

# **Human Lean**

**Combining Sense of Coherence and Lean to  
achieve productivity and health**

**Bengt Halling**

## **ABSTRACT**

The purpose of this thesis is to identify barriers to and supportive factors for Lean implementation and to investigate how application of the Sense of Coherence (SOC) theory combined with Lean philosophy may affect health and productivity. The thesis is based on five studies. The first study compared similarities and divergences in barriers to Lean described in interviews by informants in manufacturing and health care. The second study was a case study at a manufacturing firm. Interviews with managers implementing Lean revealed how their views on Lean influenced the implementation. In the third study, a literature analysis was used to conceptualize the concepts and roles of leadership and management in regard to Lean. In the fourth study it was explored how productivity, quality, work attendance and numbers of rehabilitation cases were influenced after implementation of sense of coherence theory based managerial behavior at three workplaces. The fifth study examined how the implementation of a new leadership approach based on the SOC theory combined with Lean philosophy relate to productivity, quality and levels of sick leave at a steel-producing company. The results from the studies show that the perceived difficulties and barriers are much the same in manufacturing and health care. Another finding was that managers' views on Lean influence the implementation but also that learning during the implementation process can alter their views. A third finding is that lean management is a matter of dualism, consisting of two complementary systems of action, management and leadership, which are related to the two basic principles of Lean, continuous improvement and respect for people. After application of the SOC theory combined with Lean as a basis for the managerial approach, there were improvements in productivity, quality, attendance at work and reduced levels of sick leave at all four studied workplaces, as well as fewer cases of rehabilitation at three workplaces. Several conclusions can be drawn. One is that Lean consultants with a limited approach to Lean, lack of a common organization-wide definition of Lean, and lack of supportive leadership are barriers to Lean implementation. Lean consultants with deep knowledge and capability to teach others Lean is a supportive factor. An organization-wide definition of Lean through an organization-specific Lean philosophy is another supportive factor. Managers that use both leadership and management to support people is a supportive factor to Lean. The study also shows that an application of SOC theory combined with Lean may be positively associated with health and productivity improvements. The overall conclusion is that people's way of thinking and acting is the nucleus in Lean. To emphasize the importance of people, I suggest to call the approach of combining SOC and Lean "Human Lean."

**Keywords:** barriers, health promotion, implementation, Lean, leadership, management, organizational change, productivity, sense of coherence, supportive factors

## **SAMMANFATTNING**

Syftet med denna avhandling är att identifiera hinder och stödjande faktorer för implementering av Lean och undersöka hur tillämpning av hälsoteorin Känsla av sammanhang (Kasam) kombinerad med Lean-filosofi påverkar hälsa och produktivitet. Avhandlingen baseras på fem studier. I den första studien studeras likheter och skillnader i beskrivna hinder från intervjuer av informanter verksamma i tillverkande industri och vårdsektorn. Den andra studien genomfördes i tillverkande industri. Genom intervjuer med chefer undersöktes hur deras syn på Lean påverkat implementeringen av Lean. I den tredje av studien studerades litteratur om Lean som bas för konceptualisering av ledarskap och management i relation till Lean. I den fjärde studien undersöktes hur produktivitet, kvalitet, närvaro på jobbet och antalet rehabiliteringsfall påverkades efter implementering av kasam orienterat ledarskap på tre arbetsplatser. I den femte studien undersöktes hur produktivitet, kvalitet och sjukskrivningar påverkats efter implementering av ett nytt ledarskapskoncept baserat på Kasam i kombination med Lean-filosofi i ett stålföretag. Resultaten visar att svårigheter och hinder beskrivs mycket lika i tillverkande industri och vårdsektorn. Ett annat resultat var att chefers syn på Lean påverkar implementationen, men också att denna syn kan förändras genom det lärande som sker under implementeringen. Ett tredje resultat var att ledarskap i Lean bör vara dualistisk. I praktiken behövs både management och ledarskap då dessa är komplementära och relaterar till de två huvudprinciperna i Lean, ständiga förbättringar och respekt för människan. Produktivitet, kvalitet och närvaro ökade samtidigt som sjukskrivningar minskade vid de fyra arbetsplatser som undersöktes. På de tre arbetsplatser där rehab-fall följdes upp konstaterades en minskning av antalet fall. En slutsats är att Lean-konsulter med verktygsorienterad syn på Lean, brist på en organisationsövergripande definition av Lean och brist på stödjande ledarskap är tre faktorer som försvårar implementation av Lean. Konsulter med djup kunskap och förmåga att lära andra identifierades som stödjande faktorer vid implementering av Lean. En gemensam organisationsövergripande definition av Lean är också en stödjande faktor, liksom att chefer att praktiserar både management och ledarskap vid implementering av Lean. Studierna indikerar att kombinationen av Kasam och Lean kan ge positiva resultat på både hälsa och produktivitet. En övergripande slutsats är att människors sätt att tänka och handla är kärnan i Lean. För att betona människans betydelse i Lean, föreslår avhandlingen att kombinationen av kasam och Lean benämns Human Lean.

Nyckelord: hinder, hälsofrämjande, implementation, Lean, Ledarskap, management, organisationsförändring, produktivitet, Kasam, stödjande faktorer

## **FOREWORD**

The journey with this thesis has sometimes been frustrating but always instructive and interesting. I am grateful for the opportunity to carry out this journey as part of my work at University of Gävle. I want to thank my supervisors, Professor Lars Bengtsson, Professor Emeritus Jörgen Eklund and Professor Katarina Wijk for their help and support. I also thank Associate Professor Andrea Eriksson for her valuable comments and suggestions. Finally, I thank all the people from the organizations that in different ways participated in the journey and made the thesis possible.

A researcher's scientific approach affects the researcher's choice of what problem to examine and how to do it. My scientific approach is affected by my experiences as operator in different industries in Sweden and from a 5-year rehabilitation process from shoulder and neck problems from my last job as operator at a manufacturing company. During rehabilitation I was told that I could not go back to work in my job as operator at the manufacturing company. During that time I had become interested about how work condition affects health, so I decided to try to study health and wellness education at a university. Later I also studied public health work. During my studies, my interests widened from how work conditions affect health to how health affects performance at work and productivity. These life experiences have of course influenced my scientific approach and thereby this thesis.

Bengt Halling

Gävle, November 2019

## **APPENDED PAPERS**

This doctoral thesis is based on the following five appended papers:

Paper 1. Halling, B. and Wijk, K. (2013). Experienced barriers to Lean in Swedish manufacturing and health care. *International Journal of Lean Thinking*, 4(2): 43-63.

Paper 2. Halling, B. and Renström, J. (2013). From fantasy to reality – Learning from seven years of Lean implementation. *Journal of US-China Public Administration*, 10(4): 268-378.

Paper 3. Halling, B. and Renström, J. (2014). Lean leadership: A matter of dualism. *International Journal of Human Resources Development and Management*, 14(4): 242-253.

Paper 4. Halling, B., Magnusson, P. Lyckström, M. and Wijk, K. Application of a sense of coherence–based leadership for productivity and health at Scania. *International Journal of Human Factors and Ergonomics*.

Paper 5. Halling, B., Bergman, M. and Wijk, K. Sence of coherence and Lean-based leadership and alterations in sick leave and production. Submitted.

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## 1 INTRODUCTION

*This chapter begins with a brief description of the reasoning behind the thesis, followed by its purpose and research questions.*

Many Lean implementation efforts fail to reach their goals (Bhasin and Burcher, 2006; Emiliani, 2006; Sohal and Eggleston, 1994; Spear and Bowen, 1999), in contrast to the success that Toyota, the originator of Lean, has had with the concept (Krafsik, 1988; Liker, 2004; Osono, Norihiko and Takeuchi, 2008; Sugimori et al., 1977; Womack, Jones and Roos, 1990; Yang, Yeh and Yang, 2012). Lean is a management concept originated from a concept labelled Toyota Production System (TPS) that has been developed within the Toyota Motor Company. The Toyota Way aims to reduce waste and create value for customers (Ohno, 1988). Since the start of the Toyota Motor Company, the leaders at Toyota are described to have regarded investment in their people as the key for company success. The underlying assumption at Toyota is that carefully selected people who are developed over time will be able to continuously improve processes, and that is thought to lead to competitive strengths. At the core of Toyota culture – how people think and behave – are the two basic principles continuous improvement (CI) and respect for people (RfP) (Liker and Hoseus, 2010). It can be argued that humans are the driving factor in Toyota Way, as it is humans that through their way of thinking and behaving reduce waste, improve processes and create value for the customer. The way of thinking is equal important in Lean, and that is seen in Yamamoto and Bellgran's (2010) argument that mind-set is fundamental in Lean, and in Dombrowski and Mielke's (2013) argument that it is employees who are the key factor for sustainable implementation of Lean. However, despite the importance of people and mind-set in Lean, the common focus in Lean implementations is on methods, so the implementation does not succeed in the long term (Dombrowski and Mielke 2013). Lean can be implemented in many ways with different goals, but methods that often are implemented include 5S, standardized work and continuous improvement (Pettersen, 2009a). Belekoukias, Garza-Reyes and Kumar (2014) assert that just in time (JIT), which aims to reduce levels of inventory through application of one piece flow, pull system, takt time, cell manufacturing and levelled production, is an essential method in Lean. According to Emiliani (2006), the RfP principle is often misunderstood or missing when organizations aim to "lean" their business. Without the RfP principle, he argues the lean concept will not work, since simple logical arguments reveal that continuous improvement is impossible without respect for people (ibid., p. 177). This line of thinking implies that people are the core of Lean in the same way as people are the core in the Toyota Way, but this is not correctly understood and thereby many Lean implementations fail. This means that there is a need for more knowledge regarding how Lean shall be



interpreted and how implementations can be done to be successful and sustainable.

Another factor that has been pointed out as important in Lean is managers (Iyer, 2017; Loh and Yusof, 2019; Loh, Yusof and Lau, 2019; Poksinska and Swartling, 2018), and when implementing Lean their role radically changes from focus on managing processes to coaching and developing people (Poksinska and Swartling, 2018; Poksinska, Swartling and Drotz, 2013). To be successful with Lean implementation, it is claimed that leaders and employees must have a complete change of mind-set (Aij et al., 2015). Emiliani and Emiliani (2013) argue that it is common that companies striving for lean development have great difficulty understanding Lean as a management system that requires CEO commitment and participation, as well as a completely different set of leadership behaviors. It has been argued that to succeed with Lean, managers must change their view on their role (Emiliani, 2006; Emiliani and Emiliani, 2013; Mann, 2010). Unfortunately, most organizations that aim for Lean have been found to lack an understanding of the importance of managers' behavior in Lean (Emiliani, 2006; Emiliani and Emiliani, 2013; Liker and Ballé, 2013).

The above-described situation of Lean and the challenges to being successful with Lean efforts can be seen as a paradox. Lean is about elimination of waste, and the many failures with Lean efforts are more or less wasted resources, so it become important to find better ways to implement and sustain Lean. As it is people through their way of thinking and behaving that are the driving force in Lean, and WHO (1998) defines health as a resource that permits people to live a productive life, health can be argued to be an important factor for Lean. Health promotion is a process aiming to enable people to improve their health and thus their ability for productivity (ibid.). So workplace health promotion can be regarded as improvement on human capacity. The relationship between health and productivity is clear in the field of ergonomics. For example, Edwards and Langaa Jensen (2014) argue that within the ergonomic profession it has always been a goal to ensure that design and redesign of production systems consider both productivity and employee well-being. In line with that, Dul et al. (2012) argue that human factors and ergonomics (HFE) has a great potential to contribute to the design of work systems, because it focuses on both performance and well-being. According to Antonovsky (1996), health promotion practice should be based on a salutogenic perspective on health; that is, focusing on health-enhancing factors rather than the pathogenic perspective that focuses on disease-causing factors. He created the Sense of Coherence theory (SOC) as such a salutogenic perspective for health promotion. Sense of Coherence (SOC) theory is based on three components: *meaningfulness*, the motivational component; *comprehensibility*, the cognitive component; and *manageability*, the behavioral component. The strength of one's SOC is described as shaped by three kinds of life experiences: consistency, underload-overload balance and participation in

socially valued decision-making (ibid.). Since managers has been pointed out as having an important role in Lean but also as having trouble fulfilling the role, maybe health promotion knowledge can be of value.

Based on the description above, it is clear that despite the popularity of Lean, there is still a need for knowledge on how to implement and sustain Lean. That makes it important to identify factors that are drivers or hinderers for Lean development and sustainability, and what kind of knowledge lean managers need. It is also important to study if health promotion knowledge and application of SOC can be supportive to Lean.

## **1.1 Purpose and research questions**

The purpose of this thesis is to identify barriers to and supportive factors for Lean implementation and to investigate how application of the Sense of Coherence theory combined with Lean may affect health and productivity.

### *1.1.1 Research questions*

1. What factors can be identified as barriers to or supports for Lean?
2. How does application of Sense of Coherence theory as a management approach affect health and productivity in a Lean context?

## **1.2 Outline of the thesis**

The thesis consist of seven chapters:

Chapter 1 consist of introduction, purpose, research questions and outline of the thesis.

Chapter 2 presents the theoretical framework and provides an overview of Lean and its relation to health and health promotion. The chapter covers such topics as Lean, barriers, and supportive factors for Lean, Lean and the manager, Lean critics, health and health promotion, Sense of Coherence theory and the relationship between health and productivity, health interventions, implementation and resistance to change, and measuring organization performance.

Chapter 3, the thesis method chapter, is about scientific approach, the studied organizations, and the methods and method considerations, followed by a discussion about the quality and limitations of the study.

Chapter 4 presents summaries of the six papers and ends with a summary of the results in regards to the research questions.

Chapter 5 begins with a discussion of the methods used in the thesis followed by a discussion of the results. The chapter ends with a summary discussion.

Chapter 6 presents the conclusions regarding barriers to and supportive factors for Lean. It further describes how application of the Sense of Coherence theory combined with Lean may affect health and productivity.

## 2 THEORETICAL FRAMEWORK

*This chapter begins with a description of Lean and known barriers to and supportive factors for Lean. Next follows a description of Lean and the manager, and thereafter critical views on Lean are presented. The chapter continues with health and health promotion and SOC theory and the relationship between health and productivity. The chapter ends with descriptions of health interventions, barriers and resistance to change, and measuring organizational performance.*

### 2.1 The Toyota Way and Lean

Toyota is the origin of Lean (Krafsik, 1988; Samuel, Found and Williams, 2015). The roots of what was to become the Toyota Way date to the early 1890s (Emiliani, 2006; Liker, 2004) and the Toyoda family's spinning and weaving business (Liker, 2004). At that time, long before the birth of the car manufacturer Toyota, Sakichi Toyoda was disturbed that the workers, his mother, grandmother, and friend, had such hard work spinning and weaving and wanted to make their work less hard. As a result, he invented the power-driven loom. Later he invented the automatic stop device for his looms, a principle known as *jidoka*, automation with a human touch (Liker, 2004). Thus, it can be argued that the beginning of what later become known as the Toyota Way started out of concern for people. Toyota is described as achieving success through their Toyota Way (Krafsik, 1988; Liker, 2004; Osono et al., 2008; Sugimori et al., 1977; Womack et al., 1990; Yang et al., 2012). With the establishment of Toyota Motor Company 1930 by the Toyoda family, the development of what was to become known as Toyota Production System (TPS) and Toyota Way started (Liker, 2004). The effectiveness of Toyota compared to other auto producers was noticed through the book *The Machine that Changed the World* (Womack et al., 1990).

Since the start of Toyota Motor Company, the leaders at Toyota have regarded investment in their people as the key for company success. At the core of Toyota culture are the two basic principles, continuous improvement (CI) and respect for people (RfP). The underlying assumption at Toyota is that carefully selected people who are developed over time will be able to continuously improve processes and that will lead to competitive strengths and mutual prosperity (Liker and Hoseus, 2010). The Toyota Way aims to reduce waste and create value for customers (Ohno, 1988). Humans are the driving factor in the Toyota Way, as it is humans that through their way of thinking and behaving reduce waste, improve processes, and create value for the customer.

Lean is described to have begun as a translation of the Toyota Production System (Pettersen, 2009a). The term Lean was coined in 1988 to distinguish production with buffering (Ford-style mass production) and thereby huge inventory levels from the just-in-time (JIT) production with low inventory levels characterizing Toyota Way (Krafsik, 1988, pp. 44-45). Although the term Lean was coined in 1988, the philosophy that the term points to was discussed previously with terms

such as JIT production, world-class manufacturing, or Toyota Production System (Langstrand, 2012), as well as the just in time – respect for the worker system (Karasek and Theorell, 1990). When the Japanese joint title meaning *just in time* – *respect for the worker system* was translated in the USA, both the translation and the approach dropped the *respect for the worker system* part and it became *just in time* (ibid., p. 266). That means that the important human side of the system was lost or at least downgraded in Lean compared to the original Toyota Way.

Lean as a concept has evolved over time. The result is confusion about what Lean is (Hines, Holweg and Rich, 2004). Langstrand (2012) explains that in the beginning the term Lean was about the amount of inventory in a production system, but that has changed to being a term about an all-encompassing company philosophy. It might be logical to expect that a concept that has been evolving for so long and has become as popular as Lean should have a clear and concise definition, but there is no such clear definition of Lean (Pettersen, 2009a; Samuel et al., 2015). Furthermore, the Lean concept itself has become translated into different versions. According to Langstrand (2012, p. 21), Lean can be interpreted in four distinctly different meanings; as being Lean (a condition), as becoming Lean (a process), as doing Lean (a ‘toolbox’) or Lean thinking (a philosophy). Ultimately the lack of a clear and concise definition of Lean means, as concluded by Pettersen (2009b, p. 33), that individuals can translate the core ideas of Lean so it suits their own frames of reference, and that can cause the Lean concept to have several different meanings within an organization. In their historical overview of Lean literature published during 1987-2013, Samuel et al. (2015) conclude that Lean has evolved a lot and will continue to evolve in the future.

### 2.1.1 The core of Lean

Osono et al. (2008) give a clear statement about the importance of having the two sides, the technical and the human, complementing each other. They tell that after six years of research and more than 220 interviews at Toyota, they came to understand that it is how Toyota combines the hard and the soft sides and their focus on the human being as the center of production and consumption that have made Toyota successful. That resembles a statement by Emiliani (2006) when he argue that Lean needs to be based on the two basic principles of respect for people (RfP) and continuous improvement (CI). Also, Rodriguez et al. (2016) has pointed to the importance of a balance between the technical and human elements to succeed with Lean. Unfortunately, often the RfP principle is misunderstood or missing when organizations aim to lean their business.

On Toyota’s corporate website<sup>1</sup>, there is an image of the guiding principles in Toyota Way in the shape of two balls representing the two basic principles of CI

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<sup>1</sup> [http://www.toyota-global.com/company/history\\_of\\_toyota/75years/data/conditions/philosophy/toyotaway2001.html](http://www.toyota-global.com/company/history_of_toyota/75years/data/conditions/philosophy/toyotaway2001.html) accessed 2018 04 11.

and RfP. The image is described as reflecting the kind of company Toyota seeks to be, and the purpose with the image is to clarify the company values and business methods that all the company's employees worldwide should embrace. The Toyota Way's two basic principles are clearly shown in the picture. Another example of the dualism of the Toyota Way is an image in Liker and Hoseus (2008, p. xxviii) showing the Toyota Way as a house with the two pillars continuous improvement and respect for people; also in this picture, the dualism is clear. A third example is an illustration of a DNA helix called the Toyota DNA (Liker and Hoseus, 2008, p. 39). In this illustration the dualism is shown as two intertwined value streams, the product value stream and people value stream, in the shape of a DNA helix.

Liker and Hoseus (2008) call attention to the importance of problem solving in Toyota culture, as it is the problem solving that connects the product and people value streams of Toyota. They further argue that without practical and continuous problem solving on a daily basis, companies could not achieve the goal of working according to Lean philosophy. TPS consists of tools and methods that are designed to highlight problems. The Toyota Human System is intended to develop people that are able and willing to respond to the problem that the production system is highlighting. They argue that the way to succeed with continuous improvement and waste elimination is to have a production system that highlights problems and a human system that develops people that are willing and able to identify and solve the problems the production system has highlighted. That requires people that are team-minded, sufficiently competent and trained, and have trust in their supervisors, because that is described to create a feeling that they are able to identify the problems and feel motivated to solve them (ibid.).

One description of Lean is that it is a management system designed to be responsive to the needs of humans in business and deliver better outcomes for key stakeholders such as customers, associates, suppliers, investors and communities. The lean management system is rooted in the two key principles, continuous improvement and respect for people. The "continuous improvement" principle embodies the tools and methods used to improve productivity. The "respect for people" principle embodies leadership behaviors and business practices that must be consistent with efforts to eliminate waste and create value for end-use customers. Waste is defined as any activity that adds cost but does not add value as perceived by end-use customers. An end-use customer is the person that pays for and uses a product or service. If the person that pays for the product or service is different from the person that uses it, the value proposition is defined by both the buyer and the user (Emiliani and Stec, 2005).

Emiliani and Stec (2005) detail fourteen methods or tools related to the lean management system. 5S, a method used to establish an organized workplace, stands for Sort, Sweep, Straighten, Shine, Sustain. *Heijunka*, a Japanese word

meaning to even out the load, aims to smooth fluctuations in customer demand. *Hoshin kanri* is a Japanese word meaning policy deployment. Hoshin kanri is used to connect corporate strategy to key objectives and resources, including daily activities across function. *Just-in-time* is a method that means that each subsequent operation acquires parts (or information) from the preceding operation when needed, in the quantity that is needed. *Kaizen*, a Japanese word meaning change for the better, is a process used to identify and eliminate waste. *Lean behaviors* mean to applying Lean principles and tools to improve leadership behaviors and eliminate behavioral waste. A *percent load chart* is a one-page diagram depicting the cycle time between operations or workers compared with the rate of customer demand. The diagram is used to identify workload imbalances. *Quality function deployment* is a process used to incorporate the wants and desires of intermediate and end-use customers in the design of goods and services. *Root cause analysis* is done with methods used to determine the root cause of a problem and identify countermeasures to avoid repeat occurrences. The two key tools for root cause analysis are the 5 Whys (asking why five or more times until the root cause of the problem is discovered) and the fishbone or cause-and-effect diagram. A *standard work chart* is a one-page diagram showing the sequence in which work shall be done. *Takt time* is based on the rate of customer demand. Takt time is used to establish a direct link between marketplace demand and workplace activities. *Total productive maintenance* is a method that aims to ensure that equipment is always in good operating condition and available for use when needed. A *value stream map* is a one-page picture that visualizes material and information flows. Value stream maps are used to identify improvement opportunities and eliminate waste. *Visual controls* are signs and other forms of visual information used to simplify the workplace and make it easy to recognize abnormalities (ibid.).

Other examples of Lean tools and methods exist. *Kanban* is a tool for communication in the just-in-time system in batch production, signaling a need for parts or products and including instructions on the quantity that shall be delivered. *Flow production* is one of the pillars in just-in-time production. In flow production, machines are arranged in processing order so that the work pieces can flow from process to process without interruptions and stagnation. *Pull production* is also important in just-in-time production; it aims to limit production to only produce the numbers of products that will be consumed in the next process. *Standardization* means documentation of the best way to do a type of work. *Standardized work* is the optimum combination of man, machine and material. The three basic elements for standardized work are takt time, work sequence and standard work-in-process. A *standard* is the best known way to do a job, namely a set of policies, directives, rules and procedures that the management has established for all major operations, that are to serve as guidelines to all employees

so they become able to perform their jobs in a way that assures good results (Imai, 1997).

An important method or principle in Lean is called *Genchi genbutsu*, which means that personnel go and see a situation to be able to understand it. This enables the personnel to solve problems and improve processes by going to the source, observing and verifying data with their own eyes rather than theorizing based on what other people or a computer screen tells them. It means to think and talk based on one's own verified data. Genchi genbutsu is also important to high-level managers and executives, so they can get data verified by themselves and not be restricted to a superficial understanding about a situation (Liker, 2004). Sometimes the Genchi genbutsu principle is called "going to gemba" (Imai, 1997).

A challenge for the future is to ensure that Lean is understood as a comprehensive system based on both the continuous improvement principle and the respect for people principle (Emiliani, 2006). This is important because, as pointed out by Emiliani (2006, p. 177):

Indeed, simple logical arguments would reveal that authentic "continuous improvement" is not possible without "respect for people."

A similar statement is made by Iyer (2017), who argues that leadership in Lean is about helping employees to work together more effectively to deliver exactly what customers value.

To be able to continuously improve processes, the humans' abilities have to be developed through education and training. In that process health is a basic resource for the individual, since health has an impact on people's capacity (WHO, 1998). Therefore, it is logical to argue that health promotion should be integrated in Lean.

The Lean concept has the potential to increase effectiveness in manufacturing (Cusumano, 1994; Emiliani et al., 2007; Kim et al., 2006; Womack and Jones, 2003; Womack et al., 1990). Indeed, Lean is a concept that has given organizations around the world the goal of becoming an organization working according to Lean principles. Today the Lean concept is found relevant not only in manufacturing but in service and health-care delivery as well (de Souza, 2009; Joosten, Bongers and Janssen, 2009; Kim et al., 2006; Kollberg, Dahlgard and Brehmer, 2007).

Despite the success Toyota is described to have had and have with the Toyota Way and the popularity of Lean in different businesses around the world, the reported results of Lean implementation efforts are divided. Some reports state that many Lean implementation efforts fail to reach their goals (Bhasin and Burcher, 2006; Emiliani, 2006; Sohal and Eggleston, 1994; Spear and Bowen,



1999). Successful examples of Lean implementation in industry are Wiremold (Womack and Jones, 2003; Emiliani et al., 2007), Jacobs Engineering Group (Emiliani, 2006) and Scania (Miina, 2012; Robinson and Schroeder, 2009). Promising results have also been reported from Lean implementation in health care (de Souza and Pidd, 2011; Mazzocato et al., 2012). In Sweden, Scania is described as the country's pioneer lean company (Sederblad, 2011), as having been successful with their Toyota-inspired Scania Production System (SPS), and as a leading lean company (Robinson and Schroeder, 2009; Miina, 2012).

In this thesis, Lean is regarded as a comprehensive philosophy about production and productivity that is based on waste elimination and optimizing value creation from a customer view. Because people carry out the elimination of waste and value creation for the customer, people are central to Lean philosophy. The philosophy is based on two basic guiding principles, the respect for people principle and the continuous improvement principle, and in practice there are methods and tools that aim to help people eliminate waste and optimize value creating from a customer view.

## **2.2 Barriers to and important factors for Lean**

Sim and Rogers (2008) concluded that among manufacturing plants in the eastern USA the primary barriers to Lean were an aging and high-seniority hourly workforce and a lack of committed leadership. They also found communication to be essential for continuous improvement initiatives, maintenance and effectiveness. Bhasin (2012), who studied 68 manufacturers in the UK, found that cultural issues and financial and human commitments are essential for Lean; he argues that the size of an organization is connected to barriers to Lean. Crute et al. (2003) studied Lean implementation in aerospace and pointed to the importance of considering a plant's specifics rather than firm specifics, as circumstances in plants belonging to the same firm can differ. They also argue that top managers' involvement is important: they have to present a coherent vision that clearly communicates how Lean is suited and related to their business strategy. They also argue that operation managers have both a strategic and tactical role. Based on the study, they proposed that a culture supporting autonomous working and learning through experimentation could speed up the Lean implementation process (Crute et al., 2003). Muslimen, Yusof and Abidin (2011) studied Lean implementations in Malaysian automotive components manufacturing. They point to the importance of skilled people with their own experience with Lean as Lean teachers and coaches. They also found that support and clear directions from top managers are important.

The same importance of skilled people with their own experience with Lean as Lean teachers and coaches finds support in Sisson and Elshennawy (2015), who conclude that all four cases of successful, sustained Lean implementations they studied had guidance from Toyota mentors that they engaged with for years

during their lean transformations. Radnor et al. (2006) found eight barriers to Lean in public services: people's skepticism about change programs in general, lack of ownership on activities or proposed processes, wretched selection of improvement team members, failure with leadership, compartmentalization (a "silo" culture), too-weak links between the improvement program and the organization's strategy, scarcity of resources and poor communication. De Souza and Pidd (2011) found eight barriers to Lean implementation. Five of the barriers were common to both manufacturing (M) and health care (H), and three barriers were unique to health care. The barriers were: perception of Lean (H), terminology (M&H), personal and professional skills (H), organizational momentum (M&H), professional and functional silos (M&H), hierarchy and management roles (H), data collection and performance measurement (M&H), and resistance to change from skepticism (M&H). Radnor et al. (2006) conclude about barriers to Lean that:

*The most commonly-reported barriers to improvement across all case studies were those posed by people at all levels of the organisation. At the staff level, scepticism was expressed about change programmes, especially about them being the latest management fad, and a feeling that they would not be listened to and that nothing would change. In one case this scepticism boiled down to the attitude that 'it was all about money' and cost reductions. Although the results clearly show that headcount and cost reduction was not a primary objective for any case study. (p. 70)*

### **2.3 Supportive factors for Lean**

Leaders at Toyota have considered investment in people as the key to their success since the beginning of their operations. The assumption at Toyota was that careful selection and development of people will lead to continuously improvement of processes and over time that will lead to competitive strength. That has led the company to create a culture based on a company philosophy with principles guiding people's way of thinking and behaving (Liker and Hoseus, 2008). That indicates that at its core the Toyota Way is about people and culture. Rother (2010) argues that the most important factors behind Toyota's success are not production techniques or principles but the skill and actions of all the people working in the organization. He found that it is how Toyota systematically works with human behavior and the subject of managing people that is the primary differentiator between Toyota and other organizations. Perhaps the importance of people and people development is best spelled out in the Toyota document entitled "Human Resources Development" (Toyota, 2003):

*Because people make our automobiles, nothing gets started until we train and educate our people.*

Longoni et al. (2013) argue that Lean, if done right with both social and technical components, should be considered a best practice, not only for its potential to improve operational outcomes but also because of its potential to improve the

health and safety of the workers who run the system. Miina (2012) argues that failure or success with Lean implementation depends on the organization's approach to Lean and the ability to create an organization-specific Lean philosophy, and he asserts that organizations should create their own Lean house as a reflection of their Lean philosophy. The lean house is an image showing values and principles of the organization in the form of a house that visualizes its own lean philosophy and represents the company specific way of implementing lean principles (Ibid.). That is in line with Sisson and Elshennawy (2015), who found that successful lean companies have their own version of TPS. Muslimen et al. (2011) point to the importance of skilled people with their own experience with Lean as Lean teachers and coaches. A future challenge is to ensure that Lean is understood as a comprehensive system based on both continuous improvement and respect for people principles and the insight that latter principle enables the former (Emiliani, 2006). According to Magnani, Carbone and Moatti (2019), many organizations make a mistake when they emulate the technical side and disregard the human side of the Toyota Way; that possibly is the reason that many organizations do not succeed in sustaining their Lean implementation. Takeuchi, Osono and Shimizu (2008) argue that companies inspired by Toyota should place humans in the center of the company, not machines. That is in line with the view on productivity described by Asian Productivity Organization (APO) (1994), which describes productivity as a matter of mind and about value adding by people that are supported by systems and machines. When people are in the center for productivity, the manager has an important role in Lean (Crute et al., 2003).

## **2.4 Managers and management and leadership**

In Emiliani et al. (2007), managers' primary role is described as providing leadership that helps people do a better job. Drucker (2007, p. 3) describes managers' role as the dynamic element that with leadership brings the resources into production, and he argues that if managers do not provide that leadership, the resources remain resources and never will become productive. Drucker argues that in the competitive world of business, it is the manager's ability that determine an organization's success, and he sees the manager's performance as a key factor for organizational performance and competitive strength. A similar view on managers and leadership can be found in Liker and Meier (2007, p. xxiii). They describe how Isao Kato tells about a saying used at Toyota, *Mono zukuri wa hito zukuri*, meaning *making things is about making people*. Isao Kato, who was a longtime employee and one of Toyota's initial master trainers, states that to succeed in the long run it is not possible to separate people development from development of the production system (ibid.). That resembles a statement by Kotter (1990), who argues that leadership is about influencing people's motivation, management needs to ensure needed resources and structures, and both leadership and management are needed for organizations to be successful. Emiliani and Emiliani (2013) define lean leadership as beliefs, behaviors and

competence that demonstrate respect for people, minimize or eliminate organizational politics, motivate people, improve business conditions and ensure effective utilization of resources. So, leadership is a very important issue and a topic that has been written a lot about and resulted in many publications (Bennis, 1959; Their, 1997; Yukl, 2010). Examples of early writers on leadership are Sun Tzu, Plato and Macchiavelli. The warrior philosopher Sun Tzu believed that leadership is a matter of courage, trustworthiness, humaneness, strictness and intelligence, and his writings, *The Art of War*, have influenced Japanese politics and business world (Cleary, 1988, p. 4). Leadership and management are also topics that have engaged many researchers, and their research has produced many different theories (Bennis, 1959; Horner, 1997; Yukl, 2010). But despite all the literature on leadership, it has been difficult to define it. As a consequence, a lot of the leadership literature is argued to be more manifestations of personal opinions than of scientific conclusions (Their, 1997).

Horner (1997) presents a picture of how the view on leadership has changed historically. An early theory was that *great leaders are* born with internal qualities that differentiate them from others. One inadequacy with the great leader theory was that situational and environmental factors that play a role in a leader's effectiveness were ignored (Horner, 1997, p. 270). Thereafter came the *leader behavior* theory. The focus was now changing to leaders in the context of organizations and the leader behavior that contributes to effectiveness in organizations. Leadership was no longer seen as inborn qualities; instead, effective leadership methods could be taught, thus leadership could be learned. The research on leadership progressed, and in 1964 Blake, Shepard and Mouton developed their two-factor model of leadership based on what they labeled "*concern for people*" and "*concern for output*." According to Horner, these studies proposed that managers exhibit behaviors that fall into the two primary categories, concern for people and concern for output, i.e., people or tasks. Depending on which type of concern was shown most frequently, a leader could be placed along one of the two continua. Later the two factors in the two-factor model were complemented with a third factor, *flexibility* (Horner, 1997, pp. 270-271). Thereafter, focus on leadership changed to the *interaction* among the leader's traits, leader behaviors and the situation in which the leader exists. The assumption was that the effects of one variable on leadership influence other variables. This concept is described as a major insight at the time, as it opened up the possibility that leadership could be different in every situation. This was an important insight for the emergence of a more realistic view of leadership that considers the complexity and situational specificity of overall effectiveness, and it led to several different situations being identified and studied. Through further research, certain leadership styles were found to be more effective in certain situations; this initiated discussion and research on matching a leader with a situation that would be most conducive to that leader's style (Horner, 1997, pp.

272-273). Future leadership is predicted to be much about motivational factors, generating motivation and participation among employees and organizational members (Horner, 1997; Nonaka et al., 2000). Shani et al. (2008) made an important remark about future research on management. They argue that management practice and management research have become too greatly separated from each other. They assert that collaborative management research (CMR) may bring the two areas closer together via broader and deeper collaboration among managers of organizations and academic researchers, and that such collaboration can benefit both parties. Managers could learn new management approaches and researchers could discover new theories and hypotheses that can be tested. They state that CMR is an effort by two or more parties where at least one is a member of the organization under study and at least one is an external researcher, working together to learn how managers' behavior, management methods or organizational arrangements affect outcomes. The goal with CMR is to improve both the performance of the studied organization and to contribute knowledge to the field of management (ibid.).

#### *2.4.1 Management and leadership*

Kotter (1990) points out that *leadership* is a word that in everyday conversations is used in two very different ways. Sometimes leadership refers to the process that is mobilizing and directing, i.e., aligning people and their ideas. Sometimes leadership refers to people in formal leader positions, such as a manager in a company. This unspecific use of the word has contributed a lot to the confusion about the topic, as it indicates that all people in formal leader positions provide leadership. According to Kotter, this is obviously not true, since some of them are leading well, some poorly, and some do not lead at all. Kotter further argues that as most people today in formal leading positions are called managers, it is easy to think that leadership and management are the same thing, or at least are closely related, but he argues they are not.

In contrast to the long history of leadership, management is a much younger topic. Management is a consequence of industrialization. With industrialization, a need to be able to create order and structure complex organizations emerged, and that gave birth to the topic of management. The purpose of management was, and still is, to avoid chaos and bring order and consistency to key factors such as profitability and quality (ibid.). The distinction between leadership and management is important (Bennis, 1997; Kotter, 1990, 2001), and several writers have highlighted the differences between them.

Bennis (1997) asserts that leadership is about doing the right thing, whereas management is about doing things right. Both are important, but Bennis argues that most organizations in the industrialized world are under-led and over managed, something he considers to be a consequence of a school system that produces good technicians and staff people but does not train people as leaders.

He states “*The leader’s goal is not mere explanation or clarification but the creation of meaning*” (p. 21).

Their (1997) describes management as production oriented and thus about administration, budget, laws and regulations, accounting and control systems. She depicts leadership as being human oriented and thus about communication and information, psychology on individual and group levels, interaction and collaboration, motivation, norms, values and attitudes.

Kotter (2001) defines management as coping with complexity. The goal of management is stated to be to bring order and consistency to key dimensions, like the quality and profitability of products. Companies manage complexity via planning and budgeting, target setting and goals, and the creation of structures. On the other hand, leadership is defined as coping with change, aligning people by means of a vision, and communicating a desired future in a way that people can understand and commit to. He argues that in a dynamic and ever-changing world, leadership is vital for organizations to compete effectively and to survive, since more change always demands more leadership.

Geller (2002) states that management can be understood as an activity that focuses on outcomes and that managers typically control consequences, dictate policies and rules, and hold people accountable. Leaders, on the other hand, are described as going beyond consequence control in order to benefit colleagues’ and coworkers’ behaviors and attitudes through focusing on processes, setting expectations, and by directing, supporting, coaching or delegating (ibid.). Another difference between managers and leaders pointed out by Geller is that managers manage what is measured, whereas leaders facilitate intangibles.

Schein (2004) asserts that management or administration is something that acts within culture, while leadership, on the other hand, is something that creates and changes cultures. He argues that the only really important thing leaders do is work with and influence or change cultures, so the unique talent of leaders is their ability to understand and work with culture.

Kotter (1990) states that few organizations are successful with both leadership and management. Among those few he points to such Japanese organizations as Sumitomo, Matsushita, Toyota, Nomura and Canon, and argues that their ability in both leadership and management is evident in their results as well as their ability to handle change. In contrast to those Japanese organizations, most organizations are over managed and under-led (Bennis, 1997; Kotter, 2001). The Japanese success is argued to be based on a collectivistic (group) mentality in contrast to the American and European leadership style, based on an individual, the strong leader at the top (Kotter, 1990).

The future leader is going to need a different mind-set and skill set from that of the majority of present leaders. These skills include the ability to create and maintain a team-based environment and get everyone in the organization involved in the activity. Thus, the mission for leadership is to enable the team to be optimally successful (Horner, 1997), a statement that is similar to one by Emiliani (2007, p. 16), who argues that the manager's duty is to provide a kind of leadership that helps people do a better job.

#### *2.4.2 Managers and Lean*

Leadership is one important factor for the success of Lean implementation (Loh and Yusof, 2018) and for performance in organizations working according to Lean philosophy (Loh et al., 2019). According to Liker and Ballé (2013), a key success factor to succeed with Lean is mutual trust between employees and management, and they stress that lean managers have to be teachers and able to teach and support people development. That mean that lean managers have to have Lean competencies as well as people development skills. To be successful with Lean implementation there has to be a complete change of mind-set among leaders and employees (Aij et al., 2015). As stated by Poksinska et al. (2013), when implementing Lean, managers' role radically changes from focus on managing processes to coaching and developing people. Emiliani and Emiliani (2013) argue that it is common that a company striving for lean development has great difficulty with understanding Lean as a management system that requires CEO commitment and participation, as well as a completely different set of leadership behaviors. Unfortunately, senior managers are described as not commonly practicing lean management, but rather continuing long-established conventional practices with the addition of selected lean tools and methods. An approach, that has been dubbed 'imitation lean' or 'fake lean' and is stated to have caused great confusion may also explain why there has been little in the way of new Lean practices since the early 1980s (ibid). Aij et al. (2015) point to six attributes connected to lean leadership that are important for lean managers. A lean manager needs skills in self-development and to be able to (a) create an culture of continuous improvement, (b) go to the work floor (gemba) to understand the processes, (c) coach and teach employees, (d) communicate well with employees and (e) motivate themselves as well as employees. Communication has also been argued to be essential for continuous improvement initiatives, maintenance and effectiveness (Sim and Rogers, 2008). Emiliani and Emiliani (2013) argue that in the context of lean management, the definition of leadership must pertain to managers' ability to facilitate information flow between people and in processes. In addition, they also assert that a definition of lean leadership must reflect an outward-looking servant-leader role aligned with the two basic Lean principles. Taiichi Ohno, who is largely credited with creating Toyota' management system, remarked upon Lean principles and practices as follows:

Companies make a big mistake in implementing the Toyota production system thinking that it is just a production method. The Toyota production method won't work unless it is used as an overall management system. The Toyota production system is not something that can be used only on the production floors. The belief that it is only a production method is fundamentally wrong. . . . [T]hose who decide to implement the Toyota production system must be fully committed. If you try to adopt only the "good parts," you'll fail (Emiliani and Stec, 2005, p. 383, citing Shinohara, 1988).

In regard to the extent to which Lean principles and practices are deployed, Emiliani and Stec (2005) use the terms "real Lean" or "imitation Lean," giving the following description:

"Real Lean" is the faithful adoption of the Lean management system across the enterprise, perhaps with appropriate modifications suitable to a companies' individual circumstances – but still consistent with Lean principles. "Imitation Lean" occurs when only selected Lean principles and practices are adopted. In "Imitation Lean", the focus is on continuous improvement, typically just the tools, and not both "continuous improvement" and "respect for people" (p. 383).

To sum up, it can be argued that managers have to regard Lean as a dualistic system that has to be organization wide and put people in the center, because the respect for people principle enables continuous improvement. Therefore, it can be argued that in a Lean enterprise managers or at least a management team need to be skilled in leadership as well as management, because these two managerial action factors connect to the two basic principles of Lean. Leadership connects to the respect for people principle and management to the principle of continuous improvement. Thus, leadership and management are two different but complementary and equally important concepts.

## **2.5 Cultural differences**

Cultural differences can affect how Lean is regarded, implemented and practiced. Lean is described to have its roots in Toyota (Krafcik, 1988; Samuel et al., 2015). However, Lean is also a concept from the International Motor Vehicle Program (IMVP). The term Lean and the findings from IMVP were made known to the world through the book *The Machine that Changed the World* (Womack et al., 1990). That situation might have influenced how Lean is understood, as there are significant differences between the American and the Japanese culture (Dorfman et al., 1997; Edström et al., 1994; Heine, Toshitake and Lehman, 2000; Wagatsuma and Rosett, 1986). This cultural difference has been described as two extremes on opposite ends of a scale (Edström et al., 1994). Larsson (2019) point to the importance of the local translation of Lean and the important role of local Lean translators. So, cultural differences may have affected how Lean has been translated.



The American culture has been characterized as individualistic, whereas the Japanese culture has been described as collectivistic (Edström et al., 1994; Hofstede, 1994). In the collectivistic Japanese culture, group harmony is important, and it has been argued that the Japanese culture tends to encourage people to identify their shortcomings so they can improve themselves, whereas the American culture tends to encourage people to see themselves in a positive view (Heine et al., 2000). This cultural difference has been a source of misunderstanding, frustration and frictions, not least in business relations, in the contact between the USA and Japan. One example given is the Japanese way of talking. The Japanese speak in two ways, *tatemae* and *honne* (Edström et al., 1994; Heine et al., 2000; Wagatsuma and Rosett, 1986). *Tatemae* is a formal way to speak, it is about form and expresses what is expected, while *honne* expresses what is really thought or felt. *Tatemae* is important in relations, because formality and politeness is the Japanese way to try to avoid frictions, but in reality it is *honne* that is done to get results that count. This way to talk has been seen by Americans as falseness. The cultural difference between USA and Japan is argued to influence and give rise to differences in leadership and leader behavior (Dorfman et al., 1997; Edström et al., 1994; Wagatsuma and Rosett, 1986). Imai (1997) argues that Japanese leaders are process oriented and acknowledge people as the cause of processes in production and improvements; therefore, Japanese managers focus on supporting and encouraging their people. In contrast, he asserts that the manager in the Western world focuses on results attained (ibid.). This means that Imai depicts the Japanese view as focusing on people and processes that create results, whereas Western managers focus on the end results.

The Toyota Way has been influenced by American industrialists and their production and management practices but not by management theorists (Emiliani, 2006). According to Emiliani (2006), there is no direct connection between the development of western management theories and the evolution of Toyota's management system. And he argues that this reflects both a lack of formal management training among key personnel at Toyota and a strong belief among Toyota's managers that they must be very practical, see reality clearly, understand the true nature of problems, and be willing to challenge existing paradigms. Emiliani finds that Toyota managers regard these practical attributes much more highly than theoretical analysis done by themselves or others. He argues that practices of Toyota's management system or lean management require, at a minimum, acknowledgement and practice by management of both principles, continuous improvement and respect for people. But that most managers practice only the first of these two basic principles, which he believes greatly limits the amount of improvement that can be achieved, as it is the second principle, respect for people, that enables the first principle (ibid.). According to Liker and Hoseus (2008), leadership at Toyota is in many ways different, even in some aspects contrary to Western leadership tendencies. The Toyota leader focuses on

processes and people development, believing that *the right process will lead to the desired results* (ibid., p. 334). This means that at Toyota understanding processes is seen as much more important than examining the figures that represent results. Liker and Hoseus (2008, p. 334) present the differences between traditional Western leadership tendencies and Toyota leadership, as shown in table 1.

Table 1. Traditional Western leadership compared with Toyota leadership

<b>Traditional Western Leader</b>	<b>Toyota Leader</b>
Quick results	Patient
Proud	Humble
Climb ladder rapidly	Learn deeply and horizontally and gradually work way up ladder
Results at all costs	The right process will lead to the right results
Accomplish objectives through people	Develop people
Overcome barriers	Take time to deeply understand the problem and root cause before acting
Manage by the numbers	Deeply understand the process

Source: Liker and Hoseus, 2008, p. 334.

They further argue that it is Western culture that seems to be a barrier to succeed with Lean (ibid., p. 334). According to Wagatsuma and Rosett (1986) there are clear differences in how senior officials behave when their organization is responsible for wrongdoing or accidents. Executives in Japan take responsibility and apologize in public, even face-to-face with the victim in public, whereas American executives are more likely to deny responsibility when something goes wrong and seek to avoid personal contact with the victims (ibid.). This difference in behavior is proposed to depend on the Japanese high value on group membership and harmonious relations, in contrast to the Americans' high value on individual autonomy (ibid.).

According to Liker and Hoseus (2008), there are some key points that companies embarking on Lean or a Toyota Way–inspired work model should consider. Since leaders create culture, Toyota takes a long-term perspective on the development of leaders. The leaders at Toyota are seen as carriers of the Toyota DNA and are expected to let the DNA become “visual” through their thoughts, words and actions. With higher leader positions, it follows that the distance to the value-adding places, the gemba (where work takes place) increases, resulting in a decrease in power and the opportunity for direct influence on the value-adding work. The Toyota leader is expected to work hard to support the people that are the value adders, the workers in gemba. This leadership philosophy is the basis of what sometimes is referred to as the “Toyota servant leadership.” At Toyota, leaders are expected to be thoughtful role models expressing the company philosophy and living the company’s core values, such as spirit of challenge,

kaizen, continuous improvement, respect for people, genchi genbutsu and teamwork.

Toyota develops their leaders from within by rotating them through different parts of the company. The people are expected to learn deeply at each step. Despite that, it is a slow, time-consuming way to develop leaders. When hiring outsiders, Toyota has a rigorous procedure that guides their selection so they get people with an approach that is in line with the company philosophy and core values (ibid.)

Based on five case studies, Poksinska et al. (2013) concluded that the role of managers in the studied organizations changed from managing processes to managing people by motivating people, coaching them, and developing people and teams. They further concluded that lean leadership shows similarities to such leadership theories as transformational leadership, servant leadership and self-managed teams. They argue that it is important to create a supporting culture and system that guides behavior and thinking among the organization's members; the result will be that managerial push is replaced by employee pull, so the system will not be dependent on individual leaders (ibid.).

Emiliani and Emiliani (2013) argue that managers often lack motivation to learn lean management, since it takes many years, and top managers have difficulty recognizing their own management weaknesses. They further argue that managers must practice lean leadership daily. To learn and understand lean management and be able to lead Lean transformations, they need to be able to recognize and alter problems in thinking and acting among themselves as well as among others. That means that managers build culture through active daily participating practice, and thus become role models to others. Culture matters in Lean.

## **2.6 Critical views on Lean**

Lean not only has its proponents but also its critics, and according to Langstrand (2012), Lean has been strongly criticized over the years. An early opposing statement was made by Berggren (1993) about Lean as a universal concept as argued by Womack et al. (1990). Berggren claims that Womack et al. (1990) have a fundamentalist view on Lean that not is connected to reality. Berggren depicts Lean as a double-edged philosophy, with both positive and negative consequences, and he believes that Lean is not the end of the development of production concepts, as he feels Womack et al. (1990) suggest. In their study on Lean and its effect on health and safety outcomes, Longoni et al. (2013) conclude that Lean without a human resource perspective, only relying on technical components, is negative for health. To have positive operational and health impact, Lean requires both social and technical components. Carter et al. (2011) depict a very different picture of Lean compared to Lean proponents' statements. They argue that Lean has negative effects on people's health, increases working hours and reduces morale among people; they further state that in their survey only 1 percent of the staff was positive about Lean. They strongly argue that Lean

has potentially disastrous consequences in the long run for public services (ibid.). Other critics are Landsbergis, Cahill and Schnall (1999), who argue that Lean creates intensified work pace and demands, so Lean work is a potential source of job stress and increased rates of musculoskeletal disorders and other health problems. Brännmark and Håkansson (2012), in an overview of international and Swedish studies regarding Lean and work-related musculoskeletal disorders (WMSDs), argue that when Lean is implemented there is a tendency to increase work pace, workload, stress and risk of WMSDs. They argue that the risk of WMSD increases if the Lean implementation is not accompanied by an ergonomic intervention with the aim of reducing repetitive work and monotony (ibid.). In line with these statements is a conclusion by de Treville and Antonakis (2006), who state there can be too much Lean, meaning excessively standardized work operations and decreased worker control, which they argue will have negative effects on motivation. This is a situation that makes Lean mean. In addition, Parker (2003) concluded that Lean could be negative for people's health, finding that the Lean way of working can be damaging to people and result in higher levels of job stress and increased risk for cardiovascular disease. Nishiyama and Johnson (1997) also argue that Lean has negative effects on health and even can lead to *karoshi*, a Japanese word that means "death from overwork."

## **2.7 Health and health promotion**

Health has been defined in many different ways according to time and culture (Brannon and Feist, 2000, p. 10). Brannon and Feist (2000), citing Stone (1987), define health as consisting of two categories. In the first category health is seen as an ideal state and implies that a disease or injury is a deviation. By removing the disease or disability, the ideal state can be restored. In the second category, health is seen as a movement in a positive direction, i.e. health is seen as a direction on a continuum and moving toward greater health is better than moving the other direction on the continuum (Brannon and Feist, 2000, p. 9). In 1946 the World Health Organization (WHO) developed what is argued to be a modern Western definition of health (ibid. p. 9): *Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity* (WHO, 1946). The WHO definition thereby points out three dimensions of health, physical, mental and social.

Within the context of health promotion, health is expressed in functional terms as a resource which permits people to lead an individually, socially and economically productive life. Health is thereby seen as a resource for everyday life and as a positive concept emphasizing social and personal resources as well as physical capabilities. Health promotion is defined as a process that enables people to take control over the determinants of health and thus improve their health, a process where participation is essential for sustainability (WHO, 1998).

There are a number of approaches to health promotion, each with a different objective (Naidoo and Wills, 2000). Naidoo and Wills (2000) describe in their overview of models and approaches to health promotion five different approaches to health promotion: (1) the medical or preventive approach, (2) the behavior change approach, (3) the educational approach, (4) the empowerment approach and (5) the social change approach.

Antonovsky (1996) argued that health promotion practice should be based on a salutogenic model such as the sense of coherence model. That model focuses on health-enhancing factors rather than the pathogenic perspective that focuses on disease-causing factors.

## **2.8 Sense of Coherence**

Antonovsky introduced the salutogenic theory, “sense of coherence,” as a global orientation and claimed that the way individuals view their life has an impact on their health (Eriksson and Lindström, 2005). Antonovsky asserted that an individual’s health is moving on a continuum between positive health and negative health during his or her lifetime. Sense of Coherence (SOC) theory is based on three components: *meaningfulness*, the motivational component; *comprehensibility*, the cognitive component; and *manageability*, the behavioral component. When a person or a collective with strong SOC is confronted with a stressor, they feel motivated and want to cope (meaningfulness), they believe they understand the challenge (comprehensibility), and they believe that the resources that they need to be able to cope are available to them (manageability). The strength of one’s SOC is described as shaped by three kinds of life experiences: consistency, underload-overload balance and participation in socially valued decision making (Antonovsky, 1996). Lindström and Eriksson (2006, p. 241) argue that people have to understand their lives and be understood by others, perceive that they are able to manage the situation and perceive it is meaningful enough to find motivation to continue. They further argue that SOC theory is applicable on the individual, group and societal levels.

Antonovsky developed two questionnaires to measure the strength of SOC. The longer SOC-29 consists of 29 items and the shorter SOC-13 of 13 items. The questionnaires are based on the three components in SOC.

Health professionals have studied the relationship between SOC and health, coping strategies and quality of life in different populations, such as the general population, healthy workers, older people and patients with different diseases such as cancer, renal disease, diabetes, HIV infection, rheumatoid arthritis, irritable bowel syndrome and cardiovascular diseases (Spadoti Dantas, Silva and Ciol, 2014). Both SOC-29 and SOC-13 are argued to be valid and reliable as tools to measure how people manage stressful situations (Hansen et al., 2017). According to Eriksson and Lindström (2005), the questionnaires have proved to be reliable, valid and feasible as well as cross culturally applicable. The

SOC questionnaire have been translated into 33 languages and used in at least 32 countries (ibid.).

The SOC concept is argued to be relevant for planning and evaluation of health promotion interventions at workplaces if a work-related sense of coherence (Work-SoC) scale is developed. A nine-item Work-SoC questionnaire has been tested and found to be a useful instrument to enhance the health-promoting quality of work environments, as well as emphasizing a resource-oriented view on health promotion at workplaces (Vogt, Jenny and Bauer, 2013). A Norwegian version of the work-SoC is argued to be useful for research as well as practical purposes in the occupational health field. According to Eriksson and Lindström (2005), the SOC concept could be a systematic orientation and perspective in professionals' daily activities. There is a need to shift focus from obstacles and problems to resources, with research focusing on implementing the SOC theory in practice (ibid.). Nilsson et al. (2012) support that statement, as they found that SOC can be useful in work health promotion to identify work-related specific enhancing factors. They identified eight specific enhancing work-related resources that are important to employees' work-related health, and organized the eight resources as subcategories within the three main categories of SOC comprehensibility, manageability and meaningfulness. The three subcategories for comprehensibility are reflective skill, open-mindedness and comprehensive view. The subcategories they found related to manageability are harmony, flexibility and responsibility. The two subcategories related to meaningfulness are reinforcement and social climate. They conclude that SOC theory can be useful to explore, understand and favour workplaces as health-promoting arenas with positive health impact on employee health (ibid.). In this thesis the salutogenic perspective on health promotion inspired me to try SOC theory as an operational approach and see if it could support managers as a managerial tool.

## **2.9 Health and productivity**

Health has been described as an important factor for quality of products and services (Eklund, 2000). He argues that the only way to achieve quality for the end customer is through quality in all work activities leading to delivery of the product or service and that a conditional requirement for that is that the work activities be free from risk of accidents and health impairments, and that instead the work conditions promote wellness. That is in line with Hamar et al. (2015), who conclude that well-being improvement programs can reduce health risks and increase well-being and productivity in organizations. They further argue that well-being improvement programs that focus on creation of a workplace culture that supports well-being is an important business strategy for organizations.

Edwards and Langaa Jensen (2014) assert that within the ergonomic profession an aspiration has always been to ensure that design or redesign of production systems consider both productivity and employee well-being, and they state that

there are many approaches about how to achieve this. In line with that statement, Dul et al. (2012) argue that human factors and ergonomics (HFE) has a great potential to contribute to the design of work systems and product and service systems. They argue that HFE has a unique combination of three fundamental characteristics as it: (1) takes a systems approach (2) is design driven and (3) focuses on two closely related outcomes: performance and well-being. They argue that performance and well-being interact so that performance influences well-being and well-being influences performance, in both the short and the long terms (ibid.). According to Dul et al. (2012), performance and well-being are reduced if there is a lack between the environment and humans' capabilities and aspirations, meaning that humans may perform below their standard and capability when other system parts are obstacles and not supportive. Example of such obstacles can be lack of time, inappropriate equipment and insufficient support. From that they argue that if work environment is fitted to the human it can lead to optimizing of both performance and well-being (ibid).

Globalization has resulted in enhanced competitiveness among companies and forces organizations to develop new business strategies. It also increases the need for innovation of new products and services and better production processes. In these tasks, employees are an important factor, because they can contribute with suggestions for more efficient production processes that can result in shorter delivery times and better quality. Managers, as decision makers, are identified as an important group that needs health knowledge. Dul et al. (2012) argue that the results if managers had better knowledge about health would be:

- Better productivity by reduced time for performing work procedures (e.g. through optimization of work equipment, work flow or worker qualifications).
- Better quality and reliability of production processes and produced goods and services (e.g. through optimization of work equipment, operating instructions or worker qualifications).
- Lower operating costs due to lower levels of health problems, motivational deficits, accidents, absenteeism and related productivity loss (e.g. through better working conditions).
- More innovation by increased employee creativity (e.g. through creativity-stimulating work environments).
- Better reputation for hiring and retention of talented employees (e.g. through attractive work), and positive worker and consumer associations with the firm and its products/services (employee well-being, sustainability, corporate social responsibility, end-user well-being).
- Better decision making through improved information about the effects of system design on employees (p. 386).

Health is important in the Toyota Way. A statement by Eiji Toyoda in the shape of a poem encapsulates this: "*Safe Work, Reliable Work, Skilled Work. Safe Work is "the door" to all work. Let us always pass through this door first.*" These words constitute Toyota's basic philosophy (Toyota, n.d.).

## 2.10 Health interventions

When creating healthy workplaces, it is important to have a holistic approach to health and be sure to encompass physical, psychological and social factors. It is also important to assess individual health as well as productivity (Kelloway and Day, 2005). Ergonomics aims to ensure that design or re-design of production systems consider both employee well-being and productivity, and there is many approaches to do that (Edwards and Langaa Jensen, 2014). Dul et al. (2012), who use the terms ergonomic and human factors as interchangeable, argue that HFE can contribute to development of work systems that are both healthy and have high performance by fitting the work environment to the human.

An important factor to succeed with interventions in organizations is the participation of different stakeholders (Dul et al., 2012; Neumann, Ekman and Winkel, 2009). However, it is important to acknowledge that normal life events can influence participants and thereby the change project as a whole, especially if the stakeholder is a key person in the project. Examples of normal life events that can influence ergonomic change projects are changes in career, illness, sick leaves, death in the family, divorce, marriage and retirement (Neumann et al., 2009). Managers and employees have been identified as stakeholders in HFE system design. Managers act as decision makers about the system's design and purchasing it and about the system's implementation and use. Employees are stakeholders because they are affected by and affect the system's performance. According to Tappura, Syvänen and Saarela (2014), quality of working life, innovativeness and organizational performance can be improved if managers' competence and knowledge about occupational health and safety issues is developed; they add that organizational support is important to succeed with that. When integrating ergonomics in an organization's system, there are some points that can help practitioners in their efforts. Neumann et al. (2009) advise trying to embed ergonomics into existing groups and processes and not create new groups focusing on ergonomics. They also highlight the importance of being prepared for the fact that integrating ergonomics into a production system takes years, and therefore it is important to ensure support in a long time perspective. They also point to the importance of successive planning as part of management support to accommodate personnel changes during the change process. They point to a need to engage decision makers early. That includes senior management, who must support changes in the process and allocate needed resources. The use of workshops was described as a way to provide communication across organizational boundaries and be a possible way to overcome communication barriers between professionals with different backgrounds (ibid.).

Comparison with other Western European countries shows that sick leave among employees in Sweden has historically been at a high level. During the last decades, the highest level of sick leave was in 2002, with 18.6 days per year per employee. Thereafter followed a decrease, but another increase followed between 2010 and



2016. Since 2015, the goal for the Swedish government is a low and stable level of sick leave in the coming years, specified as the sickness cash benefit rate to be no more than 9.0 days by the end of 2020. The sickness cash benefit rate was 10.7 days in May 2017, which means that there was a slight decrease for four consecutive months (Socialförsäkringsrapport, 2017, p. 13).

### **2.11 Implementation and resistance to change**

It is well known that change in organizations is a difficult task to succeed with, and change efforts in organizations often fail to reach their goals (Kotter, 2006; IBM, 2008; Kotter and Schlesinger, 2008; Neumann et al., 2009; Socialstyrelsen, 2012). The situation is the same for ergonomic-based health interventions (Neumann et al., 2009). Oxford Dictionary defines implementation as *the process of putting a decision or plan into effect; execution* and in Socialstyrelsen (2012), implementation is defined as the procedures that are used to introduce new methods in existing activity. Kotter and Schlesinger (2008) argue that there is nothing more difficult and doubtful of success than to initiate a new order of things. Hasle (2014) assert that change can be a source for problems resulting in health issues for employees, and that is also the case when Lean is implemented. Kotter and Schlesinger (2008) argue that change initiatives in organizations often encounter resistance from humans and that managers, although generally aware of that, surprisingly rarely systematically search for sources of resistance before beginning change initiatives. They identify four common reasons for human resistance to change: (1) a desire not to lose something of value, (2) a misunderstanding of the change and its implications, (3) a belief that the change does not make sense for the organization and (4) a low tolerance for change. They assert that it is important for managers to be aware of these four common reasons for resistance to change, because that gives them a chance at predictability and to act (Kotter and Schlesinger, 2008). Other explanations for why major change efforts in organizations fail include an inwardly focusing culture, a paralyzing bureaucracy, parochial politics, low level of trust, a lack of teamwork, arrogant attitudes, middle management's lack of leadership competence and the general human fear of the unknown. According to Kotter (2006), these known barriers to change have to be addressed if an implementation of change is to succeed.

When implementing Lean, focus is often on methods, but the key factor for sustainable Lean is the employees, and the biggest challenge is to change the mind-set and behavior among managers and employees (Dombrowski and Mielke, 2013). To implement and create a Lean workplace requires both employee motivation and good management and involves all levels of an organization. Thus, lean management can lead to health and safety in organizations (Anvari, Zulkifli and Yusuff, 2011). Lean management to be effective shall encourage employees to participate in the generation and implementation of ideas by endorsing honesty and teamwork and thereby creating intra-team psychological safety (van Dun et al., 2017).

Seppälä and Klemola (2004) conclude from their study that critical factors when implementing Lean are the management of change, the opportunity to develop oneself at work and the social climate. They argue that when people feel that their work is meaningful, autonomous and provides opportunities to learn new things and to develop themselves, they are involved and satisfied with their work. Other important factors when Lean is implemented is why it is implemented, how it is interpreted and what aspects of Lean are emphasized. To have positive effects on employees' working environment, health and well-being it is important to consider psychosocial factors when starting to develop Lean practices (Hasle, 2014). According to Kotter (1995), a change is fulfilled only when it has become a new behavior that is rooted in shared values and social norms, a culture in the organization that is naturally expressed as "the way we do things."

Piderit (2000) argues that resistance to change is a widely studied subject but has limitations in both terminology and in practice; research on the concept is in need of a new approach. Based on a new conceptualizing that sees individual responses to change as multidimensional attitudes, she suggests that one thing that is overlooked by researchers is that people might resist change out of potentially positive intentions. Kotter and Schlesinger (2008) have also pointed out that possibility, as they argue that people might resist change when they do not understand the implications and believe that it might cost them much more than they will gain. They argue that such situations often occur when there is a lack of trust between the person initiating the change and the employees. A second common reason people resist organizational change is when they assess the situation differently from their managers or the people initiating the change and see more costs than benefits resulting from the change, not only for themselves but for their company as well (ibid.).

The lessons that can be drawn from change initiatives will probably be of increasing interest with increasing competition (Kotter, 1995). That viewpoint is supported by an IBM (2008) report, which concluded that the normal situation in the future will be a situation of continuous change. This is particularly the case in Lean, since Lean means to strive for continuous improvement, and that also means continuous change. Piderit (2000) argues that research on resistance has to change in the future. Instead, via a multidimensional research approach, it would become better to offer guidance on change in organizations, not only to change agents but to all employees involved in change processes; that would minimize stress effects to the individuals (ibid., p. 792). Vogt et al. (2016) have argued that the increasing uncertainty and complexity in work life creates a need for sustainable development of employees through making their work more comprehensible, manageable and meaningful. In this thesis that was tried through a leadership approach based on the SOC model at Scania and Fagersta Stainless.

## 2.12 Measuring organization performance

The term *productivity* is described as having different meanings to different people (APO, 1994; Pritchard, 1995). In 1958 productivity was defined by The European Productivity Agency at the conference in Rome called “The Concept of Productivity and Aims of the National Centres” as:

*“Above all else, productivity is an attitude of mind. It is mentality of progress, of the constant improvement of that which exists. It is the certainty of being able to do better today than yesterday, and less well than tomorrow. It is the will to improve on the present situation, no matter how good it may seem, no matter how good it may really be. It is the constant adaptation of economic and social life to changing conditions, it is the continual effort to apply new techniques and new methods; it is the faith in human progress.”* (APO, 1994, in the glossary).

That definition later underwent some adjustment by Japan Productivity Center and influenced the Asian Productivity Organization (APO) definition of productivity (Roghanian, Raslia and Gheysari, 2012; APO, 1994). The APO definition of productivity is:

In fact, productivity is really an "attitude of the mind." It is about people adding value to a work process by their skills, team spirit, efficiency, pride in work and customer orientation, aided by machines and systems (APO, 1994).

According to Pritchard (1995), there are three main definitions of productivity. The first is the engineer/economist definition. This definition is an efficiency measure based on the ratio of outputs over inputs (Pritchard, 1995). The definition that is about the relation between the quantity of output and the quantity of input used to produce the output is explained as  $\text{Productivity} = \text{Output}/\text{Input}$  and has been called a technical definition of productivity (APO, 1994). A strict mathematical interpretation of the technical productivity equation  $\text{Productivity} = \text{Output}/\text{Input}$  shows that productivity can be improved by decreasing input or increasing output. However, as productivity is not only about efficiency, there are situations when increased productivity may not be positive, such if it is reached at the expense of the desired quality of the product or service, reasonable pricing, time delivery or work processes and environment (APO, 1994). The second definition of productivity is a combination of the efficiency definition ( $\text{Output}/\text{Input}$ ) and effectiveness ( $\text{Output}/\text{Goals}$ ). In this definition, organizations that make a product could measure productivity by a combination of efficiency measuring and effectivity measuring, such as number of produced products divided by the number of products aimed to produce that month (Pritchard, 1995). The third definition of productivity, described as broader than the two prior definitions, considers productivity as anything that makes an organization function better. In this definition, productivity includes efficiency and effectiveness but also such things as morale, innovation, turnover and absenteeism. *Productivity is how well a system uses its resources to achieve its*

*goals* (Pritchard, 1995, p. 3). With that view on productivity, measures of quality, attendance and other types of measures seen as leading to fulfilment of goals are also relevant (ibid.). Measuring productivity might be complicated, since there is an array of methodologies available (Del Gatto et al., 2010). Given Pritchard's (1995) view that *productivity is how well a system uses its resources to achieve its goals* (p. 3), measures of quality, attendance, and other factors that are seen as leading to the fulfillment of goals are relevant. According to Karasek and Theorell (1990), it is important to measure both productivity and health (or wellness) when an organization's performance is measured. However, it is important to realize that sick leave is not necessarily related to health status. Examples of factors that can be involved in individual sick leave are types of work, attitudes to work and insurance system (Lindberg et al., 2006). Other factors that can influence the occurrence of sick leave are age, gender and socioeconomic status (Allebeck and Mastekaasa, 2004). Blank and Diderichsen (1995) found in their study that working conditions may be a key element in the explanation of repeated short spells of absence from work. Van Poppel et al. (2002) found the sensitivity of questionnaires for detecting an episode of sick leave to be very low. Based on their results, they argue that data on sick leave gathered from company records are clearly preferable as an outcome measure in research.

The interest in measuring health effects on productivity has resulting in the development of numerous instrument for such measurements (Mattke et al. 2007). In their overview Mattke et al. identified 17 survey instruments that assess the effect of respondents' health problems and found that questions that address absenteeism and presenteeism were common. It was also found that this instrument varies substantially in length, from 3 to 44 questions. They also found several methods for estimating the cost of lost work time, and they argue that the challenges involved in measuring presenteeism, or working while sick, and its costs are far greater than those involved in measuring absenteeism, because reduced performance on the job is less tangible than absence. Measuring presenteeism is complex. The most common approach is argued to be assessment of perceived impairment, accomplished by asking employees how much their illnesses hinder them in performing common mental, physical, and interpersonal activities and in meeting job demands (ibid.). Another approach to capture presenteeism is the comparative measure of productivity, performance and efficiency. Attempts have been made to validate employees' self-reported performance evaluations by comparing them with their supervisors' assessments (ibid.). Many people are negative about performance measuring at work, because they are accustomed to measurement that ends with blame, punishment and a search for the guilty. However, when performance measuring is used for improvement, it can be positive. The different is that when performance measures are used to motivate it has a positive effect, and when used to judge it has a

negative effect on people. That means that it is the context in which the measuring is used that makes all the difference (Spitzer, 2007).

According to Karasek and Theorell (1990), when measuring organizations performance it is important to measure both productivity and health (or wellness). One example of previous research to measure both productivity and health (or wellness) is Rajaratnam et al. (2014), in whose study health was measured by questioners and biometric measures, and productivity was evaluated by measuring presenteeism, or working while sick, in terms of productivity loss. They concluded that a well-being program can improve both health and productivity. Rodriguez et al. (2016) hypothesized that implementation of lean production combined with human resources practice would have positive effects on perceived job autonomy, job satisfaction and operational performance. Through a laboratory experiment, they argue that the results indicated a significant increased level of perceived job autonomy, job satisfaction and operational performance. They also argue that their study revealed a positive relation between job satisfaction and operational performance. By collecting data through questionnaires from 227 human resource managers in Hong Kong and China and analyzing the data with exploratory factor analysis and multiple regression analysis, Chan and Mak (2012) examined the mediating role of occupational safety and health on the relation between high-performance human resource practices and organization performance. They found that an organization's performance could benefit with effective human resource practices.

Rolander et al. (2013) examined changes in working conditions, health and productivity among dentists in Sweden from a 5-year period of rationalization and layoffs in Swedish public dental care. Questionnaires were used to measuring work conditions and health while productivity was measured through an electronic register with data on patient's treatment time. The study showed that the perceived working conditions improved as well as productivity, but psychosocial working conditions in terms of perceived degree of control of work and quality of leadership deteriorated.

Sick leave and retained work ability are not only a question of health status. Sick leave and work ability are influenced by whether or not it is possible to adjust work demands and working conditions according to an individual's needs. This means that sick leave is an issue that is not solely concerned with the nature of the work, but partly also with the attitudes of management, superiors and coworkers. Identifying factors that are influencing working ability is valuable knowledge for workplace health promotion in order to prevent long-term sick leave (Lindberg et al., 2006).

Pritchard (1995) and van Poppel et al. (2002) inspired the measurement in studies 4 and 5 of this thesis. Pritchard (1995) argues that productivity is how well a system uses its resources to achieve its goals. Such a view on productivity makes

measures of quality, attendance and other type of measures that are seen as leading to fulfilment of goals relevant (ibid.). van Poppel et al. (2002) concluded that data on sick leave gathered from company records are clearly preferable as an outcome measure of health in research.

### **3. METHOD**

*In this chapter, a description of the scientific approach, data collection and analysis methods, and quality of the study is presented.*

#### **3.1 Scientific approaches**

The scientific approach is fundamental, since it affects the researcher's choice of problem to examine and how. In the foreword, I presented life experiences that have influenced my scientific approach. The purpose of this thesis is to identify barriers to and supportive factors for Lean implementation and to investigate how application of the Sense of Coherence theory combined with Lean may affect health and productivity. The interest in learning about factors that can hinder or promote Lean implementation was because many Lean implementations are described as unsuccessful (Bhasin and Burcher, 2006; Emiliani, 2006; Sohal and Eggleston, 1994; Spear and Bowen, 1999).

Below follows a description of the five studies in the thesis. Studies 1-3 aimed to identify barriers to and supportive factors for Lean. Studies 4-5 aimed to investigate how application of the SOC theory can be supportive to Lean. Van Poppel et al. (2002) argue that data on sick leave gathered from company records are clearly preferable as an outcome measure in research.

Based and inspired by the previous studies on measuring health, this thesis has a health promotion perspective, but health was examined as presence at work (i.e., not absence from work) and numbers of rehabilitation cases. It was thought that the number of rehabilitation cases might decrease with a sense of coherence based leadership (study 4, the Scania cases). The data was from the company's records and the amount of sick leave (study 5, the Fagersta Stainless case). The thought was that if the health promotion (SOC theory) -based managerial approach was working, it should have a positive affect on health and wellness, and that should be seen in a positive trend in the examined numbers. If the health promotion was unsuccessful, that should be seen as no or a negative trend.

The first study (paper 1) aimed to investigate similarities and divergences in how the concepts of Lean and barriers to Lean are described by key informants at a production unit in a large manufacturing company and two emergency units in Sweden. The two emergency units belong to the same county in mid-Sweden and will from here on be called Health Care. At the manufacturing company, there were 14 interviews; and at Health Care there were nine interviews. The key informants were the personnel leading and responsible for Lean implementation at the workplaces. All selected respondents agreed to participate in the study. The data was collected through semi-structured interviews. The interviews lasted one and one-half to two hours, and took place in the respondent's office or in a nearby conference room. The interviews were recorded with a digital voice recorder. The recordings were then transcribed to text. The analysis proceeded through two

major steps. The first step was to find obstacles from both industry and health care informants and compare them; this was done with the constant comparative method (CCM) (Boeije, 2002). The second major step was to analyze the barriers with a proposed model for change (Porras and Robertson (1992).

The second study (appended paper 2) addressed the question of how managers' views on Lean in terms of "toolbox Lean" or "Lean thinking" impact their view of the implementation process. The study was a case study at a globally established Swedish manufacturing company. Two of the company's six product areas were focused on in the study: the initial production step delivering raw materials to the other product areas and the one with the greatest number of employees. The study had a multilevel, vertical perspective, covering the company's five hierarchical management levels. The president of the company, the two product area vice presidents, three production unit managers, three production managers, and 11 first line managers participated in the study. Data were collected through individual interviews with the 20 managers. The interviews were recorded with a digital voice recorder and transcribed to text. Analysis was done by comparing and clustering theme titles emerging from the transcribed material and by supporting narrative arguments with verbatim extracts from transcripts to support the case, in a process influenced by interpretative phenomenological analysis (IPA). IPA is a qualitative research approach originating in psychology but increasingly used in human, social and health sciences that attempts to explore personal experience and is concerned with an individual's personal perception of an object or event (Smith, Flowers, and Larkin, 2009). The results were finally structured into three themes: (1) the managers' view on Lean, (2) the managers' view on the implementation process and (3) the relationship between how lean production is defined and implemented. Furthermore, the analysis resulted in the structuring of the five hierarchical levels into three management levels: top managers, middle managers and shop floor managers.

Since the two first studies highlighted the importance of leadership in Lean, my interest for the third study was in exploring leadership *in relation to* Lean. In the third study (appended paper 3) the purpose of the study was to conceptualize the concepts of leadership and management in regard to Lean with the goal to increase understanding about the roles of leadership and management in Lean. The method chosen was to study the research literature. The analysis began with a search in the three databases ISI Web of Science, Scopus and Google Scholar. The result showed that leadership and management are topics with a huge number of publications. As a result of that huge number, phase one became to search for central publications and writers in terms of citations. That was done according to the snowball method. According to Guldbrandsson, Nordvik and Bremberg (2012) and Lewis (2012), the snowball method is a suitable method to identify people who are influential on the public. In this study, influential and central



persons were identified through their publications in an approach inspired by Pettersen (2009a, p. 128) and Langstrand (2012, p. 13), via the citation analysis tool Publish or Perish (PorP), downloaded from [www.harzing.com](http://www.harzing.com). When searching in PorP for most cited publications the system ranks both books and articles as publications. In phase 1 the search word used was *leadership*, and the three most cited works were three books: *Organizational Culture and Leadership* (Schein, 2004), *Leadership and Performance beyond Expectations* (Bass, 1985) and *Leadership in Organizations* (Yukl, 2010). These three books were included in the study. In Yukl's book, a distinct description of differences between leadership and management led to the second search step.

In the second search in PorP, the search term *management vs. leadership* was used. The three most cited works were the following three books: *Management of Organizational Behavior* (Hersey, Blanchard and Johnson, 2013), *Leadership in Organizations* (Yukl, 2010) and *A Force for Change: How Leadership Differs from Management* (Kotter, 1990). All three most cited books from the second search steps were included in the study.

Two researchers that Yukl (2010) and Hersey et al. (2013) described as authorities on leadership are Warren Bennis and John Kotter. The third search in PorP was to search publications from these two researchers, first with the search term Kotter J P and then with the search term Bennis W. The search on Kotter resulted in one article that was included based on the purpose of this work. The article is "What leaders really do," a *Harvard Business Review* reprint. The search on Bennis resulted in including two books related to the purpose of the study. The books were *On Becoming a Leader* and *Why Leaders Can't Lead*.

The fourth search was a search in PorP with the search term *lean leadership*, for publications between 2013 and 2014. This was done because older publications have an advantage to be cited compared to more recent publications. The two articles that were seen as relevant and included in the study were Poksinska et al.'s "The daily work of lean leaders – Lessons from manufacturing and healthcare" (2013) and Emiliani and Emiliani's "Music as a framework to better understand lean leadership" (2013).

Also included in the study was one article and one book not found by searching PorP but known by the authors from previous work. The article was Geller's "Leadership to overcome resistance to change: It takes more than consequence control" (2002). The book that was found through discussion with colleagues was Their (1997), *Det pedagogiska ledarskapet* (Pedagogical Leadership).

The analysis of the included literature was done by both authors jointly identifying central themes related to the concepts of leadership and management found in the publications. In a second step these themes were compared with the source material on Lean that was referred to in the theoretical background for relevant

connections, in an iterative process. Comparisons were done by comparing descriptions of leadership and management with descriptions of lean development approaches, lean value flows and lean principles.

The result from the thesis's three first studies showed that people, through their way of thinking and behaving, are the driving force in Lean, and that leadership is important to help and support people so they can do their best at work. That was leading to the idea that human factors and ergonomics and health promotion knowledge, especially the SOC model, could be of value for managers as a leadership approach. When Scania showed interest for such approach, it opened the opportunity to test the idea. That was done in the fourth study in this thesis.

In the fourth study (appended paper 4), the purpose was to explore how key performance indicators are influenced from using a health promotion approach based on the SOC model as a base for managerial behavior in Lean at three units at the truck manufacturer Scania. There were several meeting with the management teams to get information about the change process and managers' experiences. The evaluations were done through the evaluation system used by the different production units at Scania to follow up key performance indicators (KPIs). The KPIs were checked before and after the interventions. *Productivity* was measured as number of components per employee per year the year before the pilot intervention. *Quality* was measured as components per million that fail to meet quality specifications. *Health* was measured as presence at work time without sick leave and numbers of rehabilitation cases.

In the fifth study (appended paper 5), the purpose was to examine if implementation of a leadership approach based on SOC, combined with Lean philosophy, can increase productivity and quality and reduce levels of sick leave. The study was done at the stainless steel wire rod and wire manufacturer Fagersta Stainless wire unit. There were several meetings with the management teams to get information about the change process and managers' experiences. The KPIs were measured for 2014, the year before the intervention and for the years 2015, 2016 and 2017, as that was the last measured period that was available. The measured KPIs were number of production workers, yearly production in tons, productivity per worker, quality and sick leaves. Production was measured in tons/year and productivity in tons per workers/year. Quality was measured as amount of yearly production that meets the quality specifications. Health was measured as sick leave/year, in relation to total amount of planned work time.

### **3.2 The studied organizations**

Four organizations were studied in this thesis. In study 1, a manufacturer and a health care organization (the two emergency units). In study 4, the truck manufacturer Scania and in study 5, Fagersta Stainless.

### *3.2.1 The manufacturer*

The studied manufacturer is part of a globally established Swedish manufacturing company. The company is divided into several independent strategic product areas, which in turn contain several production units. The company's Lean journey was initiated by the company's president due to a perceived need for improvements to delivery precision, quality, utilization of competence and resources, and profitability. Initially an international consulting agency was hired to train a number of designated change agents within the company. As Lean was seen as a set of tools for increased profitability to be gained by higher productivity, shorter lead times, and higher and more stable quality, focus for the transformations was on production, leaving out support functions.

### *3.2.2 The health-care organization*

At the time of the research the health-care organization consisted of five main divisions. The study took place in one of the divisions in two emergency units. The health-care organization's Lean journey was initiated by the top managers with the aim of increasing the organization's efficiency, thereby expecting to lead to better availability for care to the patients, increased control over the production of care and reducing costs. It was further argued that Lean should be seen as a part of the organization's strategy and part of the political agenda, in connection with a project called the "sustainable way" (*hållbar väg* in Swedish). The overarching goal for the "sustainable way" was to increase efficiency, reduce patients' time in the care chain, increase patient safety and increase participation among employees. The health-care organization had been using big, globally established consultant firms to obtain basic Lean knowledge, and the teaching was directed to nurses and some managers. The education and training was about 5S and daily steering using visualization boards, with the aim of building continuous improvement through group kaizen activities. After around two years, the organization saw a need for more Lean knowledge and employed "lean coordinators," one for each of the organization's five divisions. The two lean coordinators participating in this study had both been working with Lean in a Swedish telecom company.

### *3.2.3 Three production units at Scania*

The purpose was to explore how key performance indicators are influenced by using a health promotion approach based on the SOC model as a base for managerial behavior in Lean at three units at the truck manufacturer Scania. The three units are the rear axle assembly unit, made up of one production manager, five supervisors, 10 team leaders and 120 operators. The assembly work was performed during two shifts. This unit was the pilot unit described above. The second unit was the front axle assembly line. The front axle assembly line was made up of one production manager, four supervisors, 15 team leaders and 120 operators. The assembly work was performed during two shifts. The third unit was the engine plant. The engine assembly line was made up of one production

manager, four workshop managers, 13 supervisors, 40 team leaders and 350 operators. The work was performed during two shifts.

#### *3.2.4 Fagersta Stainless wire unit*

The purpose was to examine if a leadership approach based on the SOC theory combined with Lean philosophy can increase productivity and quality and reduce levels of sick leave. The study was done at the stainless steel wire rod and wire manufacturer Fagersta Stainless wire unit. At the wire unit in 2014, the year before the intervention, there was one production manager, three production leaders and 49 workers at the unit.

### **3.3 Method considerations**

The purpose of this thesis is to identify barriers to and supportive factors for Lean implementation and to investigate how application of the Sense of Coherence theory combined with Lean may affect health and productivity. Yin (2009) states that the case study is a method suitable for explanations and descriptions of complex real-life interventions. Cohen and Manion (1994, p. 106) explain that a case study, by studying and analyzing an individual unit, typically establishes generalizations to wider populations. Based on that, the case study method was selected as research method in the first and second studies in the thesis.

The first study was done as two case studies at two different organizations, manufacturing and health care. The aim was to research what barriers key personnel had experienced in the Lean implementation process and compare the results from the two organizations. The data was collected through semi-structured interviews that were recorded with a digital voice recorder, and the recordings were then transcribed to text. Semi-structured interviews were seen as a favorable method instead of more “limited” closed questions, since the informant’s story was in focus. Analysis of the interviews was done with the constant comparative method (CCM), and Porras and Robertson’s (1992) change model. The analysis started with transforming the recorded interviews to text, which was printed out in A4 sheets, and then the barriers and difficulties mentioned by the participants were cut out with scissors. These pieces of paper were thereafter arranged and rearranged in different clusters during the analysis process, ending with the 14 barriers. If instead of barriers, the interactions among human-organization-technology-environment were in focus, the model proposed by Eklund (2000) composed of five generic elements – humans, technology, organization, environment and work activity – might have been a good alternative for the analysis.

The second study aimed to gain a deeper understanding of the barriers and difficulties experienced among managers on different hierarchical levels. Through cooperation between this thesis author, who was primarily focusing at the production level, and Jonas Renström, who was primarily focusing on top management, this was possible. Semi-structured interviews with the managers

were the method selected based on the same reason as in study one, better than closed questions since the informant's story was in focus. The interviews were recorded with a digital voice recorder and transcribed to text. Both researchers together identified barriers and difficulties and wrote them on a whiteboard with a notation indicating which manager had mentioned it. The analyzing process continued with clustering the individual barriers and difficulties in clusters and in three management levels, once we could see on the whiteboard that there were differences between the top managers, middle managers and shop-floor managers in their views on barriers and difficulties.

The third study's purpose was to conceptualize the concepts of leadership and management in regard to Lean from descriptions in previous studies, thus increasing understanding concerning the roles of leadership and management in Lean. After it was found that leadership is a topic with a lot of articles and books written about it, we decided to search for influential people or central writings on the topic. That was done through the snowball method. According to Guldbrandsson et al. (2012) and Lewis (2012), the snowball method is a method suitable to identify people that are influential on the public. In the study, influential and central persons were identified through their publications. The influential core publications were found via the citation analysis computer program *Publish or Perish*.

In the fourth study, the purpose was to explore how key performance indicators are influenced by a health promotion approach based on the SOC model as a base for managerial behavior in Lean at three units at the truck manufacturer Scania. The evaluations were done through the evaluation system used by the different production units at Scania to follow up KPIs. The KPIs were checked before and after the interventions. As Scania has their established systems for following up KPIs and that systems make it possible to compare results between different units, such as between units with the new leadership approach with units practicing other leadership approaches, the Scania system was chosen for evaluation. It will also be possible to follow up the KPIs at the three units participating in the fourth study in the future, as long as Scania continues to use their system, which also was seen as important.

In the fifth study the purpose was to examine if a leadership approach based on the SOC theory combined with Lean philosophy could increase productivity and quality and reduce levels of sick leave. The study was done at the Fagersta Stainless wire unit. The results reported by Fagersta Stainless were measured through the company's system of following up KPIs. As Fagersta Stainless has way to following up key performance indicators and that systems make it possible to compare results and changes between different units, such as between units with the new leadership approach with units practicing other leadership, the company's system was chosen for evaluation. It will also be possible to follow up

the KPIs at the wire unit in the future as long as the company continues to use their system.

### **3.4 Quality of the study**

The quality of the study can be evaluated in regards to validity, reliability and replicability.

#### **3.4.1 Validity**

Validity is an important criterion of research; it essentially is about the question whether the measuring really reflects what is measured (Bryman, 2008; Yin, 2009). According to Yin (2009), validity can be improved by use of multiple sources. When researching an organization, the use of multiple sources can mean interviewing as many people as possible according to their relevance for the research goal. Based on Yin (2009), the participation of all the appointed key informants in the interviews at the manufacturing company and the health-care units were seen as important in the first study (appended paper 1).

The second study at the manufacturer, appended paper 2, consisted of interviews with managers and had a multilevel, vertical perspective covering the company's five hierarchical management levels, from president of the company to first-line managers at the shop floor. Getting information from different managerial levels was a way to strengthen the validity of the study, in line with Yin (2009), who states that validity can be improved by use of multiple sources. Comparing the result of the second study with the existing literature on Lean, the literature can also be seen as a source that contributes to the validity of that result. The third study, a literature study, showed that using search terms such as leadership and management yields a very high number of hits in databases and on the internet. So the topic of leadership/management has been researched and written about a lot. It was decided to use the computer program *Publish or Perish* as an instrument to find central publications based on citation frequency as a way to strengthen the validity. The same was done for the topics of Lean and lean leadership.

In the fourth study the aim was to explore how key performance indicators (KPIs) are influenced by a health promotion approach based on the Sense of Coherence model as a base for managerial behavior in Lean at Scania's rear axle assembly, front axle assembly line and engine plant, all located in Södertälje, Sweden. To evaluate the same KPIs at three different workplaces and compare the results was a way to see if the outcomes were different or similar, which in turn should weaken or strengthen the validity of using SOC as a base for managerial behavior to increase productivity and health. As Scania has been working with their interpretation of Lean for many years, it was seen as interesting to try the SOC-based leadership in a workplace where Lean was untried. The plan was to see if the results from Scania would be repeated elsewhere, as that would strengthen the validity of the SOC theory as a managerial approach with positive impact on

productivity and health. An opportunity to do so presented itself when Fagersta Stainless showed interest in the leadership approach.

The fifth study, at the Fagersta Stainless wire unit, was done to see if the results on the same kind of KPIs would be similar or different compared to Scania when using the Sense of Coherence as a basis for managerial behavior. If the results were different, it would weaken the validity, whereas if the results were similar it could strengthen the validity.

### *3.4.2 Reliability*

Reliability is about the question whether the results of a study are repeatable; it's an issue that is important in qualitative research together with the issue of stability of results (Bryman, 2008). In the two first studies, the basic questions were the same, enabling us to find differences and similarities in the descriptions of factors that different organizations and professions experienced as barriers to and factors supportive of Lean. That was followed by the study of the literature relating to leadership and management. By comparing the empirical results from the first and second studies with the literature in study three, the aim was to strengthen the reliability and stability of the results in the thesis. In studies 4-5 the same basic theory and intervention process described in papers four and five were used at three workplaces. That was done to strengthen the reliability and stability of the results from the studies. To further try to strengthen the stability of the results from the three Scania workplaces, we applied the SOC approach as base for managerial behavior at the Fagersta Stainless wire unit.

### *3.4.3 Replicability*

Replicability is important in research (Bryman, 2008); in case studies, it is important to conduct and describe the research done so that the research process can be repeated by others (Yin, 2009). Sometimes results from a study make the researcher want other researchers to replicate a study. That might happen if the result is controversial or contradicts other results. To make it possible to replicate a study, researchers need to describe the research process in detail. Despite the generally "low status" of replication compared to originality in the academic world, replicability is valued in social research (Bryman, 2008). The informants in studies 1 and 2 are described in appended papers 1 and 2. The interview questions for both studies are presented in paper 1. Keeping the questions the same was done to make the process in the first and second studies repeatable. The literature research reported in paper 3 is also described so others can repeat the research process. The process in studies 4-5 is described in papers 4-5, which makes it possible for others to replicate those studies. Thus, all five of the studies in the thesis may be repeated by others.

### *3.4.4 Limitations of the study*

A limitation in the study is that only people responsible for the Lean implementations participated and expressed their experiences. This means, for

example, that operators in the manufacturing company and nurses in the emergency units might have given different descriptions if they had participated. The same is when it comes to studies 4-5, because the operators' view of the new leadership approach might be different from the managers, something that is important to research in the future. A third limitation, that I argue is the major limitation, is that there was a limited number of workplaces participating in the studies. The outcomes from studies 4-5 show increased productivity and health at all studied workplaces after using a combination of SOC theory and Lean philosophy as a management approach guiding managers' behavior. However, the promising approach should be tried and evaluated at more and different kinds of workplaces to find out if the results are stable and if the approach is universal.



#### **4. SUMMARY OF THE RESULTS FROM THE APPENDED PAPERS**

*This chapter presents summaries of the six papers and ends with an summary of the results in regards to the research questions.*

##### **4.1 Summary of paper 1**

In the first study, the research question was: Which barriers to Lean implementation in manufacturing and health care are described in the literature and among managers and key personnel active in Lean implementation? The data was collected via semi-structured interviews with key informants active in the implementation process at a manufacturing industry and a health-care organization. The results showed that in both organizations the view of Lean changed from a toolbox to a human behavior view. Eight barriers were described as experienced in both researched organizations: (1) consultants with limited Lean knowledge, (2) leadership, (3) time, (4) no vision, (5) no common view of Lean, (6) organizational silos, (7) insufficient communication and (8) reactive culture. There were also three barriers found to be unique to each organization. In the manufacturing industry the unique barriers were (1) lack of support functions, (2) operators lack Lean knowledge and (3) lack of work standards and the black book (the black book is a black notebook that the individual operator uses for notes kept for him- or herself). In health care the unique barriers were (1) insufficient cooperation with external organizations, (2) no follow-up and evaluation and (3) rules not followed. When analyzed with Porras and Robertson's (1992) change model, nine of the barriers were found to be elements of social factors and five of organizational arrangements. No declared barriers were related to the other two clusters in the model: physical settings or technology. Despite the differences in the two businesses, similar barriers related to organizational arrangements and social factors were described as experienced in both manufacturing industry and health care. Practical implications from the findings include that organizations intending to develop their organizations based on Lean should consider organizational arrangements and social factors in order to limit barriers to Lean implementation. This study focuses on how Lean is viewed and what barriers key personnel in manufacturing industry and health care have experienced in regard to implementation. By comparison of the experienced barriers to Lean in industry and health care, barriers that are common, archetypical or unique for industry and health care were identified, thus contributing to knowledge about barriers to Lean implementation. This is knowledge that can be useful for people responsible for future Lean implementations in organizations.

## **4.2 Summary of paper 2**

In the second study the purpose was to address the question of how managers' views on Lean in terms of "toolbox Lean" or "Lean thinking" impact their view of the implementation process. This study was done as a case study at a globally established Swedish manufacturing company. Data was collected through individual semi-structured interviews with 20 managers and covered all hierarchical management levels in the manufacturing company. The study shows that the participating managers' view of Lean had evolved from a "toolbox" view toward more of a "Lean thinking" view, due to the learning taking place in the organization during the implementation. The study also shows that fragmented development of an organization, such as production units developing individually without the support they need from middle management or HR due to variations in knowledge about Lean, may impede Lean development efforts. From the study a conclusion is that even if Lean initially may be perceived as a "toolbox" where the tools in themselves are regarded as Lean, the definition may during an implementation evolve into a definition that also encompasses the design and management of the work. So to claim that a "toolbox" approach will result in a project like implementation may be initially correct, but may prove to be incorrect over time due to organizational learning. Lean implementation initiated as a project directed at production units within an organization might thus over time evolve into a process of continuous improvement and prove a viable starting point, provided that sufficient time is given for adaptation and learning. As the definition of Lean develops, new and unforeseen deviations or needs may be identified, as happened in this case, with an increased need for leadership, people development and dialogue. These developments in turn affect the managers' views on the implementation process and the perceived needs in regard to Lean development. The impression or even fantasy that Lean can be implemented as a project in selected parts of an organization is clearly challenged by the study results. Lean implementation and development require system-wide change in order to be sustainable, which primarily concerns the management system and management approach but also all support functions within an organization. The use of external consultants in selected parts of an organization, thereby bypassing management levels and support functions, may generate conflicting priorities and tension within an organization. Developing an organization toward a Lean way of working is clearly an evolutionary process, underlining "people development." The study contributes to a deeper understanding regarding the learning process related to Lean implementations and to the aspects of people development and leadership required for sustainable Lean development in organizations.

### 4.3 Summary of paper 3

In the third study, the aim was to conceptualize leadership and management in regard to Lean and thus increase understanding of the roles of leadership and management in Lean development. The study was a literature study with a snowball method design. The study shows that management and leadership are two different but complementary systems of action, both of which are needed in organizations that strive for continuous improvement, elimination of waste and optimal performance, the nucleus of Lean. Management is described in the literature as being about organizing, structures, budgeting, work standards and routines, with the aim to create order, stability and predictability. Leadership, on the other hand, is described as being about the alignment and development of people within an organization by communication and anchoring of visions, in order to establish a context where people are willing and able to contribute to the company efforts in reaching set targets and visions. The understanding of the complementary aspects of these two concepts in relation to a Lean business operation can be said to be vital for sustainability and development. The duality of leadership and management is reflected in the duality and complementary aspects of Toyota's two foundational principles, continuous improvement and respect for people. The presence of these two principles is perhaps what ensures that Toyota maintains a functional balance between management and leadership abilities within its operations, and their presence is thereby equal important in Lean. These two main principles are connected to two value flows. The Continuous improvement principle is connected to the *production value flow*, while the RfP principle is connected to the *human value flow*. These two value flows have to be systematically supported and developed via a production system and a human system, which clearly reflects a need for both management and leadership in Lean. The study contributes to knowledge about the importance of both leadership and management in relation to Lean. Practical implications include the need to further train managers in leadership and to work within organizational culture to influence on-the-job behavior. Lack of leadership competence may be one reason companies tend to address Lean as a toolbox rather than an enterprise-wide system that covers all its operations and entails cultural and behavior standards.

#### 4.4 Summary of paper 4

In the fourth study (appended paper 4), the purpose was to explore if Sense of Coherence (SOC) theory can be used in human factors and ergonomics (HFE) practice as a leadership approach to decrease the rate of sick leave and rehabilitation cases and increase work attendance among assembly personnel without impeding productivity. Three studies were carried out at the Swedish truck manufacturer Scania. We investigated the company's key performance indicators (KPIs) and documented meetings with managers during the intervention. The three workplaces that were studied were the rear axle assembly line and front axle assembly lines, which are two parts of Scania's axle and gearbox assembly unit with the same management team, and the engine assembly plant. The intervention process comprised four areas: management education, including theories and tools; adoption to test a new management model; reflection within the group on the new approach; and, finally, broadening the implementation to new units in the organization. Documenting the processes revealed what the managers said about the planning and implementation of the intervention, and how this intervention led to the changes. Based on the managers' experiences and the dialogue described in the documentation of the process, the management team identified six changes in their managerial behavior as important to enable them to practice the new leadership approach (which they called MCM-leadership, for meaningfulness, comprehensibility and manageability) and succeed in increasing both health and productivity. The six changes were: (1) obtain facts with your own eyes, (2) practice present leadership, (3) support the position owner, (4) act fast on proposals and try them out, (5) react as quickly as possible to behavior deviation and (6) systematize and create a standard for rehabilitation cases. The evaluations were done through the evaluation system used by the different production units at Scania to follow up KPIs. The KPIs that were checked before and after the interventions were *Productivity* that was measured as number of components/employee/year. *Quality* was measured as components/million that fail to meet quality specifications. *Health* was measured as presence at work time without sick leave and numbers of rehabilitation cases. The results show that SOC can be used in HFE practice and that productivity, quality and attendance at work increased, while rehabilitation cases decreased. Our conclusion is that a health promotion approach among managers is essential in a lean organization that aims to reduce waste in the company and optimize human capability and thereby productivity. SOC theory can support the creation of workplaces that are high performing and healthy, starting with concerns for the people creating the output.

#### **4.5 Summary of paper 5**

In the fifth study (appended paper 5), the purpose was to examine how productivity and rate of sick leave changed at a stainless wire manufacturing unit after implementing a new leadership approach based on Sense of Coherence theory (SOC) and Lean philosophy. The company's wire mill had for years had low productivity and high rates of sick leave among the workers on the production floor. The newly hired four-person management team at the wire mill decided to try to combine SOC and Lean philosophies as a basis for new leadership in order to improve productivity and reduce the rates of sick leave. Productivity, quality and sick leave were evaluated through the company's key performance indicators. The follow-up of the new leadership was also based on narrative descriptions from the management team in the course of four meetings during the intervention. Notes were taken and analyzed regarding perceived outcomes of the intervention. The new management approach based on SOC theory meant that it became the management team's primary work to help the workers to feel that their workday was characterized as meaningful, comprehensible and manageable. To be able to reach that goal, frequent discussions were seen as important to make both the management team and the workers feel that they were participating and could influence the changes, thereby also creating a feeling of ownership and meaningfulness. Through the many discussions and proposals, the management team decided to carry out seven major changes at the unit:

- Ensure that the production leaders could spend as much time as possible on the production floor
- Introduce whiteboard meetings
- Build a common coffee and lunch area
- Create standardized procedure on deviations
- Act on sick leave as quickly as possible
- Build a flexible crew and
- Eliminate night work if possible.

The results showed that the number of production workers decreased from 49 the year before the intervention to 42 workers in 2017. The productivity per worker increased from 158.3 tons in 2014 to 228.2 tons per worker in 2017. Quality, measured as the amount of yearly production that meets the quality specifications, increased from 95.3 percent in 2014 to 97.2 percent in 2017. In 2014 the amount of sick leave was 15 percent; that decreased to 2.5 percent in 2017. The main conclusion from the study is that a leadership approach based on SOC combined with Lean philosophy may positively influence productivity and decrease the rate of sick leave. Therefore, managers interested in organizational performance should consider basing their leadership on a combination of SOC and Lean philosophy.

## 5. DISCUSSION

*This chapter begins with a discussion of the methods used in the thesis followed by a discussion of the results. The chapter ends with a summary discussion.*

### 5.1 Method discussion

The case study method apparently functioned well in the first two studies, matching the purpose of identifying barriers and supportive factors that can be generalized to contexts other than the participating organizations.

In the first study, at the manufacturing company and the health care units, I argue that the semi-structured interviews worked well as a method to delve into the respondents' experiences, since the interviews were not limited by "closed questions." Instead, it was more of a story about their experiences told by the informants, with the interview questions as a guideline for sticking to the topics as the story was told. I believe that the semi-structured interviews worked well to find out the informants' experiences with Lean and Lean implementation. Cutting out the individual answers from the transcription of the interviews with scissors, clustering, and comparing them worked especially well, as it gave me a feeling of overall control during the analysis process of clustering and reclustering. Using Porras and Robertson's change model to cluster barriers was found to work well, as it helped to give an overall picture of the nature of the barriers. I found that the methods used in the first study worked well to find out the respondents' experiences about Lean and the implementation.

The second study aimed to gain a deeper understanding of the barriers and difficulties experienced among managers on different hierarchical levels. Through cooperation with my coauthor Jonas Renström, it was possible to gain information from different hierarchical levels in reasonable time, since as doctoral students both of us had limited time for the study. The use of a whiteboard as a visualization tool when working together was found to work very well. as it helped us focus on the same thing, made the discussions in the clustering process focused and helped to reach a common view of the results. It may be important when using a whiteboard as a visualization board to ensure from the beginning that the whiteboard is big enough. The methods used worked well to construct the participants' experiences, but one must remember that it is a construction made by informants and researchers and not an objective picture. My experience from this process, which is influenced by interpretative phenomenological analysis (IPA), is in line with Larkin et al. (2006), who express the opinion that IPA may be more of a perspective or a stance than a distinct method in research, however it worked well in these studies. When in studies 1 and 2 we were searching for barriers the informants experienced, they also often mentioned what they should have done to avoid the barriers so there could have been support for the Lean implementation process instead. My opinion is that the methods used in the second study are a

functional way to work when researchers are working in a team with the purpose to find out how people described their experiences from life events.

The third study was a study of the literature of the management field with the purpose to explore the role of leadership and management in Lean. After it was found that leadership is a topic with a lot of articles and books written about it, we decided to search for influential people or central writings on the topic through the snowball method. The decision was based on Guldbrandsson et al.'s (2012) and Lewis's (2012) description that the snowball method is a method suitable to identify people who are influential on the public. In the study influential and central persons were identified through their publications. The influential core publications were found via the citation analysis computer program *Publish or Perish* (PoP). Using PoP as an instrument to find central publications based on citation frequency, worked well. The snowball research approach, I argue, functioned well in the study too, since one influencer also can lead to another through the reference list. The result, the findings of the dualism of lean leadership, depended on the snowball research approach, I believe.

In the fourth study the purpose was to explore how key performance indicators are influenced by a health promotion approach based on the SOC model as a base for managerial behavior in Lean. The research was done at three workplaces at the truck manufacturer Scania. The evaluation were done through the evaluation system used by the different production units at Scania to follow up KPIs. There are things that can be problematic when using a company's system for evaluation – one is the company's willingness to share information about KPIs. In this case the company was willing to share their KPIs, but if the result had been more negative would they have been equally willing? Another problematic factor is that the figures that are reported by the company can be impossible to check for bias. Another problematic factor is the time it took from the moment a researcher asked for a KPI to the moment she/he got the figures. Sometimes that took several months, which was frustrating and a stressor. Therefore, researchers intending to use a company evaluation system should request available data as soon as possible.

In the fifth study, at the Fagersta Stainless wire unit, the purpose was to examine if a leadership approach based on SOC theory combined with Lean philosophy could increase productivity and quality and reduce levels of sick leave. The results were measured and reported by Fagersta Stainless. As long as Fagersta Stainless continues following up key performance indicators in the same way, it will be possible and easy to compare results and changes over time at the wire unit. It will also be possible to compare KPIs between different units, such as between units with the new leadership approach with units practicing other leadership approaches in the future, which was the reasons to let the company measure the KPIs. One problem with using Fagersta Stainless's system of

following up KPIs for evaluation was that they could not provide any figures before 2014. Figures from several years before the intervention had been better than just one year before the intervention. So a piece of advice to future researchers that plan to evaluate through a company's system is to try to get historical data on the KPIs that they intend to measure before starting the intervention. Another problem might be that the figures a company reports on KPIs is cannot be checked for biases. In my case, I had to trust that the figures that the company reported were OK. However, my opinion is that using an organization's system for tracking KPIs in general is a functional method to evaluate the kind of research that was done in studies 4-6.

After what I learned during my time with this thesis I would now do the studies a little different. For example, I would not only ask managers about their experiences about Lean but also blue-collar workers and people working in support functions. Another thing I would do is complement the KPI data with using a SOC questionnaire suitable for measuring health at work, to gain a better understanding of how the new management approach affected people's sense of coherence.

## **5.2 Result discussion**

The result discussion consists of evaluating the results for each of the two research questions.

### *5.2.1 RQ1. What factors can be identified as barriers to or supportive of Lean?*

Several barriers to and supportive factors for Lean were identified.

*Consultants with limited Lean knowledge.* In the first study, the informants pointed to consultants with limited Lean knowledge as obstacles to succeed with the implementation and development of Lean. Muslimen et al. (2011) have argued that making sure the people teaching and coaching others in Lean have knowledge and experience of Lean is important. Sisson and Elshennawy (2015) agree, as they conclude that all four cases of successful, sustained Lean implementations they studied had guidance from people with experience from Toyota. That both respondents from industry and health care had experienced Lean consultants with limited knowledge, and that knowledge limitations were seen as a barrier to succeed with their Lean efforts were two things I found startling. If it is common that organizations use consultants with limited knowledge, perhas those consultants are the reason for the many failures with Lean efforts around the world. Lean implementations aiming to reduce waste in businesses instead become a huge waste of resources if the "wrong" Lean consultant is used. Therefore, if organizations that want to become Lean working organizations are receiving help from consultants, it is important to engage consultants that have enough knowledge and experience about Lean.



*No common definition of Lean.* In the first and second study in this thesis, the informants found that the lack of an organizational common definition was creating tension between different parts of the organization. As pointed out by Pettersen (2009b, p. 33), lack of a clear and concise definition of Lean means that individuals in an organization can translate the core ideas of Lean to suit their own frames of reference, which can cause the Lean concept to have several different meanings within an organization. Therefore, organizations that aim for Lean should pay attention to the possibility of different individual translations of Lean in the organization, take actions against such a situation and create an organization-wide shared view of Lean. This statement finds support in Sisson and Elshennawy (2015), who mean that successful lean companies create their own version of the Toyota Production System. In a similar way, Miina (2012) argues that failure or success with Lean implementation depends on the organization's approach to Lean and the ability to create an organization-specific Lean philosophy. He further argues that organizations should create their own Lean house as an image of their Lean philosophy. With a common organization-specific Lean philosophy and image, it might be possible for organizations to avoid or at least decrease the problems with organizational silos and insufficient communications between units and hierarchical levels that were depicted as barriers to Lean in studies 1-2 in this thesis.

*Inadequate leadership.* The respondents from both the manufacturer and health care units in the first and second studies felt that with Lean they needed a new way of managerial behavior that was focused more on aligning people through a vision. That statement is in line with Aij et al. (2015), who argue that to be successful with Lean implementation there has to be a complete change of mind-set among leaders and employees. The respondents also said that the new managerial behavior had to be much more supportive compared to what they were used to. That finds support in Poksinska et al. (2013), who state that when implementing Lean the managers' role radically change from focus on managing processes to coaching and developing people. Unfortunately, it is described as common that organizations striving for Lean have great difficulties understanding Lean as a management system that requires different leadership behaviors as well as CEO commitment. Instead of changing their mind-set and focus, managers have been described as commonly practicing long-established conventional practices with the addition of selected lean tools and methods, instead of changing their leadership so it suits Lean philosophy better (Emiliani and Emiliani, 2013). Drucker (2007) argues that if managers do not provide sufficient leadership, resources remain resources instead of becoming productive. Not making use of resources is waste and thereby contradictory to the nucleus of Lean philosophy. Managers' primary role has been described as to provide leadership that helps people do a better job (Emiliani et al., 2007). According to Liker and Ballé (2013), a key factor to succeed with Lean is mutual trust between employees and

management, and they stress the importance that lean managers have to be teachers and able to teach and support people development. Managers that are to lead and support Lean have to ensure they have Lean knowledge and are able to support people instead of practicing long-established conventional practices, if that is insufficient to Lean. Lean managers, or at least a lean management team, need both leadership and management skills as these two systems of action by Kotter (1990) are described as two different but complementary systems for action, and for organizations to be successful both are needed.

Inadequate leadership is described as a barrier to Lean. However, *Leadership and management are both needed in Lean*. The thesis's third study concluded, based on leadership research (Bennis, 1997, 2009; Geller, 2002; Kotter, 2001; Schein, 2004; Their, 1997), that management and leadership are two different but complementary systems of action, each related to the two basic principles in Lean, leadership to RfP and management to continuous improvement. As Lean needs to be based on both the two basic principles to work (Emiliani, 2006), both systems of action, leadership and management, are needed in organizations that strive to work according to Lean. That means that at least within the management team in a lean-working organization there needs to be skill in both leadership and management. In Lean it is important that managers support and develop people, so it is important to be able to spend time at gemba, the production floor. At all the studied workplaces, going to gemba was seen as important, so managers could make decisions on verified data on current conditions collected from their own observations and communication from the gemba. In my view it is important to realize that visiting gemba is not enough, because depending on managers' behavior the visit can create either a negative or a positive response from the people working in gemba. To create a positive response, managers can use the Sense of Coherence theory as a guiding approach to find out if the workforce is finding their work meaningful, comprehensible and manageable and take actions to strengthen and develop this feeling among the workforce. Thus, I argue that SOC theory can work as a strategy for managers striving to fit the (work) environment to humans, in line with the statement by Dul et al. 2012) regarding system outcomes from HFE design.

*Performance and well-being interact.* Performance influences well-being, and well-being influences performance. Fitting the work environment to the human can lead to optimizing both performance and well-being (Dul et al., 2012). Edwards and Langaas Jensen (2014) state that the goal for ergonomics always has been to design or redesign production systems that consider both productivity and wellness. In this thesis that view on productivity finds further support in WHO (1998), where health is described as a resource for everyday life with impact on personal resources as well as physical capabilities. That means that health is an important factor for people's capacity and thereby for organizational performance, so health promotion can be argued to be an important issue for

organizations interested in high performance and working to eliminate waste, which is the purpose with Lean. That is a way of thinking in line with Hamar et al. (2015), who conclude that well-being improvement programs can reduce health risks and increase well-being and productivity in organizations. They further argue that well-being improvement programs that focus on creation of a workplace culture that supports well-being is an important business strategy for organizations. Eklund (2000) states that the only way to achieve quality for the end customer is through quality in all work activities leading to delivery of the product or service, and that requires work conditions that promote wellness. The conclusion is that health is a fundamental issue for productivity and thereby a very important issue for organizations that are interested of minimizing waste and optimize their resource utilization. That I will express as *concern for output starts with concern for the people creating the output*. That means to create the optimal conditions for the “value creators” to do their best every day at work, creating value for the customer, eliminating waste in the production processes and improving those processes.

#### *5.2.2 RQ2. How does application of Sense of Coherence theory as a management approach affect health and productivity in a Lean context?*

Implementing SOC theory in practice is important, since health is essential for productivity and health promotion is essential to improve human capacity, in line with the WHO description of health promotion (WHO, 1998). I believe that health promotion can be regarded as continuous improvement on the human capital so the humans are in the best condition to improve products and production processes. I argue, based on the results from the studies in this thesis, that Sense of Coherence is a theory that can be used as an approach or method by managers in their work to build workplaces that are fitted to the humans for jointly increased performance and health and thereby less need for rehabilitation and sickleave among employees. The results from studies 4-5 bear this out. This statement finds support in Eriksson and Lindström (2005), who argue that the SOC concept should focus less on obstacles and problems and instead change to focusing on resources. Thus, research should begin to focus on implementing the SOC theory in practice. To use the SOC theory as a managerial approach guiding them to create a workplace that is fitted to humans need for performance and health is to make use of SOC as a “real” health promotion theory.

*Combining Sense of Coherence theory and Lean philosophy* was tried as a managerial approach guiding managerial behavior to enhance productivity and health at four workplaces (three workplaces at Scania and one at Fagersta Stainless). Scania has been working with their Toyota-inspired Scania Production System for many years and been successful with that. Fagersta Stainless had not implemented Lean, so the company’s wire unit was pioneering when trying to implement a combination of sense of coherence and Lean as base for managerial

behavior. The results, after trying the new managerial approach, showed increased health and productivity and at both the Scania, where Lean had been a philosophy in use for years, and the Fagersta Stainless, where Lean was untried. At both Scania and Fagersta Stainless the SOC based leadership approach made the managers aware about the importance to react fast to sick leaves and the need to create a standard for how to work for supporting people and making it possible for them to come back to work as fast as possible. I argue that these results show that SOC can support managers in their efforts to decrease sick leaves.

As the results from Scania and Fagersta Stainless showed, context is important when managers use SOC theory in their managerial work. Managers' actions should be based on the current needs among the workforce at a workplace. As the goal is to strengthen people's feelings of meaningfulness, comprehensibility and manageability, the needs and managerial action will change over time. That can be seen as equivalent to the focus on continuous improvement in Lean. Therefore, even if managers at different workplaces are working to strengthen people's feeling of meaningfulness, comprehensibility and manageability, their actions might be different.

Another factor is time. In both industry and health care (paper 1), the Lean implementation process was much slower than expected. That mean that the time required for implementation of Lean can be very different in different organizations. I argue that health promotion initiatives that aim to change behaviors at a workplace also might take more time than expected. At Toyota, the assumption is that people are the source for the development of production (Liker and Hoseus, 2010; Rother, 2010; Takeuchi et al., 2008). When people are seen as the source for production, health promotion is important, because health is a resource that enables people to lead individually, socially and economically productive lives, emphasizing social and personal resources as well as physical capabilities (WHO, 1998). Actually, I believe that introducing Lean and a combination of Lean and a SOC-based leadership should not be seen as a project with start and end points. Instead, it should be seen as a never-ending process that has a starting point but no end, just as there is no end to making work processes better and work environments healthier. This working with human capital according to the respect for people and continuous improvement principles is in line with the statement by Emiliani (2006):

Indeed, simple logical arguments would reveal that authentic  
“continuous improvement” is not possible without “respect for people.”  
(p. 177)

To sum up in regards to the thesis purpose: *Lean consultants* can themselves be a barrier to successful lean development in organizations if the consultant's Lean knowledge is too limited, but Lean consultants with knowledge and their own experience together with the capability to teach others Lean can be a supportive

factor. *Lack of a common organization-wide definition of Lean* is an obstacle to successful Lean development, whereas an organization-wide definition of Lean through an organization-specific Lean philosophy, preferably represented by an image such as a Lean house, is a supportive factor. *Inadequate leadership* from managers is a barrier to Lean, but if managers focus on coaching and developing people with a leadership that aims to help people do a better job combined with management to build a supportive work environment, then it is supportive of Lean. *Performance and well-being interact*: if the work environment does not support people, it is negative for productivity and health. But if the work environment is fitted to people's needs to do their best at work, the fundamentals are built that can lead to optimizing both performance and well-being. The *Human Lean* approach for managerial behavior in a Lean context, based on the SOC theory and Lean philosophy, seemed in the cases in this thesis to support increased health and productivity.

### **5.3 Toward Human Lean**

To distinguish a toolbox Lean approach to Lean from a view on Lean centered on people and health and introduce a supportive management approach based on SOC theory, I propose the term *Human Lean*.

The Human Lean concept can basically be described as: Sense of Coherence theory + Lean philosophy = Human Lean. The results of the thesis indicate that combining the health-promoting SOC theory with Lean philosophy seems logical and fruitful as a way to enhance both organizational performance and health among the people in the organization.

Human Lean can be described as based on the same basics and reflecting the roots from the 1890s of what was to become the Toyota Way, as it all started out of concern for the people who were working with value creation for the customer. Human Lean is also in line with what Emiliani and Stec (2005) call "Real Lean." I contend that the Human Lean concept can be seen as an original Lean-based concept.

The Human Lean approach can be described as based on the following reasoning. Productivity is dependent on mind-set and is about people adding value to a work process through skill, team spirit, efficiency, pride in their work and customer orientation; in that work they are aided by systems and equipment (APO, 1994). Based on that view, it becomes clear that people are the nucleus of productivity. That means that people, or more precisely, how people think and behave, are the basis for productivity. That is in line with the Toyota Way (Hoseus, 2010), and it is equally important in Lean, where it is humans that through their way of thinking and behaving reduce waste, improve processes and create value for the customer. Yamamoto and Bellgran (2010) clearly state that mind-set is fundamental in Lean. That means that health is an important factor for people's ability to do their best at work, which implies a need for health promotion knowledge among managers

so they can utilize the resources at the workplace. That is in line with Drucker (2007), who describes managers as the life-giving element that through leadership make resources productive that otherwise never would have been. That is also in line with Emiliani et al. (2007), who argue that managers' primary job is to provide leadership that helps people do a better job. Although a common statement in organizations is that the people are their most important resource, that is not the view in Human Lean. It is important to understand that in Human Lean people are not seen as resources but rather as *having* resources. Therefore, it is important to create a workplace that makes people willing and able to make use of their resources to do their best every workday at participating in value creation, elimination of waste and continuously improving the work processes as well as knowledge and skills. That means that Human Lean philosophy can be described as based on the insight that concern for output starts with concern for the people creating the output in the sense that it is about creating the best working conditions possible. Thus, the design of workplaces becomes an important issue.

According to Dul et al. (2012), human factors and ergonomics (HFE) aim to use system design to contribute to the creation of workplaces that are both healthy and high performing, so HFE knowledge is one health issue that managers need to learn about to fulfill their important role in creation of health and productive workplaces. As pointed out by Dul et al. (2012), if the work environment is fitted to humans, two related system outcomes may be achieved: performance (e.g. productivity and quality) and wellness (health, satisfaction and personal development). Fitting the work environment to humans for health and productivity is the manager's job. If there is a lack of support in the work environment in relation to people's requirements, they may perform below their capability (Dul et al., 2012). That would be a waste and oppose the heart of Lean.

This thesis regards Antonovsky's salutogenic health promotion theory, *sense of coherence* (SOC) with its three basic components: *meaningfulness*, the motivational component; *comprehensibility*, the cognitive component; and *manageability*, the behavioral component, as a managerial approach and a guiding tool. SOC can, as this thesis shows, act as an approach or tool for managers in their work to fit the work environment to humans and thus help people do a better job in their work to create value for the customer, eliminate waste and utilize available resources for efficient production. In daily practice the Human Lean concept means that managers aim to make everything personal for the organization's people:

- Feeling motivated to do their best at work every day (meaningfulness).
- Feeling that they know how to do the work (comprehensibility).
- Feeling that they have what they need to be able to do their jobs in a healthy and profitable way without waste, or at least as little waste as possible (manageability).

To be able to practice Human Lean through the SOC approach, managers must be in close touch with the people to find out if they experience the work as meaningful, comprehensible and manageable, as well as to find out how to enhance that feeling. A basic way to do so is to visit people when they are working to observe and talk to them, discussing how to improve the processes and work environment. In a way that process can be seen as continuous improvement on humans and a way to practice respect for people, thus strengthening people's willingness and ability to participate in kaizen (change for the better) work. This improvement work leads to the continuous improvement of productivity in the organization.

As people make up the nucleus for productivity, it seems logical to call the combination of health promotion in the form of SOC theory and Lean philosophy as just described Human Lean.

Figure 1 below illustrates Human Lean in relation to human factors and ergonomics theory regarding design of workplaces for two system outcomes. The figure is based on and developed from a figure that illustrates the HFE design effect on performance and well-being (Dul et al., 2012, p. 380).

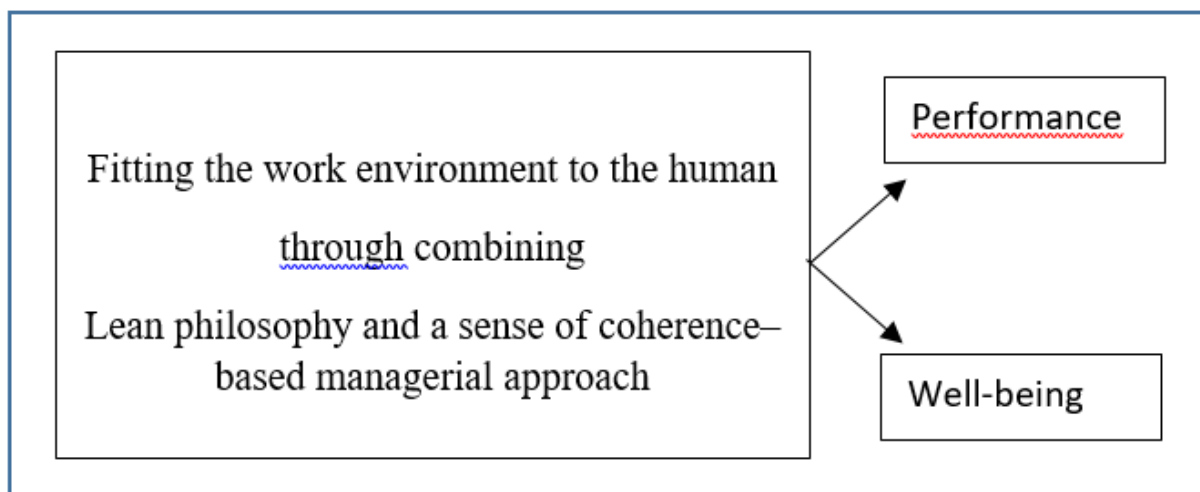


Figure 1. Illustration of Human Lean's basis.

## 6. CONCLUSION

The purpose of this thesis was to contribute to the understanding of barriers to and supportive factors for Lean and to investigate how application of the Sense of Coherence theory combined with Lean may affect health and productivity.

This thesis shows that people responsible for the implementation of Lean in manufacturing and health care describe their experiences of barriers to Lean in a similar way. One factor that was described as a barrier to Lean was receiving help from consultants whose Lean knowledge is limited to Lean tools and does not include understanding the Lean concept as a philosophy with guiding principles and tools. Other barriers are the lack of an organization-wide common definition of Lean and the lack of a shared vision of the goal with Lean. Not having a common definition of Lean in the organization can lead to silo thinking instead of flow thinking. The silo (or departmental thinking) was leading to another barrier, insufficient communication between different parts of the organization as well as between hierarchical levels. Another barrier was having a reactive culture: The respondents meant that they were used to firefighting and quick fixes for the moment instead of eliminating the root cause of the problem. Inadequate leadership was seen as an additional barrier to succeed with Lean.

However, the findings also shows that managers' view of Lean can evolve from a "toolbox" view toward more of a Lean philosophy view, due to the experiences and learning taking place in the organization during the implementation. Managers or the whole management team in organizations working to implement Lean need competency in both leadership and management, which were found to be two different but complementary topics. Leadership is needed to create and communicate a vision that people are willing to work to realize. Management is needed to create structures and routines and to provide resources. Leadership was found to be related to the Respect for people principle, whereas management is related to the continuous improvement principle, the two basic principles in Lean. The study also shows that fragmented development of an organization, such as production units developing individually without the support they need from middle management or HR, due to variations in knowledge about Lean, may impede Lean development efforts. To have an organization-wide common definition of Lean and managers that are able to support people through leadership and management are important supportive factors to succeed with Lean.

The thesis shows that combining SOC theory and Lean as an approach to guide managers in their work to support people's feeling of meaningfulness, comprehensibility and manageability at work may be positively associated with productivity as well as health. Therefore, it can be concluded that organizations that are going to implement or develop their Lean approach may consider combining SOC and Lean, i.e. Human Lean, as an approach for their managers to increase health and productivity.



## **6.1 Theoretical contribution**

The barriers and supportive factors relating to Lean that were identified through the literature and the empirical findings in the thesis contribute to the knowledge regarding Lean implementation and sustaining Lean over time. The thesis also contributes empirical evidence that the health promotion theory Sense of Coherence in combination with Lean philosophy as a base for managerial behavior are associated with positive effects on organizational performance and health in a Lean context. It was also shown that the SOC theory can be used as a strategy for managerial behavior in human factors and ergonomics practice, when the goal is to fit the workplace to the humans for increased organizational performance and increased health. The managerial strategy is to strengthen people's feeling of meaningfulness, comprehensibility and manageability. The thesis's overall contribution is the introduction of the Human Lean concept, which as an approach fills a lack of knowledge in existing Lean knowledge regarding implementation and Lean sustainability and maybe should be a part of a Lean approach.

## **6.2 Managerial implications**

The thesis's managerial implication is that managers can learn about the barriers and supportive factors regarding Lean implementation and sustainability that were identified through the literature review and the empirical findings in the thesis. That knowledge can be useful for organizations that are or intending to become a Lean organization. The Human Lean concept, based on a combination of SOC theory and Lean philosophy guiding managerial behavior, seemed to have positive effects on productivity and health at all four workplaces where the concept was applied. The results from using the Human Lean concept show that the SOC theory can support managers working in a Lean context in their efforts to create a workplace that increases performance as well as health. Therefore, organizations and managers working in a Lean context or aiming to do so should consider the Human Lean concept as part of their Lean approach.

## **6.3 Future research**

To my knowledge, this is the first time the SOC theory has been used together with Lean philosophy with the goal to increase productivity and health. The purpose of this thesis was limited to evaluating whether productivity and health were increased. If the result from the Human Lean approach had been negative in the thesis's five studies, the idea to combine SOC and Lean philosophy would probably been judged as not working and not useful, and therefore the idea would have died. The result of combining SOC and Lean as a managerial approach in the thesis is based on only four workplaces and needs more studies in the future. As the outcomes from the use of the Human Lean concept were positive, researchers should continue investigating the Human Lean concept in the future. Suggestions for future research are as follows:

- The positive result that is reported in this thesis from using the Human Lean concept as a base for managerial behavior makes it important to try the Human Lean approach in organizations in different businesses and of different sizes to get more empirical data that can be analyzed and compared.
- Another possible research topic could be to examine the same variables for the same period in organizations working with different (Lean) approaches as a way to enhance productivity and health, then comparing the outcomes.
- Researchers should examine the mechanisms that are working in the Human Lean concept.
- In future research, it is important to include professions other than managers.
- Another possibility would be to examine the impact of a managerial approach based on SOC theory on employees through a sense of coherence questionnaires.

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