TAMPEREEN TEKNILLINEN YLIOPISTO
TAMPERE UNIVERSITY OF TECHNOLOGY

ANTTI HEININEN

UTILIZATION OF VISUAL MANAGEMENT IN ACCORDANCE WITH LEAN IDEOLOGY

Case Spare Parts Distribution Center

Master of Science Thesis

Examiners: Assistant Professor Heikki Liimatainen & Lecturer Markus Pöllänen
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ABSTRACT

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This thesis focuses on Lean ideology and visual management. Lean itself is an ideology of which main target is to highlight the meaning of customer value and reduce waste from different processes. Visual management in turn is one tool of Lean ideology. The basic idea of visual management is the visualization of information. The case distribution center (DC) is starting their journey towards a Leaner organization and visual management boards are one of the first steps in this journey. Nowadays each team inside the case DC has their own visual management board but the boards could be more visual. The aim of this thesis is to find out how visual management boards can ease the case DC to move towards a Leaner organization culture.

The thesis consists of two parts, theoretical and empirical. The theoretical part concentrates on supply chain management and Lean ideology. The first one is gone through as the case DC is a crucial factor in the supply chain. The Lean chapter introduces different ways to support the ideology of Lean. Both theoretical chapters support the understanding of the research problem. In the end of both theoretical chapters the introduced theories are connected to the case DC. The empirical part of this thesis has been done as a case study. To understand the current states of visual management boards and to identify the needs for the future visual management boards, theme interviews were arranged. Based on observations and the results of interviews, an analysis of the current visual management boards was created. In addition to this, the needs for the future visual management boards from different point of views were also analyzed.

The results of this thesis are improvement actions which can be divided to two categories: short-term and long-term improvements. The basis for the actions of this thesis are the theoretical and empirical studies. The short-term improvements are actions which should be possible to implement during the next six months while even the start of the long-term improvement actions could take a long time. Based especially on the empirical study, a model for daily visual management board was created. The most important factors of the model are showing the team's status and emphasize continuous improvement. In addition to the created model for example needs for new visual management boards and agenda for the daily meetings were detected.

TIIVISTELMÄ

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Tämä diplomityö keskittyy lean-ideologiaan ja visuaaliseen johtamiseen. Lean itsessään on ideologia, jonka päätarkoituksena on korostaa asiakkaan arvoja ja poistaa hukkaa prosesseista. Visuaalinen johtaminen on puolestaan yksi leanin työkaluista. Sen perusideana on information visualisointi. Kohdejakelukeskus on aloittamassa matkaa kohti leanimpaa organisaatiota ja visuaaliset johtamistaulut ovat ensimmäisiä askelia tällä matkalla. Tällä hetkellä jokaisella kohdeorganisaation tiimillä on oma visuaalinen johtamistaulu mutta taulut voisivat olla visuaalisempia. Tämän diplomityön tavoite on selvittää, kuinka visuaaliset johtamistaulut voivat helpottaa kohdeorganisaatiota kohti leanimpaa organisaatiokulttuuria.

Diplomityö koostuu kahdesta osasta, teoreettisesta ja empiirisestä. Teoreettinen osa keskittyy toimitusketjun hallintaan ja lean-ideologiaan. Ensimmäinen kappale käsiteltiin, koska kohdejakelukeskus on oleellisessa asemassa toimitusketjussa. Lean-kappale puolestaan esittelee erilaisia tapoja tukea Lean ideologiaa. Molemmat teoreettiset kappaleet tukevat tutkimusongelmaa. Molempien teoriakappaleiden lopussa esitellyt teoriat yhdistetään kohdejakelukeskukseen. Diplomityön empiirinen osuus on toteutettu tapaustutkimuksena. Teemahaastattelujen avulla pyrittiin ymmärtämään nykyisten johtamistaulujen tila sekä tunnistamaan tarpeet tuleville tauluille. Nykyisten visuaalisten johtamistaulujen analyysi perustui havaintoihin ja haastattelujen tuloksiin. Tämän lisäksi erilaisten näkökulmien tarpeet tuleviin visuaalisiin johtamistauluihin analysointiin.

Diplomityön tulokset ovat parannustoimia, jotka voidaan jakaa kahteen kategoriaan: lyhyen ja pitkän tähtäimen parannuksiin. Diplomityön toimien perustana ovat teoreettinen ja empiirinen tutkimus. Lyhyentähtäimen parannukset ovat toimia, jotka pitäisi olla mahdollista toteuttaa seuraavan kuuden kuukauden aika, kun taas jo pitkäntähtäimen toimien aloittaminen saattaa kestää pitkään. Empiirisen tutkimuksen perustella luotiin malli, joka soveltuu päivittäiselle visuaaliselle johtamistaululle. Mallin tärkeimpiä ominaisuuksia ovat muun muassa tiimin statuksen näyttäminen ja jatkuvan parantamisen korostaminen. Luodun mallin lisäksi havaittiin tarpeet esimerkiksi uusille visuaalisille johtamistauluille ja päiväpalaverien agendalle.

PREFACE

The process started already in the end of 2017 when the case DC told that they have a need for a study. The writing process of this thesis started in the beginning of 2018 with good meetings regarding the ideology of Lean and what the expectations for this study are. I have been lucky enough to work in the case DC for a couple of years before the thesis writing process. That helped a lot because the culture and the processes of the case DC were already quite familiar to me. However, the research and writing process gave me a vast amount of completely new information and insights on how a big, international company is working.

I want to thank the case company and the case DC for the chance you provided to me. Although the Lean journey is in the beginning, I think that we will achieve good results in the future. I would like to thank my supervisor for the support and comments you gave to me. In addition to this, a big thank you for all the interviewees and my colleagues.

Assistant Professor Heikki Liimatainen and Lecturer Markus Pöllänen; thank you for the revision, comments and insights during the thesis writing process. Both of you have had many great courses in my university journey. Those courses maintained my interest in transportation and logistics.

Special thanks also to my family and friends for your continuous support. You all have helped in my journey through university and now finishing my studies. Henkka & Kim, the last years have been memorable. If those years would be described in one sentence, it would be: “Thanks for the motivation!”.

Finally, Olivia. I cannot even describe how much you have supported me during this process. I believe that when the words come directly from the heart, their meaning increases a lot. Thank you dear.

Tampere, 30.7.2018

Antti Heininen

CONTENTS

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

3PL	Third party logistics
DC	Distribution center
e.g.	For Example
HSE	Health, Safety and Environment
KPI	Key Performance Indicator
PDCA	Plan-Do-Check-Act model by doctor Deming
SCM	Supply chain management
TPS	Toyota Production System
TUT	Tampere University of Technology
VM	Visual Management
VSM	Value Stream Map

1. INTRODUCTION

This study focuses on the first steps of Lean ideology and especially to visual management boards. The purpose of this chapter is to introduce the background of this thesis, present the research problem and research questions, give reasons for the scope of this thesis as well as clarify both the methodology and the structure.

1.1 Background and motivation of the thesis

This thesis is made for a distribution center (DC), which is part of a Finnish-based company operating worldwide in industrial machinery area. The company offers products and services in different business areas. The company has a great number of distribution centers all around the world. This study concentrates on the DC of which office is in Finland and also has multiple warehouses around Europe. In short, the case DC is working in service business area and operates as a DC in the supply chain of spare parts. The case DC has different teams which have a major role in the control of the whole supply chain. A more detailed description of the supply chain is presented in chapter 2.3.2 whereas the relationships between the teams and the partners of the case DC is presented in chapter 4.1.

As mentioned above, the company operates in different business areas. Some of these business areas have already advanced with Lean implementation. Because all of the implementation processes have not gone as expected the company has highlighted the meaning of starting the Lean implementation. One of the Lean tools is visual management board of which basic idea according to Hines et al. (2008) is seeing, knowing and acting together. Based on previous experiences inside the company, visual management boards seem to be a suitable start for the step by step implementation process of Lean culture. In avoiding the known and potential challenges, this thesis has an important role with the first steps of adapting Lean culture.

The aim of this thesis is to analyze the current visual management boards of the case DC and study the needs of different teams for the boards to be even better and more supportive of the Lean ideology. One of the biggest motivations of this study is to create the best possible visual management boards for the use of the case DC. If the boards, created based on this thesis are successful the implementation of the Lean ideology will get a smooth start.

1.2 Research problem and research questions

The case DC is currently adopting Lean ideology and visual management should be a big part of the cultural change in the future. The research problem of this thesis is to develop

visual management boards which will make management of the case DC better and Leaner. The research problem in its simplicity is the following:

What kind of visual management boards can be used to develop the management of the case DC towards a Leaner ideology?

In order to find solutions for the main research problem, it is important to have sub-questions which provide ideas, answers and solutions in a smaller scope. The following list of questions shows the sub-questions of this thesis.

- What is the structure of the supply chain in the case DC?
- How can one develop the case DC and the idea of continuous improvement with visual management and Lean ideology?
- What is the current state of visual management boards at the case DC?
- What are the needs for visual management boards in the case DC from different points of view?

The previously mentioned sub-questions focus on the research problem. The first sub-question describes the supply chain of the case DC. The case DC operates in spare part business where quick actions are sometimes needed. The second research question is based on Lean and its ideology. While first two questions focused on the case DC in general, last two questions focuses especially on the combination of visual management boards and the case DC. The aim of the third research question is to study the current state of visual management boards whereas the focus of fourth question is to understand the needs of different teams from different points of view (e.g. company & managers).

1.3 Research scope

The scope of this thesis is limited to office operations of the case DC. Although the case DC has warehouses, the warehouses are not in the scope of this thesis. The main reason for not including the warehouses is the different type of work. While the employees in the case DC's office are mainly in charge of handling the information flow, the warehouse actions are connected mostly to the material flow.

As stated in the research problem, the main focus of this thesis is to find out what kind of visual management boards would support the Lean ideology. The starting point for the study is quite optimal as the case DC is already using visual management boards. Because visual management boards are a part of the whole management system the study includes also the management of the case DC.

The case DC is part of the entirety of the company's DC's. Based on the business area's commonly agreed goal in the end of 2017, all the DC's started the Lean implementation in spring 2018. Because of that, one of the goals of this thesis is to create a model for visual management boards, which could be used in any DC of the company, not only in

the case DC. Although the scope for this thesis is the DC office located in Finland it should be possible for all DC's in the same business area to use the same model, because the systems and most of the principles are similar in different locations.

1.4 Methodology

Hirsjärvi et al. (2014, p. 183) have stated that methodology is an approach to understand different methods used in the research. To understand the idea of methodology better, Saunders et al. (2009, p. 108) have developed a model called research onion, which describes the different steps for the researcher while conducting the research. The research onion is introduced in Figure 1.1.

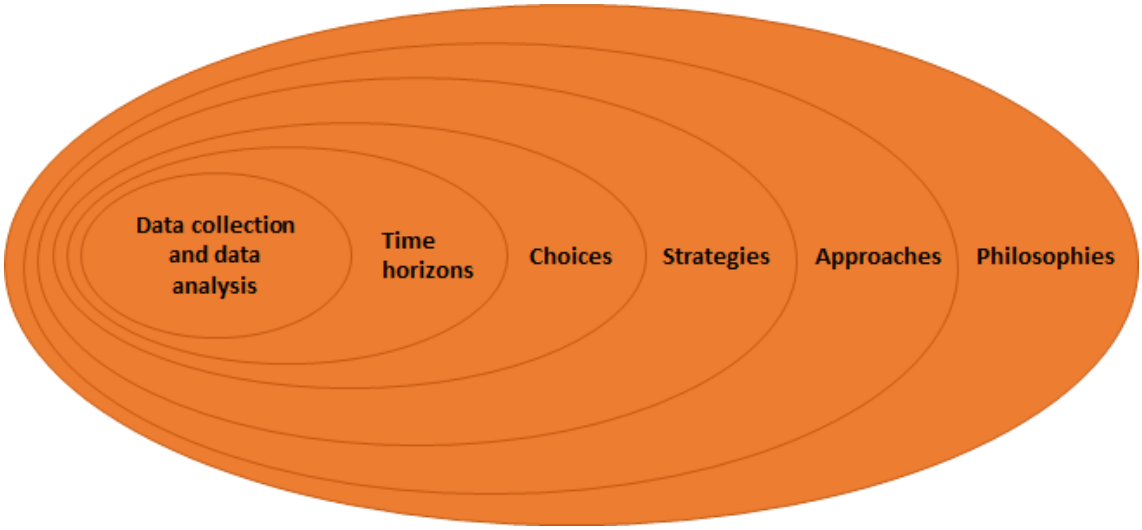

Figure 1.1. *The research onion (adapted from Saunders et al. 2009, p. 108).*

Starting from the outermost layer of the onion model, this thesis follows the philosophy of pragmatism. According to Saunders et al. (2009, p. 109) pragmatism emphasizes the meaning of research questions but also notices philosophical concepts of epistemology, ontology and axiology. Pragmatism offers a quite wide research philosophy because it allows for example multiple points of view to figure out the best answers to the research question. It also allows the researchers own opinions. (Saunders et al. 2009, pp. 119 & 128) Moving on to the next layer, due to multiple points of view, pragmatism allows the use of both research approaches; deductive and inductive. Where deduction is focusing on testing theory, induction is an alternative approach where the target is to build theory and create new (Saunders et al. 2009, pp. 124-126). For this thesis, the inductive approach was chosen, because the main goal of this thesis is to develop and create new visual management boards for the case DC.

Based on Saunders et al. (2009, pp. 141-149), for the third layer, seven different research strategies can be named. Hirsjärvi et al. (2014, p. 134) have stated three most traditional strategies of them; experimental research, survey research and case study. The strategy of this thesis is case study. In case study, either one or multiple cases are researched to

understand the process behind the case (Saaranen-Kauppinen & Puusniekka 2006). In this thesis, Lean ideology combined with the visual management boards of the case DC form the case. The boards form an entirety, of which main target is to offer valuable data for the employees and management of the case DC. According to Saunders et al. (2009, p.146) it should be possible to generate answers for "what?" and "how?" questions with the case study strategy. Based on that, the chosen strategy supports the research problem "**What kind of visual management boards can be used to develop the management of the case DC towards a Leaner ideology?"** quite well. In addition to the research problem, each of the research questions start with "what" or "how". The aim of the case study is to gain a rich understanding of the research problem (Saunders et al. 2009, pp. 146-157). Flyvbjerg (2006) has written an article which focuses on case studies. The article highlights the meaning of practical information while conducting a case study and the writer has stated that practical information is more valuable than theoretical information (Flyvbjerg 2006).

The choices layer of the research onion by Saunders et al. (2009, p. 109) includes two different method categories, which can be used during the research process (Saunders et al. 2009, p.152):

- **Mono method**: only one data collection and analysis method is used
- **Multiple method**: more than one data collection and analysis methods are used.

In addition to previously mentioned, multiple method divides further to multi-method and mixed-methods based on the use of quantitative and qualitative studies and research choices. Because the main goal of the whole thesis is to create and improve the current visual management boards, multi-method qualitative studies were chosen. Qualitative studies support the inductive approach, because it creates general conclusions from single observations (Hirsjärvi et al. 2014, pp. 162-164). Qualitative studies give a lot of different insights for example via semi-structured interview. For this thesis, multi-method qualitative studies generate a big part of the whole thesis but in addition to that, a literature review was conducted in order to also get some theoretical background. From time horizons' point of view, this thesis is a cross-sectional study, which is according to Saunders et al. (2009, p. 155), a more popular opinion than longitudinal study. In general, a cross-sectional study means that the thesis has a particular phenomenon at a particular time (Saunders et al. 2009, p. 155).

The data collection and data analysis layer of the research onion is a combination of theoretical and empirical research. As mentioned above, the theoretical part of this thesis was conducted as a literature review in order to get good background for the empirical research. In addition to good background information, the theoretical research provides information to two of four research questions. The questions are rather theoretical, so the literature review and its slight application are used to answer those questions. The sources for the literature review were mostly found from the library of Tampere University of

Technology (TUT), Scopus or TUT Andor. Table 1.1 introduces few keywords which were used in the data collection process.

Table 1.1. *Keywords for literature review.*

supply chain	logistics	spare parts logistics
supply chain management	Lean	visual management
Lean tools	visual management boards	daily management

To get as reliable information as possible the aim was to use references which already had some citations. It created some slight issues because especially visual management boards are not that studied.

The empirical part of the thesis was conducted with an approach of qualitative studies. Although it should be possible to get a lot of data through quantitative studies (e.g. questionnaires), Hirsjärvi et al. (2014, p. 195) have stated that the data may not be deep enough, and it can be theoretically informal. Due to the weaknesses and unsuitableness of quantitative studies, qualitative studies were chosen for this thesis. According to Eskola & Suoranta (2005, p. 15), qualitative material is in its simplicity text which can be collected by the researcher or the researcher can use material, which is written by someone else like diaries or letters. In this thesis qualitative interviews were used. The main goal of the interviews is to find out what the interviewee thinks about specific topics or areas (Eskola & Suoranta 2005, p. 85). Saunders et al. (2009, p. 323) have stated that qualitative interview as a data collection method fits into many different situations. One of those situations is the purpose of the research (Saunders et al. 2009, p. 323). According to Saunders et al. (2009, p. 324), qualitative interviews are a good choice for data collection if the motives for decisions, attitudes or opinions must be understood. Solving the research problem of this thesis requires the best possible understanding of the needs of different teams for improving the visual management boards.

There were two different structures chosen for the interviews: semi-structured and unstructured. Semi-structured interviews are also called as theme interviews (Hirsjärvi & Hurme 2009, p. 47). The topic or the topics of the theme interviews are same to everyone, although there would be some differences in questions (Saaranen-Kauppinen & Puusniekka 2006; Hirsjärvi & Hurme 2009, p. 48). Because the questions used in theme interviews are open-ended (Saunders et al. 2009, p. 324), the answers could be surprisingly wide and give a lot of information about some topic for the researcher. While the theme interviews have at least some structure, unstructured interviews, or open interviews, remind daily conversations where the topic has been defined beforehand (Hirsjärvi et al. 2014). According to Hirsjärvi & Hurme (2009, p. 46), in some cases the participants of open interviews do not even know that they are part of a research process. Hirsjärvi & Hurme (2009, p. 46) have also mentioned, that the people chosen to the open interviews

are not picked randomly as they have specialized information about some topic. Both unstructured and semi-structured interviews settled quite well for the purpose of this thesis. Unstructured interviews were suitable for situations where the aim was to increase the knowledge of some specialized topic like HSE (health, safety and environment) principles, whereas the semi-structured interviews were used to find out the needs and opinions about the current and the future visual management boards. The frame for the theme interviews has been described in Appendix A. As it has been mentioned earlier, a theme interview does not have an exact frame and it can be changed if needed. One should note that for example a question regarding the management system was not asked from the team members.

The interviews can be divided to two different categories based on the number of participants. In this thesis, half of the interviews were individual interviews while another half were group interviews. According to Hirsjärvi et al. (2014, p. 210-211), a group interview is an efficient way to gather information, because it is possible to get answers from many people at once. The theme interviews of this thesis were divided in a way that the managers of the case DC were interviewed as individuals whereas the team members were interviewed as a group, one interview group per one team. The main reason for this was to ensure smooth interviews and create a conversation where participants can either support each other or present other viewing points. One should also note that visual management boards provide information for the team members, so it was vital to also interview the users of the boards. In total 15 different interviewees took part in the 10 interviews but for example one interviewee attended three different interviews. The sampling method for choosing the interviewees was purposive sampling. According to Saunders et al. (2009, p. 237) the purposive sampling allows the researcher to pick up people, who have the best possibilities to answer the research questions. While choosing the interviewees, experience inside the case DC was highlighted. All interviews were held face-to-face. The table 1.2 introduces the arranged interviews.

Table 1.2. *Interviews arranged during the thesis writing process.*

#	Interview	Type	Duration	Date
1	Open interview 1	Group of 5	2.5 h	19.3.2018
2	Theme Interview 1	Group of 2	0.75 h	3.5.2018
3	Theme Interview 2	Group of 2	0.8 h	3.5.2018
4	Theme Interview 3	Group of 2	1.0 h	3.5.2018
5	Theme Interview 4	Individual	0.8 h	4.5.2018
6	Theme Interview 5	Individual	0.75 h	4.5.2018
7	Theme Interview 6	Individual	0.6 h	7.5.2018
8	Open interview 2	Group of 4	2.0 h	10.5.2018
9	Open interview 3	Individual	0.5 h	25.5.2018
10	Open interview 4	Individual	0.4 h	28.5.2018

In order for the analyzing of the interviews to be simple and efficient, all theme interviews were recorded with the permission of the interviewees. In addition to that, notes were written during all theme and open interviews. Although all theme interviews were recorded, interviews were not transcribed. Hirsjärvi & Hurme (2009, p. 138) have stated that it is not always necessary to transcribe the whole material as the researcher can make conclusions straight from the material if the amount of material is not too wide. In this thesis, the aim was to find out the most important parts from the recordings, which were then carefully analyzed and transcribed if needed. After the analyzing process, the most important parts were written out. As an example of transcriptions, the chapter 4.2 includes a lot of quotations from the interviews. To keep the anonymity of all interviewees, the number of the interview was not mentioned in the quotations.

The analysis part of the thesis is possible to conduct in multiple ways. As the focus of this thesis was to understand the needs of different teams, according to Hirsjärvi et al. (2014, p. 224) qualitative analysis should be used. Hirsjärvi et al. (2014, p.224) have stated that the choice of data analysis method is not that simple because there are a lot of different opinions and no one has created strict rules for choosing the method. According to Verne (2018) content analysis can be used especially while analyzing documents. The aim of content analysis is to create compact information from incoherent data (Verne 2018). For this thesis, an application of content analysis was chosen. All of the gathered data was not analyzed as the main goal was to find out the most relevant points from the interviews. In the thesis it means that first, interviews were analyzed and written out. Second, the interviews of team members and managers were combined team by team to build up an introduction to current state as well as figure out the needs of different teams. Finally, the aim was to find best practices but also the tools that were not preferred in use. Based on the

analyzed information and previously mentioned steps, answering the research problem as well as the research questions should be possible.

According to Hirsjärvi et al. (2014, p. 231), the basic presumption of a research is to avoid mistakes. Although the presumption is clear, there could still be some variations in the reliability and validity of the research. A good but complex measure for reliability is that two different researchers end up with similar findings. On the other hand if the same interviewee would be interviewed and analyzed twice and same results would be achieved, reliability would be on a good level. (Hirsjärvi et al. 2014, p. 231) The theme interviews of this thesis were held to managers and team members. The sample of the team members was quite small compared to the number of the employees in the case DC. In general, it means that other employees would maybe have answered in a different way, which would have had an effect to the results. The previously mentioned factor decreases the reliability of the results, because the answers of the theme interviews cannot be generalized as opinions of all team members. All in all, it was noteworthy that in the interviews the managers and team members of the same team highlighted mostly the same concerns. From the reliability point of view, it means that the research is reliable. At the same time, the validity of the research can be seen as fair. The interviewees answered the semi-structured interviews in a way, that it was possible for example to find out the needs for the visual management boards.

1.5 Structure of the thesis

This thesis includes two different approaches, theoretical and empirical. Figure 1.2 introduces the outline of the thesis as well as how the different chapters answer the research problem and research questions.

Figure 1.2. *Thesis structure.*

Chapter 1 is reserved for the introduction. The introduction goes through the background of the study, research problem, scope and methodology. Chapters 2 and 3 establish the theoretical study for the thesis. The theoretical part of the study is a background for the empirical study. Chapter 2 focuses on SCM and it introduces the supply chain of the case DC as a diagram. The main goal of chapter 3 is to introduce the Lean ideology. The chapter goes through the basics of Lean and Lean management, presents strategic viewing points and introduces some Lean tools. Because the research problem is connected to visual management, the theory of visual management is addressed widely. Empirical research results are presented in chapter 4. The chapter answers to two research questions which are connected to the current state of visual management boards and to the needs for the future boards. The main goal of the chapter 5 is to answer the research problem. In addition, chapter 5 provides a plan for the actions, which are divided to short- and long-term improvements. Finally, the thesis is summarized in chapter 6. In the conclusions, answers to the research questions, a description of the whole process and theoretical learnings are presented.

2. SUPPLY CHAIN MANAGEMENT

The purpose of this chapter is to introduce the theory of supply chain management. To achieve knowledge of the basic idea of supply chain management it is relevant to understand for example differences between supply chain management and logistics. First of all, one should note that good management is needed throughout the supply chain because the number of actors can be quite large. The chapter will discuss concepts of supply chain, logistics and spare parts logistics. The above-mentioned terms also have a great role throughout the whole thesis. Most importantly this chapter answers to first research question: **What is the structure of the supply chain in the case DC?**

2.1 Supply chain

Common-known goal of supply chain is to deliver ordered and needed products from supplier to customer. Although the goal of the supply chain appears to be quite simple, there are a lot of stages behind the process. (Beamon 1999) According to Beamon (1999) a typical supply chain is a complex of four different parties: supplier, manufacturer, distributor and consumer. The typical example of supply chain is not the only way to manage the entire supply chain. There can also be more or less parties affected by the supply chain, for example a supply chain straight from supplier to consumer is one variation of supply chain. (Cooper et al. 1997)

The above-mentioned general description of supply chain is not the only way to describe the term supply chain. One of the descriptions is written by Chan in 2003 and according to the author, supply chain "… *is a continuous process, from raw materials to finished goods via each traditional distinct function such as forecasting, purchasing, manufacturing, distribution, and sales and marketing.*". While Chan (2003) describes supply chain as a continuous process, Fiala (2005) has defined supply chain "… *as a system of suppliers, manufacturers, distributors, retailers and customers where material, financial and information flows connect participants in both directions.*". Lastly, to give a third perspective, Lee et al. (1993) share a definition of: "*A supply chain is a network of facilities that performs the functions of procurement of material, transformation of material to intermediate and finished products, and distribution of finished products to customers.*".

To sum up, although one can find quite a lot of different ways to describe the term supply chain same principles repeat themselves in all definitions. A supply chain contains different parties who have their own activities during the process to achieve the target, delivering ordered goods to customer. One must notice that there can be unlimited amount of different supply chains in a business world. Each company can decide themselves how to build up their own supply chain to achieve best results.

Since the main target is to deliver needed material to customers, the target creates material flow from supplier to consumer going through all the steps of supply chain. When turning the chain vice versa, consumer creates at least information and financial flows going from consumer to distributor and all the way to the supplier. (Beamon 1998; Fiala 2005) In some cases and nowadays because of the importance of green and environment values, reverse product flow can be added to chart of different flows in supply chain. It can be said that returning materials also close the supply chain. (Lee et al. 2008)

From a business point of view, one must note that supply chains and different flows, especially material flow, produce a lot of costs. While optimizing company's supply chains and flows affecting to supply chain at least two goals should be achieved; reducing costs and increasing the company competitiveness. (Childerhouse et al. 2003) According to Prajogo et al. (2012) one should not forget the equal role of two main flows, material and information, affecting the supply chain. Although the role of information flow can be seen as invisible compared to material flow, optimizing and developing the information flow should be as important as optimizing the material flow (Prajogo et al. 2012). Figure 2.1 describes the basic idea of supply chain with both material and information flow integrated to supply chain.

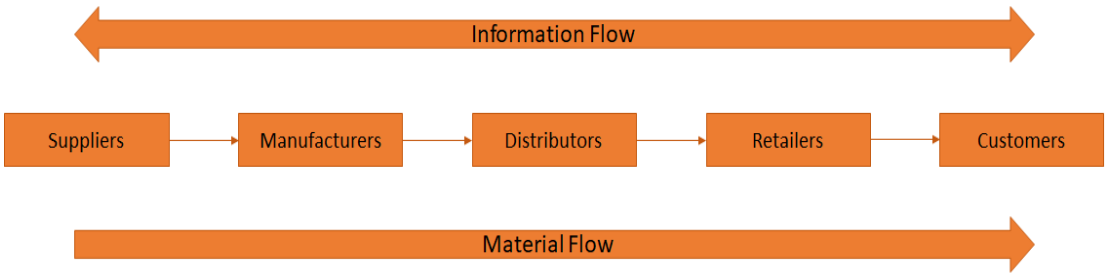

Figure 2.1. *Supply chain with main flows (adapted from Min et al. 2002).*

As one can notice from figure 2.1, material flow can be seen as a forward flow while information flow is moving both forward and backward. In general, information flow is described only backwards although information is moving nowadays more and more mutually. Sometimes one must for example inform customers about shipping schedules. The supply chain process demands that accurate information is flowing smoothly from one party to another. (Min et al. 2002) When material flow matches with information flow one can achieve the goal of delivering the correct amount of correct material to correct customer and match it with the demand of the customer (Harrison et al. 2014, p. 18).

Supply chain, from the point of view of Min et al. (2002), includes material and information flow. Taking a closer look to other supply chain models, differences can be detected. Figure 2.2 describes three different supply chain models by Mentzer et al. (2001).

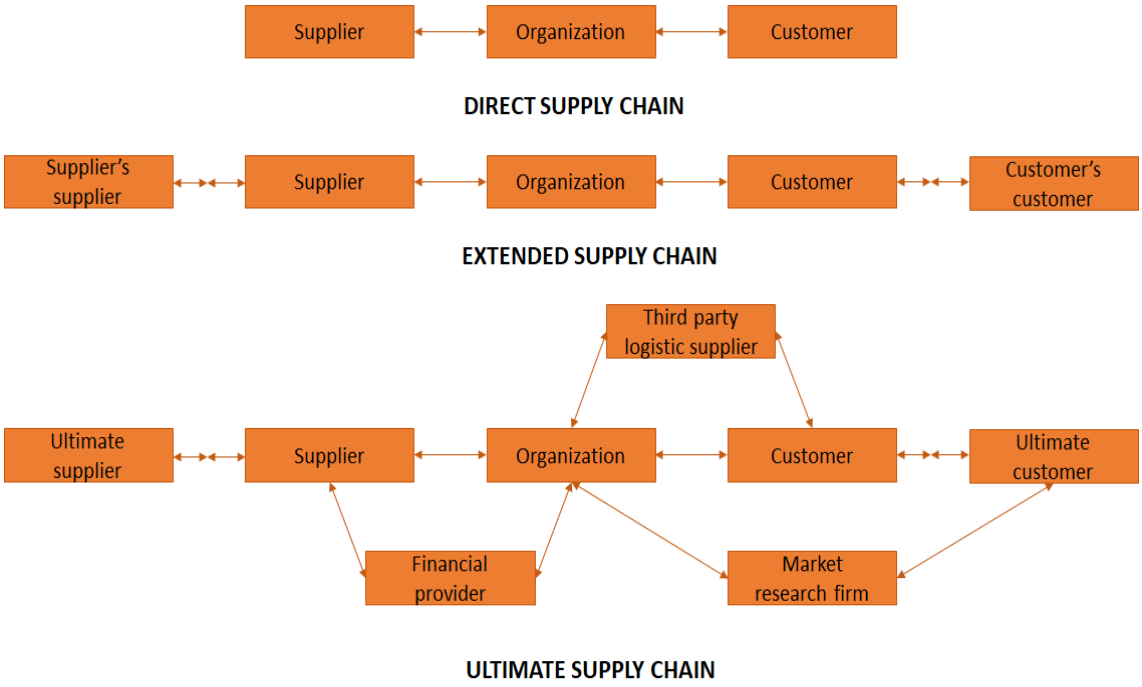

Figure 2.2. *Supply chain models (adapted from Mentzer's et al. 2001).*

Direct supply chain is the simplest model of these three. It is an entirety of a supplier, an organization and a customer. Parties are involved in flows of for example products and information. Extended supply chain can be compared quite well to direct supply chain although the extended supply chain ends to supplier's supplier or customer's customer. It includes also material flow and information flow. (Mentzer et al. 2001) If one compares extended supply chain to figure 2.1, one can find a lot of connecting factors and similarities from these models.

Whereas direct and extended supply chains are both quite compact, ultimate supply chain is not that simple. Quoting Mentzer et al. (2001) *"An ultimate supply chain includes all the organizations involved in all the upstream and downstream flows of products, services, finances, and information from the ultimate supplier to the ultimate customer."* Container shipping via ocean can be mentioned as an example of ultimate supply chain. When information flows up- and downstream throughout the extended supply chain, material flow goes downstream all the way to the ultimate customer. In the meantime, financial flow goes upstream from ultimate customer to ultimate supplier. (Chang et al. 2015; Mentzer et al. 2001)

Mentzer's et al. (2001) model is a combination of three models but Harrison et al. (2014) treat supply chain as a wider and more complicated network as can be seen in figure 2.3. In order for the entirety, pictured in the model, to retain full control supply chain management is strongly needed in all tiers.

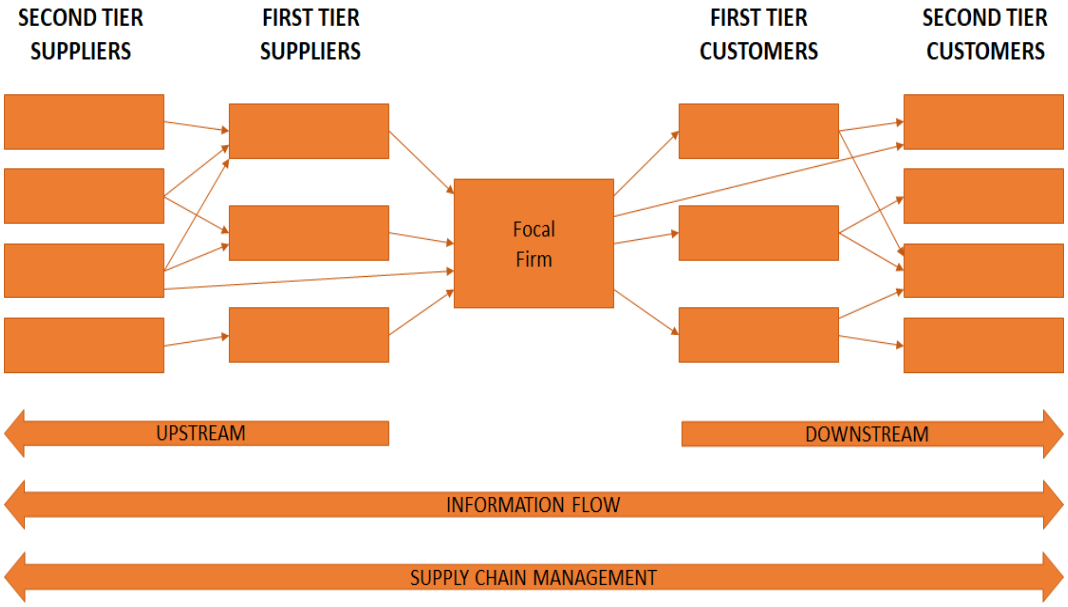

Figure 2.3. *Supply chain as a network (adapted from Harrison et al. 2014, p. 11).*

Compared to other models of supply chain the basic idea of supply network looks simple. There is an option for shipping goods straight from and to second tier through the focal firm, although the usual way to operate is to use first tier as a middle point. Material flows in figure 2.3 are presented with arrows between tiers. Information flow can be described similar as supply chain management, double-headed arrow from second tier supplier to second tier customer. (Harrison et al. 2014, pp. 10-11).

Supply chain management (SCM) itself is a wide process. It is a process of planning, implementing and controlling the operations of the supply chain in an efficient way. Managing the supply chain means that one should take care of an entire supply chain from raw materials to the point-of-consumption. (Melo et al. 2009) SCM involves many companies and business activities while coordinating the whole supply chain (Mentzer et al. 2001). Even tough results can be achieved in an efficient way, it should not be the only goal of a company's SCM. The main target of company's SCM should be creating a competitive supply chain compared to other companies. Competitive supply chain and good management skills may create a positive advantage when choosing the partner. (Croom et al. 2000; Melo et al. 2009)

According to Harrison et al. (2014, p. 81) SCM can affect an organization's financial performance. The model of Mentzer et al. (2001) of SCM confirms the theory of Harrison et al. on financial matters. SCM has an influence on customer satisfaction. If a company keeps failing to satisfy their customers, the customers may want to change their supplier to a more reliable one. This also means that the financial flow throughout the supply chain decreases. As the competition between different companies remains tight, the company must take good care of their SCM to achieve their financial targets.

2.2 Logistics as a part of supply chain management

When taking a look at terms logistics and supply chain management (SCM), one can note that SCM is a considerably newer term than logistics. First studies of SCM have been published in early-1980s whereas logistics was used in military applications already in late-1890s (Cooper et al. 1997; Lummus et al. 2001). One of the newest definitions of SCM is created by Council of Supply Chain Management Professionals (CSCMP) in 2016: "*Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities."* The definition of CSCMP (2016) also states the importance of co-operating with parties included in the supply chain. As can be seen from CSCMP's (2016) definition, one cannot use logistics as a synonym for SCM because it can be considered as a subset of SCM. Logistics (management) operates and develops *"...effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements."* (CSCMP 2016). The definition of logistics has developed a lot since 2001 as for example defined by Lummus et al. (2001) one saw logistics as a concept including usually only transportation and warehousing. Although the term of logistics is nowadays broader it is also clearer. Still one should note that the basic idea remains the same. Looking at it from a customer point of view, reliable delivery on-time may be the biggest factor when comparing organizations.

Transporting goods to destination is usually a compulsory action for each business. Freight forwarders' role in logistics and supply chain is crucial because when forwarder takes care of delivering the goods, focal organization can focus on their main competencies. Outsourcing the transportation to third parties (3PL) is not an easy task as one has to focus on many different subareas. One must for example coordinate loading times and negotiate both transportation costs and quality measurements with 3PL providers to achieve efficient material flow. (Burkovskis 2008) Transportation costs are a common challenge for all companies because arranging transportation between points A and B without any costs is not possible by any means (Sahin et al. 2007). Having an economical transportation system can give an advantage for an organization to be competitive compared to other organizations (Sahin et al. 2007). However, one must note that economical transportation system requires as cost-effective logistics processes as possible (Lummus et al. 2001). Another way to compete against other businesses is to create value-added services which have an influence on transportation. Advanced tracking system or specialized packing materials are examples of improving customer experience. (Uckelmann 2008)

While transportation may be the longest and most visible stage of logistics for a customer, one should not forget the important role of warehousing. Warehouse is a physical space to store and control goods moving forward through material flow (Karrus 2001, pp. 34-35). Karrus (2001, p. 36) justifies that in general the term warehouse can be divided in

two categories: storing goods which have regular customer-demand and safety stocking of goods which may be needed in a big hurry, but demand is occasional. One of the most important steps is to decide the size and accurate place of the warehouse (Karrus 2001, p. 35; van den Heuvel et al. 2013). According to van den Heuvel et al. (2013) companies must find a balanced location regarding two factors: upstream and downstream. After taking care that the warehouse is in a good spot for both streams, cost and time savings can be achieved. (van den Heuvel et al. 2013) Warehouse processing includes a great amount of different activities like inbound controlling, picking and packing (Faber et al. 2013). Warehouse processes, possible rent costs and warehousing itself creates a lot of costs which increase the total costs of the supply chain (Faber et al. 2013). To keep the entire supply chain as cost-efficient as possible (Sahin et al. 2007) one must keep in mind that warehousing has an effect on the total costs of supply chain (Haapanen et al. 2005, p. 124). As well as transportation, warehousing must be organized effectively (Haapanen et al. 2005, p. 124) as for example warehousing costs can be approximately 20% of all logistics costs (Solakivi et al. 2017, p. 102). The warehousing costs would be bigger, even 40% of logistics costs if one would count also the value of capital goods stocked into warehouse to the amount of warehousing costs.

Companies see logistics as a big part of their strategy nowadays. Attitudes have been changed a lot, because earlier logistics seemed to be only a term in the entirety of whole supply chain management. (Haapanen et al. 2005, p. 15) Logistics strategies can be divided into many categories as companies and customers appreciate different values (Solakivi et al. 2017, pp. 122-123). There is no specified way of how to mention logistics in company's strategy. The vital thing is that one must have a precise and clear understanding of logistics (Mellat-Parast et al. 2014) to understand the value created to customer (Haapanen et al. 2005, pp. 17-18). Figure 2.4 describes the field where companies can create value for customers.

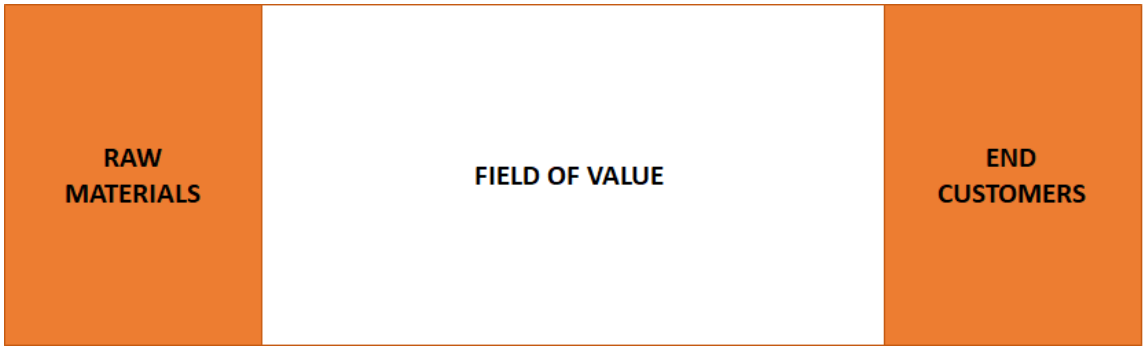

Figure 2.4. *The field of value (adapted from Haapanen et al. 2005, p. 18).*

Defining two common values for all companies regardless of their size, quality and speed stand out from all factors. On the other hand, for example small companies appreciate more customer-specific orders than cost-efficiency whereas the situation is vice versa with larger companies. Above-mentioned matters reflect the field of value, described in

figure 2.4, in a great way. While small companies want to highlight customer-specific values, large companies aim to be as quick and cost-efficient as possible without much flexibility. (Solakivi et al. 2017, pp. 122-123)

Organization's goal is to negotiate and build up the best possible supply chain. It must be an entirety of different partners and include also the strategic targets. While developing strategies and aiming to have the best possible partners, the ultimate target of logistics must be clear in mind: Quoting Uckelmann (2008) *"Having the right product at the right time at the right place and in the right condition…* "should be known as the requirement for successful logistics. Based on above presented figure 2.4 and customer values, in addition to previously-mentioned four R's, one could add with the right costs as fifth R (Solakivi et al. 2017, pp. 122-123).

2.3 Spare parts logistics

Spare parts logistics is a sector of logistics where demand for specific spare part can be anything between urgent and standard stock order. An example of this is a situation where a customer's machine is inoperative, which has a straight effect to a customer's business, so the need is urgent. The case DC of this thesis operates in spare part business, so it is important to define the line of business and accurate logistics model on how the case DC's logistics has been built. As it can be assumed, the case DC's customers appreciate flexibility and quickness as logistics values.

2.3.1 Definition

According to Glueck et al. (2007) and Wagner et al. (2012) service business, including spare parts, can produce a great amount of profit for organization. That's one reason why successful spare parts logistics is a good competitive factor for any organization (Wagner et al. 2012). Predicting the demand of spare parts is a hard challenge for any company, although some forecasts can be done in advance. While building the demand analysis of spare parts, one must remember that forecasts are only forecasts and a need for specific part may come at any minute. (Dekker et al. 2013) Because of unpredictable matters, managing spare parts is an important task for organizations (Synteos et al. 2009). As the demand may be critical from customer's point of view, supply chains must be flexible (Wagner et al. 2012). According to Huiskonen (2001), important things for customers who are ordering spare parts are that parts are available, and a combination of service and costs is competitive. Executing customers' requirements can be sometimes challenging for a partner who manages supply chain. Versatile challenges make spare parts logistics an interesting sector of business. (Huiskonen 2001)

Spare parts logistics' supply chain consists usually of three partners: supplier, service provider (for example distributor) and customer. To provide a simple action model of supply chain in general: customer orders needed spare parts from provider who is co-

operating with a supplier to ensure smooth material flow. While material flow is moving downstream, management of relationship and good communication between all parties are needed. Customer must for example inform criticality and specificity of their order as soon as possible. (Huiskonen 2001) To figure out the entire concept of spare parts logistics, Huiskonen (2001) has developed a model of spare parts logistics system, consisting of control characteristics and logistics system elements. The model is presented below as figure 2.5.

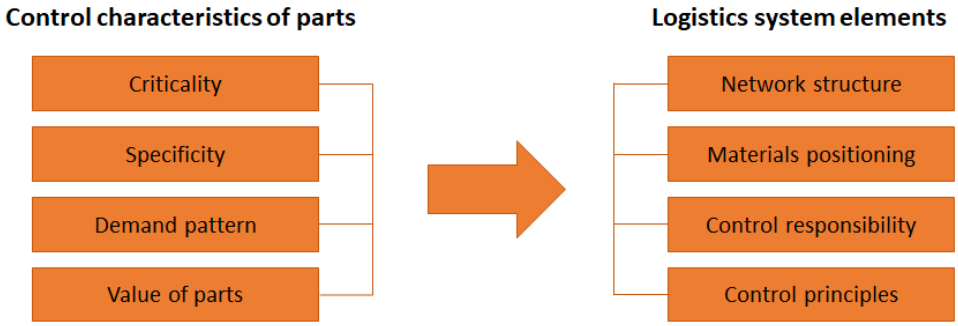

Figure 2.5. *Relevant control characteristics of parts and logistics system elements (adapted from Huiskonen 2001).*

According to Huiskonen (2001), a logistics system should respect above-mentioned elements: **structure**, **positioning**, **responsibility** and **principles**, which are controlled by four different control characteristics. The **criticality** part of Huiskonen's model should be understood for example as a time-related matter. When the customer has placed an order, there are usually three possible situations of how quickly the replacement is needed (Huiskonen 2001):

- **immediately**, customer's business is losing income
- **as soon as possible**, temporary repair with other materials is possible
- **when available**, no effect to customer's business but repairing is needed.

Identifying the correct situation of above-mentioned three categories is important for both customer and service provider. When both parties know the current demand, planning and controlling can be done. While service provider measures and informs customer of how quickly they can fill the customer need, customer can schedule needed maintenance actions. In order for this to work, one must have good information flow. To serve the customer in most critical situations, safety stock is usually needed from the service provider's side. If the service provider does not have needed materials on stock and situation remains critical, direct deliveries from supplier to customer can be a solution. (Huiskonen 2001)

While criticality may be the most important factor, one should not forget the role of other characteristics. **Specificity** usually determines the stocking possibilities of different spare parts. For service providers standard spare parts like screws and belts are much easier to

supply because of wider number of suppliers. Specific spare parts may produce some issues as neither service provider nor supplier want to keep those parts on stock because of low demand. In some cases, the needed spare part may be make-to-order part which has a straight impact to its lead-time. Customer should understand that if the needed spare part is specific, forecasting becomes more important in order to avoid any critical situations. Forecasting and predictability are of big importance when defining the term **demand pattern**. It is a combination of volume and predictability where demand changes between parts may be massive. Because of low and irregular demand, the service provider may have to increase the amount of safety stocks to guarantee availability in unpredictable situations. Instead of only trusting the service provider's stocking, customer can improve their performance by dividing spare parts to different categories based on their predictability. According to Huiskonen (2001), categories parts with random failures and parts with a predictable wearing pattern may create added value for customer's forecasts. **Value of parts** affects quite similarly to logistics elements as the specificity of parts. While aiming to keep the value of the whole warehouse as low as possible, one should note that keeping expensive spare parts on stock does not fit this target. Per Huiskonen (2001), high valued parts or materials should not be in any intermediate storage. (Huiskonen 2001)

2.3.2 Case DC's operating model

As it has been discussed already, the case distribution center (DC) operates in spare parts business. The case DC has three warehouses, two of which are in the Nordic countries to serve especially the customers of those areas. The third warehouse is in central-Europe to serve customers all over the world. Figure 2.6 presents the basic idea of the case DC's supply chain without return flow.

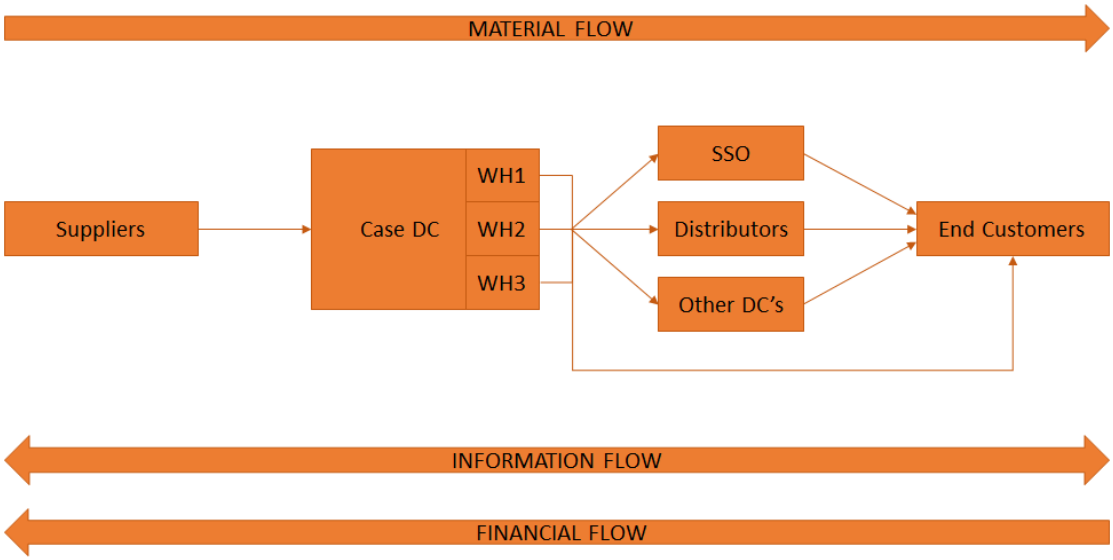

Figure 2.6. *Case DC's supply chain as a diagram.*

To sum up, the case DC's supply chain is a combination of extended supply chain (figure 2.2) and supply network (figure 2.3). As one can see from figure 2.6, all three warehouses of the case DC receive spare parts from suppliers. From each warehouse it is possible to send spare parts to the case DC's own customers: to different sales and service offices (SSO), distributors and to company's other DC's. In addition to previously mentioned customers, the case DC has a possibility to send orders straight to the end customers without intermediate storing through the case DC's customers. In urgent cases shipping straight from suppliers to (end) customers is possible but because of rare usage it is not described in figure 2.6. To ensure smooth material flow the case DC has a selected set of reliable and efficient freight forwarders for transportation between different countries and continents.

As it was mentioned earlier in this chapter, Huiskonen (2001) has described three different order priorities for shipping spare parts based on their criticality. The case DC has also three different categories for different situations:

- **breakdown**, customer is in immediate need of spare parts
- **express**, customer can wait but shipping parts as soon as possible is desired
- **standard**, spare parts are needed in the future, for example based on forecasting.

Choosing the correct forwarder for each order is based on three factors: criticality, weight and cost-efficiency. For example, if a standard order is a light-weight one the cost-efficient option is to choose a courier even though the order is not that critical. When an order is treated as breakdown, the (end) customer may want to pay more for the fastest possible option, although the order would be heavy. Meeting the customer's expectations in any situations is the most important matter for the case DC. That is why it is also necessary for the case DC to measure the performance of all factors, which have an effect on delivering the goods to customers. This creates a flexible supply chain. This thesis supports the above-mentioned ideas because Lean ideology highlights the meaning of customer values. In addition to this, one of the goals of visual management boards is to ease the measuring of performance.

3. LEAN IDEOLOGY, MANAGEMENT AND TOOLS

The aim of this third chapter is to go through the theory of Lean. The basic concept of Lean has mainly been adapted from Toyota's Production System. To do tasks in "a Lean way", means that one should avoid waste and appreciate the customer. If Lean would be described by one figure, the sustainable Lean iceberg per Hines et al. (2008) could be the figure.

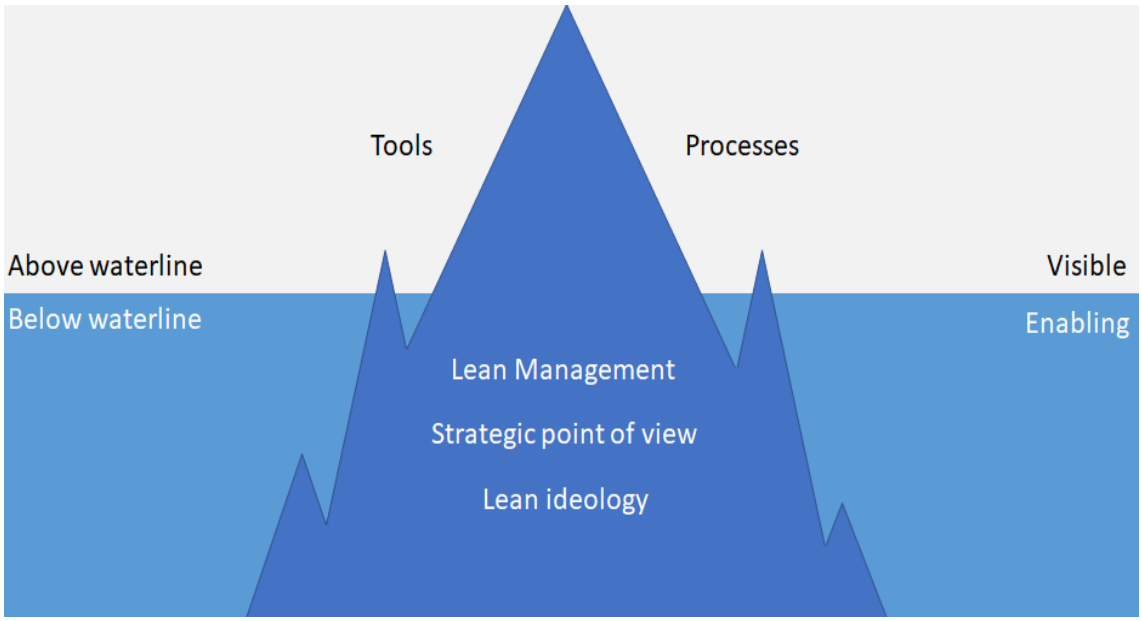

Figure 3.1. *Lean described as an iceberg model (adapted from Hines et al. 2008).*

The chapter will discuss the concept of Lean as it is presented in figure 3.1; from bottom to top including Lean ideology, strategic point of view, Lean management in different situations as well as tools and processes linked to Lean. The third chapter aims to answer to second research question: **How can one develop the organization and the idea of continuous improvement with visual management and Lean ideology?**

3.1 Ideology

Ideology of Lean has been developed in the United States during the end of 20th century (Liker 2004). To understand the ideology, one should know the story behind it. Lean is also a concept of hundreds of different words, which have been adapted to business language. Following subchapters go through the history and development of Lean as well as the basic concepts which become familiar while working with Lean ideology.

3.1.1 History and development

Finding the roots of Lean one must go all the way back to post-World War II time in Japan. Toyota's top management had to do something special to re-build the company and catch up with the productivity of other car manufacturers. Taiichi Ohno and Eiji Toyoda came up with the idea to develop the concept of Toyota Production System (TPS) based on their experiences and borrowed ideas especially from the USA. One of the most important concepts borrowed from the USA was the idea of a pull system, of which purpose is to replenish parts only when there is a need. Above-mentioned concept of pull system describes the basic idea of Toyota's manufacturing since 1950s: trying to avoid waste. While waste is described usually as overused material, Ohno and Toyoda wanted to eliminate the wasted time too. These thoughts helped Toyota make a critical discovery: *"when you make lead times short and focus on keeping production lines flexible, you actually get higher quality, better customer responsiveness, better productivity, and better utilization of equipment and space"* (Liker 2004). The discovery made a big difference to other manufacturers. Companies like Ford wanted to produce and offer cars cost-efficiently by mass production while Toyota was able to offer a greater variety of choices to their customers. TPS developed in a period of many decades and different aspects, like just-in-time (JIT) and jidoka, which were added to the entirety of TPS. One should also note that Toyota appreciated their employees a lot as a part of building TPS. (Liker 2004).

When Toyota had worked almost 30 years efficiently and flexibly, other companies all around the world noticed in early 1980s that the Japanese company was doing something differently, yet in a correct way. (Liker 2004). From the beginning of 1980s companies changed their way of thinking towards manufacturing and tried to adapt best practices from TPS. When TPS got more and more publicity, also researchers became interested. Womack and his partners published the book "The Machine That Changed the World" in 1990, where term Lean was introduced for the first time. In the year 1996 it was understood that Toyota and TPS were in fact the models for Lean. (Liker & Morgan 2006). While companies had previously focused especially on mass production and cost savings, TPS-based Lean thinking started a new chapter (Liker 2004). The pioneer of Lean, Toyota, is still one of the largest actors in the car industry (Schmitt 2017) including a vast variety of cars for example with hybrid technology (Lean Enterprise Institute 2018a).

While Lean used to be the tool only for manufacturing (Liker 2004), the scope is nowadays distinctly broader (Lean Enterprise Institute 2018a). Improving an overall performance of a company or an organization in various business areas is possible with an approach of 5 Lean principles, based on identifying value, described in figure 3.2.

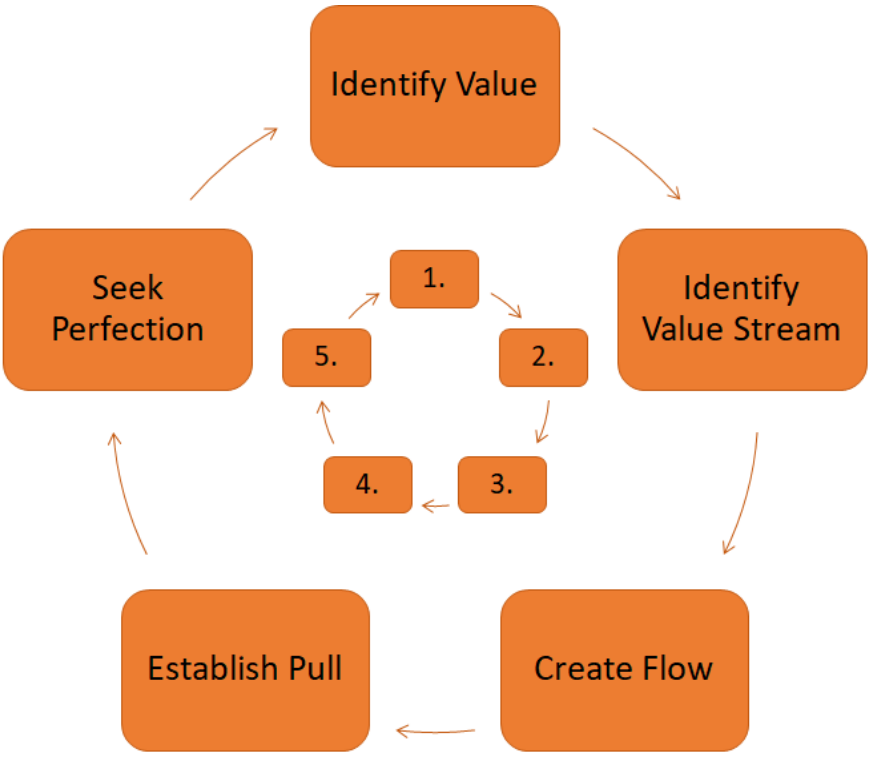

Figure 3.2. *The 5 Lean principles (adapted from Lean Enterprise Institute 2018b)*

No matter which section the organization is in, the aim of Lean must remain the same: reducing waste and improving overall performance (Bortolotti et al. 2014). The principles of Lean have been adapted for example to police departments and hospitals. Results have been remarkable (Adler et al. 2012; Collar et al. 2012). The traffic-police department of Israel improved their efficiency, affecting especially to road safety, in mid 2000s. They brought computers to police vehicles and focused on quality over quantity when fining motorists. Although the concept of road safety is quite abstract, and it can be measured in many ways, according to Adler et al. (2012) Israel's traffic-police succeeded to improve road safety with these methods. (Adler et al. 2012) In the meantime some hospitals in the United States managed to improve the occupation rate of their operation rooms by the principles of Lean. Employees and researchers succeeded in finding wasted time both before and after an operation. They also found solutions on how to avoid that waste and because of these solutions hospitals can now complete more cases within a given time frame. (Collar et al. 2012) One can find the principles of Lean from software-development companies too. As those companies have a large demand from different business areas, optimizing the process is quite important (Petersen & Wohlin 2010). Because knowledge of Lean has spread all around the world (Lean Enterprise Institute 2018), one can generalize that organizations worldwide are trying to find their own way on how to use Lean despite their business area. (Liker & Morgan 2006; Bortolotti et al. 2014).

3.1.2 Basic concepts

To understand Lean, one must note that both understanding customer and their values should be known as key elements. The main target of Lean is to create value for the customer. While creating value, a company must concentrate on their processes. Excessive activities neither creates value for customers nor brings income to the company. (Hines et al. 2008) According to Hines et al. (2008) and Liker (2004) companies should focus on eliminating or at least reducing below-mentioned three M's from their processes and way of work:

- **Muda**, waste
- **Mura**, unevenness
- **Muri**, overburden.

The best-known individual of 3M-model is muda (Liker 2004; Hines et al. 2008). According to Hines et al. (2008) it also creates a lot of problems because companies concentrate only on muda and that may cause serious issues while implementing Lean principles. Waste can be divided into different categories. Figure 3.3 describes seven different waste types which do not create any value to a product or service.

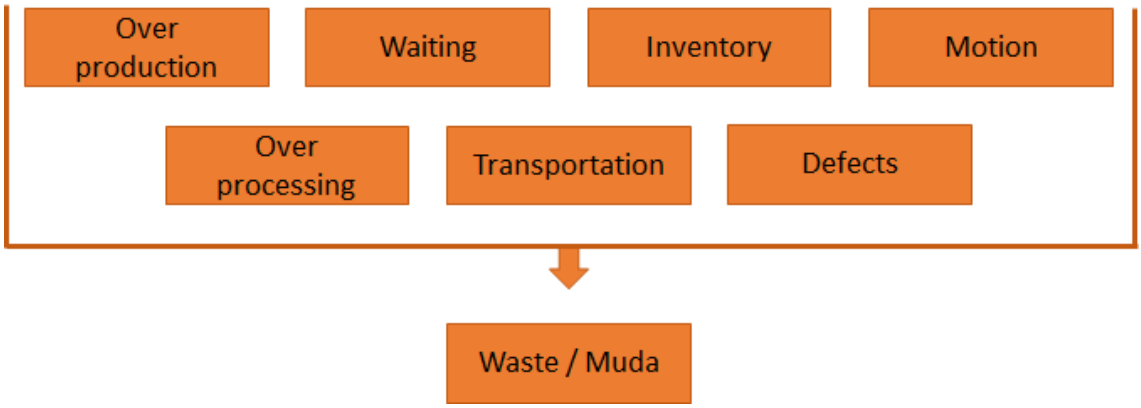

Figure 3.3. *Seven types of waste in Lean (adapted from Hines et al. 2008).*

According to Liker (2004) waste can be divided also into eight factors. If the eighth waste is used, it relates to unused employee creativity. Liker (2004) has also stated that overproduction is the most important factor as it gives a reason for most of the other waste types. One cannot connect all factors only to manufacturing goods because one can observe factors in other situations too. (Liker 2004) For example, one can connect waiting, overproduction, defects and (unnecessary) motion to office work quite simply. While thinking if something is waste or not, one should keep in mind the quote by Hines et al. (2008): *Waste is anything that does not add value to the customer".*

While muda is the most famous M of the 3M-model, one should not forget the importance of mura and muri (Liker 2004). Mura is unevenness (Liker 2004; Hines et al. 2008) or variability which is caused for example by a too broad product selection (Hines et al.

2008). One can find mura for example from production or different stages of jobs (Hines et al. 2008). Mura is usually the root cause for muda so while one is focusing on muda one should keep in mind that reducing mura reduces also muda (Liker 2004; Hines et al. 2008). To understand the idea of the last M, muri, one should note that standardized work, which will be introduced later in this chapter, is the key for reducing overburden of employees and machines (Liker 2004). It may be hard to find muri for example from office work, because employees handle their workloads differently. Hines et al. (2008) have stated that muri is *"... the most engaging and least threatening..."* item of the 3M-model. Figure 3.4 describes the overall picture of 3M-model because as well as for muda, mura is the most common cause for muri (Hines et al. 2008).

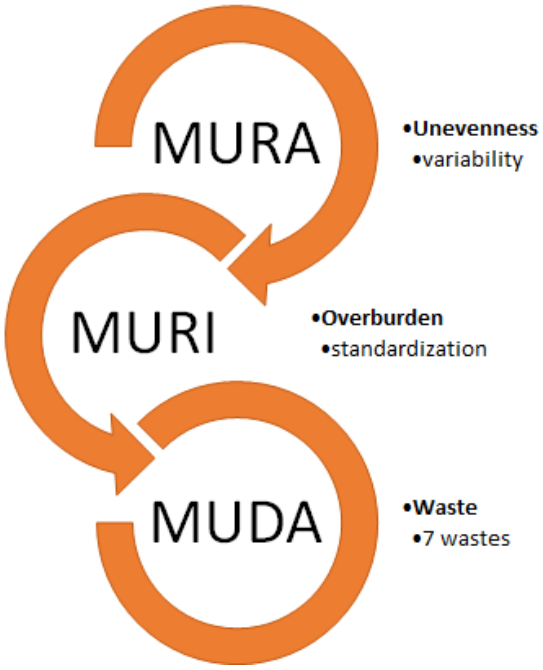

Figure 3.4. *Cause analysis for the 3M-model (adapted from Hines et al. 2008).*

As the figure 3.4 describes, reducing only muda does not influence other factors. Companies should keep their focus on the whole 3M-model as influences are repeating while going downwards. It is the key to achieve benefits of Lean ideology.

Companies who are implementing Lean should identify their value stream to understand their value-added actions as well as non-value-added actions. A tool for identifying value stream is value stream map (VSM). The target of VSM is to describe and identify all types of waste in the value stream (Abdulmalek & Rajgopal 2007). VSM can include company's own actions or actions through the whole supply chain (Abdulmalek & Rajgopal 2007; Hines et al. 2008). Per Hines et al. (2008) VSM acts also as a framework to deliver value for the customer. Companies should divide processing of VSM to three stages; first, select a process to improve, second, create a map of current state and third, create a map of target situation. When comparing these maps, it is possible to identify activities which should be changed. (Abdulmalek & Rajgopal 2007)

3.2 Strategic point of view

When a company is implementing the ideology of Lean, one must note that according to Hines et al. (2008) Lean and its goals should be mentioned in the company strategy. According to Fullerton et al. (2014) Lean must be a holistic business strategy to achieve its potential. Hines et al. (2008) have stated that in general, minority of an organization's employees have basic knowledge of the organization's strategic targets. The lack of knowledge affects directly to the employees understanding of how the changes affect to the effectiveness. While strategy determines the targets for organization, initiating the targets to everyone in the organization must also be done. Orientation underlines the meaning of everyone's contribution while trying to reach the strategic targets. (Hines et al. 2008) A good way to follow up the organization's performance and keep the employees updated about the current situation is the use of key performance indicators (KPIs).

When the organization is using KPIs, it is quite simple to find out differences between the current and target situations. Process improving may be needed if the differences are remarkable except if the current situation is better than the target situation. (Hines et al. 2008; Rohac & Januska 2015) Hines et al. (2008) have stated that *"... there must be a link between the KPIs, the strategy and the Lean improvement projects."*. As organizations can determine their own KPIs by themselves they should take care of the fact that the determined KPIs have an influence on their business (Carvalho et al. 2011), strategy and Lean improvement projects. Otherwise KPIs can be seen as waste because the organization has focused on wrong substances. (Hines et al. 2008) By the findings of researchers one can say that KPIs are working well for example when measuring the performance of a supply chain (Carvalho et al. 2011). One can also compare the organization's previous performance for example for last quarter or year, from the point of view of KPIs (Rohac & Januska 2015). Strategy and KPIs can be seen also as good starting points for the purpose of the organization's improvement (Hines et al. 2008).

According to Chiarini (2011), Plan-Do-Check-Act (PDCA) model by Dr. Deming can be used as a framework while implementing different management systems, for example Lean ideology. As can be seen from the name of the model, PDCA has been divided to four different parts, which all have their own targets (Chiarini 2011). Hines et al. (2008) have stated that using PDCA gives an organization a good start in building up the organization's processes to match those with strategic targets. Deming's PDCA is executed in a way that the first two stages, planning and doing, may require a great amount of action from everyone participating the process whereas check and act stages may take a long time without any big actions, since operators are controlling the results of first two stages. (Hines et al. 2008; Chiarini 2011). Although the stages are totally different, one cannot underestimate the need of each stage (Hines et al. 2008) as the entirety of PDCA creates an attitude of continuous improving which has no determined ending (Pietrzak & Paliszkiewicz 2015). The organization can continue the PDCA cycle until they are satisfied with achieved results. Figure 3.5 introduces Deming's PDCA model as diagram.

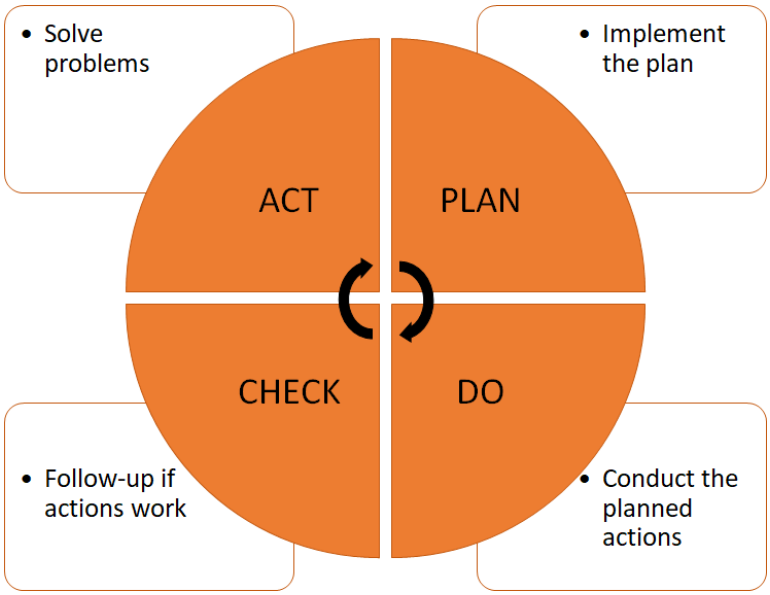

Figure 3.5. *Deming's PDCA model (adapted from Hines et al. 2008).*

The first half of the PDCA model, plan and do, are closely linked to each other because one is implementing planned actions in the doing stage (Pietrzak & Paliszkiewicz 2015). Defining the strategy (Hines et al. 2008), based on the organization's vision and mission should be known as the main goal of the plan stage (Pietrzak & Paliszkiewicz 2015). According to Pietrzak and Paliszkiewicz (2015) both strategy and especially vision should be challenging but there should still be knowledge about the possibility of achieving the appointed targets. To define achievable strategy and targets, one should analyze the organization's strengths and weaknesses together with knowledge of the organization's current situation (Hines et al. 2008). The do part of the PDCA model instead focuses on development, for example with tools suitable to Lean ideology (Chiarini 2011). According to Pietrzak & Paliszkiewicz (2015) communicating, education and goal setting as well as employees' rewarding are important factors when trying on improve an organization's performance. Pietrzak & Paliszkiewicz (2015) have stated that to gain acceptance for the strategy one must interview and communicate with employees all the way from lower level employees to managers. According to Hines et al. (2008) this previously-mentioned way is called catchball, where *"…the plans are shared horizontally and vertically throughout the organization…"*. Another aim of the catchball is activating people to highlight problems and look at targets and KPIs (Hines et al. 2008).

Another half of PDCA, check and act stages, are more about managing performance and improvements on what has been done and following if something needs changes (Chiarini 2011). Pietrzak & Paliszkiewicz (2015) have stated that there may be a lot of changing factors while implementing strategies to the real business world. In worst-case scenario an organization must change their strategy or strategic targets because something has not functioned as was thought (Pietrzak & Paliszkiewicz 2015). The entire check stage may take a couple years. It is also important to follow-up changes on what has been done already in the do stage, for example on a monthly basis. (Hines et al. 2008) Per Chiarini (2011) the best Lean tool for the check stage is visual management as one can note easily

if there have been some issues during the check stage. The last stage, act, or like it is mentioned in some publications - adjust, is the stage where one is solving the problems caused by previous stages (Hines et al. 2008). While solving the problems, one should determine the root cause of every issue (Pietrzak & Paliszkiewicz 2015). Per Hines et al. (2008) problems are usually built up out of several smaller issues, which is why the root causes should be taken into careful consideration as this could prevent the big issues from arising. Figure 3.6 describes the evolution and levels of problems.

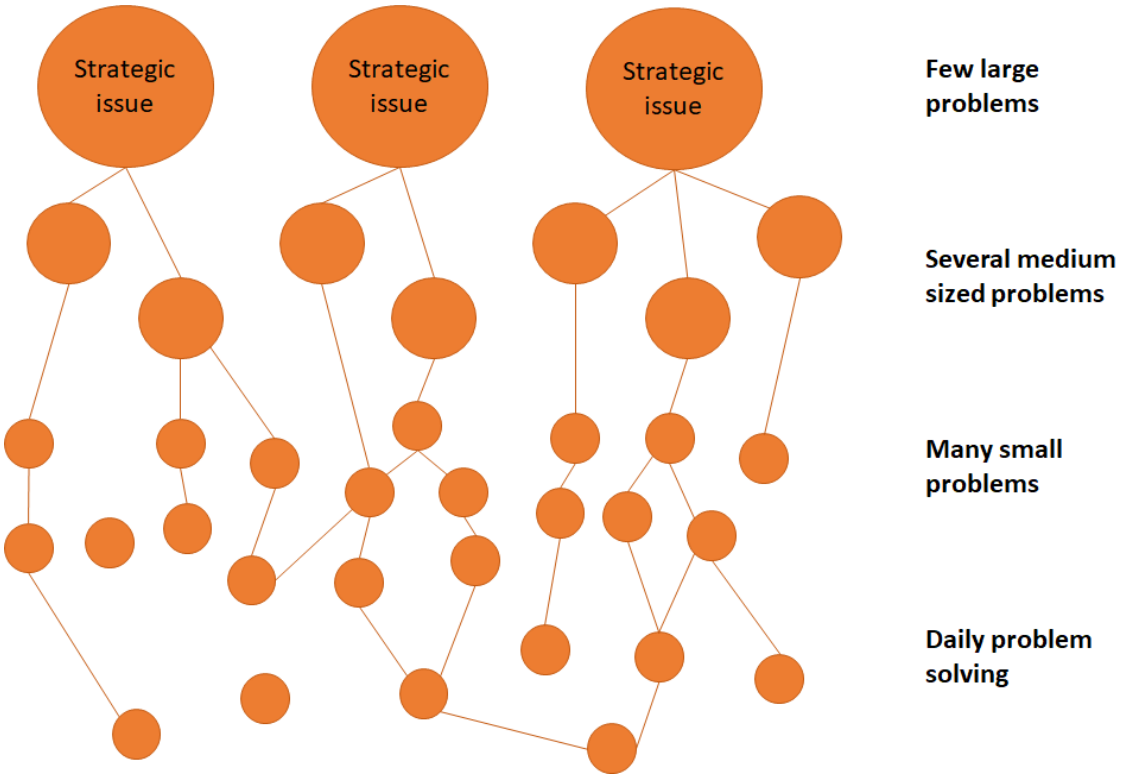

Figure 3.6. *Different levels of problems (adapted from Hines et al. 2008).*

Underlining the meaning of solving root causes, figure 3.6 describes how both daily and small problems can create larger problems in a longer period of time. If one is solving the problems right after those occur, it should be possible for an organization to avoid bigger problems, which may have an effect on for example the organization's strategic targets. Hines et al. (2008) have stated that problem solving should be done throughout the organization with simple tools. It is especially relevant to divide the responsibilities of the problem solving between a large number of employees. This way, when achieving great performance, the organization can emphasize the meaning of each employee and their skills. While problem-solving throughout the organization ties everyone to work towards the targets, it also allows process specialists to keep their focus on more demanding problems. (Hines et al. 2008)

To sum up, after completing the PDCA cycle, the organization should have a new standard to follow (Pietrzak & Paliszkiewicz 2015). If the organization has not adapted the idea of continuous improving the act stage is the last stage of the PDCA model. Otherwise

the model keeps repeating while strengthening the thought of continuous improvement. While completing the next cycle of the PDCA model, the organization can observe that the last implemented plan has not worked, and it is time to modify standards again. That is how an organization is going forward to satisfy their customers better.

3.3 Management

Since an organization has started to adapt the principles of Lean the importance of leaders and managers becomes emphasized. First, a great number of changes should be executed throughout the organization, before Lean principles become visible. According to Hines et al. (2008), an organization cannot execute too many changes at the same time because it may create an atmosphere where one does not realize the opportunities created by Lean. Implementing Lean means that good knowledge of management of change is needed. Second, after Lean has been implemented successfully, the organization should stay Lean and follow the defined activities. The target of Lean management is to focus on creating value for customer and maintain the thought of continuous improvement. Daily management aims for everyone throughout the organization to have consistent possibilities to find out if something is not going according to plan.

3.3.1 Management of change

To highlight the need for knowledge and importance on how to implement cultural change from old habits to a more Lean way, Liker (2004) has stated that: *"On a scale of difficulty, it is "extremely" difficult."*. When a company is starting their Lean process, according to Liker (2004) at least the top management of organization should answer positively to the following statements:

- Organization tries to gain profitability in long-term
- Organization wants to improve the performance of their employees and partners
- Lean is not only a trend but also a future state of organization's way of working.

As it was previously discussed, if the organization is going to implement Lean ideology, it should be mentioned in their strategy. Höök & Stehn (2008) confirm the above-mentioned theory (Liker 2004) of top management's attitude towards Lean because according to them, Lean must be mentioned clearly in the strategy and top management must be committed and aware of it (Höök & Stehn 2008). That is why companies should always start the implementing of Lean from the top (Liker 2004; Kusy et al. 2015). Liker (2004) has also stated that understanding the strategy is not the hardest part for Western companies as *"...sustaining and constantly improving the system."* seems to be the most difficult one to execute. Despite their business areas, organizations worldwide are willing to learn the ideology of Lean. Although business areas can be totally different, one can adjust good manners from all business areas to the company's own way of Lean thinking. (Liker 2004) Kusy et al. (2015) have discovered the following list of five key elements, which

have worked well in medical business and in other organizations when the organizations have started a cultural change process towards a Lean way of thinking:

- Establish a planning team
- Plan the organization's first large-scale Lean event
- Provide Lean training and coaching
- Initiate small tests of change
- Plan a second large-scale Lean event.

The key elements of Kusy et al. (2015) match quite well to Liker's (2004) ideology of Lean cultural change, although Liker (2004) has mentioned 13 different tips on the same matter. Both Liker (2004) and Kusy et al. (2015) underline the meaning of change leaders; organizations must have true leaders, who believe that the cultural change process is possible to achieve. In the beginning of the process, leaders can divide organization's employees to smaller groups, which study, test and develop new, Leaner, activities (Liker 2004; Kusy et al. 2015). When teaching the new activities step by step and group by group, Lean culture should become more embedded throughout the organization (Kusy et al. 2015). This way the organization can also avoid situations where the purpose of Lean is not defined, processes are not clearly specified and the people are not fully engaged to Lean (Hines et al. 2008). Liker (2004) has stated that leaders must get employees to believe in Lean completely, because the organization cannot accomplish Lean transformation *"…as a nice thing to do in any spare time or as voluntary…"*.

Since the cultural change process in the organization has begun, one should remember that the progress may take a long time (Liker 2004). It must also be noted, that for example each employee requires their own time to understand new activities, (Liker 2004) because changing the old habits to Lean way of thinking may be quite difficult (Mann 2010, p. 19). During the implementation process, possibilities of resistance for change should be noticed. According to Hines et al. (2008) the most common form of resistance is technical resistance. Employees are not sure about their skills (Hines et al. 2008) and they are afraid that they will lose their job because of cultural change (Quast 2012). Other resistances of change are associated for example with timing, mistrust of manager and political matters (Hines et al. 2008; Quast 2012).

To get over the situations of resistance for change and other barriers while implementing Lean, good leadership is needed at every stage of Lean transformation. Although the cultural change process may start from the top-management level, middle managers, who are in charge of the organization's operational work, have a vital role while implementing Lean. Middle management must work as balance between employees and top management. Leadership becomes emphasized especially in two stages: at the start of the process and during the phase where management cannot see the benefits through the challenges. Motivating the organization, all the way from employees to the CEO, to change their

habits Lean leaders should communicate with everyone about why the change is necessary. In this scenario communicating means mutual intercommunication; Lean leaders must also listen the opinions of the process from different points of view.

The organization should aim to reach the results of cultural change in a longer time scope. If the organization becomes satisfied with the results gained in the beginning of the cultural change process, it may affect as a lack of interest to improve more efficient and sustained actions. The target situation, when going towards the Lean culture, is an environment of continuous improvement. (Hines et al. 2008)

3.3.2 Daily Management

Daily management and meetings once a day should be known as key elements while an organization tries to achieve results with Lean ideology (Mann 2010, p. 85). Per Mann (2010, p. 86) Lean management is all about focusing on the process. Daily management supports the thought of Mann quite well, as the basic idea of daily management for managers is supporting, discussing, coaching and doing things with the employees (Sydänmaanlakka 2012, p. 110). According to Sydänmaanlakka (2012, p. 110) vital for good daily management is that a manager knows his or her employees well. In these situations, managers can support each employee in a way that supports each employee (Sydänmaanlakka 2012, p. 110). As mentioned previously, both knowledge and appreciation of employees were the main factors also in TPS.

Daily meetings with the team, including the manager and the employees are of course important but one should not forget meetings with other managers and leaders. In these meetings one can share information of actual status of each team (Mann 2010, p. 86). The information flow from both bottom-up and vice versa ensures that immediate actions can be taken if needed (Poksinka et al. 2013). Mann (2010, p. 86) has stated that daily meetings should be divided to three stages (level 1-2-3) depending on the participants of each meeting. Daily routines are an example why it is important that everyone from lower level employees to top management are committed on the ideology of Lean and its demands.

The structure of the daily meetings should be standardized (Mann 2010, p. 87; Poksinka et al. 2013). Mann (2010, p. 87) has stated that the daily meetings for example, should not take more than 15 minutes and the place of meetings should be located nearby employees' working area. As an agenda, the team should go through the events of the previous day and find out if something can be done better in the future (Mann 2010, p. 89). During their research process, Poksinka et al. (2013) noted that daily meetings with standardized agenda was one of many factors to increase employees' empowerment and involvement. To have the standardized agenda in the daily meetings should be known as a starting point for successful meetings. One can still arrange for example different themes for different days (Mann 2010, p. 89). As discussed previously, the team should do things together during the meetings. Mann (2010, p. 89) highlights that one should not forget

the role of listening to the employees. Daily meetings should be built as an environment, where mutual communication between the manager and the employee is possible. It also develops the idea of continuous improvement as employees can participate in the conversation too. (Mann 2010, pp. 89-90) Poksinka et al. (2013) have stated that communication between employees and management should not be restricted only to meetings as managers should have conversations with the employees for example while they are working.

Even though daily meetings were divided to three stages by Mann (2010, p. 86), the basic idea of each meeting remained the same. (Mann 2010, pp. 90-96). In general, every meeting focuses on continuous improvement which is a big or the biggest part of daily management. When the team or the managers are having daily meetings, they should always handle the expected situation as well as the actual situation and compare these situations (Mann 2010, pp. 87-96). Sharing the status of their own teams with middle and top management, different ways of improving performance can be found. (Mann 2010, p. 87) As it has been discussed previously, smooth information flow gives an option to react quickly if the need for change can be detected.

3.4 Tools and processes

Lean ideology includes a great number of various tools to improve an organization's performance and reduce unnecessary actions. Unlike most of the previously discussed matters, one can observe the tools of Lean while doing everyday actions. According to Hines et al. (2008), Lean tools can be used anywhere through the entire organization. Following subchapters will focus especially on the theory of visual management. The case DC has a need for visual management boards to facilitate the leading of employees and following up organization's performance. Also, other lean tools like standardized work and a problem-solving tool A3 will be introduced.

3.4.1 Visual management

Tezel et al. (2015) have introduced numerous descriptions by different authors for visual management (VM), which seems to be a well-known concept all around the world. To sum up all the descriptions shortly, the aim of VM is to emphasize organizations' performance, transparency and development from top management to employees throughout the organization (Tezel et al. 2015). In the best possible situation, the organization's performance could be seen at glance with the tools of VM (Eaidgah et al. 2016). Tezel et al. (2015) highlight that VM should be defined also as a managerial strategy and a key element, which combines for example an organization's core values and strategy. Although the managerial point of view may be emphasized in different descriptions, one should not forget the role of employees. According to Liff and Posey (2004, p. 45) VM helps employees keep their focus on critical performance goals. Like Sydänmaanlakka (2012, pp. 110-112) stated already with daily management, one should take knowledge into account

and this applies to VM too (Hines et al. 2008). To improve the culture of continuous improvement it is meaningful for employees to participate in problem-solving and share their concerns and opinions about different issues (Hines et al. 2008). Liff and Posey (2004) have stated that VM affects especially on productivity but also to customer satisfaction and accuracy. VM is similar to Lean ideology in a way that one cannot achieve the full potential of VM if the organization has not determined a bigger plan for it (Eaidgah et al. 2016). It might be a good solution for the organization to implement the idea of VM around the same time with implementing the ideology of Lean.

In the beginning of an implementation process of VM one should understand that VM consists of a large number of different tools. While the organization may aim to present its performance at glance in visual management board, visual signs, site maps and color-coded clothing can be seen as tools of VM. (Tezel et al. 2015)

As discussed previously, this thesis focuses especially on implementing visual management boards. Mann (2010, p. 87) has described that a visual management board is a good tool for noticing if everything is going according to the plans. In general, it means that the users of the visual management boards can see easily if there is a need for corrective actions or is the performance in a good condition (Mann 2010, p. 87). Development and implementation of the visual management boards should be done by a group of specified people (Bateman et al. 2016). Bateman et al. (2016) have presented a list of nine different points to consider, while developing the visual management board. The most important points of the list are simplicity and interestingness (Hines et al. 2008; Bateman et al. 2016). Focusing on both simplicity and presentation is important (Bateman et al. 2016) because an overload of information may cause a situation where employees, including team members and managers, do not exactly know what to do (Viana et al. 2014). In order to make something interesting the development team must listen to the users of the visual management boards. This usually leads to a situation where visual management boards may have differences between different teams. Listening to the users of visual management boards is also important, because the development team can then follow the principles of the Deming's PDCA model. (Bateman et al. 2016) That is how the visual management board should find its shape in a longer time frame. Figure 3.7 describes the implementation process of visual management board and how it allows the utilization of the PDCA model throughout the process.

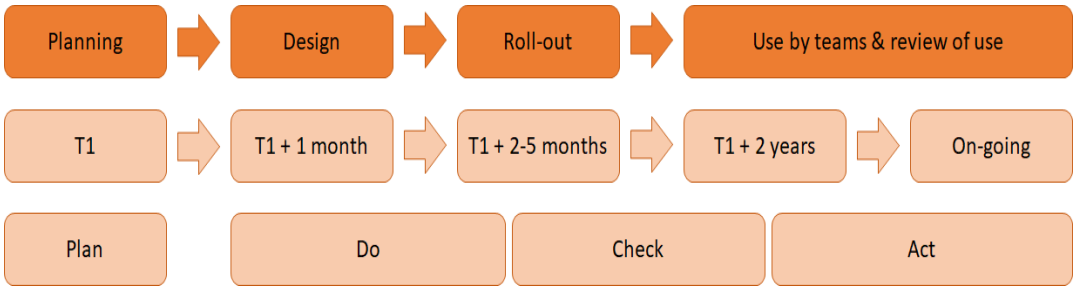

Figure 3.7. *The implementation process of visual management board (adapted from Bateman et al. 2016).*

As one can see from figure 3.7, the implementation and development process of visual management board may take years. Although the process can be long, organizations can get it completed also faster. The most important matter is that the plan of the process is clear for the whole organization and they believe that they can accomplish it.

High-quality information is needed by all members of the organization. In wider scope one should think how to present the information in an easy way. According to Eaidgah et al. (2016), well developed visual management boards bring the right information to the right people at the right time. As it has been discussed previously, one should focus on keeping the visual management board simple and interesting. The organization can follow as many metrics as they want (Eaidgah et al. 2016) but presenting only the metrics that you need to manage and monitor processes, is the key to achieving efficiency (Hines et al. 2008). The organization can follow for example metrics of higher tier categories listed below, stated by Eaidgah et al. (2016):

- **Delivery**
- **Productivity**
- **Quality**
- **Morale.**

It is obvious that an organization focuses on its financial measures, such as revenue and profit, but as can be seen from the above-mentioned list one should focus also on processes as the financial measures may not give an exact status of the organization's current situation (Eaidgah et al. 2016). Quoting Eaidgah et al. (2016): *"...many organisations seek non-financial measures, hoping to establish a more accurate and comprehensive view of the business (Parry and Turner, 2006)."*. Hines et al. (2008) and Bateman et al. (2016) have stated that for example the following KPI metrics, matching to each higher tier category discussed above, may be good for an organization to follow, depending on their business area:

- **On-time Delivery In Full,** deliveries delivered on time and in full during cycle
- **Total Cycle Time,** time from start to end of the process
- **Right First Time,** parts delivered in good condition
- **Attendance,** percentage of time that employees attended work.

An exact description on how to build the organization's visual management boards cannot be found. As previously stated, identifying the needs of the organization is the most important task of the development process (Hines et al. 2008; Tezel et al. 2015; Eaidgah et al. 2016). Per case examples by Bititci et al. (2016), one can develop many boards for different purposes while Bateman et al. (2016) presents an example of one board with several different themes. Per previous case examples, the organization may have to think about the need for following categories while developing the visual management board for daily use:

- **Overall overview,** for example the company strategy
- **Organization overview,** for example standard work and attendance
- **Performance overview,** for example KPIs
- **Project overview,** for example a list of projects in the organization
- **Improvement overview,** for example PDCA model.

Keeping the visual management boards informative and simple is not the easiest task for the development team. If one wants to present for example an overall and performance overview with visual management boards, some color-coded system to tie the main categories together should be considered (Hines et al. 2008). However, indicating the actual status of each meter as simply as possible, is the key to keeping the entire visual management boards informative and simple (Hines et al. 2008; Bititci et al. 2016). Both Hines et al. (2008) and Bititci et al. (2016) have mentioned the benefits in using the traffic lights to present the current state of each meter and compare it to the target situation. Since everyone knows the idea of traffic lights, the current performance can be tied to different colours (Bititci et al. 2016). This traffic light system has similarities with Toyota's andon system. In general, the basic idea of the andon system is to be able to easily report for example from manufactory lines if something deviates from standards (Liker 2004). The reporting is done with traffic lights: the green light is on if everything goes as expected whereas the yellow light burns if an employee reports a problem. After the problem has been reported, the team leader has a set time to react until the process is interrupted by a red light. (Liker 2004) Following the andon model (Liker 2004) and above-mentioned case examples by Hines et al. (2008) and Bititci et al. (2016), creating standards for traffic lights to follow KPIs is possible. The traffic light system is presented in figure 3.8.

Figure 3.8. *Traffic lights and meanings to follow organization's KPIs (Liker 2004 & Bititci et al. (2016).*

While following the organization's performance with the visual management boards, the idea of the environment of continuous improvement should be kept in mind. PDCA in different levels of the organization is highlighted by Hines et al. (2008). According to Eaidgah et al. (2016) everyone should be updated through the organization about the actual status of the development actions. Presenting the situation is easily done with visual management board. An example of visual management board based on previously-mentioned theories of this subchapter is described in figure 3.9.

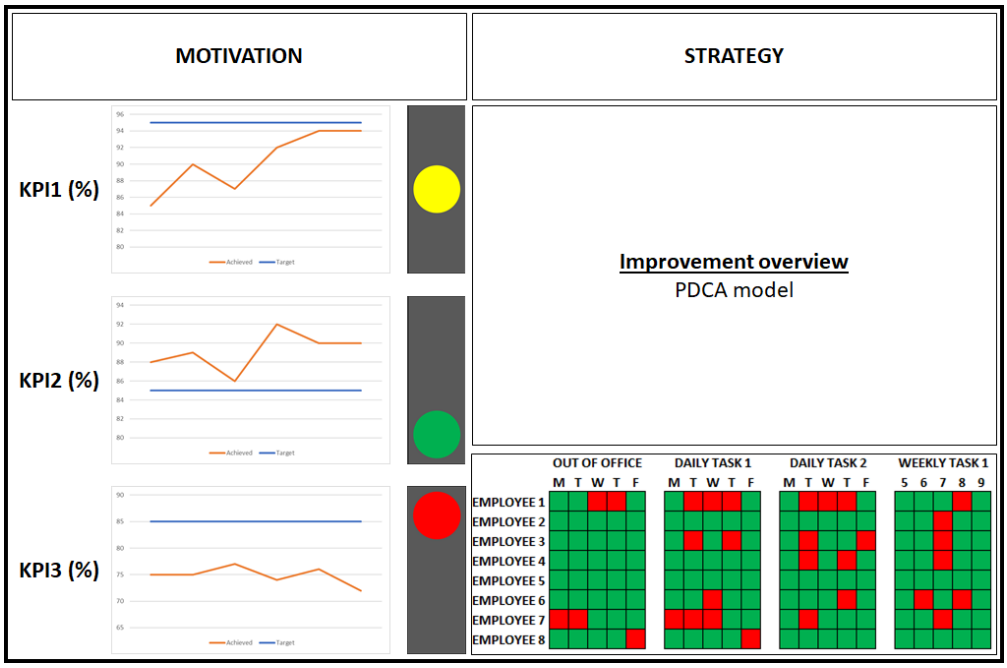

Figure 3.9. *An example of visual management board.*

Like it can be seen from the figure 3.9 above, the example visual management board can be quite simple but also informative. One can see the organization's performance at glance, because of the KPI traffic lights. The standard work part in the down-right corner informs, if employees are out of office and if they have completed their daily or weekly tasks. To find possible points for improvement, one should look at red points of standard work. For example, it should be investigated why half of the team have not completed their second daily task on Tuesday. The most important part of the visual management boards is to notice the red points or lights in the board. In these cases, something is not going according to plan. The improvement overview should be presented in a way, which is suitable for the tool used. For example, the PDCA model could be presented with percentages of each improvement. It should still be remembered, to keep everything as simple as possible.

One cannot be sure that the implementation or use of the visual management boards will succeed. Markovitz (2016) has presented three possible challenges and dangers of visual management boards. First, the organization should see problems as opportunities to fix the system, not as someone's fault. Second, Markovitz (2016) highlights the need of standard work: Employees must know their jobs. Last, the organization should know what they want to improve and how they can measure the improved process. Markovitz (2016) also states that the organization must know their ultimate goal and focus on it before focusing on any additional matters, which could create confusion. When bringing information available to everyone in the organization, the probability to detect possible issues and needs for development in processes increases (Hines et al. 2008). It is not the only positive side of the visual management boards. While Markovitz (2016) focused on challenges, Eaidgah et al. (2016) have listed 10 different pros, described in table 3.1, why VM works:

Table 3.1. *10 reasons why visual management works (Eaidgah et al. 2016).*

Pro	Description
#1	Visualization simplifies the flow of information
#2	Provides information at the point of use
#3	Empowers employees and increases participation
#4	Allows better communication and feedback
#5	Increases transparency
#6	Improves discipline
#7	Creates shared ownership
#8	Promotes management by facts and actual information
#9	Boosts morale
#10	Supports continuous improvement

A lot of presented matters are connected to transparency. When information is available, one can for example notice easier what co-workers have done or what is the status of their work. This empowers employees and adds discipline in turn. One does not want to neglect neither personal tasks nor organizational goals but to take responsibility of own performance to complete tasks and maintain processes (Eaidgah et al. 2016). In addition to this, Eaidgah et al. (2016) highlights the meaning of information flow and continuous improvement. When we see together, we can know and act together too (Hines et al. 2008).

3.4.2 Standardized work

Organizations started to pay attention to standardized work when companies started to adapt the rules of mass production. A well-known fact is that Henry Ford started the idea of standardization, but it has been modified especially by Toyota. The idea of standardization extended in Toyota to include also time, material and sequence factors. While Ford focused only on manufacturing process, Toyota paid attention to office work too. (Liker 2004)

Standardized work is based on processes and different ways of completing given tasks. Based on different working habits the manager, in co-operation with the team, should pick the best way to complete each task. (Liker 2004) Both Liker (2004) and Hines et al. (2008) emphasize the meaning of standard work while trying to obtain an environment of continuous improving. If each employee would do their job as they wish, it would not be easy to change the way of working in the organization, because the amount of different

variations would be quite vast (Hines et al. 2008). In fact, each created improvement to process would be only one more variation added to the list of how to do the task (Liker 2004). Standardization minimizes variability and uncertainty possibilities in processes (Ungan 2006). When the organization has discarded the variations and they have succeeded in stabilizing the standard work to proceed, the organization can focus on continuous improving (Liker 2004). While everyone is following the idea of standardized work, irregular matters come visible easier and persistent problems repeat themselves more often (Hines et al. 2008).

When everyone is doing things in the same way, it creates a routine for each employee (Ungan 2006; Hines et al. 2008). It should be kept in mind that although the idea of standardized work can be connected to various amount of different processes, all processes are not suitable for standardization (Ungan 2006). While analyzing processes, one should focus on classifying different processes and jobs. If the routine is missing, it is much harder or even in some cases impossible to define standards for working. (Feng & Ballard 2008) Feng & Ballard (2008) have stated that managers should focus especially on critical tasks, which have a straight effect to the organization's performance while creating the standards for different processes. If tasks are not likely to have an effect on the organization's performance, employees should find their own ways of completing those tasks. Tasks, which are between previously mentioned frames, may be important for the organization's performance. With these tasks, managers and teams should define some standards, which can be slightly modified by everyone to achieve routines. (Feng & Ballard 2008)

Standard work should not be defined to lower lever employees only, as it is also important for the leaders of the organization to know their standard work. It also adds the transparency of the leaders' work because they should follow along with their supervisors if they are able to complete the defined tasks (Mann 2010, p. 48). Based on thoughts of Mann (2010, p. 37) the closer the leader is to the employees, the more standard work should be defined. Mann (2010, p. 38) states that at least two benefits can be achieved with leader standard work. First, the possibility to keep the best practices increase, although some changes in management can appear. Second, standard work shows quickly, if the leaders are unable to make the transition to a more Lean organization. The term *gemba walk* is highlighted from Mann's (2010, pp. 41-42) plan of leaders' standard work. In general, gemba walk means that the leaders should go see the processes and interview the employees, who in fact create the value (Mann 2010, pp. 123-124). Examples, actions and instructions by leaders are emphasized, while creating a Lean culture. (Mann 2010, pp. 38-39)

3.4.3 Problem solving tool A3

The idea of the problem solving tool A3 is to keep the reported issue compact, as all information needed must fit on one side of an A3-sized paper. Like a vast number of Lean

tools, the A3 tool is also originally developed by Toyota. The A3 report consists usually of the following sectors:

- **State of the problem**
- **Current situation**
- **Root cause**
- **Alternative solutions**
- **Recommended solutions**
- **Cost-benefit analysis**
- **Recommended actions.**

Above-mentioned sectors should be described as visually as possible. The A3 tool has its roots on the Deming's PDCA model. (Liker 2004) Bassuk and Washington (2013) have stated that the majority of sectors belong to the plan stage. The planning stage is important because the root cause should always be found and the target situation of each issue when using the A3 tool described. While it is important to find the root cause and plan the needed actions, the target of the A3 is to fix the named issue and to follow if corrective actions work in practice. Like discussed previously, this maintains the environment of continuous improvement. (Bassuk and Washington 2013)

The A3 highlights the ideology of Lean, because the aim is to solve problems without waste. For example, problems should be solved only with people who are really connected to the issue (Liker 2004). This may be the reason, why organizations have realized that problem solving with the A3 tool works. Thoughts of Liker (2004) are supported by Sobek and Jimmerson (2004), who have stated that problem solving and processes improving should be done by everyone throughout the organization as long as suitable employees for each issue are involved. In addition to previously mentioned, Sobek and Jimmerson (2004) highlight the meaning of documentation. When first hand employees describe an issue, situations with highlighted irrelevant matters can be avoided. When the documentation is done well, it is also easy to use in the future. (Sobek & Jimmerson 2004)

3.4.4 Other tools and their use

As it was mentioned in the beginning of this chapter, Lean ideology includes a great number of different tools. According to Liker (2004), one cannot adapt all the tools straight from the example made by Toyota but one should find the correct tools for each situation. The table 3.2 below introduces a few Lean tools and their use in general in addition to the before-mentioned tools.

Table 3.2. *Lean tools and short description of their use.*

Tool	Description	Reference
5S	System for workplace organization. Includes following categories: Sort – Set – Shine – Standardize – Sustain. Usually one of the first tools to use.	Hines et al. (2008)
5 Why's	Tool to solve the root cause of a problem. One keeps asking why until the real root cause of the problem has been found.	Liker (2004)
Value Stream Mapping (VSM)	Tool to identify activities and stakeholders of processes. Can take into action also suppliers and customers points of view.	Abdulmalek & Rajgopal (2007) & Hines et al. (2008)

All the tools introduced in the table 3.2 share the ability to easily connect the tools to VM and visual management boards. For example, 5 Why's can be combined with the PDCA-model and turned into a funnel-model where the first intention is to solve the root cause of the problem and then find the solution for creating a new standard for the organization. VSM instead is an important tool to understand the organization's processes and activities. As it was mentioned earlier in this thesis, one can identify the value as well as the waste of the processes with VSM (Abdulmalek & Rajgopal 2007; Hines et al. 2008). While 5 Why's and VSM concentrate especially on problem solving and understanding, 5S is a good tool for organizing almost everything. In some cases, 5S means that everything organized visually well and employees keep following the example, whereas in some cases 5S can mean that computers' folders are organized well and efficiently. All in all, the main target of the 5S tool is to improve productivity. (Hines et al. 2008)

3.5 Lean in the case DC

The case DC was not very familiar with the Lean ideology until the year 2018. The implementation process of Lean started in the case DC during this thesis writing process but the decision of taking Lean into action was made on the end of 2017. Lean is seen as an ideology, which could have a major effect to the performance of the case DC. As the introduction of chapter 3 presents, Lean can be seen as an iceberg. A great amount of work with strategy, management and ideology must be completed that Lean would be visible for all. Luckily the case DC is in situation where some Lean culture has already been built without knowing that it is actually Lean. For example, the teams have used visual management boards in the daily meetings during the last years. Based on the listing

presented in chapter 3.3.1 (Kusy et al. 2015), the case DC is currently going through the stage where training and coaching are needed.

The majority of Lean tools presented in chapter 3.4 have been at least introduced in the case DC previously. Like mentioned above, the teams have used visual management boards daily for approximately two years. In addition to this, especially the procurement team has developed their way to define and complete standardized work. Where visual management boards and standardized work are still at use in the case DC, the use of A3 problem solving tool has ended completely, although it was tested with some cases in 2016. To sum it up, the Lean implementation process in the case DC can benefit a lot from the fact that some tools are already familiar for the employees. Despite the fact that the tools may be known, changing the culture, habits and old practices will probably cause resistance for change. In order for the implementation process of Lean to succeed, it is vital that the Lean planning team can explain the benefits of Lean for everyone and get the whole organization committed to it.

4. EMPIRICAL RESEARCH RESULTS

The fourth chapter presents the results of the empirical research. Empirical research was conducted with different methods but mostly interviews were used. The number of interviews, participants and style of the interviews have been introduced in chapter 1.4. The results of the empirical research have a strong effect on resolving the research problem. The subchapter 4.2 will answer the third research question about the current state of visual management boards whereas the subchapter 4.3 will provide answers to the fourth research question.

4.1 Description of the case DC

The case DC operates in spare parts business and in general the main goal is to deliver the right spare parts in the right condition to the right customer at the right time. The case DC is an entirety of four different teams whose aim is to complete different processes and tasks to achieve the previous-mentioned main goal. Figure 4.1 describes the most common relationships within the case DC, which is highlighted with blue borders.

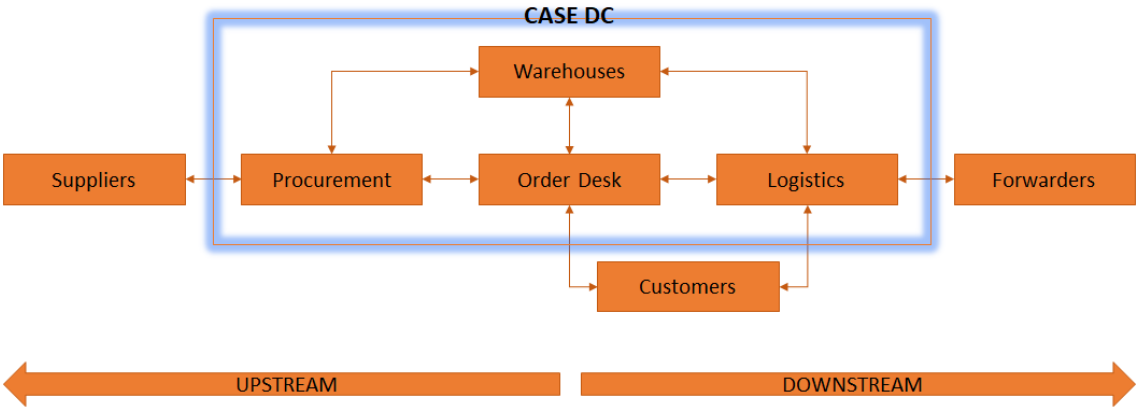

Figure 4.1. *Relationships in the case DC.*

As one can observe from figure 4.1, the teams of the case DC are in contact with the customer as well as with the partners. The teams of the case DC and a short description of their responsibilities are presented below:

- **procurement**, ensures that the upstream is in control
- **order desk**, is the main contact for the customers in order-related matters
- **logistics**, ensures that the downstream is in control
- **warehouse**, receives and sends the goods based on orders.

Procurement is the biggest team of the case DC based on the amount of team members. The team is a combination of buyers and item experts. Mostly, the tasks of procurement

are connected to upstream. They ensure that the availability of spare parts is in control and parts are available. Procurement should improve the lead time if the order desk team cannot fulfill the customer needs. The procurement is mainly communicating with suppliers as well as order desk team.

Order desk team is working in the customer interface. The team has been divided to two different sub teams based on their work assignments. Most of the employees of the team are working with order related matters: they are creating and confirming orders, monitoring that everything goes as planned and trying to ensure that the customers would get the best customer service in each situation. For employees who are working with orders the importance of reliability is notable. If one promises something, one should do the best to fulfill the promise. Instead of creating orders a minority of the order desk team is working as technical experts for spare parts. Just like the other sub team spare part experts are working in customer interface too but their tasks include mainly spare parts identifying, pricing and consulting. The entire order desk team has a lot of contacts because they are located between up- and downstream. In general, they need to be in tight contact with both procurement and logistics teams as well as the customers.

Logistics team is the smallest team of all the above-mentioned. As mentioned earlier in this thesis the main task of the logistics team in its simplicity is to ensure the reliability and functionality of the downstream. To accomplish the main task, for example the following actions are needed: booking transportations, invoicing orders, creating documents and monitoring transportations. Like the other teams, the logistics team has also a lot of contacts. Controlling the downstream means that the employees of the logistics team must communicate especially with the order desk team, customers and freight forwarders.

In addition to the core teams listed above, the case DC also has a few specialists and experts. They support the above-mentioned teams with their knowledge and help them to achieve the best possible results in different processes. In general, the specialists report to the team managers based on their special know-how and the team managers report the current state of actions to the manager of the case DC. As it has already been discussed in the beginning of this thesis, warehouse activities are not in the scope of this thesis. Still, it is important to understand that warehouses are a big part of the whole DC and its supply chain. In addition to the teams, the employees of the case DC usually have conversations with warehouse employees regarding for example receiving in- or outbound deliveries.

The performance of the case DC and teams is followed by several KPIs in different categories. Currently, the case DC has defined three main KPIs which have been listed below:

- **inbound reliability**, do the suppliers deliver spare parts in accepted time-frame
- **availability**, are the spare parts available when needed
- **outbound reliability**, are deliveries picked and packed on time.

Because the main KPIs are quite extensive the case DC has also determined some supporting KPIs, which help them for example, while trying to locate the cause of why the performance is not at the required level. A big part of the more detailed KPIs is related to the above-mentioned main KPIs but there are also indicators which are linked to safety and quality. While the previously mentioned indicators described mainly the performance of different processes, the case DC follows also its financial performance with financial indicators such as the amount of net sales and backlog. Lastly, it is also important to follow-up the volumes of the processes. Those numbers, e.g. the amount of ordered lines and sent shipments, tell quite straightforwardly the recent trend chart.

4.2 Current state analysis

As a part of the development and implementation process, it is appropriate to analyze the current state of the case DC. Because this thesis focuses especially on visual management boards, the current state of the boards was analyzed before implementing new boards. As teams are using the boards especially when having their daily meetings, opinions about the daily meetings were also asked and analyzed. This subchapter describes also the current state of the management system in the case DC.

The current state analysis of the case DC was done in two parts. As a first part a group meeting between managers was held to understand the current state of visual management and what matters are gone through in the daily meetings with current visual management boards. The second part consisted of few interviews on both managerial level and employee level. All perceptions from the interviews as well as from the group meeting have been gathered together to below subchapters based on their topic. The author's own observations are also brought up. It is to be noted, that the quotations introduced in the below subchapters as well as the appendix A are translated from Finnish to English because the interviews were held in Finnish.

4.2.1 Management system

While the chapter 4.1 described the case DC and different teams of it, the main target of this subchapter is to dive in a bit deeper to the management system of the case DC. The manager of the logistics team changed during the thesis writing process and because of that there were challenges to interview the new manager of the logistics team. The new manager was able to attend some group meetings so all in all it was possible to hear her opinion too. As warehouse operations is not in the scope of this thesis, the warehouse manager of the case DC was not interviewed in a separate interview, but he attended the group meetings. The team managers experienced that their focus is to lead their teams. Although the focus of the managers was the leadership of people, the managers lead also processes and partners of the case DC.

All interviewed managers highlighted the meaning of good people management. In general, the case DC works in a way that the team members are in charge of their own suppliers or customers.

> *"The main focus is leading the people because if I lead only the process and I don't lead people I don't have people to do the process and if they are led badly they don't want to work for me."*

Team managers assist employees usually only in special cases or when assistance is needed. In addition to this, team managers take care of daily leadership: they need to ensure that the main goal, serving the customer in the best possible way, is fulfilled.

> *"I try to get our main goal achieved in a way that people are doing well. We have the needed resources and tools to do it and I enable their working that we can do what we must do, serve the customers in the best possible way."*

The difference between terms manager and leader were also talked during the interviews. Although the title is manager, interviewed managers want to be leaders.

> *"I lead employees with my own personality which means being a person close to all employees."*

While leading people is vital, one should not forget the meaning of leading the process and the whole supply chain. Each team manager has an own process to lead whereas the manager of the case DC leads the whole supply chain of the case DC.

> *"Process is an entirety and it includes defined supply chain, partners, teams and resources which are doing specific tasks."*

> *"The aim of the leadership is to reach the planned objectives and see what is wrong and what can be fixed in a precise level."*

The interviews showed that the managers really trust and believe their teams. As it has been previously introduced, managers assist their teams usually only in special cases. In general, this means that team members are doing the actual process. Also, special know-how in the teams was seen as an important sub factor while leading the process; the managers received support from their teams. If corrective actions or assistance are needed, team members should keep their manager updated. On the other hand, processes are also led by visual management boards and KPIs. Those tools create a possibility to compare the performance of for example, different weeks and quarters and share information about the partners. However, it must be taken into account that in addition team-specific visual management boards and KPI follow-up board, the case DC do not have another visual management boards for continuous use.

4.2.2 Daily meetings

All of the teams in the scope of this thesis; procurement, order desk and logistics, are using visual management boards especially in daily meetings. Because the meetings bring teams together the interviews for this thesis could not have been conducted only for managers, but the team members needed to get involved too. This is because it allowed the author to get an overview of the daily meetings as well as the visual management boards. Keeping everyone updated about the current performance is easy with the daily meetings. In addition to this, daily meetings offer possibilities to discuss and share information about work-related issues regularly.

> *"We used to have monthly meetings - - compared to that daily meetings are better for example when talking about information sharing."*

Teams have reserved a time-frame of fifteen minutes every day, when they get together to have the daily meeting. Participants almost in every interview mentioned that daily meetings are useful.

> *"Short daily meetings are good. Decreases the number of official meetings."*

Commonly it can be said that teams stayed on their 15-minute time-frame. Like Mann (2010, p. 87) stated, 15 minutes should be enough for a daily meeting. Based on the interviews, the attitude towards daily meetings is positive. However, the interviewees mentioned issues, which should be improved.

> *"We should have more information from the grass-roots."*

> *"I like the structure of daily meetings which are being held on Wednesdays, Thursdays and Fridays but there should be more content on Mondays and Tuesdays too."*

> *"We are not necessarily always reaching the point of matters."*

Interviews and author's own observations revealed that there are big differences, for example with agendas between teams. One should also note that the situation is not ideal if the team members do not share information during the daily meetings.

> *"I would like to add more process controlling and results orientation. And also monitoring, why are we having these meetings - more results, root cause analysis and continuous improvement."*

> *"It is good that we have daily meetings but as I have led those meetings for a while, I'm irritated that I don't get people to participate to conversations."*

Although there were some matters to develop in the case DC, the daily meetings were seen mostly as useful. In addition to this, the daily meeting culture supports the ideology of Lean (Mann 2010, p. 85).

> *"All in all, we have to do slight improvements but we have a good basis already."*

It is notable that every team in the case DC have their own daily meeting but neither managers nor different teams have daily meeting together. Participants of an interview mentioned that information sharing could be easier if team members would participate to daily meetings of other teams at least sometimes.

4.2.3 Procurement's board

Procurement team has an entire board for their use. It turned out that the interviewed people saw their board as informative, visual and clear compared to other boards. Figure 4.2 describes the current state of the procurement team's visual management board.

> *"If someone from the other teams would read our board I would say that it should be easy to figure out the current state of procurement."*

> *"We don't have any space to add more sectors."*

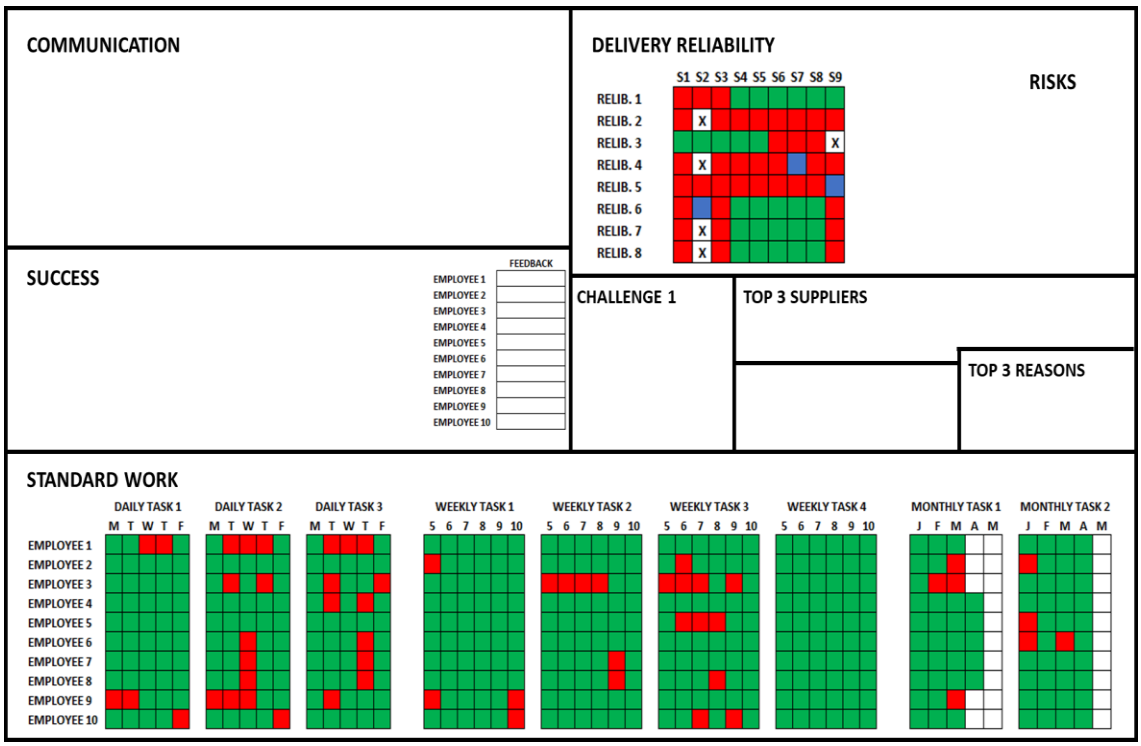

Figure 4.2. *Visual management board of procurement team in the current state.*

Communication, success and feedback sectors have such similar meanings in all the boards if applicable. The communication sector seems to be challenging because keeping it up-to-date is not easy. The biggest reason for the challenge is the difference between

stated matters: Sometimes one must inform about deadlines which may be far ahead while sometimes the communication sector has a note for example, stating about a system issue, which needs to be fixed.

> *"The communication sector is important, because we can have a lot of remote work weekly. Sums up a lot of information"*

> *"I cannot manage it (the communication sector) sensibly even by myself."*

The procurement team has a few special themed daily meetings during the week. According to Mann (2010, p. 89) themed daily meetings can be arranged, although the clear agenda should be obeyed. On Fridays the theme of the daily meeting is positivity. All positive matters and successes are handled at that time. Each team member must say one positive matter, which has happened during the week. Positive matters and successes have a specialized sector on the visual management board.

> *"Positive Friday irritates a bit because I can't figure out anything."*

The themes for the daily meetings continue on Thursday when the theme is inbound delivery reliability. Delivery reliability is connected directly to the case DC's KPIs. The goal of the table assigned for delivery reliability in the visual management board is to observe challenges and try to find solutions to improve processes continuously. One of procurement team's tasks is to focus on a group of selected suppliers for seven weeks at a time. This is done because the team has noted some deviations in the processes with those suppliers.

> *"The selected suppliers are not the worst suppliers but there may be risks in their actions."*

> *"Writing the names of suppliers on paper beforehand is not the best way of working. It is hard to add new supplier if some changes in performance appears."*

One should also not forget the meaning of the risks sector on the top-right corner. It is the place for the team members to inform about possible issues, which could affect the entire case DC's performance.

> *"The risks sector could be more visual."*

> *"The risks sector has been added this year, because we did not have enough space for actions sector. The sector is a simplified version and the purpose is to widen the sector to real action sector."*

The sectors; Challenge 1, top 3 suppliers and top 3 reasons are all linked together. The information sector of the challenge 1 keeps everyone updated about the amounts and percentages. Top 3 suppliers simply tell, which suppliers have performed the worst compared

to standards. Top 3 reasons instead tell the reasons for bad performance. The challenge 1 based daily meeting is held on Wednesdays.

> *"I think that we have a good focus on suppliers and their performance."*

> *"I don't like the challenge 1 box because there is too much information in such small space. Everything is also written by hand."*

Procurement team members have a vast amount of standard work to do daily, weekly and monthly. In general, the information received from the standard work sector remains the same even though the task should be completed in any time-frame: if the task is completed, a green magnet is used and if not, a red magnet.

> *"Standard work is a good tool for all of us to remember what to do. Especially the weekly standard work helps a lot."*

> *"We could have even more standard work. For example, maybe monthly standard work about the quality of the data might be essential for all."*

> *"There should be a possibility to add more standard work in some period."*

According to the first group meeting if the number of red magnets is increasing, the team manager should react. One way of reacting is to have a conversation with the employee who is not able to complete their own responsibilities.

> *"Sometimes it feels unnecessary to fill the daily standard work as those are tasks which we have to do anyway. On the other hand, our manager can see easily what is our workload and she can react if needed."*

> *"On the other hand, the standard work is kind of magnet monster but it gives a lot of information for the manager."*

Compared to the other boards of the case DC the visual management board of the procurement team is clearly the most visual one. Also, the interviewed people see their board as visual and informative. It turned out that the team has developed their visual management board during the years together. As a result of the team's innovations, there is a small sector for claims in a different board for procurement team's use only. Because the claims sector is small and it is on the different board, it is not described in figure 4.2. Despite the positive observations mentioned above, the manager and the interviewed team members mentioned also some weaknesses. The lack of space may be even the biggest weakness of the board because based on interviews it has already limited possible improvement actions.

4.2.4 Order desk's board

The order desk team and the logistics team have only one board to share for the use of both teams. The main reason for this is lack of space. The order desk's current visual management board is introduced in figure 4.3.

> *"Well maybe the board is clear and simple. But I also think that the board has something useless and something to add."*

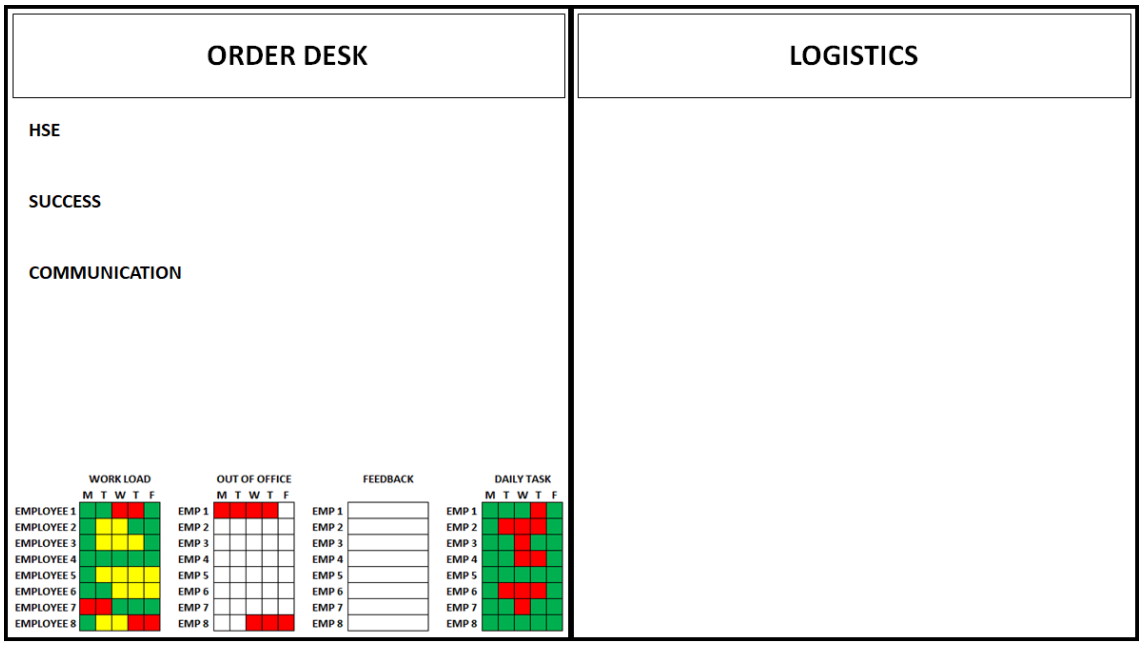

Figure 4.3. *The visual management board of order desk team in the current state.*

Like it can be seen from figure 4.3, the current state of the visual management board is not that visual. The visual parts of the current board are from the process point of view quite unnecessary because three of four visual sectors focus on employees. On the other hand, knowledge of the employees and of their jobs is a big part of operational work. Therefore, understanding the status of team members is important.

According to a meeting held for this thesis, HSE matters are mentioned on the board because the company emphasizes the meaning of HSE values. If something unusual happens, it should be reported on the board. The meaning of the success sector is to add motivation and increase the well-being of the employees. It turned out that both sectors, HSE and success, could be done in a better way or even remove them from the visual management board.

> *"In some way it is frustrating to have these both (HSE and success) on the board because both are usually empty."*

> *"Good that both are on the board but there could be some other way to present these."*

The most important aim of the communication sector is to decrease the amount of emails. The employees of the entire case DC receive a huge amount of emails daily. Because of that reason the communication sector is a good way to inform for example about incoming deadlines and training sessions, which could easily get lost in the inbox.

> *"There is so much information in the communication sector that it is not easy to find the relevant matters."*

> *"I should figure out the best way to inform the team without thinking about it (what to write) too much. I hope that common communication between team and manager would increase and team members would bring their matters more and more to the board as well as to the communication sector."*

While both the work load and out of office information concentrate especially on planning the resources for operational work, the feedback sector is another way of motivating employees. The presented feedback is always positive and anonymous.

> *"We should know better what different magnets mean in the work load sector. There should be standards for everyone on how to define personal workload."*

> *"I have not used the out of office information ever. I have not even put my own out of office days to the table. It is much easier to check the information from SharePoint."*

> *"If we want to keep the feedback sector on the visual management board, it should be in each teams' boards. Then it should be easier to give positive feedback."*

Last sector of the order desk's board, the daily task, is the most important one for a succeeded process. The specified daily task has almost a direct effect on the case DC's KPIs. If standard work is not done, the possibility to receive worse KPIs increases. The idea of the sector is the same with procurement's board: green magnet indicates that task is done while red magnet indicates undone standard work.

> *"In some way I would like to have more standard work as the current daily task is working very well."*

Based on the comments said in the interviews, the board is seen all in all as an informative one. Both the manager and the interviewed team members highlighted that the board has a lot of weaknesses but the team has not had enough time or ideas to fix the issues and develop a better visual management board.

4.2.5 Logistics' board

Like it was mentioned in chapter 4.2.4, the order desk team and the logistics team are forced to use the same board. Figure 4.4 introduces the visual management board of the logistics team.

> *"The current visual management board is too small. If we want to develop our board and add for example more standard work, we would need more space."*

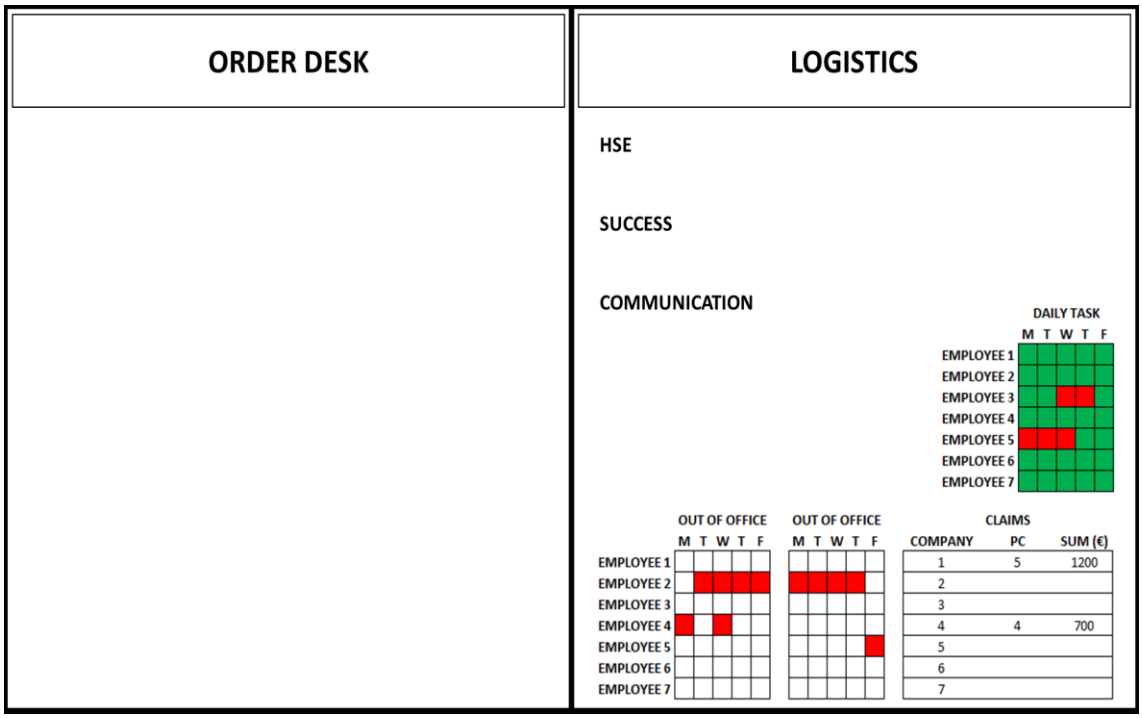

Figure 4.4. *The visual management board of the logistics team today.*

The board of the logistics team has many sectors in common with the order desk's board. The board is not that visual and in addition, two of three visual sectors focus on out of office information. The most important observation is that in general, there is not more than one visual sector for process: the daily task.

Upper three sectors on the board; HSE, success and communication have basically the same meaning than in the order desk's board. The former manager of the logistics team mentioned in the meeting that it is not that easy to find out success factors because employees are usually focusing only on big successes, although sometimes small successes would be good to tell too.

> *"Usually no one wants to say anything to HSE and success matters."*

The last parts of the logistics board have something in common with the order desk's board but also some slight differences. For example, the logistics team has an out of office information for two weeks.

"Having the out of office sector for two weeks is a good one. One can see easily if someone is away or doing remote work."

The claim sector relates to the company's targets for quality costs. If there is a mark in the claim sector, it is a sign of an issue. The logistics team currently has only one daily task to do as a standard work. It does not have a straight affect to the case DC's KPIs, but it indicates how fast the customers receives their orders and increases the performance of warehouses.

"No one is really updating the claim sector. I'm sure that some claims are made but if there are no updates on the visual management board, is this sector useless?"

"In my opinion standard work should play a big role in the future visual management board of the logistics team."

The interview and the analysis revealed clear weaknesses from the logistics team's board. The interviewed employees have good ideas on how to develop the board but for example, the lack of space creates its challenges. In addition to this, clear standards between the team, for example how to prepare for daily meetings, should be determined to get the best out of the visual management board.

4.2.6 Summarizing the current state

The current state analysis of the case DC was an interesting task which clarified many different matters of the case DC's management system, daily meetings and visual management boards. As it has been introduced already in chapter 4.2.3, the current state of procurement's visual management board is the best compared to the other boards. The board has some tools, for example the tool for inbound reliability, which supports the ideology of Lean. If the reliability is not satisfying, the responsible should do needed actions and seek perfection, which is one of the Lean principles (Lean Enterprise Institute 2018b). Although the visual management boards of the order desk and logistics team are quite similar, those boards do not support the Lean ideology in the best way possible. For example, one cannot find the idea or tool for continuous improvement. Eaidgah et al. (2016) have stated that visualization of continuous improvement is one of the reasons why visual management works. One should also notice that the interviews gave many good ideas and opinions of the current state. The team members and the managers identify also a lot of waste from the visual management boards.

Where the research problem is especially focused on visual management boards, the research questions gave a possibility to identify also other challenges of the case DC. The interviews and observations revealed that the communication in the case DC, for example between the teams, could be more transparent. It is strongly in contact with the visual

management boards because if all boards would be visual, informative and easy to understand it would be easier to receive the needed information. The theory of daily management introduced the concept of three level daily meetings: one with team (level 1), one with all team leaders (level 2) and one with top management (level 3) (Mann 2010, p. 86). Now the case DC holds only level 1 daily meetings. It may create some challenges, as the daily information flow between different teams is not ensured. If level 2 or even level 3 daily meetings would be arranged, the team managers as well the case DC manager could have a better view of the whole supply chain and processes. This would also support the idea of continuous improvement, as development ideas and process issues would come out easier. All the managers and teams would be more aware of possible challenges and planned improvements because of shared communication.

4.3 Understanding the needs for visual management boards

The chapter 4.3 focuses especially on visual management boards and the changing needs of different teams. The three teams; procurement, order desk and logistics have all their differences with their processes and needs of information during the daily meetings. One of the most important matters is to identify all differences between teams for the visual management boards to be as useful as possible for all teams, team members and managers. Identifying the good practices from the current visual management boards may also help to figure out the possible needs of each team. Being an international company creates its own possibilities and therefore the company's expectations and a way of working have also been introduced.

4.3.1 Company guidelines

Like it has already been mentioned, the case DC is a part of a company, which operates worldwide. For all departments and DC's worldwide to do matters preferably in similar ways, the company has arranged international events where it is possible to get some information from professionals and also share opinions with colleagues from different countries. During the thesis writing process, the author attended one of these events, e.g. to get some more information about the implementation of visual management boards and company guidelines regarding visual management boards.

Because the company has a lot of good examples of implementing visual management boards to different business areas, the event gave multiple new perspectives on both the implementation process and the development process. Inside the company, implementation of visual management is seen as one of the first steps while taking steps towards a Leaner culture. While developing the visual management boards, a good knowledge of processes is needed. That may be the biggest reason, why it should be necessary to interview both managers and team members. The team manager should know a lot about the different processes but the team members can bring different insights on the subject.

When combining both viewpoints, it should be possible to reach the best result with the visual management boards.

According to different experiences, the company guidelines highlight especially two principles: 1-3-10 rule and boxed symbols. The 1-3-10 rule emphasizes the meaning of simplicity:

- **in 1 second:** possible to figure out the status of performance
- **in 3 seconds:** possible to find out the causes of undesirable performance
- **in 10 seconds:** possible to find out the corrective actions made

As discussed previously in the theory chapters, the aim of the visual management boards is that an organization's performance could be seen at a glance (Eaidgah et al. 2016). When following the 1-3-10 rule, the organization's performance should be possible to see at a glance because it should take only 14 seconds to figure out everything needed. Of course, the understanding of processes as well as reasons, what really effects on the performance, must be known beforehand to get the real benefits of the visual management boards. With the 1-3-10 rule the possibilities to achieve the potential of the visual management boards increase. The boards must be visual, interesting and easy to read. When following the visual management boards created based on the 1-3-10 rule, it should be even possible to create a clear agenda for the daily meetings.

The boxed symbols support the 1-3-10 rule as the basic idea of the symbols is to observe quickly if there has been something unusual in the measured area. The meaning of each box inside the symbol is to describe one day of the month: if the box has been colored as green, everything is ok whereas if the box is red, there has been a deviation of standards. Figure 4.5 shows the basic idea of boxed symbols.

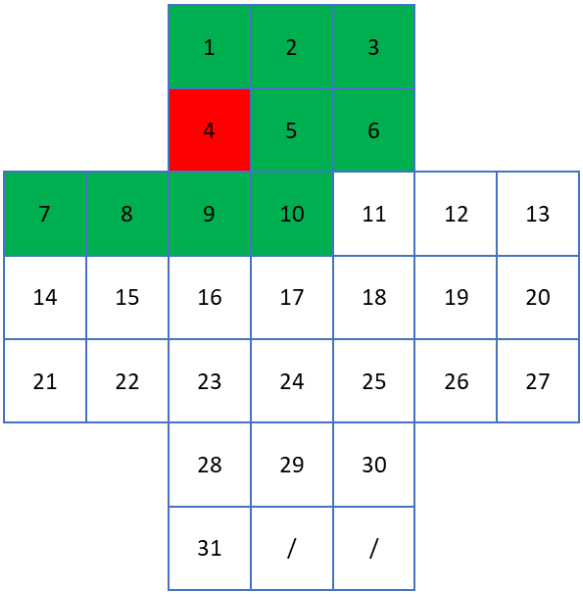

Figure 4.5. *HSE cross based on boxed symbols principle.*

Figure 4.5 states clearly that it is the 11th day of the month and the performance in the HSE sector has been quite good. Because there is a red box on the 4th day of the month, it is easy to see that a HSE issue has happened, which has been marked correctly to the HSE cross. The HSE cross is not the only example of the boxed symbols because for example a boxed R could be a measure for reliability compared to its target.

The HSE and quality matters and the successfulness in those sectors are emphasized by the company policy. Both words are also mentioned in the company strategy. In general, the practice through the company is that every meeting should begin with the HSE and quality matters.

When comparing figures 4.2 - 4.4 to the company guidelines, one can easily notice that the current situation mostly does not match with the guidelines. The visual management board of the procurement team is the best example of all boards currently in the case DC in comparison to the company guidelines. It has the clearest idea of color-coding and problem-solving but still procurement's board does not fulfill the 1-3-10 rule. Seeing the actual status of the procurement team's performance in one second is quite difficult. Both order desk's and logistics' boards are based mainly on communication throughout the team. Both boards have some visualization but as with procurement's board, especially figuring out the current state of the team's performance in one second is hard. One should also note that both boards are focused mainly on resourcing and motivating the team members and do not pay much attention to processes or possible deviations. Instead, especially HSE matters have a big space in two of three boards, although the execution is not the best in the current state.

4.3.2 Case DC manager

From the current visual management boards, the case DC manager emphasizes the meaning of leading people and listing successes. People management in visual management boards is an easy way to raise conversations. It also tells the current situation of the whole teams' workload. Positive matters and successes challenge employees to change both the culture of the whole case DC as well as their mindset. There should always be time to focus on successes. For example, the workplace well-being could improve if positive matters were concentrated more on during a hectic working day. In addition to the above-mentioned, the case DC manager finds that all boards should be fairly similar to each other. It would be easier to figure out for example, the performance of each team if all boards would have a similar concept and e.g. a team based KPI.

Continuous improvement is an important factor in the Lean ideology (Hines et al. 2008). It came out multiple times during the interview with the case DC manager that the space reserved for continuous improvement should be large enough. This would increase traceability, whereupon all employees of the case DC would be more aware of the current situation and the development actions. The case DC manager reminded that even though

the development actions would stand out easily, continuous improvement is still related also to the team's performance and results. If the teams would have determined actions on how to increase their performance, it should be possible to keep track on if agreed actions lead to desirable results. When necessary, there should be a path for escalation too. From the case DC manager's point of view, focusing only on different teams and their improvement should not be the only way to describe continuous improvement: The case DC should also pay attention to their supply chain. Commonly there are a lot of different developments, actions and strategic projects which may affect to the performance of the whole supply chain.

Based on the case DC manager's opinions, processes and especially process deviations should be visible in all visual management boards. As there are clear processes for each team, deviations from standards should be stated clearly. The case DC manager emphasizes that whenever a deviation appears, there should always be some actions. However, actions do not mean that there is always a need for developments or big process changes, but it is vital to react and notice the deviations from standards. Each team of the case DC have described at least some of their standard work. For example, uncompleted daily standard work is a deviation from standard. Computer and system issues are also deviations from standards. Continuous improvement is dependent of deviations: if there are not any deviations, the process seems to be perfect. Otherwise, there is always a need for continuous improvement. The case DC manager wants that deviations and process issues would come up in visual management boards to highlight the meaning of continuous improvement.

The scope of a visual management board is certainly wide, and boards can include multiple tools, follow-ups and actions. One of the most important concerns was the definition of factors in the visual management board. A clear agenda for daily meetings could be built around the visual management board. For example, the case DC manager mentioned that every meeting could start with going through yesterday's team KPIs. The same definition is also valid for standard work. The case DC manager mentioned that standard work could also be applied to leaders. The important matter is not only to do the task but also complete the needed actions and react if needed, based on the standard task. The case DC manager stated that a good visual management board would be of course as visual as possible, include some continuous improvement as well as successes and it would be tied up to the strategy of the case DC and the whole organization. The manager also mentioned that a good example of visualization is the sector of delivery reliability from procurement team's board.

4.3.3 Procurement

While analyzing the interviews of the procurement team members and the manager, it was visible that the overall picture of the current visual management board is positive. The current board is seen as informative, visual and successful. The standard work and

especially the weekly tasks, communication and delivery reliability sectors were experienced as practical. The success sector and some of the daily standard work did not get a full agreement from all people who were interviewed.

Although the communication sector was seen as an informative and important sector, based on interviews, the use of the sector is not standardized. The communication sector could include different matters from minor information to process developments or vital training sessions. The confusion in communication sector is partly explained by the lack of actions or continuous improvement sectors which both were also mentioned in the interviews. Although some risks are mentioned in the board, the risks sector does not cover the needed actions or even describe the risks clearly. From the actions point of view one specified improvement action came out during the interviews. If the boards would include some KPI-number, it could be easier to figure out actions based on KPIs and lead the development process. The manager of the procurement team told that nowadays the KPIs are only shown for the team members and actions are not usually driven by the performance of KPIs.

Also, some other improvement ideas were found from the current visual management board (figure 4.2.). One of those was connected to the challenge section, which could be more visual. Currently the challenge sector is full of hand-written text. The delivery reliability sector was seen commonly as one of the best sectors in all boards of the case DC. However, it came out in the interviews that the seven weeks' time-period in the sector may be too long. Because the sector is built on A3 sheets, team members cannot make any changes to chosen suppliers during the following-up period although there might be a need to follow a different supplier closer. If the visual management board would have some clear sector for actions, it could be also easier to figure out actions based on delivery reliability sector.

Besides the current board, especially the interviewed team members enquired, if it would be possible to build a monitoring tool for the workload. From the team members' point of view, it might be interesting to find out how time is spent compared to how it should be spent. Both the team manager and the team members told that the standard work sector does not describe the actual workload. However, in some specific situations the sector could give a sign to the team manager that someone's workload is too big. The percentage of availability from suppliers and total volume got also some attention in the interviews. The interviewed team members also mentioned that in order to avoid unnecessary tasks, process changes and together agreed matters should be informed better in the visual management board.

Overall, the interviewed people from the procurement team saw that the current visual management board serves the supplier and the team's own needs quite well. The team is kept updated about challenges e.g. while taking goods to stock. In addition to previously-mentioned, the risk and delivery reliability sectors pay attention to the performance of

different suppliers. In the best possible scenario, the interviewed people hoped that the board would be informative and had a clear structure. This is fulfilled quite well with the current visual management board too.

4.3.4 Order desk

As discussed already in chapter 4.2.4, the current visual management board of the order desk team is not seen as a complete success story. Although there are a lot of improvement actions needed, the interviewed team members and team manager found out also some good practices. One of those was the workload sector. It was seen as especially practical if all team members described honestly their situation with their workload. The team manager told, that it is quite easy to react to different situations, because the team members are helpful to each other. Another good sector, which came out during the interviews, was the standard work sector and the actual standard work. Adding the standard work was also seen as important for new visual management board. Both team members and the manager would like to have more standard work, e.g. with the situation of open purchase orders.

Based on the interviews, the order desk team shares the same issue with the communication sector than the procurement team. The communication sector was seen as an important factor for daily work and information sharing. However, the topics and messages described on the communication sector must stay in line. At the moment, the communication sector was seen as a bit confusing because the highlighted topics could be everything from crucial actions to case DC's basic information. The structure of the topics plays a significant role and it would be important, on the basis of the interviews, that for example actions would have their own sector.

During the interviews it was shown that the interviewees had some clear visions about the needs for the future visual management board. Multiple ideas had a direct link to customers and following-up the performance of the case DC to a certain customer. Every team member could for example pick one customer out of their own field and follow-up the reliability of outbound deliveries of that customer more closely. According to some comments, the outbound delivery reliability could be presented with the same kind of format than the procurement team is monitoring their delivery reliability. The format like this could also support the work of logistics team as it would be possible to see if the same customer has always some reliability issues. Another idea was related to big customer orders. To monitor big orders, either from financial or the amount of lines point of view, the biggest orders could be highlighted on the visual management board. While ensuring that everything goes as expected and possible issues could be excluded, the team could learn from different cases or challenges with orders during the order-to-delivery process. The idea would also support the culture of continuous improvement because if necessary, corrective actions could be completed. Based on the interviews, paying attention to different customers and their orders would serve the benefit of the whole team. The other

team members would also find out some interesting facts and tricks from other than their own customers. The interviewees also mentioned that reacting from the basis of customer satisfaction should be considered.

Although the case DC is having weekly KPI meetings, the order desk manager would like to have some KPI on the daily visual management board. As the weekly KPI meeting is not mandatory for customer service representatives, having the KPI on the daily visual management board would increase the awareness of the targets. From other teams' point of view the KPI would describe quite easily the current status of the team's performance. If the team would pay attention to specified KPI every day, the habit could create the basis at least for some agenda to the daily meetings as well.

The interviews gave a lot of good ideas where to focus while developing the new visual management board. In addition to all above-mentioned needs, the interviewees talked also about the continuous improvement from a different point of view. If the main focus of continuous improvement and PDCA-cycle is to create new standards and better ways to work, one should also pay attention to previous actions and cases. If same mistakes or process errors happens over and over again, although the issue has been solved once, something is not working as it should. From the learning point of view documentation acts a big role because then one can see if correct actions have been done and unnecessary work can be avoided. The previously-mentioned is also connected to the tools of problem solving. All in all, the interviewees hope that the new visual management board is clear and informative, and the board itself motivates employees to use it.

4.3.5 Logistics

Shortage of the information from the grass roots was one of the first comments during the interview with the logistics team members. The visual management board of the logistics team was seen as empty and small. As the interviewee said, the board includes too much so called soft values, e.g. success. The logistics team is also missing the real and hard data of their work. Although the situation is not the most optimal with the logistics team board, the interviewees told that the current daily task is working well and out of office listing can be seen as a habit, which is also working well. After these, the interviewees stated a long list of needs to ease the work of the team manager and members as well as increase the team's overall performance.

In general, the logistics team has many areas, which should be described better in the visual management board. One of those is the need for broader standard work. As mentioned above, the interviewees have seen the first part of standard work as useful while for example monitoring the workload of each team member. Based on the interview, the implementing process of standard work is not the easiest task, as team members should absorb all specified tasks as a part of their daily, weekly or monthly habits. One should

also keep in mind that one of the main meanings of the standard work is to improve the customer satisfaction and ease the monitoring of completed tasks (Feng & Ballard 2008).

Continuous improvement is seen as a needed sector in the future state of the logistics team's visual management board. The interviewees highlighted for example, the meaning of analyzing biggest delayed shipments or IT-issues. In addition to continuous improvement from case DC's point of view, analyzing would send a message about learning and caring to the customer and highlight the customer service attitude. According to the interviewees, the logistics coordinators are in a tricky situation with some courier and road shipments. The customer may know the actual status of specified shipment better. In order to avoid annoying situations, the data presented in the visual management board could also inform team members more proactively according to the comments of the interview.

The case DC is usually led with different KPIs. For logistics team it creates an issue because currently there are not clear KPIs to measure the logistics team's performance. It may create some confusion with possibilities to have an impact – if the team's performance is not measured, it is no possible to see differences in performances between different days, weeks or even years. The interviewees told that there should be a KPI for the logistics team in the near future but in addition to that the interviewees suggested also some other possibilities. One of those could be a booking indicator: it would tell if deliveries have been booked within the correct timeframe. The indicator would at least increase the concreteness of logistics team work and create a clear target for all team members.

The logistics team's visual management board creates clearly its own issues for the leading of the whole logistics team. Based on the interview, the culture of the daily meetings is not the most efficient. One example of inefficiency is that the team members are not prepared when the daily meeting begins. As it was mentioned during the other interviews too, the visual management board could, and it should, create an agenda for the daily meeting. In addition to previously-mentioned, the interviewees hoped that the visual management board would activate team members to use the board also during the work day, not only on the daily meetings.

Overall the interview revealed many needs, which could ease the normal day of the case DC's logistics coordinator. To figure out the workload of each team member, a table for workload was also seen as a potential sector on the interviews. All in all, the interviewees highlighted that the values of the company, e.g. quality must also have their own sector. In the best possible scenario the visual management board would be visual, concrete and readable.

5. DISCUSSION

The fifth chapter sums up the theories and the empirical results of the thesis. The thesis writing process gave a lot of ideas and improvement suggestions, which could be accomplished either in short-term or long-term. The actions have been divided to short- or long-term especially based on the interviews and current situation. The most important part of the discussion chapter is answering to the research problem: "**What kind of visual management boards can be used to develop the management of the case DC towards a Leaner ideology?"**.

5.1 Short-term improvements

The concept of short-term is sometimes hard to define. In this thesis short-term means that the improvement actions are already in process or those actions should be started at least within the next six months. Short-term improvements are connected specially to visual management boards and daily meetings.

5.1.1 Daily visual management boards

It has been mentioned multiple times in this thesis that the visual management boards are a big part of each teams' daily work in the case DC. The boards are used mainly during the daily meetings. The interviews implicated that the concept of daily meetings is working but the current status of the teams' visual management boards is remarkably different. As one of the solutions to the research problem, a model for daily visual management board was generated. The created model is a result of both, theoretical and empirical research. From theoretical point of view, attention was drawn to the fact that an overload of information may cause confusion on what to do (Viana et al. 2014). Because the basic idea of visual management board is for example to support teams' performance and increase the traceability, the model is mostly based on empirical results. Figure 5.1 describes this created model, which supports Lean ideology and drives the case DC towards a Leaner ideology.

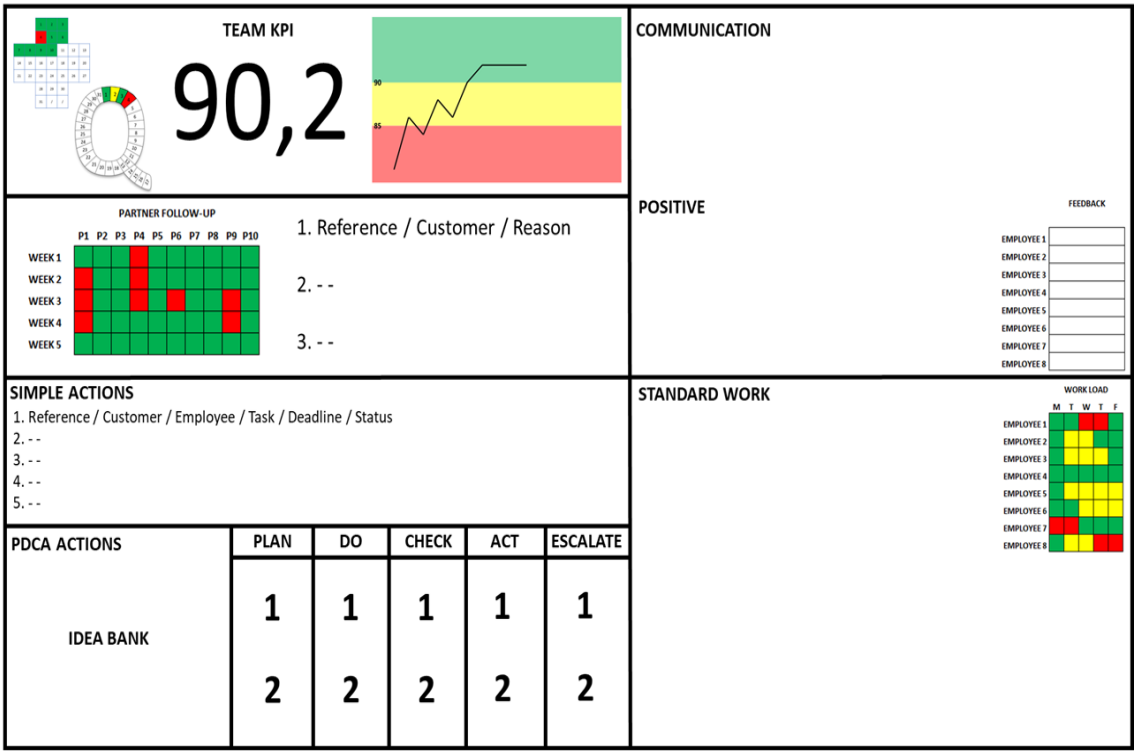

Figure 5.1. *The model for daily visual management board.*

Figure 5.1 shows that the model follows the company guidelines regarding the layout of the visual management board. The left side of the board completes the 1-3-10 rule: top-left corner shows the status of each team in one second. The sector under it fulfills the three seconds rule; it should be possible to see the possible reasons in three seconds. The two sectors on the bottom-left corner; simple and PDCA actions, tell the actions for different issues in ten seconds. Because the 1-3-10 -rule is eventually a guideline the right side of the model does not support the rule. It was brought up during the interviews that the right-side sectors were seen as important or at least they should be seen as important sectors. The right side of the model serves also a possibility to modify the table if for example different DCs want to focus on different matters. The next chapters will explain the meaning and the use of each sector.

Boxed symbols in the top-left corner illustrate the HSE (cross) and quality (letter Q) issues inside the case DC. Both are mentioned in the board mainly because of the company strategy. The use of the HSE cross was explained in chapter 4.3.1. The Q-letter is filled mainly based on the same rules: if claims have been created, the daily box will be colored as red, while a day without a claim is described with a green daily box. The only clear difference to HSE cross is the yellow color in the daily box. The teams can define themselves if the yellow color indicates for example a deviation in some process or if the number of claims is not over the permitted line. The basic idea of the whole Q-letter is to highlight the meaning of all kinds of quality issues or standard deviations.

The one second sector in the model includes also a team performance based KPI, which was mentioned as a need in almost every interview. Showing the performance at a glance supports Lean ideology as according to Eaidgah et al. (2016), well developed visual management boards bring the right information to the right people at the right time. Because the KPI varies between the teams, an overall picture of the case DC could be observed with an assistance of the KPIs. Automated daily updates in systems guarantee that the used data is always up-to-date and reliable. The KPI could be seen as hard data and within the KPI it should be easier to lead the teams with actual knowledge. During the thesis writing process different comments and availability of data have brought up that the team KPIs could be e.g. validity of open purchase or sales orders as well as reliability of forwarders' performance. A traffic light based daily trend chart describes the current and the past situation of each teams' KPI. If a black marker is used, the drawn line points out clearly and shows if the team is on target (green sector), nearby the target (yellow sector) or far away from target (red sector) with their team KPI. Although the traffic light colors are the wrong side up in the trend chart, teams should still react in same way as it was introduced in figure 3.8. If the current status is on the red sector, immediate actions would be needed while in the yellow sector teams should only be aware of possible actions. The green sector is the best of all sectors as the team is on their target with the team KPI. While the trend chart easily describes the status in a longer scope, it can also reveal some unevenness, which is one of the most vital concerns in the Lean ideology (Hines et al. 2008). A big range and changes between different days could describe that something is wrong with the process, although good results are achieved somedays.

In the three second sector of the visual management board model, one can find sectors for partner performance follow-up and orders to be considered. Based on both the results of the interviews and the procurement team's inbound delivery reliability tool the partner follow-up tool was developed. The follow-up tool is used with quite similar principles than the procurement's tool for suppliers. Based on either hard data (e.g. KPIs) or the thoughts of the team members (e.g. emails), the box should be colored as green or red depending the performance of partner. With the tool it is possible to track for example the outbound reliability for a specified customer or the performance of a logistics partner as the use of the tool is multipurposed. According to the comments of the procurement team the time-scope for the follow-up tool is a maximum of one month. In that case, one can change the follow-up partners more often if needed.

The three second sector focuses especially on reasons and how it would be possible to increase the performance. As Liker (2004) and Hines et al. (2008) have stated, striving for perfection is one of the principles of Lean. That is why it is relevant to figure out what can be done better. While the first half of the sector focuses on partners, the rest of the sector is reserved for order tracking. The data analyzation tools make it possible to provide the status of critical and late orders in a separate monitor. Critical order can be described as an order, which has a possibility that it is not leaving on promised time. The

most critical orders based on the value, urgency or the number of lines could be transferred to the visual management board, where the whole team would be then aware of those orders. When the reference number, the name of the customer and the reason why the order is highlighted (e.g. some part missing) as critical are on the board, the teams throughout the case DC could pay attention to specific orders. The logic would work for all teams inside the case DC. To be noted is the fact that every team would only focus on the tasks and challenges within their area of expertise. The need for the tool, which focuses on the big and critical orders was generated especially based on the needs of the order desk interviewees. The KPIs of the case DC react quite hard if big orders are late. Therefore, a follow-up tool like this should improve the reliability of the case DC.

Providing information on continuous improvement was one of the biggest needs based on the interviews. Continuous improvement is strongly linked to Lean (Hines et al. 2008), as one of the aims of Lean principles is to seek perfection (Lean Enterprise Institute 2018b). The actions sector is the correct space for tracking the progress of improvement and development actions. The simple actions are mainly based on TOP 3 orders, informed in three seconds sector, which could have an effect to the team's KPI. Basically, the simple actions sector is a listing of orders and responsibilities. The reference number and a customer's name help identify the case, while the employees name, deadline and status tell the person in charge of the action its deadline and status with magnet. In order for the use of the simple actions to be as simple as possible, the teams should determine all the tasks used in the simple actions sector. For example, the order desk team members could use the following tasks:

- **expedite:** investigate with the buyer if it is possible to get the materials faster
- **double check:** ensure that the order has been entered correctly to the system
- **report**: inform the customer that the order will be e.g. delayed.

An action would remain in the sector until it has been totally completed and the status magnet has been changed from red to green. After the action has been completed, the person in charge should tell the colleagues during the daily meeting if there were something special with the case. After this the action could be removed from the board. If a team member cannot complete the action, it should be transferred to the PDCA action sector for more detailed problem solving.

The PDCA actions sector is designed for more complex problem solving than simple actions. Tentatively each PDCA action should be possible to solve inside the team with the teams' own knowledge and contacts. The PDCA actions could come originally from a simple action but also an action could be determined directly as a PDCA action. Priority has an important role in the PDCA actions sector because each stage of the PDCA cycle could not include more than two actions. The rest of the actions, which are not in the cycle remain in the idea bank until the cycle has enough space. The different stages of the cycle, excluding escalation, are equal to the normal PDCA cycle:

- **plan**: team defines the problem, person in charge, actions and deadline
- **do**: the person in charge completes the defined steps
- **check**: the team follows if completed actions work
- **act**: the task is either completed and archived or escalated to the next level
- **escalation**: the task is more complex and needs assistance from elsewhere.

If the person in charge or the team notice that the problem is not advancing in the cycle, it could be moved to the escalation stage from anywhere inside the cycle. All of the problems, which need PDCA actions are documented in a A6-form, color-coded for each team. This form is introduced in figure 5.2.

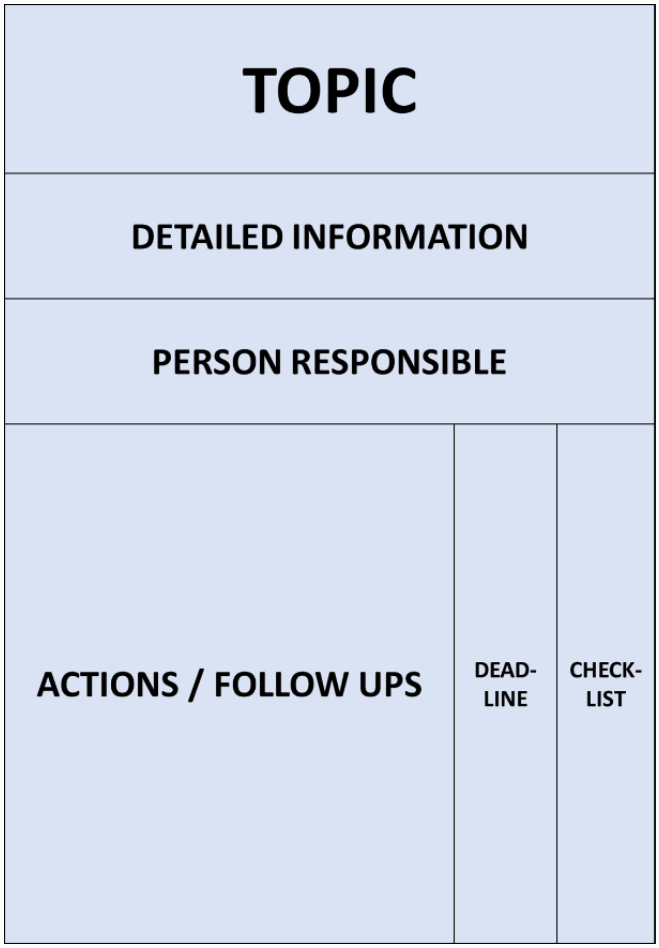

Figure 5.2. *PDCA action reporting form of order desk.*

Sobek & Jimmerson (2004) highlighted the meaning of documentation while solving problems and creating new standards. The interviewees of the order desk team also mentioned documentation for example as one need to check if same issues are repeating day after day. The form has a double meaning: first, enabling the documentation as well as archiving and second, physical moving of the form, when the improvement actions are advancing. In a case where the form is not advancing on the PDCA cycle, it can be transferred to the escalation stage. From there, the form should be transferred physically to the case DC's action board, of which idea will be introduced later in chapter 5. Because the

teams' forms have different colors it is easy to observe also from the case DC's action board, which team has the most actions going on.

The right side of the model has been adapted quite directly from the current visual management boards. Because the action sector should include all improvement and development actions the communication sector is reserved only for general information. The managers of the case DC highlighted the meaning of paying attention to successes and positive attitude. Because of those comments the positive sector has its place on the model. The positive sector has also a table for anonymous feedback. All the interviewees mentioned something positive about standard work and based on those comments, approximately 20% of the model has been reserved for teams' standard work. Feng & Ballard (2008) stated that while defining the standard work the teams should focus especially on tasks, which could have a direct effect on the KPIs of the case DC. The only common standard work defined by the created model is workload. The workload tool is based completely on each employees' own thoughts about their workload as today measuring the workload from the available data is not possible. The workload is described with magnets where the red color indicates overload, yellow underload and green color can be seen as suitable workload. Every team can use the follow-up tool however they want to get the best possible results. For example, the order desk team may continue with filling the form on the daily meetings based on the mornings workload while the logistics team can fill the form based on yesterday's workload. All in all, the workload tool should give an overall picture of workload in both long- and short-term. In order to get positive results while implementing Lean ideology, the managers and employees of the case DC should focus on waste (muda), unevenness (mura) and overburden (muri) (Liker 2004; Hines et al. 2008). The workload tool eases the observation of those non-value adding activities because one can observe easily from the magnets if someone has an overload of work or big differences with workload during the week.

Summing up the whole subchapter 5.1.1, the basic idea of the visual management board model is information sharing for each employee inside the case DC with simple tools. The teams use visual management boards mainly during the daily meetings and a regular possibility for communication between all the team members is offered. In addition to this, the model includes a lot of information about the team's actions and performance, which eases the work of the whole team and pays also attention to the customers. From Lean ideology's point of view, creating value for the customer is the most important matter (Hines et al. 2008). Finally, approximately 30% of the model's area is reserved for continuous improvement. All previously mentioned points are connected to the statement of Eaidgah et al. (2016). They stated that visual management works if it for example helps to allow better communication and feedback through different sectors, provide information at the point of use, increase transparency as well as support continuous improvement (Eaidgah et al. 2016).

5.1.2 Daily meetings

According to the results of the empirical research, the practices for daily meetings were not clear enough. According to Mann (2010, p. 87) and Poksinka et al. (2013), the agenda for daily meetings should be standardized. In general, this means that the meetings should have a permanent place and duration (Mann 2010, p. 87). Because the visual management boards are used especially during the daily meetings the agenda of the meetings could be built to match the model presented in figure 5.1. Also, Lean ideology supports the idea of keeping daily meetings between the managers (Mann 2010, p. 86).

The agenda for the daily meetings with the team would follow the visual management board model completely. According to company guidelines, each meeting starts with HSE and quality concerns. After this, the team goes through yesterday's KPI and marks it to the trend chart. When the current status of the team has been handled, the agenda moves to the reasons sector. Each team member or team manager can highlight cases from the previous day in order to increase the traceability but also share their knowledge on how to act in different situations. In addition to this, the performance of partners could be undertaken daily but the rating of measured partners would be completed only once a week. Based on the status and reasons sectors, the agenda would continue with actions. As the model suggest, actions could be either simple or PDCA actions which should be marked to the visual management board in a relevant way. Each team member and the team manager must keep in mind that reacting even to small issues is important because based on Hines et al. (2008) small daily problems are usually the basis for the big problems. After the left side of the board has been gone through, the agenda continues with communication, positive matters and workload. The most important factor in the agenda is that the teams are able to handle the left side of the visual management board every day, because it has an effect to the team's performance. Because the time-frame of each meeting is 15 minutes the teams could undergo the right part of the model faster in situations where there is a risk to exceed the reserved time.

The standardized agenda in the daily meetings is a first point for successful meetings. According to Mann (2010, p. 89), there could still be some themes for different days. Inside the case DC, the procurement team already has some experience about daily meetings with different themes. Because the empirical study proved that this practice works, it could be used also with the new agenda based on the visual management board model for example with following themes:

- **Monday - Partners**: going through performances from the previous week
- **Tuesday - PDCA actions**: going through the actual status of PDCA actions
- **Wednesday**: -
- **Thursday - HSE & Quality**: focus on HSE & quality matters
- **Friday - Positive**: focus on positive matters and success.

When every team member knows the agenda and possible theme for each day, it should be easy to prepare to the daily meetings. In this way, the full potential of the daily meetings could be accessible as everyone knows what is going to happen.

To keep the information flow smooth, according to the empirical research teams should have more shared meetings. Because the team meetings are only held between each team's members and manager there is a possibility for an information gap between the different teams. One possibility to solve this is to highlight that each member could join any team's daily meeting. Another possibility is to hold daily meetings between the case DC managers. Mann (2010, p. 86) stated that daily meetings should be divided to three stages: one with team, one with the managers and one with the top management. In the case DC, the first two stages are possible to realize but currently only the meetings with teams are held. As an improvement action the team managers and the case DC manager should have a daily meeting after all team meetings. This would enable the information flow between all managers. Then it should be possible to keep the whole team updated about the situations of different teams through the team manager. In a case where the team manager would be unable to attend the meeting, a team member could attend the meeting instead. Ensuring smooth and necessary information flow between different teams should be known as a vital factor in all situations.

5.1.3 Other visual management boards

The research problem of this thesis was not focused only on daily visual management boards. Although the model for daily visual management board may be the most important finding, the empirical research revealed that there could be a need for other boards too.

Because the size of the case DC is quite big, and it serves customers worldwide, a lot of different projects, actions and issues are always on-going. Because each team has their own actions sector in their daily visual management board, an action board for the projects and actions of the whole case DC is needed. The DC level action board would increase the transparency of projects and actions, which have an effect on the functions of the case DC. The action board would support the idea of continuous improvement, which was a clear wish from the manager of the case DC. The common action board for the case DC would also offer a path for escalation. If the teams are unable to proceed with their PDCA action in the daily visual management boards, the action should be moved to the common actions board. It would indicate that e.g. a closer plan for the action is needed.

Because the A6-PDCA-form presented in figure 5.2 is color-coded by each team, the common actions board would indicate easily, if some team has more actions or issues.

In the event that the daily meetings between the case DC managers would begin, a visual management board for those meetings would be useful. The board would sum up the current situation of each team in one board. Based on the empirical research the board could be presented for example in supply chain form. According to the interviews, the managers lead teams, partners, processes and supply chain. If the visual management board of the managers' meeting would be in supply chain form, it would complete the chain of managing all the known management areas.

5.2 Long-term improvements

Long-term improvements in this thesis are goals of which realization is possible but not topical. In general, all long-term improvements are connected to visual management boards but those actions include also a lot of other actions. The implementation process of each long-term improvement will take a long time to be totally completed.

5.2.1 Digitalization of the boards

Nowadays all visual management boards in the case DC are physical and only available when the employees are at the office. During the last two years, the employees have received a permission to have remote working days. The remote work creates some variability to days but it can also create difficulties with the information flow. In order to reach the visual management boards also outside the office, the boards should be digitalized. The digitalization would support remote work, offer possibilities for the top management of the international company to follow-up the performance of all the teams or DC's if needed and ease the use of the visual management boards. To succeed with digitalization of the visual management boards, the data used in the boards should be available easier than now. In general, it means that the data should be harmonized, which would help users of the boards to keep the boards up-to-date. With today's technologies it should not be a hard task to digitalize all visual management boards.

However, the digitalization of the boards and other actions concerning that are not a top priority at this point of the implementation process. More important than digitalization is to build up a culture for using the visual management boards in the best possible way to get the best possible results.

5.2.2 Expansion of visual management boards

The scope of this thesis was limited to the office actions of the case DC. In the future, it could be possible to expand the use of visual management boards to the warehouses as well as the partners of the case DC. The expansion process of the boards would be a lot easier to warehouse actions as all three warehouses of the case DC are already using same systems. Also, the communication between the case DC and warehouses has developed a lot during the years. Instead, the expansion of visual management boards to partners would be a huge task. To achieve the best results of expanded visual management boards all the boards must be digital. In that case, it would be possible to monitor all digital boards, follow the information flow and detect potential issues from one place. The challenge is huge because all partners should have possibilities to use the same kind of data in order to guarantee the comparison between different partners.

To increase the communication and information sharing between the DC's inside the same business area, all of the DC's could use a top level visual management board with the same format. The format would be rather simple and describe only the overall performance of each DC. If all DC's would use the same format, it would open possibilities to arrange level 3 daily meetings for example between DC managers. In these meetings DC managers could share ideas and experiences of how to solve different situations. On the other hand, daily meetings and performance follow-up between DC's could create good competition on who is performing the best. In the worst-case scenario different DC's could focus only on their own activities to reach best result and to be on the top. Instead, in the best possible scenario daily meetings and information sharing would drive each DC towards better results and performance.

6. CONCLUSIONS

This thesis examined the visual management boards inside the case DC. The main focus of this thesis was to find out if the current visual management boards could be developed to be more Lean. The study proved that there are a lot of different possibilities to improve the current boards but also to create completely new visual management boards. The last chapter summarizes the whole study, describes the process and undertakes the potential theoretical learnings.

6.1 Answers to the research questions

The research problem and the research questions for this thesis were first presented in chapter 1.2. The main research problem is presented again below:

What kind of visual management boards can be used to develop the management of the case DC towards a Leaner ideology?

Based on the research problem, the following four research questions were created to ease the complete understanding of the research problem. These research questions are answered briefly below.

What is the structure of the supply chain in the case DC?

The case DC's supply chain has been described as a diagram in figure 2.6. The supply chain is not the simplest because the case DC has for example customers inside the company as well as end customers. Shortly, the material flow starts from the suppliers whose main target is to deliver needed materials to the warehouses of the case DC. The warehouses serve customers in different market areas. Two of three warehouses serve especially customers in the Nordic countries while the last warehouse serves customers worldwide. Depending on the location of the customers the order is shipped from determined warehouse either to the customers of the case DC or directly from the warehouses to the end customers. While the material flow goes one way from the suppliers through the whole supply chain all the way to the possible end customer, the information flow in the supply chain moves both ways. In addition to the previously mentioned, the financial flow goes vice versa than the material flow.

How can one develop the case DC and the idea of continuous improvement with visual management and Lean ideology?

According to Hines et al. (2008) the basis of Lean ideology is the knowledge of customers and their values. Liker (2004) stated that reducing waste, unevenness and overburden

from the processes drives the organization towards a more Leaner culture. As Lean ideology includes a great number of different tools for example to define the customer value and remove waste, a lot of different possibilities can be used to develop the case DC and the idea of continuous improvement. Visual management is one tool of Lean, which can be used when adapting the Lean ideology to the daily work. Visual management boards support the idea of continuous improvement as a board can include for example the ongoing actions, which should increase the performance of the case DC. According to Mann (2010, p. 87) the users of the visual management boards can easily see if corrective actions are needed. In case corrective actions are needed, the employees of the case DC can use the PDCA model, of which basic idea is to create an attitude of continuous improvement (Pietrzak & Paliszkiewicz 2015).

What is the current state of visual management boards at the case DC?

In order to understand the current state of visual management boards, opinions from the employees of the case DC were studied. From Lean ideology point of view, existence of visual management boards was crucial as the idea of the boards was already known. The states of the boards were different. The procurement team has developed their visual management board for a couple of years and compared to the other boards, it was clearly the most visual and informative one. The board also followed the ideology of Lean because it for example empowered employees and allowed better communication (Eaidgah et al. 2016). In general, the boards of the order desk and logistics teams were quite similar. Both boards have slight applications of visualization but mainly the board was reserved for basic information sharing without any information about the current level of performance. Chapter 4.2 summarizes the current states of visual management boards more detailed.

What are the needs for visual management boards in the case DC from different points of view?

The empirical study gave a lot of different ideas from multiple viewing points. Company guidelines highlighted the meaning of 1-3-10-rule, the case DC manager continuous improvement while the team managers and employees mentioned for example needs for more space, a tool for partners' performance follow-up and a workload tool. Chapter 4.3 summarizes the different needs more detailed.

The basis for the solutions of the research problem were based on both theoretical and empirical studies, of which the latter was more emphasized. Recommendable improvement actions were mainly short-term, but a couple of long-term actions were also introduced. As a main solution for the research problem the model presented in the figure 5.1 was developed. The result of the current board analyzing determined also the implementation order and time-frames for different teams. As a start, the model replaces the current boards of the order desk and logistics teams. Because procurement team's current board

supports Lean ideology from most sectors, it will not be changed until the created model has proved its functionality in practice. To be noted is the fact that the order desk and logistics teams got entire boards for their use, because the model does not fit into a half board. In addition to this, an extra board for the procurement team was arranged. The created model was presented in three different events and the comments were mainly positive. Based on the received comments the model could be taken also to other DCs inside the business area, which was one objective of this study. In addition to the created model, the needs for new visual management boards as well as digitalization of boards were understood and agenda for daily meetings was created.

6.2 Lessons learnt from the process

All in all, the research process went smoothly. The whole process took approximately 7 months from start to finish. The research problem and questions of this study were summarized already in the previous chapter but in general it can be said that the problem was understood and the basis for the solutions was this study. Both short- and long-term improvements for the visual management boards as well as daily meetings were introduced.

The methodology of this thesis was introduced in chapter 1.4. The table 6.1 below sums up the methodology and chosen methods based on the research onion by Saunders et al. (2009, p. 108).

Table 6.1. *Summary of chosen methods.*

Layer	Chosen method
philosophy	pragmatism
approach	inductive
strategy	case study
choices	multi-method qualitative study
time horizons	cross-sectional
data collection	theoretical and empirical (qualitative)
data analysis	content analysis

Based on short- and long-term improvements, the chosen methods worked very well as improvement actions were found. Pragmatism as the philosophy was a good choice because it emphasized the meaning research questions (Saunders et al. 2009, p. 109) as the whole study was quite practical. Inductive approach as well as the case study strategy also worked well because the case was clear, and the aim of the study was to build theory and create new instead of testing theories (Saunders et al. 2009, pp. 124-126). The multi-method qualitative study was an obvious method for choices layer because the aim was

to understand the different boards and gather needs for future boards. Although the answers inside the teams were quite like each other and reliability of the study was good, it could still be better. One way to increase the reliability would be interviews of all team members. However, it would be quite time-consuming because based on held interviews, an interview can last over an hour. Another way would be a use of mixed-method study, which combines qualitative and quantitative studies (Saunders et al. 2009, p. 152). After interviews, answers would be analyzed and based on the answers a questionnaire would be created. The questionnaire should be sent to different teams and all team members would have a possibility to for example rate the current situation and the improvement ideas. As the method is qualitative, the analyzing part would be quite direct. This would also be a way to involve all team members. Anyway, the multi-method qualitative study as well as the rest of the layers from time horizons to data collection and data analysis worked well to gain good results.

The results of the study can be applied to daily work of the case DC employees. Because the team members and managers use the boards daily, it will have an effect to daily routines. As stated in the end of chapter 6.1, the created visual management board model can be adapted to each DC within the same business area of company as the same systems and KPIs are mainly used. Because the created model is theoretical, and it has not been tested completely in practice, the changing process may create some challenges because for example resistance of change may occur.

6.3 Theoretical learnings and future studies

This study focused especially on visual management boards. As stated in chapter 1.4, it was challenging to find out academic research concerning visual management boards. This thesis could be a theoretical learning about visual management. Another theoretical learning could concern the 1-3-10-rule presented as company guideline. Based on the solution of the research problem, the 1-3-10-rule can be seen as a good rule for everyone who is creating a visual management board.

Based on the study, future studies could be multifaceted. While supply chain management and Lean ideology are quite studied topics, the theoretical background of visual management boards could be broadened. In addition to this, researching the connection and possible benefits between the Lean ideology and visual management boards could be a good study in the future, as well as the implementation process of the whole Lean ideology. On the other hand, the implementation process of visual management boards could be studied even further. While the solutions of this thesis are theoretical, the future study could also include more information on the practical aspect of what happens after the created visual management board is implemented. The questions for the future study to be answered could be for example: How do the employees react? How does the created model change? Has the board had an effect on the performance of the team?

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APPENDIX A: THE STRUCTURE FOR THE INTERVIEW

Daily Meetings:

- What do you think about your team's current daily meetings?

Current Visual Management Boards:

- Describe your team's current visual management boards with three words.
- What do you think are positive factors in your team's current visual management board?
- What do you think are negative factors in your team's current visual management board?

Future Visual Management Boards:

- What would you add to the visual management board to make your job easier?
- How could partners/customers be noted better in the visual management board (/in the daily meetings)?
- Which two words would you use to describe the kind of visual management board that would best meet the needs of your job?
- What should the visual management board have to prevent you from doing un-necessary work?

Leadership:

- What is actually being led in the case DC?
- If you would see some deviations from standards in the visual management board, when you should react at the latest?