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<td></td>
<td>Physician</td>
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<tr>
<td>THE DEPARTMENT OF ANESTHESIA AND SEDATION</td>
<td>Chief Physician</td>
</tr>
</tbody>
</table>

Table 3. Summary of the medical and administrative personnel which shadowing were conducted with at a large emergency hospital in Stockholm

3.3.5 Process Mapping within the healthcare department at a large emergency hospital in Stockholm
A process mapping was conducted in the initial stages with three main targets, 1. To gain an overview of the working processes, 2. Identify important inter-departmental relationship and 3. To aid the development of a process map of the surgery scheduling. The last target would in turn aid the application of the concept of ToC, as well as already had gain an accurate overview of working processes within the department. Process mapping as a method was an effective way to visualize steps and activities in a process in order to identify hidden problems (Abdulmalek & Rajgopal, 2007).
Process mapping normally consists of five main parts, process identification, data gathering, briefing interviews, map development and analyzing the data (Jacka & Keller, 2009).

The data from the empirical findings such as observations and interviews was utilized to map the process of surgery scheduling. The process mapping helped to fully understand the performance and flexibility of the activities within the process of surgery scheduling.

### 3.4 Analysis Method

The qualitative data collection included interviews, shadowing and observations at the case setting. In order to draw valid conclusions from the collected data, each source of collected data needs to be each analyzed uniformly.

#### 3.4.1 Analysis of Interviews

The chosen method for analyzing the interview data was a content analysis (Collis & Hussey, 2013). The content analysis was complemented with specific categories and themes created from the interview transcripts which in turn was used to analyze the empirical data collected from interviews.

In a content analysis, researchers should avoid utilizing predestined categories, but allow categories and themes to emerge after collecting the data (Blomkvist & Hallin, 2015). The analysis of the collected interview data began with a thorough and independent reading of all the transcripts from the collected interview data. The data was then divided into sections in order to assign codes to sort the data in detail. By highlighting a certain word or phrase that had previously appeared when capturing a key thought was afterwards derived as a coding unit (Collis & Hussey, 2013). Then, the transcripts of the interviews were approached independently, systematically structuring thoughts and first impressions from the interviews. After multiple iterations carrying out the analysis of the collected material, themes were created by specific data sorting out codes describing key thoughts. Thereafter the different themes that had emerged were divided into certain categories dependent how they linked with other themes.

A few citations were chosen to be added in the report as a way to illustrate the connection to a certain theme. The themes, connected with the citations were then linked and coordinated with previous research and theory in the literature review. This was done in order to find answers to the research questions.

#### 3.4.2 Analysis of observations

The chosen methods for analyzing the collected data from the observations was a general analytical procedure (Collis & Hussey, 2013). The method general analytical procedure involves three types of activities, reducing data, displaying data and drawing conclusions and verification of validity of those conclusions (Miles & Huberman, 1994; Collis & Hussey, 2013). Since the method itself is not tied to a particular data collection method (Collis & Hussey, 2013), it allowed a structured and systematic analysis of the observation data collected at the healthcare department.

The first activity of reducing the data, the codes for selecting relevant data was based on themes from the theoretical framework whilst allowing relevant themes to emerge from the collected data. However, the emergent themes needed to be fitted with the theoretical framework. The themes were then sorted into relevant categories and lastly, a thorough summary was conducted of the collected data, concluding the themes and categories in headlines of a diagram.
The objective of the observations was to get a detailed understanding of a key staff member’s working routines and activities. The second step in the general analytical approach is to displaying data, it was decided that creating an *events flow network*, was the best way to display a complex sequence of events, especially in terms of displaying chronological order and relevant relationships (Miles & Huberman, 1994).

Lastly, the final step was to draw conclusions based on the previous two steps, by reducing the data and displaying it in a suitable way, the researcher was given a greater chance to draw valid conclusions.

**3.5 Reliability and Validity**

In this section, the concepts of validity and reliability in the study will be discussed for the literature review, the interviews and observations.

**3.5.1 Literature review**

The references used in this study was utilized in the analysis and discussion of the empirical findings, the references were mainly collected from established and renowned journals in the field of Industrial Management and Operations management. The concepts and theories from previous research were verified and acknowledged using journal rankings and number of occurrence for the concepts and theories. These secondary sources were critically reviewed by evaluating the validity and reliability of the sources research methods and approaches.

**3.5.2 Interviews**

A qualitative research usually produces findings with high validity since the aim is to gain deep and comprehensive explanations about a certain phenomenon and the people involved (Collis & Hussey, 2013). The qualitative data is grounded on the perceptions of the interviewees. The nature of the semi-structured interviews is a suitable method when capturing a reflection of the participants’ perceptions (Maxwell, 1992). In addition, by utilizing data triangulation, using multiple data sources from the same department, may increase the validity of the conclusions drawn from the collected data.

A qualitative study tends to be characterized with low reliability, especially since interpretations of interviews and analyzing observations are decidedly dependent on the researcher’s ability to perceive and explain the reality (Collis & Hussey, 2013). In order to increase reliability for the interviews, a detailed description has been given of the data collection method for interviews and the guidelines for interviews are attached in the appendix. All of the 24 interviews held at the department were transcribed and the majority were also recorded when permission was granted, this enabled the material to be analyzed several times.

An important factor to consider when conducting interviews is the interview effect, which may affect the interviewees when trying to answer the questions. The urge to answer what he or she believes is the “right” answer in accordance to the organization's beliefs and values or the researcher, may hamper the study’s accuracy of reflecting the reality (Miles & Huberman, 1994). A way to alleviate this issue, have been to ask open-ended questions and assure the interviewer confidentiality.

**3.5.3 Observations**

Observations as a qualitative data collection method have been conducted in order to aid and complement the understanding of the behaviors and perceptions among the staff members.
within the healthcare department. In terms of reliability and validity concerning observation as a method, qualitative data collection methods generally provide high validity given that the aim is to gain deep and comprehensive explanations about a certain phenomenon and the people involved (Collis & Hussey, 2013), this reasoning aligns with the reasoning behind choosing interviews as a data collection method.

Threats to validity is the alternation of the behavior of the people being observed (Collis & Hussey, 2013), people realizing their actions and behavior being observed or even scrutinized may create an artificial behavior not representative of the reality, a behavior that is “correct” and according to the organization’s beliefs and values. To avoid this alternation of people’s behavior, a thorough description of the objective of the observations has been given beforehand in order to clear suspicions and questions. The description has avoided biased language and instead focused on objectives that would gain the whole department.

Other threats to validity concerns observer bias, as the observer may or may not be able to fully capture the nature of the actions and behaviors of staff members in the department (Miles & Huberman, 1994; Maxwell, 1992). In order to avoid this threat, all observations have been transcribed with an open mind, purely documenting actions and quotes of value, afterwards data triangulation has been utilized as to verify the collected perceptions and thoughts. In fact, the observations were conducted in a way to create interview questions where certain perceptions could be followed up and the interviewee could answer the previously perceived actions or behaviors. Discussions have been continuously conducted with the colleagues at CTMH (those who provided me with this opportunity of research) which has deep knowledge of the healthcare department. This was a way to alleviate the observer bias, as discussing actions and behaviors perceived at the department could be verified with the other researcher’s collected data.

3.6 Ethical Aspects

The study was conducted at the healthcare department at a large emergency hospital in Stockholm, one of the stipulations that needed to be satisfied, if the hospital would approve of the study and grant access, was the obligation to sign a non-disclosure agreement (NDA). In the legal contract between the researcher and the hospital, it was specified that sensitive information, such as patient journals, patient queues and details of surgical procedures would not be leaked or disclosed to a third person. Additionally, the interview data concerning the study was desired by all of the employees at the department including managers that it would remain anonymous. As a consequence, interviewees’ position and role are the only information of each interviewee. The answers of a certain interviewee will not be re-traceable for a third party as only the researcher is aware of what each interviewee has previously said.
4. Empirical Setting; the department of Obstetrics and Gynecology at a large emergency hospital in Stockholm

In order to gain insights about the context of the organization where the case study was conducted, this chapter has the purpose to provide an overview of the health department where the concept ToC was applied.

4.1 Description of the Empirical Setting

The entire study, including the case study, was based on an initiative from the Center for Technology in Medicine and Health (CTMH). CTMH is an organization that cooperates with universities such as Royal Institute of Technology, Karolinska Institute and the Stockholm city council. The joint organization shares the mutual objective to improve and ensure a continuous development of the Swedish healthcare.

One of the organization’s fellowships, is Clinical Innovation Fellowships (CIF). This particular fellowship had previously engaged in a cross-functional teams with various backgrounds in order to conduct research across different health care departments in hospitals. The common objective of the projects was to identify different needs and dysfunctional processes.

The studies conducted at the emergency hospital preceding the application of ToC, identified problems within the healthcare department. The major identified issue was the surgery scheduling process. Specifically, the coordination of activities was inefficient and not structured, the communication was not functioning with miscommunication as a result. The origin for the case study was therefore to find improvement and rationalize and optimize the surgery scheduling process.

The healthcare department had previously applied and implemented other rationalization projects and efforts to increase the efficiency and/or productivity. In year 2008 a project was initiated to implement Lean concepts. Today, the Lean project has lost the initial benefits once implemented and the long-term goals have not been achieved. Despite the less successful implementation of the Lean concept, the hospital had an outspoken desire to continuously improve and rationalize the processes within the healthcare departments, in order to provide more reliable and high-quality care for their patients. In general, the hospital is very receptive towards new ideas for improving the processes and the organization as an entity. However, as previous projects had experienced failure, a slight contingency is developed among employees and managers.

4.2 The structure of the healthcare department

In the health department the structure of the employees is divided into medical and administrative staff. The administrative staff connected to the surgery scheduling process is three surgery coordinators; the medical staff consists of three main groups, physicians, nurses and anesthesia physicians and nurses. The medical staff have different roles in the surgery scheduling process. The surgical coordinators form the core of the process, complemented by physicians and the anesthesia physicians and nurses. The physicians possess the task to provide surgery notifications after examining the patients (at the clinic in-house and from external referrals) where they conclude if surgery is necessary. Anesthesia physicians and nurses have the important task to evaluate the patient’s medical condition and her patient
history. This has to be done in order to determine if the patient is fit for the planned procedure and if the ordered sedation is sufficient.

![Diagram showing inter-departmental functions in the process of surgery scheduling]

In conclusion, the surgery scheduling process is constructed out of a set of activities that are pre-defined. The activities in the surgery scheduling process should reflect the particular patient and her condition. Therefore, the process time will be increased or shortened due to the variation of number of activities. In other words, depending on the health condition and other circumstances one patient may need to go through more activities than other patients needed in order to complete the scheduling process.
5. Results

The results of this study consist of three qualitative parts and an application of the concept of ToC. The data were collected from observations, interviews and the method process mapping within the healthcare department. The results are presented in a way that represents the process of the research method. Therefore, the results of the observations will be presented first and following the results of the interviews and the process mapping. Lastly, the findings from the application of the concept ToC are revealed.

5.1 Results from the observations

This section of the results presents the qualitative results from the observations conducted in the healthcare department, i.e. the results from the observations reveals the perspectives and perceptions of rationalization within the department and the observations related to the application of ToC.

The results for the observations begin with an identification of the current situation in the department in terms of working routines and specific tasks for each position involved in the process of surgery scheduling.

5.1.1 Description of current status for work routines and tasks in the healthcare department

Surgery Coordinators

The current working conditions in the healthcare department were found stressful and tedious by the surgery coordinators. The main assignment for the surgery coordinators is to have a confirmed schedule for the upcoming week, the schedule needs to be confirmed with patients and the patients themselves need to be confirmed from the anesthetic staff. Overall, the surgery coordinators need to go over and constantly review all patients and plan for the upcoming week’s surgery schedule. Therefore, all activities in the surgery scheduling process needs to be coordinated and reviewed; this responsibility belongs to the surgery coordinators. Furthermore, different groups within the healthcare department are providing the surgery coordinators with feedback and information regarding certain processes in the surgery scheduling process, thus an important task for the surgery coordinators is also to review the feedback and information in order to suggest improvements.

The surgery coordinators main activities are:

- Provide guidance and support for patients (direct patients to different inter-departmental functions such as the anesthetic department) via telephone
- Schedule elective procedures using the computer systems TakeCare and Orbit
- First assessment of health declarations from patients
- Evaluation of surgery notifications
- Maintain patient relationships
- Coordinate the full surgery scheduling process with all staff members in the healthcare department
  - In detail, coordinating the full surgery scheduling process is about:
    - Ensuring a smooth transition for information delivery
    - Translating the physicians’ prescriptions into activities for the patient
    - Sending out notifications to patients
    - Managing cancellations and unforeseen interruptions in the surgery schedule
The activities that have been identified as inefficient among the surgery coordinators are the evaluation of the surgery notification, coordination with anesthetic personnel and maintaining patient relationships. Currently, the surgery coordinators are spending the majority of their time on the telephone and the digital systems, searching for information about patients from inter-departmental functions, such as physicians, nurses and anesthetic staff.

Communication and interaction with inter-departmental functions are currently very limited and sparse. Exceptions occur for meetings with the chief surgeon every second week to discuss the patients and the draft schedules created by the coordinators.

**Physicians**
The physicians in the department have been identified with two main tasks, to perform surgery and also to consult and assess patients and their medical conditions in the clinic. Thus the physicians determine whether a patient needs surgery. A surgery notification is made where information is added to internal computer systems TakeCare and Orbit where information is shared with all inter-departmental functions.

Brief communication occurs between inter-departmental functions and physicians, except for surgery consultation with anesthetic staff before surgeries.

**Anesthetic staff**
The anesthetic staff works across departments within the hospital and provides consultation for multiple patients; their work is independent from the healthcare department. The anesthetic staff is responsible for assessing a patient’s medical condition in order to ensure their safety for the prescribed procedure. Patients may be referred to the anesthetic clinic if the assessment of the health declaration concludes that it is necessary. This process is carried out in cooperation with the surgery coordinators and staff from the anesthetic department.

The anesthetic staff and the healthcare department collaborate intensely before surgeries with daily meetings discussing patients for the next day, collaboration with the surgery coordinators are currently brief.

The anesthetic staff’s main tasks are:
- Assess patients’ medical condition in accordance to the prescribed procedure
- Provide an individual plan for each patient’s sedation
- Assist the surgery coordinators in consultation of minor cases

**5.2 Results from the interviews**
In this section the results from the interviews are displayed, the interviews conducted were with five key staff members in the healthcare department. These key staff members were chosen because of their position and understanding of the process of surgery scheduling. In total three different stages of interviews were conducted, the overall objectives for the interviews was two-fold as the main purpose of this study was to investigate the perception of rationalization and the implications of applying the concept of ToC. The interviews were influenced by the previous observations conducted at the healthcare department where the questions reflected the preceding situations at the department.

The results displayed in this section are based on the inductive content analysis of the collected interview data which in total constitutes of fifteen interviews divided into three
major perspectives reflecting the three major inter-departmental functions involved in the process of surgery scheduling. The analysis from the interviews presents a full coverage of the additional perspectives within the two major themes, staff members’ perceptions of rationalization and the implications from applying the concept of ToC.

5.2.1 First stage of Interviews: The orientation phase
The first stage of interviews was conducted with the purpose to understand the process of surgery scheduling and the problems associated with the process and to understand the different views among key personnel a first stage of interviews were conducted. Previous observations allowed for a more intricate discussion regarding the nature of the surgery scheduling process.

The format of the questions was standardized in order to enable comparisons and to be able to more accurately locate and thus validate the identified constraints.

The results from the first stage of interviews are divided into three groups, surgery coordinators, anesthetic staff and physicians.

Surgery coordinators
In the interviews with the three surgery coordinators regarding the surgery scheduling process and the difficulties, a number of perspectives were brought up. A certain pattern was identified. The answers from the surgery coordinators have been grouped into four themes. In particular, the answers regarded problems identified in:

- General problems in the process of surgery scheduling
- Surgery notifications
- Coordination with patients
- Coordination with anesthetic staff

General problems in the process of surgery scheduling
The results from the interviews with the surgery coordinators reveals issues regarding the overall collaboration with different functions within the healthcare department. Furthermore, the surgery coordinators main activities as previously described is to coordinate the information from the inter-departmental functions in order to ensure an efficient scheduling process. Thus the relationship and collaboration with different inter-departmental functions is very important for an efficient scheduling process.

“We are today led and indirectly controlled by the physicians, depending on the surgery notification and the surgeon who notifies a patient, there are substantial variance in general information and how detailed the notification is submitted”- Surgery coordinators

The information following each surgery notification that the surgery coordinators receives are varies in terms of patient details and prioritizing. These two components are perceived as very important for the surgery coordinators. If this specific information is missing or unclear, it will create additional work in terms of following up the missing information with the physicians. All additional work consumes valuable time which is currently spent on unnecessary work.
“The surgery scheduling process is tricky, there are a lot of steps and it involves multiple follow up phone calls to patients, physicians and anesthesia staff.” - Surgery coordinators

In general, the process is perceived to be complex by the surgery coordinators. The training and education is however regarded as sufficient, but what seems to be the problem is the constant additional work that is required by the surgery coordinators. The already limited time for the surgery coordinators in combination with a large workload due to the need of additional investigations regarding the surgery notifications is highly unnecessary.

“We surgery coordinators are educated and trained nurses; this gives us a head start when we have to follow up information regarding surgery notifications to the physicians regarding the patients”. - Surgery coordinators

“This process of additional investigations of surgery notifications is highly unnecessary in our opinion”. – Surgery coordinators

The surgery coordinators general perception of the problems at the department and the process of surgery scheduling is the inefficient collaboration between the inter-departmental functions.

“The cooperation and communication with other departments is today not synchronized. Every department works almost fully autonomously and communicates when it is necessary”. - Surgery coordinators

The problems within the process of surgery scheduling do not seem to have affected other related processes in the department. The remaining processes within the healthcare department are found relatively efficient in comparison with the surgery scheduling process. For example, one of the coordinators compared the scheduling planned elective surgeries and emergency surgeries.

“The process of scheduling emergency patients is today much more efficient compared to the elective patients. I believe the biggest difference is the well-functioning cooperation between inter-departmental functions” - Surgery coordinators

One possible reason could be the overall complexity increases as external and internal forces are influencing the scheduling process, for example it is dependent on information from patients, physicians, nurses and anesthetic staff. In comparison, the scheduling of emergency patients is only dependent on the emergency staff (which contains all of the medical staff required) and the emergency surgery coordinator. The communication and collaboration is simplified as the number of dependent stakeholders is reduced. Thus an efficient process requires efficient collaboration.

**Surgery notifications**

A specific problem appears to be that the incoming surgery notifications lacks vital information which causes problems in terms of prioritizing patients for the next schedule. As the notifications arrive and continue to pile up, the surgery coordinators claim that this problem is becoming more and more important to solve.
“Day surgery receives a dozen or more patients a day, a persistent problem is the difficulties of prioritizing incoming surgery notifications as interpreting patient priority is almost always difficult because of either lack of information or in general vague information” - Surgery coordinators

“Time is running out for us, we do not have enough time to do our job including the extra tasks we have been given in terms of assessing vague surgery notifications” - Surgery coordinators

Thus, finding a solution to correct this problem is highly demanded among the surgery coordinators. In detail, a solution to improve the collaboration with the physicians is highly desired.

**Coordination with patients**

The biggest issues related to patients are the cancellations of the surgery appointment, not only are they allowed canceling with short notice, the current system do not enable a quick rescheduling process.

“Patients are today cancelling their appointments with very short notice before their scheduled date, this creates difficulties to reschedule new patients and fill the vacant space” - Surgery coordinators

According to the surgery coordinators, a more efficient rescheduling process would potentially minimize the effects of patient cancellations. Another important issue identified was the health declarations, which was also very time-consuming, just like the surgery notifications.

“The procedure with healthcare declarations are today very difficult and tedious, the process of mailing patients the healthcare declaration is very inefficient” - Surgery coordinators

**Coordination with anesthetic staff**

The communication with the anesthetic staff was identified as an important factor for a fast and efficient process for surgery scheduling. From a safety perspective, the anesthetic staff needs to clear each patient to ensure the patients’ safety. Currently this procedure is considered inefficient where certain decisions are not motivated according to the surgery coordinators. For example, the evaluation from the anesthetic staff regarding each patient is occasionally delayed without further information. This situation creates unnecessary follow up work for the surgery coordinators.

“There is continuous information exchange with the anesthesia department, especially for the institutional care patients” - Surgery coordinators

“The information from the anesthetic staff is often confusing, certain decisions they have made are not always understandable” - Surgery coordinators

The relationship between surgery coordinators and the anesthetic staff is currently perceived as inefficient since information exchange between the two inter-departmental groups is occasionally characterized as confusing and vague.
**Anesthetic staff**

In the interviews with the anesthetic staff, chief physician and chief nurse of the department, a number of perspectives were brought up. A certain pattern was identified in their answers. The answers from the surgery coordinators have been grouped into three themes. In particular, the answers regarded problems identified in:

- General problems in the process of surgery scheduling
- Surgery notifications
- Coordination with surgery coordinators

**General problems in the process of surgery scheduling**

The anesthetic staff shared the surgery coordinators’ view of the process of surgery scheduling as problematic and inefficient. In fact, it was the anesthetic staff that first recognized the inefficiencies. From the anesthetic staff’s perspective, the constant delays and the low transparency between them and the surgery coordinators are identified as the main inefficient part of the surgery scheduling.

“The surgery coordinators are causing problems for us when the schedule is revised and changed constantly. Certain decisions are not motivated as the information is missing regarding these decisions. Currently there are many delays regarding the process of handling patients who need anesthetic evaluation.” - Anesthesics staff

**Surgery notifications**

The anesthetic staff shares the perception of vague and inconsistent surgery notifications with the surgery coordinators. They agree with the surgery coordinators’ and their view on the importance of explicit and clear surgery notifications. Thus it remains important to provide clear and consistent notifications as a vital factor for an efficient process of surgery scheduling.

“Surgery notifications are vaguely described to us. Misunderstandings happens a lot and previously scheduled patients may be cancelled because we have a different opinion than the physicians and coordinators” – Anesthetic staff

Currently, the surgery notifications are causing confusions among surgery coordinators and the anesthetic staff. The importance to solve the problem is imminent as both groups are relying on the surgery notifications in order to provide the best treatment for the patients.

“Surgery notifications are the documents which travels through the process of surgery scheduling, thus determining the best treatment for patients are done through the surgery notifications.” – Anesthetic staff

**Coordination with surgery coordinators**

The coordination with the surgery coordinators is working but as the coordinators mentioned, it remains inefficient and suffers delays in terms of information transfers. Due to this situation, certain decisions regarding certain patients are currently difficult to make without additional consultation.

“Since the information transfer is inefficient, there is a constant need for consultation between the surgery coordinators and us at the anesthetic department.” - Surgery coordinators
This tedious and inefficient situation causes both the anesthetic staff and the surgery coordinators to use valuable time to intervene and update each other on certain patients. This time used for intervention and updates is currently consuming valuable time for other activities which are also vital to carry out in the process of surgery scheduling.

**Physicians**
In the interviews with the chief of surgery for the department, and a physician of the department, a number of perspectives appeared. A certain pattern was identified in their answers. The answers from the physicians have been grouped into three themes. In particular, the answers regarded problems identified in:

The first stage of interviews with the physicians resulted in three identified problematic areas:
- General problems in the process of surgery scheduling
- Surgery notifications
- Coordination with surgery coordinators

**General problems in the process of surgery scheduling**
The physicians at the healthcare department agrees with the identified issues by the surgery coordinators and anesthetics staff, however, in their perspective the overall process of surgery scheduling appears to be functioning without large disturbances.

“The process of surgery scheduling is relatively well functioning without major disturbances. From our perspective, the process is very straightforward, we fill in all the necessary fields of information about each patient and then it is done”
– Physicians

As the quote from the physicians suggest, their knowledge of the overall process of surgery scheduling appears to be fairly limited compared to the surgery coordinators and anesthetic staff. On the other hand, it is not strange as when they are asked to describe their working routines and their collaboration with the surgery coordinators.

“Each group among the medical staff works autonomously, as for us we are responsible for performing surgery and examining patients, as this consumes all of our time, we have very limited insight and knowledge about the other staff members in the department” – Physicians

The autonomous working routines certainly contributes to the limited insights about the problems perceived by other staff members regarding the process of surgery scheduling.

**Surgery notifications**
The physicians generally possess high confidence and trust in surgery coordinators, as they believe that the surgery notifications do not need deeper descriptions but only the necessary information.

“We rely on the coordinators in the surgery scheduling process; we believe that they are competent and capable. There is no need to add further information other than the required information. They possess the adequate knowledge to interpret our physicians” – Physicians
Clearly there seems to be a misunderstanding and/or a gap in knowledge between the physicians and surgery coordinators.

“Additional information for the surgery notification is normally not necessary, we are required to add information regarding patient’s diagnosis, proposed type of surgery and code for surgery (internal message for the system used for surgery notification)” – Physicians

During the interviews when discussing with the physicians about the surgery notifications, they claim that the surgery coordinators possess adequate education and skills in order to interpret the received surgery notifications. As a result, the current information provided in the surgery notifications are sufficient according to the physicians.

**Coordination with surgery coordinators**

Overall, the physicians consider the relationship with the surgery coordinators to work adequately although there are some minor identified issues. The coordination between the two groups is currently characterized as a constant dialogue between the two groups.

“Currently, we physicians receive a couple of phone calls and emails per week regarding questions that the surgery coordinators have regarding the surgery notifications.” – Physicians

“It has become a habit to answer calls and emails, we expect a few calls from them every week” – Physicians

“Every second week the chief of surgery for the healthcare department visits the surgery coordinators in order to evaluate and discuss patients that requires more attention” – Physicians

As the habit of following up their own surgery notifications has become a part of their work, it is also perceived as the process of surgery scheduling is time consuming for the physicians. Time spent on follow up discussions and further explaining their intentions consumes valuable time which could be spent elsewhere in the healthcare department.

**5.2.2 Second stage of interviews, application of ToC**

In the second stage, the application of ToC was conducted in cooperation with key staff members; simultaneously the staff members were surveyed of their perception regarding rationalization projects. The participants were the surgery coordinators and anesthetic staff.

Three main themes emerged from the interviews regarding the application of ToC and the general perception of rationalization in the department:

- Challenges and motivation for rationalization
- Thoughts and opinions for ToC
- Contingencies concerning the concept of ToC
- Evaluating ToC as a method of complementing CI
**Challenges and motivation for rationalization**
The surgery coordinators were asked about previous rationalization projects and the main motivation behind them. According to them, previous projects had the objective of improving the financials by cutting costs and resources.

“Previous rationalization projects had failed and we in general rationalization projects only have the purpose to cut down costs and save resources. There are usually limited benefits for us employees” - Surgery coordinators

The surgery coordinators have revealed an openness and positivity towards change and that there are ambitions to improve the working routines.

“We want to participate in change projects and improve the working routines, but the previous rationalizations have had vague objectives which was confusing.” - Surgery coordinators

“This project of applying ToC has illustrated the need for constant evaluation of processes in order to maintain efficiency” – Surgery coordinators

When the anesthetic staff was asked about their general opinion about rationalization projects, they acknowledged the need and ambition for rationalization. But as with previous failed projects, it made them question the current approach of conducting rationalization projects.

“We understand the purpose of rationalization, that it is needed. In fact, we embrace it as it may improve the current working processes. But we request for an approach that is not only focused on directly improving financials, such as cutting costs and resources but also improving the working habits” – Anesthetic staff

“Increased resources for driving rationalization projects are desired, but difficult to realize” – Surgery coordinators

Thus a sustainable approach for rationalization is requested, specifically an approach that pays attention to the needs of the staff members within the healthcare department. In other words, the complex of problems is to find the correct balance between the objectives of lowering costs and efforts that are observant for the staff members.

When asked about the staff members for good incentives for rationalization, the staff members mentioned two arguments:

“Good incentives for rationalization would be if we were able to treat more patients, as increasing capacity of our current production” – Anesthetic staff

“Improving the working routines and decreasing the workload while maintaining the desired production capacity would be very desirable” - Surgery coordinators
The previously mentioned incentives are two non-monetary incentives. The first incentive reveals a great empathy among the staff members towards patients. The other incentive emphasizes on hopes for better working conditions.

**Thoughts and opinions for ToC**

The surgery coordinators were initially open-minded towards the concept but remained contingent about the eventual results. Especially since they possessed limited knowledge of the concept and also with the previous failures of rationalization in the department created contingencies regarding the outcome.

“The concept seems interesting; we have limited knowledge of the concept but if it generates good results and delivers on improving the processes within the department, we are happy” - Surgery coordinators

The expectations of the concept were many; one of them was to shed light over the process of surgery scheduling and in particular the issues in the department.

“Hopefully this methodology illuminates the process of surgery scheduling; it will hopefully shed some light in a forgotten but nevertheless important process” - Surgery coordinators

The anesthetic staff was similar to the surgery coordinators interested in the application of the concept of ToC, and made comparisons to Lean, showing concerns for the unknown projects.

“We are interested in what this methodology may yield; we have never heard of it before, is it similar to Lean?” – Anesthetic staff

“What is the approach to ToC? The concept is quite complex to me” – Anesthetic staff

The main reason for the comparisons to Lean was described by the anesthetic staff as it gave them bad flashbacks from a previous failed implementation of Lean. Since Lean was an external concept being applied within a healthcare context, related concerns was raised towards the application of ToC. Especially since Lean and ToC shares many similarities.

“We are concerned since we do not want to experience similar rationalization projects similar to the Lean project conducted in 2008; it was heavily time-consuming and yielded no sustainable results. Our time is already very limited.” – Anesthetic staff

The suspicion towards the concept was partly shared with the surgery coordinators. One detail that caught the surgery coordinators’ attention was that the main objective of the concept had a unique approach of rationalization. It was intriguing that the concept’s main objective was about locating constraints and solving them instead of only cutting down on resources and other types of costs.

“That is very interesting, a project focusing on identifying constraints and not just focused on cutting costs, I am interested in the potential outcomes.” - Surgery coordinators
Evaluating ToC as a method of complementing CI

In the application of the concept of ToC, the concept promotes a continuous approach of working with improvements, e.g. to work with CI. When surveying the staff of this approach, it was very different according to their current working routines.

“Working with a continuous approach to improvements is not something we are used to, normally the efforts for improvement are limited to singular projects of improvement” – Anesthetic staff

“Our schedules are currently stacked, and an evaluation of the entire process which is required when working with the concept of ToC is very difficult. Especially since the evaluation is very time consuming.” – Surgery coordinators

Working with the concept ToC was as the surgery coordinators describe, very time consuming. Considering their current working schedules, they argue that it will be difficult to continue this process together with other staff members within the department. Thus, in the perspective of ToC complementing the concept of CI, the contribution is low. Especially since CI promotes continuous working routines where improvements can be made and achieved continuously.

The current approach of short rationalization projects is shared with the surgery coordinators and the physicians. Meanwhile, surgery coordinators and emphasize that their main tasks are to ensure a functioning process in order to provide care to patients. Rationalizing efforts and projects within the department comes in second place.

“Our current working routines do not involve an approach to continually improve the internal processes; our main task is to ensure that the surgery scheduling process is running”- Surgery coordinators

“We are doctors, we cure patients’ diseases and other types of conditions, and our focus is devoted towards this objective.” - Physicians

Although, the main objective is to provide health care and advice for patients, the need for rationalization and improvements are starting to become more and more important. Especially since the department find it difficult to accommodate all patients in need of treatment, rationalizing working processes and routines may then be a solution for enabling the department to accommodate more patients in need of treatment. Thus, a new approach towards working with improvements was desired by the majority of the staff members in the healthcare department

“We are interested with adapting to a new approach concerning improvement efforts, since the current approach is not efficient. Previous efforts in terms of rationalization have been forgotten and not sustained” – Anesthetic staff

“A different approach to working with improvements would be interesting, an optimal approach would consider feedback and insights of the current status of our working routines” – Surgery coordinators
5.2.3 Third Stage of Interviews: Evaluation of ToC

In third and final stages of interviews, the results of applying the concepts of ToC were finalized and the questions asked regarded the preceding application.

The emerging themes for the third stage, evaluating ToC regarded:

- General opinions regarding the application of ToC
- Contribution
- Validation of the method
- Challenges
- Opinions and results regarding suggested changes

Opinions

The general opinion of applying the concept of ToC and utilizing the tools had an initial positive effect in the department.

“This tool called ToC has helped us pin-point the specific issues in our working routines, it has worked mainly as a visualization tool” – Surgery coordinator

“The outcome of the application of ToC resulted in constraints that were located, it helps to know where to direct efforts to alleviate the constraint” – Anesthetic staff

However, contingencies surround the concept and the long term effects from the surgery coordinators. But, the identification of constraints has been achieved which was one of the main objectives from the start.

“It is difficult to say anything further as the timeframe has been short, long-term effects we will see. It has located constraints that we need to look into” – Surgery coordinators

All in all, the general opinion about the application of ToC was perceived as satisfying. It shed light over the process of surgery scheduling and where issues and possible inefficiencies were located. For many staff members the method has been relatively easy to understand once they understood the concept. As the method starts with examining a process which is already well-known by all of the staff members, it has benefitted the understanding of the method.

“After we understood that the method of ToC is about incremental changes and examining a process which we all are familiar with, it facilitated the understanding of the concept a lot.” – Surgery coordinators

Contribution

The main contribution according to the surgery coordinators was the identification of constraints in the process of surgery scheduling.

“The biggest issues related to the identified inefficiency have been to locate the problems.” – Surgery coordinators

Locating the constraints has thus provided valuable insights towards the current status of different working processes. The method according to the surgery coordinators and anesthetic
staff has provided a thorough evaluation of the process of surgery scheduling besides locating constraints in the process.

“The application of ToC has provided a thorough evaluation of the process of surgery scheduling. This was very useful for our own internal meetings where we discuss changes and different deviations in the department” – Anesthetic staff

“The application of ToC, gave us new insights of evaluating the performance in a certain process.” – Surgery coordinators

Validation of the method
The identified constraints from the process of surgery scheduling was partially validated by comparing the actual performance at the specific activity with the numbers of patients waiting in queue and also by verifying the constraints by comparing them to other departments and their previously identified issues through similar rationalizing projects.

“The located constraining activities are similar to other departments within the hospital.” – Anesthetic staff

The anesthetic staff members have observed similar types of rationalizing projects within other departments in the hospital felt safe when the identified constraints were similar to other departments. The comparison to other departments also enabled an accurate development of solutions as previous knowledge could be utilized.

“The comparison in terms of constraints, enabled a more accurate development of solutions for alleviation than if the identified constraints were completely new without previous knowledge” – Anesthetic staff

Challenges
The challenges with applying the concept have been to adapt the mindset needed for the concept of ToC according to the anesthetic staff. In particular, it has been a challenge for employees with medical background to adapt to a manufacturing concept and mindset.

“The concept is not similar to anything we have heard of before; it takes a different approach to understand the prescribed mindset” – Anesthetic staff

Another feature that was different and challenging according to the surgery coordinators was the opportunity to participate in the rationalization process.

“Normally, this type of work, rationalization projects have been conducted by external expertise. A challenge but also an opportunity has been to participate in the process”– Surgery coordinators

In general, the biggest challenge perceived by the staff members was to understand the concept and also what kind of impact the identified constraint had on the overall performance of the process of surgery scheduling.

“It was a big challenge to both understand the concept and the impact that the constraints had on the surgery scheduling process. It definitely required an adaption to the preferred mindset you need when evaluating impact of constraints.” – Surgery coordinators
The challenge to understand the concept and what impact it had on the department is an aspect of the application of ToC which the anesthetic staff agrees with the surgery coordinators. In the same time, the anesthetic staff withhold that this investigation has shed light in other areas where there currently also are issues.

“The application of ToC has been a challenge for us all, it has been difficult from time to time to understand why certain steps in the focusing five steps are carried out. In addition, the effect of the application has not been immediate, which also has tested our patience and motivation.” – Anesthetic staff

Opinions and results regarding suggested changes
The suggested changes for the identified constraints were displayed during a short presentation in the healthcare department. These suggestions were in general well received and both the chief of surgery and the head of the anesthetic department were positive. But, as for a few of the solutions, there were a couple of questions.

“Interesting ideas and solutions, however, many solutions will require further discussions before an implementation”- Physicians

“Especially anchoring the proposed solutions and getting consent from the board is essential before an implementation”- Physicians

The presentation of the identified constraints and changes did yield some interesting discussions about coordination within the department.

“It is good to meet and discuss the current situation within the department and its processes. It is a very efficient way to evaluate and discuss improvements on current issues.” - Physicians

The mapping of constraints alone helped them realize what types of problems that affected the process of surgery scheduling.

“It is very beneficial to just locate and identify constraints in the process, as it is difficult for us to understand the process and what types of problems that exist, the application of ToC definitely helped the identification.” - Physicians and Anesthetic staff

In conclusion, the application of the concept of ToC has yielded a constraint mapping of inefficient activities and other sub-processes. This identification has been the main benefit of applying ToC, as for the solutions for alleviating the identified constraints, it is yet to be studied (as the timeframe was too short). The majority of the solutions are still a work in progress and thus not implemented. For two of the identified constraints, solutions have been fully implemented and thus far the surgery coordinators perceive the solutions to work with good results.
*Healthcare guarantee is where Swedish hospitals guarantee patients an appointment within three months from first visiting a physician

Figure 5. A full process map regarding activities in the surgery scheduling process in the healthcare department
5.3 Process mapping of the healthcare department at a large emergency hospital in Stockholm

One step before the application of the concept of ToC, a thorough overview of the surgery scheduling process was managed through the method of process mapping. As described in the methodology about process mapping, the main purpose was to visualize and identify important steps and activities in the process. The result of the process mapping was twofold, a flow chart of the activities in the surgery scheduling and valuable insights of the current status of the department.

The main findings of the process mapping consisted of three insights:

- **Ad hoc solutions** – The surgery coordinators dealt with the surgery notifications as they arrived, there was no framework of how to systematically deal with new incoming patients and their notifications.
- **Variation in surgery notifications** - There was a variation of the incoming surgery notifications, the information about priority and need for anesthetic consultation was inconsistent.
- **Inter-departmental collaboration** – many staff members both medical and non-medical staff members perceived difficulties to collaborate as information transfers were inconsistent, with no or very limited information shared among the inter-departmental functions.

The department layout is set up as physicians, anesthetic staff, nurses and coordinators work separately as independent entities. There are limited coordination and information transfers in the current structure. It is also identified that confusion and lost messages occasionally occur within the inter-departmental functions.

5.4 Application of the Concept ToC in the Surgery Scheduling Process

In this section, the results from the application of ToC are found, the process called focus five focusing steps, have been iterated six times, where six specific constraints have been found. Each step is described with details concerning the application.

1. **Identify the constraint**

   In this first step, finding the appropriate unit of measurement was the important step. The specific unit of measurement was number of patients, waiting ahead of a particular activity in the process of surgery scheduling. Utilizing this idea in the specific case and the combined measures resulted in identified constraints in for example in activity 4 in the flow chart (from previous page) and the second round in activity 5. (Note that all identified constraints can be accessed in table 4.) Activity 4 was considered to be an internal constraint as the collaboration between the coordinators and surgeon is inefficient and activity 5 is considered to be an external constraint as the communication between the patient and coordinators is inefficient as well as communication between physicians and coordinators is inefficient.

2. **Exploit the constraint**

   When a constraint is found, the hospital management is recommended to efficiently maximize the usage of a constraint’s capacity and ability to reach the system/process’s goal. The joint system goal regardless of objectives is to manage the constraint so it in the future will be able to operate close to 100 percent of the available time.
By determining the throughput yield per unit of time at the constraining activity, the measurement will provide necessary information to the managers to prioritize the work performed at the activity.

As an example, using the first constraint of surgery notifications, the key activity to improve the performance of the activity was to set up an efficient system where redundant follow-up work is reduced. This meant to scan surgery notifications and sort patients into categories to increase the overview. Patients with a severe medical history, patients in need for complicated procedures or other conditions are examples of categories. In general sort out every patient that would potentially be projected to be time-consuming for the coordinators. In other words, it was important to set common guidelines for every patient in regards to medical history, proposed surgery, specific preferences etc. By standardizing the arriving surgery notifications, the proposed effect should allow the coordinators to spend less time on follow up work and in general aid the selection of patients for the upcoming surgery schedule.

3. **Subordinate everything else to the preceding decisions**

The third step in the five focusing steps is described as an activity with the objective of reviewing the surrounding activities to the constraint activity in order to increase performance of the constraint activity. ToC recognizes that increasing performance of non-constraint activities does not increase overall system’s performance, rather it might aggravate the constraint by diverting already limited resources away from the activity in need. Ultimately, the focus for managers is to coordinate operations of the non-constraining activities with the constraint activity itself allowing the latter to operate at maximum efficiency. Maximizing the constraint activity will maximize the system’s performance.

Returning to the example of determining priority among patients, coordinating the communication between physicians and coordinators and setting up guidelines when determining priority was two possible activities for step number three in the five focusing step guide.

4. **Elevate the constraint**

Elevating the constraint’s resource is the fourth step and is normally done by simply adding resources to elevate a constraint’s capacity. By increasing capacity at the constraint, it should (if the constraint is truly the constraining activity) increase the performance of the system’s throughput.

In the example of prioritizing patients, possible actions were to hire consultants to supervise the physicians when determining priority, hiring more coordinators to be able to follow up patients or invest in technology that aids determining priorities for certain surgeries. However, in theory, once completing this step the initial constraint will no longer affect the overall performance and throughput. Instead, according to the concept, another factor will limit the performance of the system.

5. **Return to step 1, but do not allow inertia to cause a system’s constraint**

After the initial constraint has been alleviated by previous efforts, it is necessary to reevaluate all of the changes made in the previous steps to ensure that they are still effective and valid for an effective process and system performance. In this final step,
when applying the theories on the constraint of prioritizing patients, evaluations were made to ensure that the efforts made at step 2 and 3 was enough to assess whether step 4 would be necessary. This evaluation was done by measuring the pre-determined unit of measurement, our throughput rate unit. In the case of the surgery scheduling process, the measurement unit was the number of patients waiting for surgery. As long as the measurement unit is lowered the constraint is considered alleviated.

In conclusion, this step should assure that the initial constraint no longer is affecting the overall performance negatively.
<table>
<thead>
<tr>
<th>Constraint location</th>
<th>Constraint type</th>
<th>Constraint identification</th>
<th>Approach to constraint alleviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient cancellation of surgery invitation</td>
<td>Policy, external</td>
<td>Patients are able to cancel the their surgery appointments just one day before surgery</td>
<td>Establish “short notice” surgery appointments where patients are offered surgery with short notice.</td>
</tr>
<tr>
<td>Coordination between physicians, anesthesia and coordinators</td>
<td>Physical, internal</td>
<td>The communication between inter-departmental functions are limited or non-existent, results in confusions and misunderstandings when scheduling patients</td>
<td>Establish daily meetings with the inter-departmental functions to alleviate communication and decrease misunderstandings</td>
</tr>
<tr>
<td>Incomplete surgery notification</td>
<td>Physical, internal</td>
<td>Surgery notifications for patients are missing vital information about patients for surgery</td>
<td>Launch workshop and establish guidelines for how to conduct a proper notification and launch a check list of required information when surgery notifying patients</td>
</tr>
<tr>
<td>Operation competence among physicians – no coverage</td>
<td>Physical, internal</td>
<td>The coordinators have limited knowledge of surgery competence among physicians aggravates connecting patients and their planned operation with capable surgeon</td>
<td>Survey the physicians in the department of their capabilities in terms of operation competence and continuously update competence</td>
</tr>
<tr>
<td>Healthcare declarations from patient</td>
<td>Physical, external</td>
<td>Coordinators lack patients healthcare declarations or vital information within the declarations are missing.</td>
<td>Inform physicians when meeting patients of importance of filling in information for healthcare declaration. Establish digital declarations for faster proceedings.</td>
</tr>
<tr>
<td>Prioritizing incoming surgery notifications</td>
<td>Physical, internal</td>
<td>Coordinators experience difficulties determining the priority of incoming surgery notifications.</td>
<td>Establish distinct guidelines for patients diseases and how to set appropriate priority in order to standardize notifications priority.</td>
</tr>
</tbody>
</table>

Table 4. Identified constraints in the process of surgery scheduling at the healthcare department
5.5 Evaluation of the identified constraints from the application of ToC

The process to integrate all of previous mentioned suggestions for constraint alleviation is currently in progress; a couple of suggestions for constraint alleviation have already been implemented, the constraint *Operation competence among physicians – no coverage* was relatively easy to solve. By surveying physicians’ competence and what type of procedures they are able to perform it gave the surgery coordinators up-to-date knowledge of each surgeon’s competence and skills. This survey was not time consuming and has saved time for the surgery coordinators in terms of unnecessary follow up conversations with the physicians.

Another constraint, *Patient cancelling surgery invitation* was also easily solved and the suggestion for constraint alleviation was a “short notice” button in the IT-systems for filing surgery notifications. The physicians who are filing the surgery notifications were then asked to survey the patients if they were ready and/or available for surgery within a short timeframe. In particular, this solution would enable a more efficient process of managing cancellations by patients. After surveying the patients, a list of patients available for surgery was made where the surgery coordinators could use whenever patients cancel their invitations. Since the system allowed small tweaks in the system for filing surgery notifications, this solution was relatively easy to implement and the effects so far indicates slight improvements.

Other suggestions for constraint alleviation will require more time in terms of implementation but also receiving consent from the technical boards and administration in the hospital. These constraints are the following, *healthcare declarations from patient, Prioritizing incoming surgery notifications and incomplete surgery notification*. All of these constraints require further investigations and discussions between the staff members involved in the process of surgery scheduling. Developing guidelines (for prioritizing patients) and implementing a new system for electronic healthcare declarations are examples of suggestions that will need additional time of evaluation and discussion before an actual implementation. The need of anchoring the suggestions among the board and the chiefs are time consuming and has caused delays thus far.

The last constraint yet to be mentioned, *coordination between physicians, anesthesia and coordinators*, was solved by coordinating regular meetings between the surgery coordinators, anesthetic staff and the physicians. By meeting physically in a regular matter, there is an expectation that problems related to coordination between the groups will decrease. Problems such as confusion regarding certain decisions and patients will be hopefully minimized as there is time appointed for discussion.

In conclusion, all six constraints have been considered and action plans have been developed as the table 3 suggests, however as previously mentioned only two constraints are fully implemented where the consequences may be studied, the indications are positive thus far regarding the solutions for constraint alleviations.
6. Analysis and Discussion
In this section, the results from the case study will be analyzed and compared to the previous conclusions from the literature review. Generally, this chapter aims to provide answers for the specific reasons and explanations of the result.

6.1 The perception of rationalizing processes in the healthcare department
The main research question within this study was to evaluate the managerial implications of applying the rationalizing method ToC, one sub-question of the main question was to evaluate the general perception of rationalization to understand if this outcome would affect an application of ToC. This section aims to discuss the findings from the case study in relation to previous research.

Derived from the results of the interviews, improvement work and efforts in terms of rationalizing processes are facilitated when the staff members have identified a need for improvement, e.g. the current working conditions creates situations where the staff members feel impeded and the work load increases. This scenario was evident when the employees’ daily working routines were affected, then the desire for improvement is high as well as for rationalization. The current motivation towards rationalization projects is generally low, due to the outcome of previous projects. However, it has also been revealed that the current set up and structure regarding resources and funding for rationalizing the working processes within the department is in a few areas limited. This conflict creates another conundrum for alleviating the pressure for the case department.

From the results of the interviews, previous rationalization projects have been rather dissatisfying for the staff members; the majority of such projects have been solely on improving the financials, by cutting costs and resources. Thus, the hospital’s directorate has a continuous objective of minimizing costs; this objective drives the majority of the rationalizing projects. But as recent changes in demographics and due to other reasons the demand for healthcare services has increased. Therefore, in order to accommodate the larger demand there are apparent requests to increase the capacity of certain processes within the hospital. Combining these two objectives in an efficient way has been found to be the most recent conundrum for the hospital’s directorate.

This conundrum observed in the healthcare context resonates well with the nature of improvement methods developed in the manufacturing industry, such as Lean, Six Sigma and TQM (Total Quality Management). Given minimal resources the methods enables big changes and also achieving large savings. This approach has attracted multiple hospitals and healthcare units to apply the concept. Yet, as shown in recent studies, the contexts from the origin (manufacturing) and the destination for application (healthcare) is different and has highlighted the importance of aligning the key assumptions for the contexts when applying these concepts (Radnor et al., 2012).

From the results of the application of ToC and the interviews surveying previous rationalization projects, there was large emphasis on understanding the concept and what it may potentially yield for the department. Especially in terms of improving the working routines for the staff members was perceived as important. Another common feature of previous rationalizing projects has been a combination of cutting costs while the production output in the department remained unchanged. The answer would in the most cases because staff cut-backs or downsizing of certain resources. Meanwhile, as the savings would benefit the hospital’s directorate the staff members would in general not receive any additional
payments for participating in the rationalization projects. Thus, the main difference between the contexts has been identified from this case study as a lack of resources and knowledge to effectively apply the concept and conflicting assumptions, ideas and incentives. In the manufacturing industry where the main objective is to strive for increasing profit and the staff members would be benefitted when participating (Frazier & Reyes, 2000), as for healthcare entities the main objective is in contrast not to strive for increasing profit but cutting costs. Also, the incentives for the staff members in a healthcare context (as derived from the results in the case study) are low; the objectives need to be reconsidered. As found from the results of the interviews, objectives should instead align with the mindset of, for example, improving the efficiency and productivity of important processes in order to be able to provide more care for more patients. Thus the physicians, nurses and other staff members are able to treat more patients; this non-monetary incentive would allude to the staff members’ empathy for the patients. Other relevant objectives found from the case study for a healthcare context, is to improve the working routines for the employees.

6.2 Implications of applying the concept of ToC in the healthcare department
The result from the case study and an application of the concept of ToC has mainly led to a discovery of a couple of constraints causing inefficiency. These inefficiencies have, in cooperation with the medical staff across the healthcare department, been evaluated and afterwards been assigned different suggestions and brief action plans of how the department may resolve them.

The timeframe for this project was relatively short, the ability to study long-term effects is highly limited, although there are indications that managing the identified constraints have been positive thus far. In regards to the initial purpose of locating inefficiency and the identification of a number of constraints, the proposed solutions to alleviate the constraints have been discussed together with the medical staff and head directors in order to maintain validity of the solutions. Furthermore, the actual implications for the staff members and the department in general for the application of the concept of ToC have been fully observed.

6.2.1 Implications regarding the application ToC in the healthcare context
The application of the concept ToC provided implications in many areas, here the implications regarding the procedure of applying the concept of ToC will be discussed. From previous research about applying ToC, the focusing five steps have been considered to be the core method that is being applied when applying ToC. The focusing five steps provides simple guidelines for systematically reviewing a process that previously has not been documented and where information is deeply tacit and incorporated within the staff members and their individual working routines. Furthermore, the method has been found to be practical and results have been straightforwardly transferred to inter-departmental functions which has facilitated discussion for rationalization. As previous research related to rationalization in the healthcare industry, especially in hospitals and healthcare units that are funded and supported financially by the government, the resources for rationalization has been found difficult motivate (Trägårdh & Lindberg, 2004). Consequently, for rationalization within the healthcare to be successful, it has been found that the management needs to consider two perspectives, limited resources and the staff members’ desires and opinions. Previous studies have shown the importance of clarifying the purpose and adjusting the rationalization project to the healthcare context as it is different compared to the private sector and the manufacturing industry. The difference in being profit-driven and not profit-driven has consequences for rationalization projects (Sjöberg & Lindblad, 2014; Radnor et al., 2012; Källberg, 2013).
In this perspective, the concept has indicated a facilitated translation of key assumptions and also adapted to the new context and new objectives. As revealed in the case study, rationalization has its origin in increasing capacity to be able to serve more patients in terms of fulfilling their need for care. Another identified objective within the case study was to improve the working environment by relieving stress to staff members. It has been found important to translate and adapt context specific objectives to the staff members when applying new improvement methods (Sjöberg & Lindblad, 2014; Marklund & Eriksson, 2014). This case study supports the findings and adds the importance of aligning objectives and key assumptions, when it comes to motivating staff members gaining acceptance among directors and management.

One of the challenges for the department ahead of applying the concept of ToC was to deal with the fact that within the healthcare context in government funded hospitals, the resources given for rationalization was and still is limited. Thus, it was very important to solve the conundrum of rationalizing processes and still use small resources. This was something that they up to this point had not found an answer for. After applying the concept of ToC, the approach has been found to provide answers to this conundrum to a certain extent. The concept provides an intuitive way to identify constraints and inefficiencies, also alleviating the effects of the constraints are aided by the concept. In comparison to other types of rationalization methods and concepts, it could be argued that ToC in particular is suited for the healthcare context as the concept aims to improve the overall throughput. In the healthcare context throughput has been translated to number of patients that enters and exits a treatment process in a given timeframe (Lubitsh et al., 2005). Optimizing the process from this perspective is highly desirable in the healthcare context, as a high throughput rate indicates a high capacity in the healthcare context (more patients are able to enter and exit a treatment process in the equivalent time as before the optimization).

Furthermore, very few resources were needed when applying the concept, minimal investments were made, and as the plan progresses for solving the identified constraints, monetary outlays may be necessary but then the money will have been verified for a good cause. In general, the application of the concept triggered nothing but incremental changes, this may have an important influence on the factor of resistance to change as small and incremental changes are easier to embrace compared to large and radical changes such as the application of Lean was when it was applied in Danderyd Hospital 2008 (Sjöberg & Lindblad, 2014). Also, the time to adapt to small and incremental changes are faster compared to large and radical changes as it may require extensive time for adaption and understanding and also the breaking-in period for the changes may be prolonged.

The concept of ToC possesses the quality or deficiency, depending on the perspective, to offer a simplistic tool/method for process rationalization. Its simple-minded focus on the process has in the case study been found to attract the project members and facilitated an application. It could be argued that the increased desire to apply the concept is a product of previous failures of improvement methods; the desire to improve the surgery scheduling process was an internal desire. This was an exception when there normally are external forces promoting rationalization projects with objective to improve the financials.

In terms of deficiencies of the applied improvement method ToC, it could be argued whether the improvement method was too simplistic. Especially since it offers limited tools for overall process improvement. These aforementioned factors are the identified potential deficiencies
of the concept in the case study. The question whether it is possible to generalize the findings from one healthcare department for an entire industry is currently unknown and should be further researched before arriving to such conclusion. However, the purpose of this study was to identify challenges and possible implications of applying the concept of ToC in a healthcare context as to add to previous research in order to fill the current knowledge gap.

### 6.2.2 Application of ToC; Implications on Resistance to Change

The application of the concept of ToC in the healthcare department has brought implications on various areas in the department. Since the nature of the concept of ToC is focusing on rationalization and improvement on different processes, changes have been realized and thus there will be implications in the perspective of change management. Implications within the topic of change management are often connected to resistance to change (Kotter, 1996; Fryer et al., 2007); introducing new concepts and methods within a new context will most likely cause resistance to change among the employees within the new context (Fryer et al., 2007; Jackson et al., 2011; Kotter, 1996). This behavior has been observed across various industries when change projects have been implemented. For the healthcare industry there are no differences, for example, in previous implementations of the concept of Lean the resistance towards the change project was perceived as relatively large (Radnor et al., 2012; Sjöberg & Lindblad, 2014). The Lean concept and the concept of ToC share many similarities, both concepts focus on rationalizing certain processes and both originate from the manufacturing industry. However, the perception of resistance to change when applying the concept of ToC was not very high, and certainly not the level of resistance as perceived in the previous implementations of Lean.

Possible explanations for the differences in the perception of resistance to change when applying the two concepts have in this study been identified as the staff members’ ambition and anticipation of change. Prior to the application of ToC within the healthcare department there was an evident need for change and improvement for the process of surgery scheduling. As described in the results of the interviews for the first stage, the inefficiencies within the process of surgery scheduling had previously been observed for a long period of time. The eagerness to change and improve was inherent among the staff members. They also felt a strong need for external help since their own actions had not resulted in any improvements. Simultaneously, there was a hesitation towards applying external concepts within the department due to previous history of failed projects with applying external concepts.

### 6.2.3 Translation Implications of ToC in a Healthcare Context

According to Trägårds & Lindberg (2004) it could be argued that the potential success of a rationalization model or method is dependent on the ability to transfer key features and assumptions into the new context. In this study, the ability to transfer key features and assumptions was aided by the simplicity of the concept. Secondly, the surgery scheduling process reassembled a production setting which further aided the translation. In particular, a set-up of activities reminiscent of a production loop aids the calculation of waiting time at each activity. This is crucial in order to determine where the constraints are located and which activities to improve upon. This important assumption is confirmed by Lubitsh et al. (2005) which highlighted it as one of the potential success factor when applying ToC.

The surgery scheduling process (as seen in figure 6) was a process which was reminiscent to a line production where the activities are sequentially structured. Since the process was already well-known to the most staff members (except the physicians), the understanding for the
The objective of the ToC concept was fairly straightforward. The identification of constraints and alleviation was described by the staff members to be very intuitive. When they had gained sufficient knowledge of the concept, the actual application was rather easy and it faced little resistance, possibly due to the lack of confusion. Lubitsh et al. (2005) who conducted an application of ToC in three different departments in a hospital, noticed that the more complex a process is the harder it is to expect good results when applying the concept of ToC. A good example was the brain surgery process. The researchers found it difficult to calculate cycle times for each activity. In detail, the cycle time of a surgery could vary significantly. Differences between two surgeries could vary with a couple of hours in a worst case scenario. This could possibly lead to identification of incorrect constraints. An activity that is characterized with a long cycle time increases the risk for incorrect determination of constraint activity. The findings from this study indicated that the surgery scheduling process contained activities with low variance in terms of cycle times. In conclusion, this study partially confirms the conclusions originally made from Lubitsh et al. (2005), the less variance in a process in terms of cycle time, the higher chance to expect successful results from an application of ToC.

6.2.4 Challenges with application of ToC in a healthcare context

The challenges that were identified in the process of applying the concept of ToC seems to all be derived from understanding the concept, the anesthetic staff claims in the second and third stages of interviews that the concept required a change in the mindset towards understanding it. Since it was unknown for the majority of the staff members at the department, many have doubted the benefits of applying the concept and also been overall hesitant towards the concept, but as one surgery coordinator pointed out, the concept encouraged deep participation which may have been a factor to facilitate the adaption and acceptance when working with the concept.

In terms of the perception of resistance to change (Kotter, 1996), the resistance towards change was initially high but after a while when the staff members had gained sufficient knowledge and thus understood the concept the resistance was low. A thorough explanation and encouraging staff participation was two factors that may have alleviated the resistance to change.

Furthermore, there were concerns among the staff members regarding the identified constraints. They requested validation of the constraints which the concept itself did not provide. However, the anesthetic staff was able to compare the results and found them to align with other departments. This provided trust and certainty that the constraints identified in the healthcare department was relevant and real. The constraints identified with ToC were compared by the anesthetic staff towards other departments that performed surgery. For example, one of the constraints identified, incomplete surgery notification had previously also been identified in the orthopedic department. Thus, as there were similar types of problems in between the departments, this type of comparison provided safety and the requested validation of the identified constraints.

An ever-present challenge when applying ToC has been to find appropriate solutions for alleviating the identified constraints. Thus determining what types of remedies and solutions that are going to be applied in order to rectify a constraint activity has been found difficult. In addition, few applications have been done in the healthcare context; therefore, there are limited approaches to get inspiration. Within other industries, more applications have been made and thus there are more effective solutions to get inspired by. However, some of these
effective approaches from other industries may not suit the healthcare context where ToC was applied. For example, within the manufacturing industry, investing in a new machine is a very effective approach as it may reduce the cycle time at a certain activity and increase the throughput rate immensely (Reid, 2007). As for the case study’s context, investing in new technology might not be as effective as in the manufacturing industry.

The important factors for the surgery scheduling process where ToC was applied to is dependent on communication and an efficient collaboration with other inter-departmental functions such as with physicians, nurses and anesthetic staff. Investing in technology to improve the communication and collaboration is unlikely. Thus it would not be an effective solution. Since many processes within the healthcare context are reliant on human interactions, it could be argued that investing in technology in order to increase efficiency is not very effective at all as an approach for alleviation in the healthcare industry. In conclusions, improving the throughput rate is not achieved efficiently by investing in new technology as it is in the manufacturing industry.

Another feature when investing in new technology within the manufacturing industry is the benefit of potentially increasing the product quality. Since investing in technology previously has not been concluded as always effective, how may quality be improved in the surgery scheduling process? It has been found from the study, that quality in the surgery scheduling process may still be improved if the definition of quality is set to be increased if the follow-up work on each patient is decreasing from current status. Thus, as observed in the case study, throughput rate and quality is linked in this case when patients being scheduled for surgery has to clear different stages of “quality control”, for example anesthetic staff, needs to clear each patient for surgery. A high throughput rate indicates that patients are cleared at a higher rate thus implicating efficiency. Therefore, as the concept of ToC aims to improve the throughput rate, improving quality could be argued to be automatically improved as long as the throughput rate is improved.

6.3 Sustainability for ToC in terms of CI

One of the sub-questions before the study was to evaluate the concept of ToC in the reference to the concept of CI. The application of ToC in a healthcare context has provided some interesting insights. In detail, the study investigated whether ToC would complement and encourage an approach of working with CI. The search for a sustainable approach for rationalization has been desired among many staff members in the department. Especially since previous rationalization projects have failed, the search was intensified. The previous general approach of rationalization has been on focused on single efforts in order to alleviate certain identified problems. However, as previously mentioned the outcome of the majority of these projects has not been satisfactory and therefore a new approach was desired. This approach would preferably involve a more continuous approach.

Since the concept of CI has been documented to provide a continuous approach to regularly work with rationalization (Fryer et al., 2007; Ahlström, 2014; Boer et al., 2000), it made sense in this study to evaluate the concept of ToC and see if it complied with the definitions of the concept of CI.

Ramström and Stridh (2008) and by Boer et al. (2000) provides two adequate definitions of CI:

“A collection of working methods which team-leaders may use in order to improve the working procedures and increase the current efficiency in the organization”
“The planned, organized and systematic process of ongoing, incremental and company-wide change of existing practices aimed at improving company performance”.

Both definitions emphasize the structured methodology and process of improving an organization. In the perspective of the case study and the findings, ToC connects with both and the short term results shows indications of confirming the definitions, with ToC contributing to a structured improvement process albeit a rather time-consuming process.

Furthermore, Ramström and Stridh (2008) and Boer et al. (2008) accentuate the benefits for the team-leaders; Fryer et al. (2007) adds to the previous authors’ conclusions and highlights the importance of involving the whole team including the employees and their opinions. “CI is where all members of the organization work together on an ongoing basis improving process and reducing errors to improve overall performance for the customer.” Thus this implicates a bottom-up application with focus on team members, rather than a top-down with emphasis on team-leaders.

The application of ToC was done by integrating the staff members of the department rather than the managers and chief physicians and other personnel in leading positions. This suggested that the application was a bottom-up application rather than top-down. When applying the concept of ToC in the department, deep participation was required with the staff members and in order to get their approval, anchoring the concept among the staff members was a key activity. Thus a bottom-up approach has been found to a favorable way to apply the concept of ToC. Therefore, it would in this perspective be found that if applying the concept of ToC with a bottom-up approach it does support Fryer et al. (2007) conclusions of working with CI.

Returning to the perspective of defining CI, Fryer et al. (2007) suggests that CI is an “ongoing development of products, services or processes through internal initiatives for improvement”, with this perspective in mind, applying it to this study, ToC as developed by Goldratt (1990), is certainly an iterative method that could be re-iterated multiple times until a desire throughput rate is obtained. However, the concept is fairly limited in providing tools for working continuously on a daily basis. The iterations of evaluating a process and its constraints has in this study been found to be very time consuming, and certainly not suitable to conduct on a daily basis. Thus, the findings indicate a slight contradiction to the definition of CI by Fryer et al. (2007)

Furthermore, in order to provide an approach of working with CI it is emphasized by Ramström and Stridh (2008) as to provide tools for improvement in more than one area. Thus, the authors suggest that improvement should not only consist of improving processes but also improving the product that is being produced. Improvement should therefore be achieved in multiple areas. The concept of ToC is in this area fairly limited in terms of flexibility and variety where the concept promotes improvement. Especially since the concept of ToC is solely focusing on improving one factor, the throughput rate. Every tool in the concept focuses on improving this factor. Thus, it appears to be fairly limited.
7. Conclusions
In this section the original research questions will be answered with regard to the empirical findings found from the case study at the healthcare department.

In detail, this chapter will provide answers to the main research question and the sub-questions previously formed in chapter 1.

**MRQ:** What are the managerial implications of applying ToC in a healthcare department’s surgery scheduling process?

*In the interest of answering the main research question, three sub-questions have been formed:*

**SQ1:** What types of inefficiencies have been identified in minor healthcare department using the concept of ToC?
  - How can the identified constraints be validated?
  - What are the identified drawbacks when applying of ToC?

**SQ2:** What is the perception of rationalization in regards to applying ToC within the minor healthcare department and what are the challenges?

**SQ3:** In what ways could ToC create an efficient way to work in the healthcare department?

The main research question will first be answered and then the sub-questions will be answered according to order above.

**MRQ:** What are the managerial implications of applying ToC in a healthcare department’s surgery scheduling process?

This study focused on the application of ToC, a concept for rationalization which originates from the manufacturing industry. After conducting a case study at the healthcare department within a large emergency hospital in Stockholm, the application of ToC has resulted in implications in three main areas, implications on translating key features and assumptions from the manufacturing industry to the healthcare industry/context, identified factors for success when applying ToC in a healthcare context and lastly how ToC as a concept could complement rationalization in a healthcare context.

The implications regarding translating key features and assumptions of a concept has been highlighted by Trägårdh and Lindberg (2004) as important factors when applying external concepts in a specific context. A possible failure of translating key assumptions and features for a specific concept/method may reduce the efficiency and potential success in an application of an external concept. In the case of ToC, key assumptions for the concept regarded the specific process where the concept was applied to, it was important that the process structure resembled a production loop, where one activity connects to another. Other features that was considered essential when applying the concept of ToC was the ability to measure the cycle times for each activity in an accurate way (Lubitsh et al., 2005; Reid, 2007; Schragenheim & Dettmer, 2001). Lubitsh et al. (2005) concluded in addition that the overall cycle times of the activities should not be exposed to high variation. The results from the case study reveals that there were no particular difficulties in terms of translation and adapting the key assumptions and features. In general, it was found that the activities within the process of surgery scheduling resembled a production loop from the manufacturing industry. The structure of a simple flow where the product (the patient) travels through all of the activities further benefitted the key activity of measuring the cycle times.
The second type of implications regarding the application of ToC concerns the staff members and their opinions in terms of change management. This topic has previously not been discussed or mentioned as frequently in previous applications of the concept ToC in not only a healthcare context but also across industries and contexts. As Reid (2007) and Lubitsh et al (2005) mentions, the application of ToC concerns a managerial focus and the application has previously only involved key managers or supervisors. Thus it has reflected a top-down approach where the managers have been involved.

As found from the case study, the resistance to change has been observed to be low overall among the staff members. There are three main reasons according to the findings of why there was little resistance towards the proposed change. The first reason was that staff members in the department had been longing for change a long time. Since the performance of the output and other issues connected to the process of surgery scheduling was unsatisfactory meanwhile the staff members’ own efforts had failed. A key to understand this desire for change was through a rigorous investigation before any actions regarding application was made. Understanding the staff members’ desire of improving the processes and connecting them to the concept of ToC’s objectives have been a key for alleviating the resistance to change.

Another reason for the low perception of resistance to change has been an honest and direct approach of communication throughout the application of ToC, the interviews and observations. Involving all of the key staff members and encouraging participation in continuous evaluation meetings have also contributed towards a low resistance to change. Throughout the case study at the healthcare department, transparency of the actions and decisions have been found valuable for a low perception of resistance to change. Thus, the results found in the case study aligns with previous research of change management and resistance to change in particular (Lawrence, 1969; Dent & Goldberg, 1999). In conclusion, encouraging participation among the staff members when applying the concept of ToC has been found to be a key activity besides maintaining an open communication with staff members in the work of alleviating resistance to change. What these two factors have contributed to is mainly to manage the social relationships with the staff members, building trust and thus being able to identify the real reasons towards resistance to change. One of the identified hidden reasons, was the perceived contingency towards the concept among staff members. Open discussions and participation were two methods that helped neutralize the perception of contingencies among the staff members.

The last type of implication from the application of ToC considers the perspective of rationalization in a healthcare context, whether or not the concept complements the process of rationalization. The previous applications of ToC in other contexts has concluded that applying ToC gives the managers in an organization an alternative tool for rationalization. Compared to the current approach for rationalization in the healthcare department have been to manage inefficiencies once they become threatening for the overall production output or in general causes large disturbances. The current approach for rationalization can be categorized as reactive, as the resolutions are planned once inefficiency is identified. ToC as a concept is rather the opposite to the current approach as it offers a tool for working with rationalization on a continuous basis. However, as the case study and the application of ToC was found to be rather time consuming, one could argue that the lengthy application was due to acclimatization and learning issues. In theory, once the staff members are acclimatized and the procedure of the five focusing steps has settled, it should provide a useful tool for continuous rationalization for the supervisors at the department. Thus, ToC have in previous
applications been described as a method for continuity and progressive approach for rationalization. The findings of this case study, have indicated support for the conclusions made from earlier research. The application of ToC has inspired a progressive approach for rationalization, which in turn has been desired by the healthcare department. Furthermore, as the overall demand for healthcare services has steadily risen for many years the supervisors and in the department have not been able to accommodate this rise in demand. It could be argued that a deficient rationalization strategy may have been one of the reasons for the failure of accommodating the increase in demand for healthcare services. The findings of this study indicates that ToC could be one of many tools in order to support an efficient rationalization strategy.

Overall the application of the improvement method ToC, has confirmed some of the benefits for a healthcare context as found in the method’s original context. Furthermore, it also supports the findings from previous applications of ToC in the healthcare industry (Lubitsh et al., 2005; Reid, 2007). It has done so by identifying constraints and successfully sorted the constraints and thus increased the throughput rate. The method has contributed to an alternative view of rationalization, generating positive support among key personnel, with medical background and without. The findings of applying ToC highlighted hidden perceptions of the process of surgery scheduling. For example, the importance regarding communication as current inter-departmental functions have inefficient relationships in terms of collaboration. However, the findings are limited to be results found on a short-term basis and thus the effects on a long-term basis are not covered in this study. The findings indicate a potential sustainable success as the waiting queues have decreased slightly and the throughput rate have been maintained (number of patients receiving medical treatment in a specific timeframe), although this could also be derived from other factors.

**SQ1: What types of inefficiencies have been identified in process of surgery scheduling using the concept of ToC?**

The identified inefficiencies have been labeled bottlenecks/constraints in accordance to the terminology of ToC. In the process of surgery scheduling six specific constraints have been identified, two are external and four constraints are internal (Goldratt, 1990; Reid, 2007). The majority of the identified constraints are categorized as a combination of either policy (a decision or a rule that prevents the system from producing more) or a physical constraint. A physical constraint could be either a machine or a staff member which causes inefficiency. The majority of the constraints identified were a physical constraint and in particular a staff member in different activities in the process of surgery scheduling that were unable to perform his or her task. However, as Goldratt (1990) described it, constraints are not singular incidents that disturbs the system, in fact it is often correlated events dependent on previous actions. This statement from Goldratt (1990) was supported when ToC and the five focusing steps was applied. The results from the case study of applying ToC and more specifically the identification of constraints illustrated the importance of efficient collaboration among different staff members in the process of surgery scheduling. The identified constraints were almost always related to inefficient handover actions from one activity to another along the process of surgery scheduling.

From the study, the following identified constraints are considered to be physical constraints:

- **Operation competence among physicians – no coverage**
- **Healthcare declarations from patient**
- **Prioritizing incoming surgery notifications**
• Coordination between physicians, anesthesia and coordinators
• Incomplete surgery notification

Thus, five out of six identified constraints is considered to be physical constraints the only identified constraint considered to be a policy constraint is:
• Patient cancellation of surgery invitation

The surgery scheduling process is considered to be an internal process with low to minimal influence by external forces, hence the few identified policy constraints. Instead, when the influence by external forces in a specific process is low, the results from the case study reveals that the majority of the identified constraints are related to physical matters.

• How can constraints in healthcare scheduling processes be validated?

The identification of bottlenecks/constraints in an application of ToC has previously not been explicitly described by researchers (Goldratt, 1990; Reid, 2007; Lubitsh et al., 2005). However, Goldratt (1990), the founder of the concept does mention that it is important to verify the identified constraints as they may be “false” constraints, hiding the “real” or the constraint that causes the most impact. As no explicit method was described of how to validate the identified constraint, the validation process at this study was inspired of a generic method of methodology triangulation. The method originally aims to increase the validity when collecting data. Thus using the same logic, if the identified constraint is verified with multiple sources where they all confirm that the constraint is indeed identified as a constraint, the probability should increase when determining a constraint is the constraint that produces the most impact on the overall system. In detail, an identified constraint were validated by mainly three methods, using the computer system and locating where most patients are stacked up/waiting ahead of a new activity in the process. The second method constitutes of interviewing the surgery coordinators, physicians and anesthetic staff of which of activities they perceive as being the most inefficient and/or the most time-consuming. Lastly, the remaining method was observations. Utilizing methodology triangulation, it could be discussed whether or not there are more efficient ways to validate a constraint, however, within the case study’s context the results indicate that the validation process of methodology triangulation does work and aids a validation process.

• What are the identified drawbacks when applying of ToC?

The identified drawbacks with the improvement method ToC derives to the difficulties realizing when and how a corrected process and its activities should resemble when a constraint is alleviated. Thus, even though two constraints of the six that were identified were alleviated in terms of a provided solution, it was still difficult to know whether or not the structure of the process was optimal. In the same time, shifting the order of certain activities could possibly impact the performance up or down and thus causes confusion and also hesitation towards when the structure is optimal.

Another drawback identified with the concept is the intense focus on the process of identifying the constraints, for the second part of solving the identified constraints, the model is rather limited. Each constraint needs to be analyzed and support for designing solutions are limited from the concept. During the application of ToC, the concept has provided good guidelines for identifying constraints but advices for the solutions it was rather limited.
An identified drawback when applying the concept of ToC had effects in terms of time management. The application of ToC in general was very time consuming as described in the results, where complex activities within the concept prolonged the overall application time. This may potentially have a negative impact for the staff members on working with the concept on a continuous basis as their working schedules are already busy.

In conclusion, the improvement method provides limited guidance for other types of improvement as it is focused solely on a certain process. The process of locating constraints and finding resolutions to alleviate them could potentially be tiresome and time consuming if a process is long and extensive. This lessens striving to continually improve the process as conducting a new iteration costs in terms of effort and time.

**SQ2: What is the perception of rationalization in regards to applying ToC within the minor healthcare department and what are the challenges?**

The main identified challenges of rationalization in the healthcare department have been to position in the rationalization project, in order to gain motivation among the staff members. As the main objective for a hospital is not being profit-driven, an adjustment has to be made when suggesting rationalization projects.

The resistance to change has been identified as an important factor in organizations across many industries with the healthcare context included. Kotter (1996) suggests that this factor is one of the most important when determining the success of a change project, in essence, two underlying reasons may influence resistance to change. Firstly, the tacit information is deeply embedded in the healthcare department and its employees, resulting in limited choices of replacing them or having them to change their working routines.

The other is the lack of incentives for rationalizing; as the healthcare department is government funded implicating that the government besides already offering few resources for rationalization, but also have very few incentives to offer the staff members to strive for a better work environment and improving processes. This fact has already caused problems for the healthcare industry and will continue in the future. Particularly when it comes to rationalization in hospitals with limited resources (government funded and other public hospitals are good examples of this feature). The concept of ToC has not at all eliminated this problem, but shown good results indicating that it is possible to accomplish changes and improvement despite limited resources. Changing working routines, facilitating discussions and create understanding for the underlying reasons to inefficiencies have been found as the main contributions for the concept of ToC.

The general perceptions of rationalization within the healthcare department are rather negative given the previous failed attempts of Lean within the hospital but also in other healthcare contexts, but the perception of resistance is reduced when the need for rationalization and improvement is imminent. For the case study within the healthcare department, the current working processes about surgery scheduling were found inefficient and therefore there was a need for rationalization. This situation was the case of the healthcare department as the surgery scheduling process affected the surgery coordinators and the rest of the department, thus the need for change lowered the resistance to change.

In particular, ToC aimed to visualize and described in a structured way where constraints and thus inefficient activities were located, when this was presented towards the staff members in
the department it became clear and only confirmed their thoughts of the need for change and rationalization. The perception that change and rationalization is needed was there originally, the contribution of ToC aimed to visualize in an intuitive way where inefficiencies are located and thus eliminate the discussion of why one should focus on a specific activity.

Creating and generating collective understanding among the staff members where inefficiencies are located and why they are perceived as constraints (reasons why the cycle time at a specific activity is long) were one of many findings from this case study of why ToC reduced the resistance to change.

Another great factor to reduce the resistance to change within the healthcare context as found from the study was the benefit of deep participation in the concept of ToC. By participating in the project, in particular, the surgery coordinators felt included and could contribute with personal insights. In general, the more involved the staff members were the more they realized the need for improvement. The concept of ToC has in this case study been found to be a tool which visualizes the inefficiencies and then the need for improvement in certain identified areas. Thus, the tool helped to improve the previously bad perception of rationalization in the healthcare department.

**SQ3: In what ways could ToC create an efficient way to work in the healthcare department?**

The application of the concept of ToC in the healthcare department of Ob/Gyn at a large emergency hospital in Stockholm yielded interesting results regarding working with CI. Since the nature of the concept requires a continuous approach of investigating a system’s performance, this concept would demand continuous attention to sustain the effects. The concept does however provide team leaders with a useful tool to evaluate intricate processes in order to search for improvement. This aligns with the definition of CI previously defined of Ramström & Stridh (2008). However, the concept does not include tools for working daily with improvements, nor does it involve the majority of the employees when utilizing ToC as an approach for CI. Thus it opposes against the definition of Fryer et al. (2007) which suggests a successful approach to working with CI emphasizes an extensive employee engagement. The approach of applying the concept of ToC is a bottom-up approach as recommended by Fryer et al. (2007) when working with the concept of CI.

In conclusion, the application of the concept of ToC has provided tools for evaluating a process rather efficiently and yielded early indications of improvements on the surgery scheduling process. However, it remains certain whether the concept may complement working with continuous improvement, as there are limited tools for a continuous approach of improving the working routines and procedures, also the time required for evaluation was found to be very time consuming which also negatively affects the approach of working on a continuous basis.

**8. Future Work**

The purpose of this study was to provide additional empirical data when applying the concept of ToC in a healthcare context. In detail, this study aimed to address the gaps that existed within the theoretical field and provide insights of how and in what ways ToC may complement the procedure of streamlining a certain process within a healthcare context. Also, the overall managerial implications of applying ToC within a healthcare context have been investigated.
Bearing this purpose in mind, there are still many more areas within this field that remains to be discovered. Since the time frame of this study was limited, the study has collected data on a short-term basis following the immediate results of applying the concept. One of the limitations of this study was thus the limited amount of empirical data concerning long-term effects of applying the concept into the context of healthcare. An interesting view of the concept would be to match the strong indications of short-term gains and evaluate these effects for a long-term basis.

Certain discussions have been done in the study comparing the concepts of ToC and Lean; these are though so far not confirmed as no actual application of the concept of Lean has been done in this study. However, a full application of both concepts enables a side-by-side comparison which could generate very interesting findings. As for this study, the discussion has covered previous failed Lean implementations within the hospital and also research suggesting less successful implementations (Radnor et al., 2012) including the reasons behind possible pitfalls. In conclusion, it has provided discussion for the indications of success of the improvement method ToC.
9. Table of References


Marklund, A., & Eriksson, R. (2014). *Production control in hospital departments: Improving coordination through better optimization of IT-support tools at Astrid Lindgren Children’s Hospital, a Case Study at the Pediatric Oncology department*. Royal Institute of Technology.


Studer, Q. (2014). Making process improvement'stick': there are five traits common to healthcare organizations that develop process improvement initiatives that successfully sustain gains. *Healthcare Financial Management*, pp. 90-96.


Appendix 1. Interview questions
The interviews held at the healthcare department included three different stages. All three stages included a pre-defined set of interview questions. The questions aimed to reflect the specific stages and enable comparisons between the inter-departmental functions participating in the application of ToC.

All the interviews were conducted in Swedish, hence the questions below are written in Swedish.

Fakta om intervjuobjektet:
- Formell tjänst
- Ansvarsområden
- Antal år på tjänsten

Frågor gällande förbättringsprojekt, tidigare erfarenhet och generell uppfattning
1. Vad är din tidigare erfarenhet av förbättringsprojekt på kliniken?
2. Vad har du för generell åsikt om förbättringsprojekt och liknande förändringar?
   a. Hur upplever du granskningen av arbetsuppgifterna och rationaliseringen av verksamheten?
   b. Vart går gränsen för förbättringsprojektten och vad som går att förbättra?
   c. Vilka incitament upplever du fungerar för att öka motivationen till vilja genomgå förändringar?
3. Vad ser du som svårigheter/utmaningar med förbättringsprojekt inom kliniken?
4. Upplever du ett behov av förbättringsprojekt i kliniken för närvarande?

Frågor gällande problem och ineffektivitet i kliniken
1. Vilka problemområden har du identificerat i processen för schemaläggningen av kirurgi för patienter?
2. Hur tycker du det dagliga arbetet och arbetsrutinerna på kliniken fungerar? (Om svårigheter att beskriva, ställ följdfrågor för att vidareutveckla svaret, upplever du stress i arbetet?)
3. Hur upplever du kommunikationen fungerar gentemot dina kollegor? Vad är din åsikt till nuvarande situation?
4. Vad anser du vara främsta orsaken till ineffektivitet i sjukvården?

Frågor gällande ToC
1. Har du hört talas om ToC före appliceringen av konceptet i kliniken?
2. Vad är den generella åsikten om förbättringsmetoden ToC?
3. Vad upplever du har fungerat, respektive inte fungerat med metoden?
4. Hur upplever du de identifierade flaskhalsarna och vad är det som inte har fungerat sedan tidigare i dessa?
Appendix 2. Framework for observations and shadowing
The observations and shadowing in the healthcare department was documented utilizing following structure

1. What is the observed objects position and work tasks?
2. Description of their role in the surgery scheduling process
3. Describe in overall the main responsibilities the observed object did during a session
4. Was there anything in particular that was not planned? What was the disturbances?
5. Was the observed object’s emotional status?
6. How did the observed object collaborate with other medical and administrative employees?
7.