

# Implementing Lean Production

- A pre study conducted at Strålfors Svenska Card

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**KTH Industrial Engineering  
and Management**

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|------------------------|--|---------------------------------|
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## Abstract

The concept Lean Production has nowadays become an accepted paradigm in several industries and it has become a fundamental part of manufacturing companies, as it seeks to reduce waste and deliver a high customer value. Lean Production is a technique that is a highly efficient manufacturing practice that helps organizations to carry on a competitive advantage. The concept works as a system of methods and measures which when combined have the potential to carry about a *lean* manufacturing.

The objective of this research is to investigate how Strålfors Svenska Card can succeed in carrying out changes in their production in order to reduce waste, with reference to Lean Production. The study starts with a brief historical review about lean production, which is followed by a theoretical framework with useful concepts to adapt. The theoretical frameworks used in this research are: Lean House, “4P” Model, Lead the Change, Culture, Processes and Performance Measurements. The main research question of this thesis is: *What are the main barriers for a successful lean implementation in Strålfors Svenska AB?* Subsequently, the main research question was broken down to four sub questions. These are: *How developed and mature in the organization are process methods? How are performance measurements employed? Which role does standardization, such as availability of tools, have? Which role do soft aspects, such as culture and values, play in understanding concepts?*

Strålfors Svenska Card has to build a good platform in order to success with their implementation of lean production. Moreover, it means that the organization has to focus on developing necessary critical factors that are in the guideline with lean production. The researchers has used observations, interviews, surveys and value stream mapping in order to collect necessary data.

**Key words:** Lean production, lean implementation, lean challenges, operational analysis, process improvement, waste reduction.

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# 1. Introduction

*In this chapter, the background to the problem, the investigated company and a problem formulation is presented to the reader. Furthermore, this chapter presents the objective and research questions, and it provides necessary knowledge in order to understand the research.*

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## 1.1 Background

In order to grow and to be able to compete with other firms in the same industry organizational improvement is extremely essential. The competition is nowadays tough in all industries and maintaining a positive outcome is only possible if companies develop or adapt new management techniques (Abrahamson & Fairchild, 1999). *Lean Production* is such a technique according to Womack et al (1990), as it is a highly efficient manufacturing practice that helps organizations to carry on a competitive advantage. The concept works as a system of methods and measures which when combined have the potential to carry about a *lean* manufacturing.

The concept *Lean Production* has nowadays become an accepted paradigm in several industries and it has also become a fundamental part of manufacturing companies, as it seeks to reduce the non-value adding activities (waste) and deliver a high customer value (Womack & Jones, 1996). A high number of firms have implemented *Lean Production* and many firms are in the process of the implementation, this in order to enhance competitiveness. The outcome of the implementation has shown to be positive and successful in many cases, but there are also cases documented where the implementation has become a failure (Parry et al, 2010).

Strålfors Svenska Card has two divisions in Stockholm, namely Strålfors Svenska Card and Strålfors Mail. The latter division has undergone a series of different development project in recent years where lean production has been in the center. They have implemented a variety of tools and principles of lean production and this has resulted in a better and smoother production. Strålfors Mail is still in the elaboration where there is a gradual development rather than a real transformation. The development of the processes and procedures in Strålfors Mail has attracted Strålfors Svenska Card to follow the same step. Strålfors Svenska Card has identified a need to be more competitive in order to grow and increase their profit. Earlier, the organization has acted by cutting down on employees by reducing services but now they want to improve their internal work and more important their core business, the production.

With this in mind, it is of interest to study how Strålfors Svenska Card can succeed in carrying out changes in their production in order to reduce waste, with reference to *Lean Production*. Strålfors Svenska Card is going to implement *Lean Production* in the near future and they are in the process of educating their production management in the philosophy behind lean production and how the leadership in lean works. This is the first step against a serious commitment towards changing their production. Yet there have not been any attempts on actively changing their production. However, improvements have been done in some areas, such as the inventory, where the order point have been regulated in order to reduce the inventory levels based on common sense.

The production manager at Strålfors Svenska Card had a request regarding the thesis, which was to identify the obstacles that could impede Strålfors Svenska Cards future lean implementation. We asked ourselves how a successful lean implementation is completed and by evaluating the theory and previous research we could identify the obstacles that Strålfors Svenska Card had to consider in order to succeed with their lean implementation by examining their production facility largely. Subsequently, the selected research question was a result of the manager's request. However, the following sub questions were developed in order to capture the essence of lean production at all levels and the question are connected to each other with reference to lean

philosophy. By investigating Strålfors processes, performance measurements, standardizations and culture critical factors are embraced in order to succeed with an implementation. Standardized processes will lead to identification of deviations in the production by performing measurements and the culture enables the organization to work according to similar guidelines, which in turn promote effective work. These factors will either impede or assist and lean implementation, as they are important factors in the implementation phase of a lean project.

Even though that the phrases *Lean* and *Lean Production* are used frequently in the report, it is essential to understand that these phrases are seen as labels. An implementation generally follows several steps: identification of problems, implementation, observation and evaluation. However, in many cases the implementation is the issue and in this research the focus is on finding key barriers for a successful implementation rather than lean itself. Hence, Strålfors primarily objective with implementing lean is to reduce waste in their production in order to increase their profit.

## **1.2 Thesis Objective**

The objective of the master thesis is to conduct a pre-study to lean implementation at Strålfors Svenska Card, in order to highlight main barriers that have to be considered when implementing lean.

## **1.3 Research Question**

The objective has been broken down into one main research question and four sub questions in order to fulfill the objective of the thesis. These questions have been selected in order to fill the gap that has been identified between current and future state. More specifically, this study addresses the following research question:

- What are the main barriers for a successful lean implementation in Strålfors Svenska AB?

The research question has been operationalized into four sub-questions. These are:

RQ1: How developed and mature in the organization are process methods?

RQ2: How are performance measurements employed?

RQ3: Which role does standardization, such as availability of tools, have?

RQ4: Which role do soft aspects, such as culture and values, play in understanding concepts?

## **1.4 Delimitations**

Strålfors production facility at Tomtebodavägen provided a first delimitation for the research. Considering the constraints in time and competence, this delimitation could have created a too broad scope and in turn threaten the quality of the research. However, since this research sought to find important barriers that have to be considered when implementing lean in order to primarily reduce waste, the whole production facility had to be considered.

Customers, suppliers and distributors of Strålfors Svenska Card will not be taken in consideration when performing the research. These areas are important and they should be considered in order to develop a good *Lean enterprise*. However, due to the complexity and time restrictions of the study and the fact that this would broaden the scope, these areas were neglected.

Furthermore, implementations usually follow several steps, from an initial identification of the problems, to implementation, monitoring and evaluation. This research however is delimited to



the initial part, namely the identification of problems and more specifically the identification of the main barriers for a successful lean implementation.

### ***1.5 Outline***

Chapter 2 – This chapter describes the scientific approach. The research paradigm, research strategy and the chosen method are explained and discussed. Moreover, the literature review, empirical research and validity and reliability are presented.

Chapter 3 – In this chapter the importance is to give the reader a review of existing knowledge about lean production and lean implementation. The collected theories will provide necessary knowledge about the philosophy of lean production and the tools used.

Chapter 4 - This chapter presents the empirical data that the researchers have obtained from observations, interviews and surveys at Strålfors Svenska Card.

Chapter 5 - The theoretical framework and empirical research are connected and analyzed based on the situation at Strålfors Svenska Card in this chapter.

Chapter 6 – This chapter presents the conclusions based on the information from the theoretical framework and the empirical research, which is discussed in the analysis.

Chapter 7 - In this chapter the possibility of whether the results in the conducted research can be generalized or not is discussed.

## 2. Research Methodology

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*In this chapter the research scientific approach is described, which includes the chosen paradigm and research strategy. The chosen methods in order to answer the research questions are described and argued about.*

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### 2.1 Identifying Research Paradigm

According to Collis & Hussey (2009, p.55) “ a research paradigm is a philosophical framework that guides how scientific research should be conducted. Philosophy is the use of reason and argument in seeing truth and knowledge, especially of ultimate reality or of general causes and principles”. Collis & Hussey (2009) have illustrated the spectrum between the two main paradigms, positivism and interpretivism. Hence, as a result of our ontology and epistemology, this research rests on a foundation of the interpretivistic area; see Figure 1 for the interrelation. Furthermore, Collis & Hussey defines interpretivism as:

*“Interpretivism is underpinned by the belief that social reality is subjective because it is shaped by our perceptions...Interpretivism focuses on exploring complexity of social phenomena with a view to gaining interpretive understanding.... findings are not derived from statistical analysis of quantitative data”*

(Collis & Hussey, 2009, p.57)

Our ontology, our view of the reality, is that the reality is subjective when concerning *Lean Production*. The reality the employees have is essential in this case and it is important to capture all the realities since it provides necessary knowledge and input to the research. Thus, our epistemology, what we accept as valid knowledge, is that the distance between the researcher and the researched object should be minimized. By interacting with the researched object we can gain knowledge and thereafter determine what should be count as relevant fact.

### 2.2 Research Strategy

After identifying our research paradigm we had a guidance of how our research should be conducted. Our research strategy ought to reflect the philosophical assumptions of our research paradigm (Collis & Hussey, 2009). Figure 1 shows how the strategic approach has been carried out in the research as a mean to certify that relevant choices have been taken with reference to our chosen paradigm.

An experimental case study has been used as a methodology, how we go about acquiring the knowledge, in this research. Case studies have an inductive approach, where variables are impossible to identify ahead of time and a bottom up approach has to be used, and the results are generally presented qualitatively (Collis & Hussey, 2009). An experimental case study is defined as a research that examines the difficulty in implementing new procedures and techniques in an organization and it applies earlier research for an evaluation of the benefits in a particular case (Scapens, 1990).

The research in this case is linked to Strålfors Svenska Cards production facility. The chosen methods, which precise procedures we use to acquire the knowledge, have the aim to link to the methodology and to fulfilling the company's demands. Knowledge has been obtained through observations, interviews, surveys and open discussions. Eisenhardt (1989) advises the combination of data collection Furthermore, the validity and reliability have been improved by the high grade of customization in the research method. Moreover, a case study has an

interpretivistic approach and can be seen as being less scientifically correct according to the positivistic paradigm (Collis & Hussey, 2009).



**Figure 1. Research strategy** - the relationship between the building boxes of the research (Source: Own illustration)

Collis & Hussey (2009) states that quantitative data usually are collected under a positivistic paradigm, however quantitative data can also be collected under an interpretivistic paradigm. In this specific case, we have both qualitative and quantitative data.

## 2.3 Data Collection

### 2.3.1 Interviews

Semi-structured and unstructured interviews have been carried out in order to allow the specific characteristics of the case to arise without restricting cross-case comparisons; these methods are most common used for qualitative data collection (Miles & Huberman, 1994; Kvale, 1996). An unstructured interview is characterized by having open questions that are not prepared beforehand, in order to find the relevant information about the researched topic. A semi-structured interview on the other hand is stricter and it follows an interview protocol with selected questions. However, it is possible to explore the replies from the participant by asking for clarification or additional information. The benefit of using both semi-structured and unstructured interviews is that the information that would not have been exposed using only one type of interview method is uncovered. In order to improve the reliability, the semi-structured interviews have been face-to-face using an interview protocol and some of them were recorded, which were transcribed later on (Dahmström, 2000).

The interviews were conducted on site in Strålfors production facility and as a mean to guarantee truthful answers anonymity was guaranteed to the interviewed person. In total 18 interviews were completed, see Table 1 for the disposition. Appendix 3 shows the interview protocol used for the semi-structured interviews. The protocol consists of 10 questions and the selected questions were design in order to collect reliable data within the case on a wide range of factors, including those identified in the literature review.

Further more, during the informal discussions and the interviews that have been carried, notes have been taken in addition to the above-described process. The selection of respondents was made on a critical base in order to try to embrace the organizational positions responsible for the production. Respondents' positions have been ranged from shop-floor workers to production management.

**Table 1.** An overview of the performed interviews in the research.

| Interview Type | Gender | Service | Work Title |
|----------------|--------|---------|------------|
| Unstructured   | M      | 5 years | Operator   |
|                | F      | 7       | Operator   |
|                | M      | 4       | Operator   |
|                | M      | 3       | Operator   |
|                | M      | 6       | Management |
|                | M      | 5       | Operator   |

|                 |   |         |             |
|-----------------|---|---------|-------------|
|                 | M | 16      | Technician  |
|                 | F | 4       | Operator    |
| Semi-structured | M | 4 years | Operator    |
|                 | M | 5       | Operator    |
|                 | M | 3       | Operator    |
|                 | F | 7       | Management  |
|                 | M | 9       | Management  |
|                 | F | 1       | Operator    |
|                 | M | 11      | Lean Expert |
|                 | M | 6       | Operator    |
|                 | M | 3       | Operator    |
|                 | M | 3       | Operator    |

### 2.3.2 Surveys

Two surveys were used in this research in order to collect necessary data. Appendix 1 and Appendix 2 demonstrates the surveys used in the research. Appendix 1 was distributed to all the employees in the production while Appendix 2 only was distributed to the operators. The reason for this is that the purpose of the survey in Appendix 1 was to get a clearer picture of how the employees at Strålfors Svenska Card understands the purpose, method and process of making use of Lean Production. On the other hand, the purpose of the survey in Appendix 2 was to get the operators opinion on how the current situation looks like in their working area, and also what areas of improvement that are available, from their point of view.

Hence, the questions and statements found in Appendix 1 and Appendix 2 are a result of the purpose of the surveys and important factors for a successful lean implementation identified in the literature review. The analysis of the survey did not take into account the employment of the respondents, as the majority of the respondents are shop-floor workers, thus titled operators.

### 2.3.3 Observations

This study required two different types of observation in order to get an overall picture of the current situation in Strålfors Svenska Card production facility. Both participant observations and direct observations were used.

#### Participant observation

Participant observation demands that the researcher becomes a participant in the culture or context being observed. In this research a participant observation was made possible due to the fact that one of the researchers have been working as an operator at Strålfors Svenska Card. Hence, the researcher was accepted as a natural part of the culture and this assured that the observations were of the natural phenomenon. This method is one of the most common methods used for qualitative data collection. The participant observation was carried out on and off for a period of 3 weeks.

#### Direct observation

In a direct observation, the researchers task is to observe rather than participating. The aim in this study was to observe certain situations rather than trying to become deep in the entire context. A direct observation tends to focus on work habits and the mentality of the workers in order to capture the culture of the organization. The direct observation was carried out on and off for a period of 4 weeks.

### **2.3.4 Value Stream Mapping**

Value Stream Mapping (VSM) is a systematic methodology to identify waste in a manufacturing process that can be eliminated. The idea is to create a “one page picture” of all the processes in an organization, from the time a customer places a product order, until the customer has received the product. In more recent times VSM has been used to re-engineer businesses because it identifies unnecessary effort and resources to permit simplification and streamlining of operations processes.

We conducted a Value Stream Mapping (VSM) in order to identify what types of waste that occurred in Strålfors Svenska Cards manufacturing process. The conducted VSM was based on the Ikea family Card flow due to the fact that this flow has got the highest volume of product produced. The purpose was to illustrate material and information flows across and throughout all value adding processes. The processes are those required to produce and ship the product to the customer and it included both value adding and non-value adding (waste) processes. Appendix 4 illustrates the conducted VSM of the current state and Appendix 5 explains what the different symbols in the VSM means.

Hence, as the current state of the value stream mapping was made, it became the baseline for improvement opportunities and for the creation of a future state value stream mapping. The conducted VSM based on IKEA FAMILY Card can be applied on the whole production facility. The VSM included the employees who were directly connected with the production and all operations such as *printing, enveloping and personalization* of plastic cards. The position of machines and employees were also included.

### **2.4 Literature Review**

In order to be able to provide a good analysis, the used framework has focused on finding conditions that have to be considered when implementing lean production in order to primarily reduce waste. In order to fulfill the objective, information has been collected from academic publications within the fields of operation and supply chain management and process management. By reviewing the literature it provided a starting point in understanding and defining *Lean Production*. According to Rowley & Slack (2004) a literature review is meant to describe the existing literature in a certain subject field and the evaluation of present and previous work makes it possible to identify areas in which further research would be necessary.

To conduct an efficient literature review of published works and previous studies, a three-step selection was carried out when collecting the data. The first step included identification of key words in order to find relevant literature. The second step included categorization and evaluation of the literature, mainly based on the abstract and key words. Lastly, the third step included an analyze of the papers, which in turn made it possible to divide the literature in different classifications by specific interventions.

The gathered information has come from reliable sources, as a means to increase the reliability of the study. Essential information about the company is taken from the company's own homepage and on site, whereas sources for the theoretical framework are from published articles and literature. The information has been conducted by using databases and library catalogues. The databases that have been used are Science Direct, Emerald and Business Source Elite (Ebsco), Scopus, ISI Web of Knowledge, and Google Scholar.

### **2.5 Empirical Research**

For the empirical part of the report, a situation analysis was performed. The empirical study's goal was to get familiar with the case and to connect the theoretical findings to the empirical

(Eisenhardt, 1989). The objective was to conduct a situation analysis in order to identify the key barriers for a lean implementation at Strålfors Svenska Card, which could lead to performance enhancements through a lean implementation (Camp, 1989). Participant and direct observations, unstructured and structured interviews were carried out in this phase of the research. Strålfors Svenska Card has not implemented lean in any of their processes in the supply chain so far.

The situation analysis is the result of the data collections that have been carried out throughout the research. The empirical data will be presented in chapter 4.

## **2.6 Validity and Reliability**

To critically examine the gathered information in order to ensure a valid and reliable conclusion increases the credibility of the study. Validity refers to the extent a test measures that supposed to be measured. In this case, it means that the barriers the thesis is based upon should measure relevant phenomena. As an attempt to illustrate this, the empirical research is connected to the theoretical framework in a way to make them comparable. Hence, we have decided to divide the barriers into process methods, performance measurement, hard issues, and soft issues.

As a mean to increase the internal validity, a pattern-matching data-analysis method through two steps was conducted. The first step was undertaken to gain familiarity with the case and to generate a preliminary understanding. The second step allowed for an in-depth understanding and it involved a search for patterns by comparing variables (Bourgeois & Eisenhardt, 1988; Yin, 1984).

Reliability on the contrary, refers to the dependability of the study. For example, a test is considered reliable if we get the same result repetitively, which in turn requires that the information should be trustworthy. This has been taken in consideration by only using published articles and literature written by individuals with a background in the area. The reliability has also been considered when selecting interviewees, focusing on persons who were active in the production as a mean to avoid second hand information. Hence, the highest deviation in reliability will occur in the unstructured and semi-structured interviews due to the difficulty in repeating the interviews continually and getting the same result.

## **2.7 Methodology Criticism**

In this research, the researchers have only examined a section within the Business are Information, namely Strålfors Svenska Card in Tomtebodå. Possibly; this has meant that the process mapping made is too narrow. Since we have not looked at the entire process from customer to customer, this can mean a risk of sub-optimization in Strålfors Svenska Cards operations processes.

Furthermore, it is difficult to determine in advance if our suggestions of barriers for a successful lean implementation are the barriers that will eventually be considered by Strålfors when implementing lean. The important part in this research is the understanding and the acceptance of the identified barriers for a successful lean implementation at Strålfors Svenska Cards production facility in Tomtebodå. The organization, production management and employees have to accept the used methods in the research and they have too embrace them as accurate tools in order to identify the barriers, due to the fact that the identified barriers are based on the observations, interviews and a situation analysis. It is important to understand the dimensions of the barriers an link them to the company's strategies and objectives and the requirements that are in the business.

This study has been conducted as a research paper, thus only the authors participated in the identification of the barriers for a successful lean implementation. This has resulted in an in-

depth picture of the organization and their operational processes for the researchers. However, it would have been more valuable if the employees would have participated in the operation and process mapping and gained the same in-depth knowledge as the researchers.

In semi-structured interviews the researchers decided that the respondents would be interviewed individually and not in pair or group in order to minimize the high possibility that the respondents may be influenced by each other during the interview session. Another choice that the researchers actively made was the choice of not letting the respondents have access to the interview questions before the interview would take place. This was done as a security in order to prevent that the respondents would be prepared in advance and providing answers that are not reliable.

### 3. Theoretical Framework

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*The importance in this chapter is to give the reader a review of existing knowledge about lean production and lean implementation. The chapter is mainly divided into two sections; the first section provides necessary knowledge about the philosophy of lean production and the tools used. The second section highlight important conditions that should be considered when implementing lean production.*

---

#### 3.1 Introduction

The purpose with this chapter is to present a choice of theory needed to understand and evaluate the empirical research in the following chapter. The subjects cover different aspect of lean production: what does the term lean production stand for; how does its philosophy look like; which tools are used in lean production; what should be considered when implementing lean production.

#### 3.2 Understanding the term Lean Production and its Philosophy

##### 3.2.1 Defining Lean

Taiichi Ohno is considered as the founder of the Toyota Production System (TPS), which was developed in the 1950s. Ohno & Largo (1988) states that TPS elaborated out of need, as the market in post war Japan demanded small quantities of cars to be produced in many varieties, which were very different from the Ford principle of mass-producing cars in large scales. TPS emerged due to the fact that improvements in the whole production process in manufacturing companies had to be done. Toyota successfully attached all the benefits of large-scale production with little waste, and with colossal profits. Nowadays, Toyota's *Lean Production* process is characterized as using half the human power, half the manufacturing space, half the investment in tools, and half the engineering hours to develop a new product in half the time less of everything compared with that of mass production (Koskela, 1992; Womack et al, 1990).

The concept of *Lean Production* first emerged in the 1990s when Womack et al (1990) for the first time used the phrase *Lean Manufacturing* in order to describe TPS in their book *The Machine That Changed The World*. Womack et al (1990) argues that *Lean Production* is not only the world's most effective system for manufacturing automobiles. Actually, it is the best way of organizing all kinds of industrial production, containing both excessive increases in productivity and developments in working conditions.

*Lean Production*, also known as *Lean Manufacturing* or *Lean Philosophy*, has got several different definitions, thus the definition of lean production is relatively vague and confused. Managers, consultants, or academics studying the area points to an absence of a common definition of the concept (Seppälä & Klemola, 2004; Bartezzaghi, 1999; Dale & Plunkett, 1991). Hu et al. has identified three major areas in the definitions of *Lean Production* from the SME (Small and Medium Enterprises) literature. In the first area, Lean is seen as a *management system*; in the second area Lean is seen as a *management philosophy*, while in the third area Lean is seen as a *technique* or a *tool*. However, the common factor to all definitions and areas is that lean is striving to eliminate waste and to increase customer value. Seppälä & Klemola (2004) describes lean as a goal that one has to work towards, like a vision. Another definition of lean is:

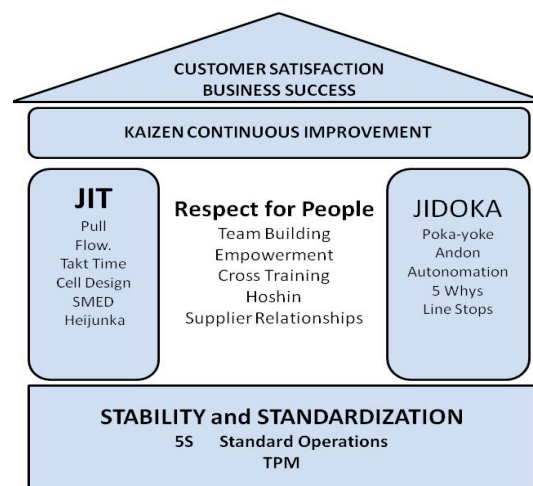
*“Lean Production is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability”*  
(Shah & Ward, 2007, page 791)



### 3.2.2 Methods and Tools used in Lean Production

Lean production strives to create processes that are continuously improved. In order to improve a process, including problems identified, also a new mind and a changing corporate culture established by the organization concerned in order to really be able to embrace this manufacturing philosophy (Liker 2009).

The lean house in Figure 3 refers to the models and tools used in lean production and how they relate to each other. As shown in Figure YY standardizations together with stability is the foundation of the house. Standardization and stability enables the possibility to eliminate supplier, customer and internal variability. Further on, Just In Time (JIT) and Jidoka are the two pillars of the Lean house that build on standardization and stability. These methods combined create reliable flows that can be continuously improved. However, standardization and stability must be established in order to put the foundation of the Lean house before further development can take place. In the middle of the house we find the people, it is important to respect the people involved in lean. This factor is more abstract than compared with the rest of the building blocks and it requires more resources. The philosophy behind lean production has to be understood by the employees and by suppliers, which creates a mutual respect and understanding of each other's work. The goal is to build an organization that creates value for the customer and increases customer satisfaction, by continuous improvements, which eventually will lead to higher profit and greater business success (Liker, 2009).



**Figure 2. Lean House** - illustration descriptive approach between theories of lean. Image taken from "The Lean Enterprise Institute," Toyota House, (Source: Lean Enterprise Institute, 2009).

#### Stability and Standardization

Stable and standardized processes are a prerequisite for lean production. Liker (2004) summarizes the sections of stability and standardization with four M:

- Man
- Machine
- Materials
- Method

Standardization, according to Bicheno & Holweg (2009), refers to developing processes and procedures that are repeatable, reliable and capable, and also to document them. Standards

should not be viewed as the absolute truth; instead they should be modified continuously when a new best practice is detected. Standards shall be established and documented by the person or persons involved in the process standard in the organization. Furthermore, if a consultant or a production engineer determines the best way and therefore the standard difficulties often arise for compliance with that standard in the long run. Bellgran & Säfsten (2005) cites several advantages to involve operational employees in the evaluation of processes. Most of the knowledge about a particular process is in it or those who work daily with the process, which creates a basis for more accurate solutions. Further on, Bellgran & Säfsten (2005) mentions that through active participation in the standardization of processes the process of accepting the standard will facilitate. Standardization should be seen as a means of stability (Liker, 2004).

## **5S**

In order to achieve standardized working methods, it is required that the workplace is clean and that the tools used are organized. A systematic approach to ensure this is 5S. By using 5S continuously will create a condition for stable and standardized processes (Bicheno, 2006). The 5S stands for:

- Sort - Eliminate tools and materials that are not needed in the process and sort the rest.
- Structure - The material and tools needed in the process are given a fixed position near each process.
- Shine - The workstation and associated equipment must be kept clean. Regular cleaning also enables checks to be done which can detect irregularities.
- Standardize - Maintain, structure, and shine by using documentation to standardize.
- Sustain - Create a new habit of working standard. Focus on continuous improvement and problem solving.

According to Baudin (2004), organizations should focus on visibility as a mean to accomplish 5S. By using labels and whiteboards it will increase the visibility of the e.g. tools and makes it easier to identify irregularities in the work habits.

## **Just In Time**

In order to avoid waste such as overproduction, which in turn often leads to many other wastes, it is important to develop processes that can produce the right quantity at the right time (Goldsby & Martichenko, 2005). Just in time (JIT) is a combination of principles, philosophy and methods that produces only what is required when it is required. Moreover, JIT creates processes that are linked together and in turn this decreases the stocks between the process and the inventory in general can be controlled. The basic of JIT is to create process that have a pull flow where the consumptive processes downstream signaling to the processes upstream to start producing. A pull flow controls the flow of work through an organization by only releasing materials into the process as the customer demands them, i.e. only when they are needed. A traditional manufacturing process however is handled by assigning work to each process separately (push flow). This form of planning where different processes are allowed to work individually without regard to the whole production, often creates large stocks between the processes and thus create waste (Goldsby & Martichenko, 2005).

## **Jidoka**

One of the guiding principles of lean production is to never produce a faulty product due to the fact that this is seen as a waste. An important part is to "Stop production so that production never stop", i.e. to identify and expose problems directly so that they can be adjusted and not disturb the production any more. In order to have a better flow there are some tools used where the interaction between man and machine can be improved. The idea is to have processes that are error free and controlled. Poka Yoke is a technique that helps avoiding quality defects; Andon on the other hand is a technique that alerts when problem is emerging. Together with standardized work and visualization these techniques deliver processes that have low quality errors (Liker, 2004).

### **Kaizen**

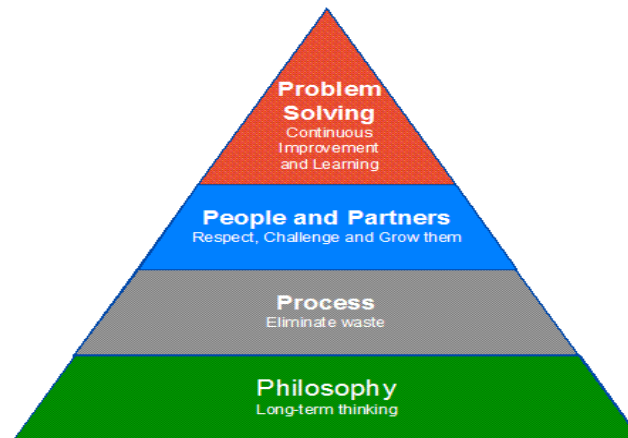
Kaizen is seen as the core of the Japanese business management philosophy. Kaizen is a combination of Kai meaning way and Zen, meaning good. These two words put together stand for "change for the better" (Brunet & New, 2003). Hence, this has led to the fact that Kaizen has been defined as continuous improvement. It is important that everyone in an enterprise, both management and employees are involved when using the Kaizen philosophy in order to be successful. The philosophy is based on continuous small improvements; such as improving knowledge, using better equipment, reducing waste and minimizing time to customer. In isolation, the philosophy of Kaizen seems simple: "with every pair of hands, you get a free brain" (Bessant, 2000). Several authors emphasize different key features, but many focus on three key concepts:

- Kaizen is continuous – Kaizen is a never-ending journey towards quality and efficiency.
- Kaizen is usually incremental in nature
- Kaizen links the intellect of the employees, which generates in vital psychological and quality of work-life benefits for employees.

### **3.2.3 "4P" Model of Lean Thinking**

According to Liker (2004), organizations tend to focus on implementing specific tools without first taking on the mindset that generates to a *Lean Production*. *Lean Production* requires *Lean Thinking*; it is a culture and not only a set of tools and improvement techniques. The dependence of the employees is high and the core consists of workers identifying hidden problems and solving them. Moreover, engineers, skilled workers, quality specialist, team leaders, and most importantly operators should on a daily basis be involved in continuous problem solving and improvement. Hence, over time everyone is trained to become better problem solvers. Holweg & Bicheno (2009) emphasizes that an organization should start with a vision first, then the necessary tools.

The 4P model originates from Toyota and it shows Toyota's own approach to *Lean Production* and *Lean Thinking*. Toyota developed fourteen principles, which in turn were divided into four main sections, 4P. These sections describe the basic philosophy behind *Lean Thinking* and the 4Ps stand for Philosophy, Process, People & Partners, and Problem solving (Liker, 2004), Figure 3 illustrates the dependence.



**Figure 3. 4P Model** – illustrating the dependence of the 4Ps (Source: Liker, 2004)

### Philosophy

The first section, and the foundation of lean production is the *philosophy*. It is important to have a philosophy that promotes long-term management decision-making. The organizations philosophical mission is the basis for all the other principles. The starting point is to generate value for the customer, which is done by evaluating every process in the company in terms of its capability to accomplish this. Moreover, its important to be responsible, strive towards determining your own path, and act with self-confidence. Principle 1 says that an organization should base their management decisions on a long-term philosophy, even at the expense of short-term financial goals.

### Process

Further on, *process* forms the second section of the model. In lean production it is essential to have the right processes, which in turn creates the right results. By evaluating the processes from a value perspective and eliminate parts of the process that do not add value for the customer, a continuous flow through the process is achieved and problems are more easily identified. This can be accomplished by embracing principle two until principle number eight. Principle 2 states: create a continuous process flow to bring problems to the surface. Work processes should be redesigned in order to achieve high value and continuous flow. This is the key to a true continuous improvement process and development of people. Principle 2 and 3 enhances the importance of using a pull system to avoid overproduction and leveling out the workload. To be able to minimize work in process (WIP) and stocking small amounts of inventory that is restocked based on the customers consumption creates a pull flow. In turn, the overburden to employees, the equipment, and the unevenness in production has to be eliminated in order to maintain and focus on a pull flow.

When having a pull flow there are some other principles that have to be complied in order to develop the processes further. Principle 5 urges that organizations build a culture of stopping the processes in order to fix the problems, as a mean to get quality right the first time. By building into the culture the philosophy of stopping or slowing down processes to get quality right the first time, it will enhance productivity in the long run. The 6th principle; standardized tasks and processes are the foundation for continuous improvement and employee inspiration is aligned with the fifth one. This due to the fact that if processes and tasks are standardizes it is much easier to detect if there are some deviations that could impede the quality. The foundation for pull is the usage of stable and repeatable methods everywhere in the organization to maintain the predictability, regular timing, and regular output of the processes. Principle 7 and 8 tells organizations to use simple visual indicators to help people determine immediately whether they

are in a standard condition or deviating from it, and to use technology to support people, not to replace people.

### **People and Partners**

In the third section we find *people & partners* and lean emphasizes that organizations develop their people and their partners. According to Liker (2004), it is unlikely that Toyota employs managers who have not worked at Toyota. The main reason is that it takes many years before a new person understands the culture and philosophies in Toyota. This leads to the 9th principle; grow leaders who thoroughly understand the work, live the philosophy, and teach it to others. It is essential that leaders are role models of the company's philosophy and way of doing business. A good leader must understand the daily work in great detail so he or she can be the best teacher of the philosophy in the company. Subsequently this will create a strong, stable culture in which company values and beliefs are widely shared and lived out over a period of many years. Which brings us to principle 10; develop exceptional people and teams who follow your company's philosophy, and principle 11, respect your extended network of partners and suppliers by challenging them and helping them improve.

### **Problem Solving**

Problem solving and continuous improvements is achieved through direct participation in different activities in the production. Organizations should avoid actions based on information from secondary sources; this also applies managers as it contributes to a deeper understanding of situations that arise. Going to the source and personally observing and verifying data accomplishes problem identification and processes improvement, this is the basis for principle 12. After identifying problems and process improvement the next step is to take the decision of what should be done in order to fix the problem. The 13<sup>th</sup> principle is the process of discussing problems and potential solutions with all of those affected, to collect their ideas and get agreement on a path forward.

Once an established a stable process is created, continuous improvement tools should be used in order to determine cause of inefficiencies and apply effective countermeasures. Develop processes that require almost no inventory. Once waste is exposed, have employees use a continuous improvement process (kaizen) to eliminate it, principle 14.

## **3.3 Implementing Lean Production**

### **3.3.1 Lead the Change**

During the implementation process it is important that the employees feel that their leaders are dedicated and involved. Moreover, Buchanan et al (2005) and Kotter (1996) emphasize the importance of a good leadership during the implementation stage. According to Scherrer-Rathje et al (2009) the most important factor in a lean implementation is that the management is behind the change to 100 per cent. If the employees get the feeling that the implementation is not well established they will loose interest quickly and return to their old work habits.

George (2003) highlights the importance of that the employees realizes what they can gain by working according to a new approach. It is essential that this understanding is present; otherwise there is no need for the employees to change from their normal work habits. If the implementation of a new approach will have a chance to succeed, there must be driving forces in leadership positions that will drive the employees when the motivation and knowledge decreases. Without good leaders there will be a high risk of incompetence or a lack of commitment from the employees, and if the employees are not committed and motivated the implementation of the new approach will fail.

One of the main challenges with managing change and implementing lean is employees' resistance to change. In order to reduce employees' resistance to new approach implementation, top management has to locate the source of resistance and use the most suitable strategy to eliminate them. Moreover, it is critical for all change management managers to understand the principles and culture of their own organizations, as they influence the way their employees will accept and adopt change (Aladwani, 2001).

Change management is necessary in order to prepare the employees for the introduction of the new approach, reduce resistance and influence the employees' mindset towards change (Kemp & Low, 2008). The primary concern with managing change has to do with the challenges the employees face during the implementation stage. Studies have shown that employees' challenges are more difficult to manage than the technical problems (Aladwani 2001). Using change management is important, starting at the project implementation stage and continuing throughout the entire project life cycle (Wang & Nah 2001). Both formal and informal training and coaching is recommended in order to introduce the employees the new skills and knowledge necessary in the new approach in order to carry out the new tasks (Nadler, 1998). In order to lead change a set of tools, activities, processes, and principles are used to support employee understanding and organizational shifts from a current state to desired future state during the implementation of the new approach (Almudimigh & Zairi, 2001).

The study made by Alballaa and Abdullah (2011) showed that there are some key conditions that contribute to an implementation failure of a new approach. They found that the employees have to be prepared enough for the new approach in order to prevent a lack of interest and commitment. The responsibility to prevent this lies with the leadership in the organization, they have to motivate and encourage the employees to work with the new approach and not against it. Furthermore, a clear communication between different departments and employees is necessary. Different departments have to have a clear idea of what their role is in the new approach and how they can contribute to achieve corporate goals. Lastly, they found that a customization of the new approach resulted in it being impossible to update, and that this would jeopardize the whole importance of the change made. Due to the fact that a customized new approach would lead to a restrict utilization and today's contemporary market requires that an organization can update themselves fast.

Lessons learned from both successful and unsuccessful implementations of Lean stress the importance of employee involvement and commitment. No matter how well thought out and prepared an implementation is, it will fall like a house of cards if the Lean house's soul, i.e. the employees is not around and holding up the various parts (Scherrer-Rathje et al, 2009).

### **3.3.2 Create a Lean Culture**

The key to a successful *Lean* implementation does not only take to account the different tools used in *Lean Production* but also the culture of the firm. The ambition in *Lean Production* is to create a culture that strives towards continuous improvements where the employees are working towards the same goals. According to Mann (2005) the focus should lie within the employees and not the result. He argues that if an organization focuses on the employees the result will follow. However, if an organization focuses on the result they will have the same problem as other organizations. They will have poor follow-ups, a lack of interest, no ambition towards improvements, and failing productivity.

Culture can be defined as how an organization mentally and physically is oriented when they perform their duties and the actions they take. According to Schein (2004, p.17) "culture is defined as a pattern of shared basic assumptions that has been learnt whilst solving problems, that has worked well enough to be considered valid, and therefore, to be taught to new members

as the correct way to perceive, think, and feel in relation to those problems”.

In order to manage change and to succeed with an implementation of a new approach it is important that old habits and work processes are eliminated and replaced with the new ones. The leaders have to be strict and push the employees in order to prevent that the employees will fall back to their old habits. The most demanding factors, which covers 80 % of a successful lean implementation, is the leadership, information and work habits. It is important to have routines where day-to-day and hour-to-hour activities are followed-up and leadership skills that are aligned with lean philosophy. Thus, the remaining 20 % includes the tools used in lean production.

### **3.3.3 Develop the Right Processes**

The right processes will help organizations to achieve the right results by evaluating the processes from a value perspective and eliminate the part or parts of the process that do not add value for the customer. This, together with standardized processes would lead to an achievement of continuous flow through the process and problems would be easier to identify. Stable, repeatable practices in processes are basic requirements for pull-flow in a process. Processes should be customer-driven and by processing downstream, the right material in right quantity at the right time will be available. This in turn would create a consumption that is controlled by the actual need and the number of work in process (WIP) is lowered (Liker, 2004).

Furthermore, quality can be assured by solving problems directly when problems occur. By stopping processes when problems occur and by solving them directly, a higher productivity can be achieved in the long run. To build in quality control and failsafe operation of the processes creates the conditions for the avoidance of human error. However, in order to achieve this it is essential that the organization have a culture that allows the employees to take these initiatives. By visualizing the processes, problems can be made visible, and having visual inspections rapid evaluations can be made if a process is operating normally or if there are any differences.

It is also essential to collect the gathered learning about a process by standardizing and developing current best solution.

### **3.3.4 Use Appropriate Performance Measurements**

A measurement is characterized as being relative, having a reference to something else. Without a reference to something else a measure has not got any meaning and the performances measured are irrelevant. With performance measurements a firm can determine areas to improve and optimize their internal operations before investing time or money. According to Liker (2009), a preferred measurement should:

- Provide timely feedback to determine the operation's successes
- Determine improvement areas
- Enable quick decision-making.

Many firms are successful in establish programs to improve their internal operations in order to reduce costs and waste. However, they repeatedly fail in evaluating if the operational changes have improved their performance or achieved their anticipated results. When implementing operational changes it is fundamental to determine what should be measured and how it should be measured as a mean to estimate the capability of the change made (Ljungberg & Larsson, 2001).

When determining what to measure the firms manufacturing strategy has to be taken into account. It is essential to link the performance measurements of key areas with the firms manufacturing strategy. Hence, it provides a framework for managers and employees to direct

their actions to work in accordance with the strategy and not against it. Many areas in the internal operations can be measured, but only a few of them are important and contribute to meaningful results. Key areas to measure include: Quality, Cost, Cycle time, Customer service and Delivery precision (Bourne et al., 2002).

### **3.3.5 Issues Regarding Lean Implementation**

Seppälä & Klemola (2004) states that companies have to strive to work towards certain objectives by implementing a process and technology. To create an ideal manufacturing system there are some important steps to implement: Design a simple manufacturing system, recognize that there is always room for improvement, and continuously improve the lean manufacturing system design.

As mentioned in the previous section, lean production has got an absence of a clear definition. Hence, a number of consequences occurs when implement lean for practitioners trying to capture the core of the concept. These issues have been addressed by a number of researchers. The lack of a clear definition will have consequences and in turn lead to difficulties. Communication will be difficult the education on the subject will be complicated and the subject will be difficult to research (Dale & Plunkett, 1991; Boaden, 1997).

Furthermore, fundamental changes in human resources (HR) policy has to be done, as the organizational logic of *Lean Production* requires it (Liker, 2004). A good documentation of the human resource management (HRM) practices (e.g., team work, quality circles, problem solving groups, job rotation etc.) is necessary within *Lean Production* and this requires a great dedication from the involved employees. Moreover, the use of operational performance effects of these HRM practices is hardly in focus or the findings are vague. The importance of managing to perform this is huge and has to be given attention if a successful implementation of *Lean Production* ought to be achieved (Forza, 1996).

The challenge that companies face in practice is the difficulty to create the necessary supporting infrastructure (Womack & Jones, 1996). One major concern in lean production is to build social subsystem or work organization in order to be able to carry on a *Lean* work. *Lean Production* embodies the elimination of inventories and other waste through small-lot production, reduced set-up times, semiautonomous machines and co-operation with suppliers (Monden, 1983).

### **3.4 Process**

The main purpose of processes is to satisfy customers demand, no matter if the customer is internal or external. Therefore, the processes should be designed and planned in the best and efficient way so that when a customer demand is identified this will trigger different activities within a process. The different processes use resources that are provided by the organization, they do not contain any resources themselves. Besides the need of resources, information is an important part for each process. Information makes the processes efficient and the supply of information is an important part in synchronizing the processes and controlling them. It is also important due to the fact that the involved employees have to be updated with the latest information.

According to Ljungberg & Larsson (2001, p.44) "a process is a repetitively used network in order of linked activities that use information and resources to transform 'objects in' to 'items out', from identification to the satisfaction of customer needs". However the authors discuss if this definition is necessary due to the fact that a process usually can be defined as "a chain of activities". Three definitions are presented, and the focus of these definitions differs a lot:

"A process is a collection of linked tasks that transform an input to generate an output"



"A process is a chain of activities in a regular flow creates value for customers"

"A process is a repetitively used network in order of the linked activities using information and resources to transform" objects in "to" items out ", from identification to the satisfaction of customer needs"

(Ljungberg & Larsson, 2001, p.44)

The third definition is the most complete explanation of a process and how it is related to the world, due to the fact that the description involves a network approach that matches the reality. The customers needs and the satisfaction of them is highlighted, and the need for information and resources to produce a result is also included. If value is to be created, resources have to be added to a process due to the fact that a process itself does not contain any forms of resources.

A process has to part where its performance is evaluated. The first performance is the object exiting the process and the effect the process has. The object exiting the process shows the direct result of the process accomplished. However, the second performance, effect, refers to the results in the long-term that the use of the process generates. Efficiency, effectiveness, adaptability and flexibility are the requirements for a process and these requirements set the standard for a process and create the path. The process should strive towards being as straight as possible and the beginning and the end have to be at the right place. Hence, it should be possible to change the process alignment or possible to make an actively choices on some activities within the process (Ljungberg & Larsson, 2001).

### **3.4.1 Performance of processes**

In order to know how good an organizations process is and how it can be measured, Bengtsson & Hjalmarson (2002) argues that the capability of the process can be divided into four categorize.

#### **Effectiveness**

Effectiveness, also known as external efficiency, refers to the process's ability to fulfil its purpose. This could mean for example customer satisfaction or quality, depending on what the aim for the organization is. If the focus is mainly on result, it will be difficult to measure and quantify. Delivery precision and complaints are some properties that are related to the effectiveness and are measurable.

#### **Efficiency**

Efficiency or internal efficiency is measured based on how well an organization can use their resources efficient and how well work in process is performed without any flaws.

#### **Adaptability**

Process's ability to adapt to a changing environment is known as process adaptability, which in turn should not affect the efficiency and effectiveness negatively. However, to measure and evaluate the adaptability is difficult and hard due to the fact that its not easy to define how well an process adaptability is.

#### **Flexibility**

The ability the process has got to manage different needs and situations refers to the process flexibility. Fundamental aspects are short lead-time and high utilization of the process.

According to Ljungberg & Larsson (2001) there is a requirement of certainty of a process and performance, which is related to the quality aspects i.e. zero defects and delivery precision.

### **3.5 Measurement**

Ljungberg and Larsson (2001, p.215) state, "What gets measured is done". The authors feel that as much work as possible should be done beforehand in order to determine what to measure and why. Intuitively, this will lead to the understanding of that the measurements used should relate to the company strategy and their objective. This relationship between process measurement and organization strategy is often far away from intuitive and requires a lot of work in order to break down the strategic objectives. (Ljungberg & Larsson, 2001)

Andersen & Fager-Haug (2006) notes, similar to the above reasoning, that organization measures that, which is perceived as important. If organizations measure something that is unimportant the employees will perform well in an unimportant area. Bourne et al. (2002) found through his studies that the lack of not being able to relate the vision and strategy for their metrics correlate with the degree of failure in implementation of the measurement system. However, they note that the pursuit of perfection undermine success and believes, therefore, that the work in the development of strategically relevant dimensions may be detrimental. Furthermore, they believe it is important to limit the number of dimensions in order not to lose focus on what is important. A large number of measurements may involve the measurement system is a load rather than a means.

### **Resistance**

Deming (1986) communicates the employee resistance to measurements and he states that it is primarily managers who are concerned of being controlled and the fear is due to the fact that they appear being bad. Bourne et al. (2002) have noticed two types of resistant of measurements. The first resistance is related to the flaws that the organization has, an interviewed manager expresses that he is scared of being exposed. Further on, a manager from another organization expresses that they lack standardization in providing feedback in a positive way. As an result, employees got the feeling of being attack personally which decreases the productivity and efficiency.

According to Bourne et al. (2002) the degree of how successful a measurement implementation will be depends on the objective. The most important part is a good communication from the management so that the purpose of the measurement system is communicated to all the employees. There are both successful and unsuccessful cases of measurement improvements. Cases where change process aimed at improving the organization's measurement directly often tend to fail and cases where organizations aimed at manage their processes more effective based on evidence showed success to a greater extent. The main reason is that employees of organizations that openly communicate the purpose of the measurements more easily embrace the measurement system, taking it as something positive (Bourne et al, 2002).

### **3.6 Waste**

Within lean production there are seven wastes that have been identified as the most common once. In order to follow the principles of lean it is important that organizations strive towards minimizing these wastes (Liker, 2009). The seven wastes are:

- Overproduction
- Waiting
- Transport
- Inappropriate processing

- Unnecessary inventory
- Unnecessary movement
- Defects

Overproduction is regarded as the most serious waste as it discourages a smooth flow of goods or services and is likely to inhibit quality and productivity. Such overproduction also tends to lead to excessive lead and storage times. As a result defects may not be detected early, products may deteriorate and artificial pressures on work rate may be generated. In addition, overproduction leads to excessive work-in-progress stocks, which result in the seven-value stream mapping tools physical dislocation of operations with consequent poorer communication. This state of affairs is often encouraged by bonus systems that encourage the push of unwanted goods. The pull system was employed by Toyota as a way of overcoming this problem.

The waste of *waiting* occurs when time is being used ineffectively in a factory. This type of waste occurs whenever products are not in the progress of being manufactured or in a movement and both products and workers in the production facility are affected. The ideal state is accomplished when no waiting time is present and this is achieved by a consequent flow of goods and work in progress.

The third waste, *transport*, involves the movement of products in the production. Any movement in the production could be seen as waste if the ideal state is to create perfection. However, the main purpose is to minimize the transportation of products and goods in the production rather than totally removing all movements that occurs. Moreover, double handling and unnecessary movements are likely to cause damage and extend the processing time.

*Inappropriate processing* occurs when organizations uses expensive high precision equipment in situations where simpler tools would be appropriate. This often results in a bad plant layout because previous or following operations are located far apart each other. Subsequently, organizations encourage high asset utilization, leading to over-production, in order to compensate the expensive equipment. However, investing in smaller and more flexible equipment will create a better layout and therefore a better production flow, which in turn reduces the waste of inappropriate processing.

*Unnecessary inventory* is a direct result of overproduction, waiting and an uncertainty in the supply chain. The end result of having unnecessary inventory is: Increased lead times, occupied floor space, delayed identification of problems and prevented communication. In order to correct these problems it is essential that organizations achieve a smooth flow in the production. Moreover, unnecessary inventories increases storage costs and, hence, lower the competitiveness of the organization.

*Unnecessary movements* involve activities such as stretching, bending and picking up in the production that could be eliminated, i.e. the ergonomics of production. Such activities are seen as waste due to the fact that it is tiring for the employees and is tending to lead to poor productivity and quality problems.

*Defects* are the bottom-line waste in lean production as these are direct connected to an organizations cost. Within lean philosophy, defects are viewed as opportunities to improve the production rather than something to be exchanged and seen as poor management.

### **3.7 Criticism to Lean Production**

The criticism regarding lean production has nowadays begun to increase and is now more frequently exposed in contrast to the pro-lean literature present. The attention has been drawn

towards the employees involved in lean, and the main criticism is concerning the human aspects of lean production.

According to William *et al.*, (1992) lean production has the characteristics of being dehumanizing and unequal. Moreover, Darius (2006) a former worker of the *Toyota Production System* gives his view of lean production. He argues that lean production does not take social aspects to account and he claims that the U.S. industry embraced the principles of lean production without thinking about the humanitarian views and morality in Japan. In the article, the author argues that lean production has a negative impact on the creativity of the practicing organization. The problem solving strategy emphasizes a benchmark vs. brainstorming culture where the engineers collect information about already existing solutions, and then compares them to the own. The idea is to take the existing solutions and if they fit in the production facility to utilize them directly. The effort of innovations is very low and no new ideas are supported, thus the creativity within the organizations is lowered (Darius, 2006).

Furthermore, due to the fact that the constant focus in lean production is about continuous improvement and elimination of waste this creates an obsession of achieving perfection which in turn causes stress in the workforce. Because of the constant pressure of performing better than before the workplace becomes too clinical and impersonal. The end result of the such pressure makes the employees to step out of their comfort zone and increase the performance for a while. However the increased stress levels will subsequently affect the productivity and efficiency (Bicheno, 2006)

Due to the fact that lean has got many different definitions and due to the divided view of lean, there is no standard lean production model available to use. Moreover, the implementation of lean takes place through various tools such as Kaizen and 5S, which aims at eliminating waste in a process. Furthermore, allowing for flexibility of approach, as there is a lack of standard lean model, will lead to employees being confused and not knowing which tool that serves the desired purpose. The success of implementing and adopting lean production depends on the extent to which each employee masters the relevant tools and understands the methodology. If one individual among the employees fails to adopt lean practices, the entire lean system can collapse.

## 4. Empirical Research

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*The chapter describes the collected data that the researchers have obtained from the observations and interviews at Strålfors Svenska Card. The reader is first introduced to the Strålfors Group and Strålfors Svenska Card, which is the company the research is based on. Moreover, in this chapter the reader gets in insight of the Strålfors process methods, performance measurements, hard issues such as availability of tools and soft issues such as their values and culture.*

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### 4.1 Introduction

This chapter begins with a presentation of the Strålfors group and Strålfors Svenska Card, which this master thesis is based on. Further on, with the help of surveys, interviews, observations and the VSM, the main barriers for a successful lean implementation could be identified.

### 4.2 Strålfors Group

Strålfors is an international group with businesses represented in 12 countries. The key focus is in the Nordic countries and its in the Nordic area Strålfors has got the strongest position. However, focus lies on increasing scale in key markets in Europe in order to broaden their scope. The main goal for Strålfors is to be a leading business partners in key application areas in order to manage and develop the system of total solution customer information transfer. Strålfors distributes information directly to the customer's customer in many different desirable shapes. The information is processed and sent to the end user either on paper, mounted on card or electronically. Strålfors group is structured based on three different divisions and common functions such as finance, marketing, business development and human resource (Strålfors, 2012).

#### **Division Graphic:**

This division includes Print on Demand solutions and other traditional forms and gaming products such as bongos and tips roll to games organizers. The division also develops, manufactures and markets information carrier for marking and identification.

#### **Division Information:**

This division offers effective outsourcing in the areas of administrative and direct marketing. The division incorporates electronic payment services in the different environments the client operates in. They are also responsible for effective concept solutions with magnetic strips and smart cards.

#### **Division SPI (System-and product-oriented information transfer):**

This division offers a comprehensive range of accessories and supplies for computers. Furthermore, they also lead pre-and post-processing system for high-speed printers. The group's objective is to be an IT-focused business-to-business company with a print heritage with total solutions active in the field of information. Strålfors develops, produces and delivers systems, services and products for effective communication of critical business information.

Strålfors Group has a number of objectives to be achieved. The group wants to maintain their leading position in Scandinavia and also become a strong player in key markets in Europe. They want to have 20 per cent return on net assets and 10 percent annual organic revenue growth. The group aims at having sales approximately at 5000 million SEK in 2012 (Strålfors, 2012).

Furthermore, the group strives at delivering solutions for information in order to facilitate for the customer to concentrate on their core business. Moreover, Strålfors strategy is to:

- Collect, process, store and deliver customer business-critical information
- Provide the right solution for information regardless of technology and materials
- Deliver both graphical information carrier label and form-like cards and electronic solutions
- Combine effective production with time-and cost-saving logistics and delivery solutions
- Prioritize ongoing, recurring transactions or transactions. in order to meet new demands and customer requirements, with consequent changes in the product and service portfolio, a learning and responsive organization.

### **4.3 Strålfors Svenska Card**

Strålfors Svenska AB is one of the four players who dominate in the Swedish market and is an IT-focused Business-to Business company with a graphical heritage providing total business solutions in the field of information. Strålfors develops, produces and delivers systems, services and products for effective communication of critical business information. The Group has net sales of 3.9 billion, has manufacturing facilities in 8 countries and 2200 employees.

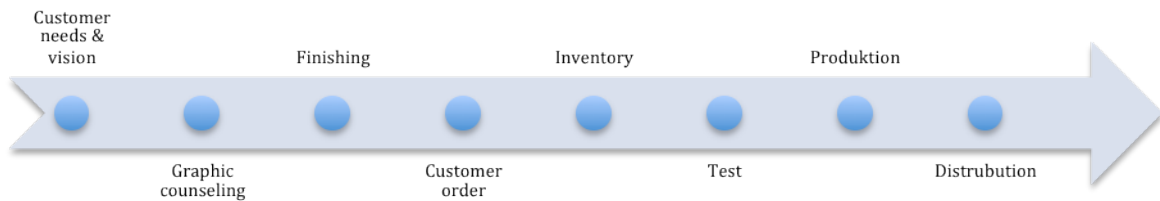
Strålfors is divided into four different business areas. Business area Label consists of pressure and print self-adhesive labels and labeling solutions. In the area Information, printing and enveloping of the business and marketing communications, electronic communications, personalization of cards, electronic payment services and logistics solutions is included. Supplies business area consists of computer and office accessories, and logistics solutions. Business Graphics is an traditional business and Strålfors is Scandinavia's leading graphics companies in the segments of business communications, pharmaceutical press and gaming products. Today there are eight specialized printing houses in 5 different countries, employing over 600 people.

Strålfors is a part of PostNord, which provides communications and logistics solutions to businesses and individuals in the Nordic countries. Thus, this gives the company a great knowledge and understanding of distribution issues. They have operations in Malmo, Ljungby, Västra Frölunda, Alingsås, Solna, Tomtebodå and Sundsvall. In addition, the company does also have operations in Norway, Denmark, Finland, Poland, France and Britain (Strålfors, 2012).

#### **4.3.1 Card Solutions**

Strålfors Svenska Card in Tomtebodå is the company that is investigated. The company has got 14 permanent employees and 3 operators that are hired in order to support the production. They are a part of business area Information and their main duty consists of printing, enveloping, and personalization of plastic cards. Strålfors Svenska Card produces various cards, such as: loyalty cards, gift cards, petrol cards, and membership cards. The company offers opportunities for all the needs of electronic card solutions with large data volumes and high safety.

Strålfors Svenska Card processes are structured with the main processes graphic consulting and finishing, customer order, test, production, and distribution, see Figure 4. These processes are the steps in which Strålfors Card transformers their customers needs and vision into customer benefits.



**Figure 4. A representation of the different procedures** - Strålfors Svenska Card processes and workflow in order to transform its customers' needs and vision to customer benefits (Source: Own illustration).

Furthermore, in order to keep their customers satisfied Strålfors Svenska Card offers warehousing, packaging of attachments and other special requirements that the customers have.

#### **4.4 Process methods**

In order to get a good overview of the situation and valuable input for the value stream analysis that was constructed the researchers initially made a tour of the factory where the production was observed. More specifically, the different processes in the production and the material flow were followed. Thereafter, more direct studies on the individual process steps was performed by holding informal interviews to get a better picture of the problems in the current situation and opportunities for improvement. When the initial tour was finished the research had a good picture of how the production looked like.

First of all, it was easy to see that Strålfors Svenska Card used a functional layout in the production, which means that similar machines/operations are located at one place based on their functions. They have three types of machine groups: printers, personalization machines- and enveloping machines. The process layout have looked the same for a long period and the organization has not changed their layout so far due to the fact that they feel that this is the right layout for them. When asking the management why they have a functional layout, we got the respond:

*“Because our layout has always looked like this and we have managed to do our job so far, we do not feel the need to change it”*

Secondly, it was found that Strålfors Svenska Card has got many different flows and that the steps when producing an item differ due to customer’s requirement. However, the main processes, printing, personalizing and enveloping, are mostly similar. Some customer demands that Strålfors have a high security of their products; other requires that several attachments or delivery notes have to be included before the delivery and so forth. Thus, this has resulted in a disturbance in the process methods where i.e. some customer’s product inventory is handled in a special manner. The process flows in Strålfors are complex pattern of material flow and information flow and the number of manufacturing orders, for a product that is to be produced, are as many as the number of operations.

*“Due to customer requirements, we have many different processes flows instead of a few similar processes flows that would facilitate our work”*

(An Operator in Strålfors Svenska Card)

The processes that Strålfors Svenska Card has got today have been developed towards having a characteristic of a push flow system where the production “pushes” the items out of the

production. This despite the fact that the organization is customer order driven and can only produce a product when the customer places an order, which is the characteristic of a pull flow. A push system has the characteristics of producing an item in advance, which in turn increases the stock levels. When the interviewees in the semi-structured interviews got the question what the processes in their organization primarily is designed to create, 8 out of 10 answered productivity. When this issue was examined in more detail, it turned out that the operators felt that Strålfors Svenska Cards processes are designed in order to produce high volumes repetitively due to the fact that that is what they do. One operator said:

*“Production is about to produce as much as possible, that's what we'll do”*

Subsequently, the performed VSM delivered a more in depth picture of the process and the methods used in the production. Appendix 4 illustrates the conducted VSM of the current state. The VSM revealed that there are several temporary stocks between the operations in the process of the production. This requires extra space and the production appears very unorganized and consequently the stress level in the production increases. Another observation that was made is, when high volumes are to be produced, the stress factor increased due to the unorganized work place. Operators had to look for the products they needed and this was time consuming and in turn the operators became stressed, which infected other employees and created a stressful environment. Moreover, the VSM showed that the total lead-time for a product was 4.125 days compared with the value-time, which was 3.36 seconds.

During the participant observation it became clear that the temporary stocks have become a natural part of the production. They are present due to the fact that the organization has build a manufacturing system where temporary stocks are accepted and a part of the production process. The VSM also revealed that the material flow is rather complex and that the distance is long between the operations in the production flow, which impedes the transportation of the material and information.

Furthermore, the starting point for the production is when the manufacturing orders are delivered to the sections concerned in the process. An operator delivers the orders manually to the involved operations and, as mentioned earlier in the section, the numbers of manufacturing orders for a product that is to be produced are as many as the number of operations.

When other flows were observed the researchers noted a red thread in the production process, which is a lack of interaction between the operations in the process. However, even though the used processes are mature they have not been developed in order to fit today's contemporary market, meaning that they are not flexible and adaptable enough.

#### **4.5 Performance Measurement**

Strålfors Svenska Card measures a variety of factors in the production that they feel is important; the utilization of their machines, products with defects when produced, material with poor quality delivered from their suppliers, delivery precision, customer satisfaction and reduced paper waste.

The documentation of the utilization of the machines is handled in separate ways. The enveloping machines for instance has got a program built in which allows Strålfors to see exactly how many minutes the machine has worked and how many minutes it has stood still. The printers and personalization machines however has not got such a program. The operators have to write down manually how many products that they have produced during their working hours. By knowing what the theoretical utilization of the printers and personalization machines is and comparing it with the actual utilization it is possible to know how high the real utilization of the



machines is. According to the operators and the management, it is important that the utilization of the machines is high. When observations have been carried out and when interviews have been held the importance of a high utilization of the machines has been raised as an important performance measurement.

In almost all the sections of the production there is a documentation of the number of products that are produced with defects. However, the operators separates the defect depending on if the defect have occurred due to a poor production or due to poor quality of an product from their suppliers. The difference in documenting products that are produced with defects depends on whether it is in the printing, enveloping or personalization area. The printing and enveloping area does not document the numbers of defect caused by poor quality of a product from their suppliers. Instead, the dissatisfaction on the quality of the items from their suppliers is expressed orally to the management team. The personalization area on the other hand keeps a precise track on the numbers of defect that occurs, regardless if the defect has occurred due to poor production nor if the quality of a product from their suppliers has been poor.

Approximately 65% of Strålfors Svenska Cards projects are delivered within the contracted time frame. According to a management employee, “ Strålfors Svenska Card was mostly about producing and distributing efficient, while nowadays it is about realizing our customers vision and achieving impact with our products. That is the biggest difference from the past in our organization and it affects us a lot”. As a result of this, customer satisfaction is measured continuously in Strålfors Svenska Card. The customer satisfaction measurement is conducted through a survey that they send out to their customers, or by a follow up call. When it comes to customer satisfaction, Strålfors Svenska Cards rating is in average 6,8 on a scale of 10.

Strålfors Group began an energy-saving program in 2001, which resulted in that the different divisions moved to more modern, better-adapted facilities and implemented cost reduction projects on existing facilities. Hence, Strålfors Svenska Card moved from their facility in Uppsala to Tomtebodavägen in Solna. As a result of the energy saving program the use of solvents has decreased drastic the last year and continuous efforts are made to minimize the amount of paper waste from production.

Every month data regarding the different measurements is compiled. The operators compile the number of defects caused in the production and by poor quality of the products delivered from their suppliers. Hence, the operators do not have access to the data automatically every month. The management present the data only if the operator's asks for it or if there has been a big deviation from the previous months.

#### **4.6 Standardization**

In order to increase the researchers knowledge about how widespread the use of standardization was in the production, a survey was distributed to all the operators. The operators were asked to answer the questions individually and the participation was voluntary and anonymous. The survey can be found in Appendix 2.

Already at the first question, it was possible to see a clear dissatisfaction among the employees where all answered that they experienced their workplace unclean and disorganized. The survey revealed that cleaning took place once a week, and machine maintenance only once a month. Regarding the tools used in the workplace, 95% of the operators answered that they did not have a good track of the tools. However, the tools were within a radius of two meters. Further on, at a mechanical breakdown only half of the respondents considered that they had a good collaboration with their co-workers and a mechanical breakdown approximately occurs 1-2 times

a week. The changeover time on a machine takes between 10 to 30 minutes until the machine is ready to start. Hence, changeover takes place minimum twice per shift.

The observations made revealed that Strålfors Svenska Card did not have any standard that describes the organization's processes and operations. For instant, as a result of this, operators have their own routine for how they perform their daily jobs and the routines differ greatly from an operator to another, which was noticed during the participant observations. Furthermore, another observation made was that when a new employee was hired he/she did not have any clear routines to follow. Instead the new employee was taught up by one of the existing operators.

Moreover, there was not any standard production plan visible that showed how the production schedule looked like. Due to the fact that the production management has not planned the production, this has led to the fact that production has been "planned" by the operators. However, at some occasions it occurred that the management did involve them in the production and determined the order in which the different products would be produced.

Strålfors Svenska Card had meetings irregularly regarding the performance in the production and improvements. In the weekly meetings all the employees were present and in the improvement group only a few selected candidates took place. However, when asked if any improvements had been made in order to improve or reduce the stops and smooth the production flow, 90% answered no. The reason for this is old work practices and an old mentality, which make them blind to changes, and we quote an operator who said, "We have always worked like this and probably always will".

A clear observation made was that there was not any documentation regarding Strålfors Svenska Cards processes and procedures.

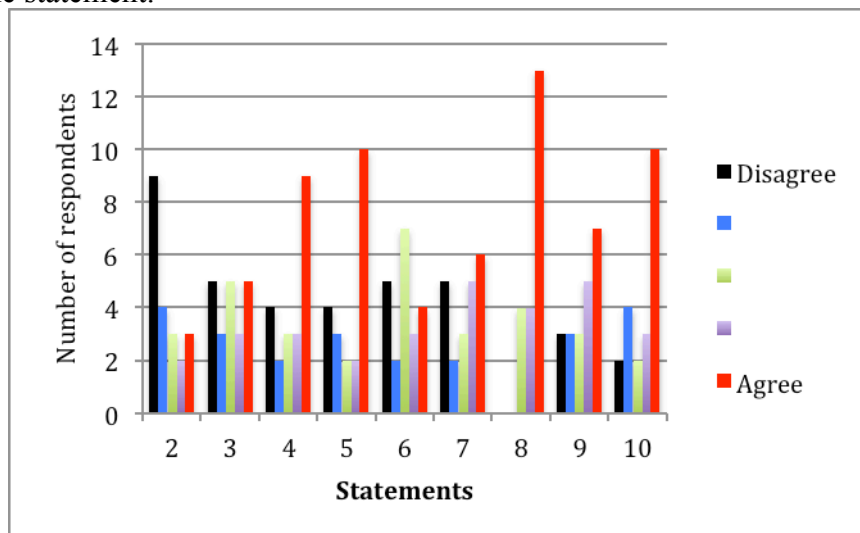
#### **4.7 Soft issues**

Regarding the soft issues, i.e. culture and value, a gap was identified between the employee's culture and value at Strålfors Svenska Card. From our participant observation and various interviews we found that due to a poor communication from the production management there was an absence of a clear corporate culture and understanding of Strålfors values. For instance, four out of ten of the interviewees that participated in the semi-structured interviews claimed that a steady worker represented the employee that best fit the organization's culture, while three out of ten claimed that a logical thinker best fit the organization's culture. The remaining interviewers answered that a ready worker represents the organization's culture. Moreover, in order to get a better understanding of the employees picture and view on production, a survey was distributed to all employees. The objective was to identify how the culture in Strålfors Svenska Card looks like and the values the employees have. The survey was structured in such a way where nine statements were presented and the respondents had to fill in if they agreed with the statement or not based on a five-point scale, see Appendix I.

Concerning the second statement, to produce something too early is as bad as producing it too late, 9 out of 21 answered that they disagreed and 3 answered that they agreed. The employees had separated views concerning the third statement where 5 did disagree, 5 did agree and 5 neither agreed nor disagreed. "It is good if employees do a little extra time on each product to enhance the quality beyond the level that the customer requires", 12 out 21 inclined to agree with the fourth statement. The employees deviated regarding the seventh statement, when I discover an error I will "alarm" it so that we can identify how the error occurred and make changes in production". The sum that did disagree, agree and neither disagree or agree where the same. However, in the eighth statement the result was clear where no one did disagree that in a

workstation, tools and materials should be arranged in order of magnitude so that even new employees can find what they need. The majority agreed that it is better that a truck drives up a large box of materials than to fill small boxes seven times a day.

Figure 6 shows the result of the survey in Appendix 1. The x-axis shows which statement that has been answered and the y-axis shows the number of respondents that have answered the question. Moreover, the colors represent to which degree the respondents have disagreed or agreed with the statement.



**Figure 6. Summary of survey in Appendix 1** – the answers that the respondents declared based on the statements from Appendix 1.

The operators manage their work basically on their own and there is little involvement from the management, and nowadays this has become a part of the culture. The production management places the responsibility on the operators and they require that the operators take care of their work in production with minimal guidance.

When a more personal communication could take place with the operators many of them expressed their anxiety to introduce lean, as they were afraid of losing their job. They were afraid that, if lean would be introduced and improvements would be made, their service would disappear with time. However, there were also those who felt lean was somewhat unnecessary and those who felt that lean would improve their production and help the operators in their daily work. The resistance to change has to do with the fact that Strålfors Svenska Card has worked in the same way for a long time, which in turn has resulted in that the employees have adapted themselves to the work mode and made them unwilling to adapt to new work habits. An employee said:

"Lean? What is lean? Production is about to produce as much as possible".

As also mentioned before the culture in Strålfors is characterized by the phrase "we shall work as we always have been working. Our direct observation, which were focuses on the operators work habits and their mentality in order to capture the culture of the organization, revealed that the culture in Strålfors Svenska Card has been defined through common assumptions that has been learnt whilst solving problems individually. When this issue was examined in more detail, it turned out that the operators felt that Strålfors Svenska Cards processes did fit the culture of the organization, as the processes are designed in order to produce high volumes repetitively. "Production is about to produce as much as possible, that's what we'll do", said an operator.

As all employees work individually, this has led to a poor communication within the company. Due to the fact that the employees are not communicating with each other, which has resulted in a tremendous deviation in routines, working habits and performance. Routines are something that is the same from day to day in Strålfors Svenska Card. The employees rarely need to think about what they do and why they do it, the action is done automatically because they have done the same thing many times before. Regarding the possibility of facing change, the employees differed in that specific point. Some saw it as something possible while other did not. Those who were against change said, "we do not need change, we only have to produce"

## 5. Analysis

*In this chapter, the theoretical framework and empirical research are connected and analyzed based on the situation at Strålfors Svenska Card. The topics are divided into the areas from the research sub questions in order to easier follow the structure throughout the report.*

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### 5.1 Introduction

This master thesis has had the objective of highlighting the main barriers that have to be considered when implementing lean at Strålfors Svenska Card. This study addresses the following research question:

- What are the main barriers for a successful lean implementation in Strålfors Svenska AB?

Consequently, the research question was operationalized into four sub-questions. These are:

RQ1: How developed and mature in the organization are process methods?

RQ2: How are performance measurements employed?

RQ3: Which role does standardization, such as availability of tools, have?

RQ4: Which role do soft aspects, such as culture and values, play in understanding concepts?

When appropriate scientific knowledge was gathered the theory was applied on Strålfors Svenska Cards current situation. The aim was to gather as much information about Strålfors situation as possible in order to identify main barriers for a successful lean implementation.

Scapens (1990) defines an experimental case study as a research that examines the difficulty in implementing new procedures and techniques in an organization where earlier research are applied for an evaluation of the benefits in the particular case. This is in line with our research at Strålfors Svenska Card, where the objective is to conduct a pre-study to lean implementation by highlight main barriers that have to be considered when implementing lean. The theory about lean production and earlier research has given the opportunity to achieve the objective by evaluating the current situation in Strålfors production facility.

### 5.2 Process Methods

According to Goldsby & Martichenko (2005), in order to avoid waste such as overproduction, which in turn often leads to many other wastes, it is important to develop processes that can produce the right quantity at the right time. In Strålfors Svenska Cards case this is extremely important to consider and try to achieve. In the current situation Strålfors produces without considering the time, meaning that they produce regardless when the customer has ordered to get their products. Very often the finished quantity is produced ahead of time and this results in high stocks levels of finished products.

The functional layout currently used in Strålfors Svenska Card is typical of an organization that does not practice lean. There is a belief that management is easier handled due to the fact that leaders have fewer functions to manage. Machines are organized based on their functions, meaning that the equipment's that enhances the value for the products are gathered in groups depending on the type of equipment, e.g. all printers are placed in a group. The use of a functional layout has influenced the way work is managed and how the production is handled. This has resulted in a long distance between the operations in the manufacturing process, which in turn requires many movements, they have many manufacturing orders due to the fact that each machine group needs its own production order.

A traditional manufacturing process is handled by assigning work to each process separately (push flow). This form of planning the production, where different processes are allowed to work individually without regard to the whole production, often creates large stocks between the processes and thus create wastes according to Waters (2003). Hence, this is the case in the Strålfors Svenska Cards current situation. The VSM revealed that there are several temporary stocks between the operations in the manufacturing process. The organization has managed to make their temporary stocks a natural part of their production by accepting them.

As with most things, though, there is a trade-off. The selection of a manufacturing process is done very much on the basis of a manufacturer choosing the process that best suits their needs. Consideration must be given to a number of factors. Before deciding on a manufacturing method three primary factors are quality, flexibility and cost. At the moment Strålfors is very flexibly and they can manage to produce products with low and high quantities and products that require different operations. To be able to be as flexible as they are is a strength, but the remaining factors (quality and cost) are being overlooked due to the fact that the workload is high and due to the fact that they are managing many different types of customers with different demands. This has led to the fact that Strålfors Svenska Card has got many different flows in their production.

In the case of process maturity and development the processes differs between new and existing customers. For existing customers Strålfors has got relatively good processes, they manage the process well and they have a relatively good control over the production. However in terms of new customers the processes are not as developed as they need to be. This is the result of having mature processes that have not been “updated” in order to suit the contemporary industry and a high customer influence, due to the fact that new customers have more advanced products and higher influence. According to Ljungberg & Larsson (2001, p.44) "a process is a repetitively used network in order of linked activities that use information and resources to transform 'objects in' to 'items out', from identification to the satisfaction of customer needs". Strålfors has not creates processes that gains their own production process instead they have focused on satisfying their customers need and developed the processes based on that.

It can be concluded that due to the fact that Strålfors Svenska card lacks important knowledge about process development they have fallen into the trap of working with old routines. New customers are treated in the same matter as the old once and the processes are not adapted to create the right value for customers in the contemporary market. The new customers have requirements on how the production should be run and this puts pressure on Strålfors and results in many flows.

However, according to Ljungberg & Larsson (2001) an organization has to consider the results in the long-term that the use of a process generates. Efficiency, effectiveness, adaptability and flexibility are the requirements for a process and these requirements set the standard for a process and create the path. Strålfors Svenska Card has to be aware of the fact that mature and non-developed processes have to be modernized in order to fit the principles of lean production and to succeed with a lean implementation.

### **5.3 Performance Measurement**

From a management perspective, measurements are important and vital in order to have an effective management and organization that is constantly improved. Ljungberg & Larsson (2001) argues that without measurements one does not know where they are, where they are going, what they have achieved and what remains to do. Measurements are tools that identify problems and provide knowledge in order to have a better performance in the future. It will allow companies to set goals, to improve and to develop. In Strålfors case it is essential that they understand the importance of measurements and that they measure the “right” thing. At the moment the

organization only measures their performance in some areas that does not say much about how they manage their internal processes. For instance, instead of blindly staring at the utilization of the machines Strålfors should try to look at the throughput time for an item to be produced, the tact time in the production and how good they are at delivering the finished products on time. These performance measurements will help the company to work aligned with lean production and it will help them to embrace the philosophy of lean more easily.

In Strålfors case we believe that there is a need of more active performance measures. The current performance measurements are only focused on productivity and profit, hence this creates a culture where the only right thing is to produce as much as possible and not to produce in the right way. Today, no time measurements regarding lead-time, tact time or throughput time are made even though these factors are important in order to increase productivity. Hence, in the performed VSM it was revealed that the total lead-time is significantly longer than the value adding time. This is something that we feel should be addressed relatively easy when the company will increase their knowledge about lean. Moreover, the current used performance measurements are not in line with what lean production advocates. If a successful lean implementation is to be conducted, Strålfors Svenska Card need to begin measuring more relevant factors that directly affects the production. The new measurements will make it possible for the management to have a better picture of how the internal processes looks like.

During both the participant and direct observations that the researchers conducted, no performance measurement could be identified in the production floor that included throughput time, setup time, downtime, waste and finally cost. For example, if a product was delayed when produced, regardless of the reason, the operators did not take any notes in order to document the disturbance. This in turn meant that there was no follow-up present and the same mistakes were allowed to occur. When new performance measurements will be implemented, Strålfors has to communicate to the employees how and why these measurements have been chosen. They have stop using any existing measurement system as a mean to reduce organizational confusion and enable the possibility to provide a measurable management direction (Bourne et al., 2002).

In order to avoid waste such as overproduction, which in turn often leads to many other wastes, it is important to develop processes that can produce the right quantity at the right time. Another important factor is that Strålfors Svenska Card should start to measure key areas that include: Quality, Cost, Cycle time, tact time and production rate.

If the organization develops their processes and modernize them, the issues regarding performance measurements will be solved. In the current situation the organization is too focused on profit and quantity. They have to employ performance measurement that enhance the internal processes and helps them to develop them continuously. Delivery precision and complaints are some properties that are related to the effectiveness and these factors are measured at the current time. However, to measure and evaluate the adaptability is difficult and hard due to the fact that it's not easy to define how well a process adaptability is. Fundamental aspects are short lead-time and high utilization of the process. According to Ljungberg & Larsson (2001) there is a requirement of certainty of a process and performance, which is related to the quality aspects i.e. zero defects and delivery precision.

## **5.4 Standardization**

In lean production standardization is an important factor as it creates the right conditions for a company to be able to work with lean. Figure 3 in section 3.2.2 illustrates the significance of standardization as it creates the basis of lean. One of the reasons for standardizing is precisely to create measurements. That is to say, without an associated standard there is no way to evaluate the processes or no possibility to identify deviations. Which in turn makes it hard to determine

what can be improved or where the process fails. By using standardization, the processes and procedures can be developed and applied. However, to choose which activity that should be standardized is crucial and varies depending on the process used, each process has its own unique activities.

Throughout the research, the researchers could notice that there was a clear absence of standardization in Strålfors production. Our survey clearly showed that the operators do not have any standard instruction on how they should maintain their machines, how often they should be maintained, when they should clean their workplace, where the tools used should be placed and how the operators should collaborate when a mechanical breakdown occurs. At site in Strålfors Svenska Cards facility, no standard procedures such as the 5S method were visible. As mentioned in section 3.2.2, 5S focuses on activities and procedures in the workplace in order to create order and visible working structures. In Strålfors case, the introduction of the 5S method would eliminate many wastes immediately and help the organization to focus on their core business, to produce.

Further more, according to Holweg and Bicheno (2009) standardization acquires that organizations develop processes and procedures that are repeatable, reliable and capable. It is also important to use documentation as a mean to enhance standardization. Strålfors lacks in all the points mentioned above. The organization has failed on developing processes that are capable, which in turn means that they are not repeatable and reliable. The organization has also missed to create standard procedures. Instead, all the operators have their own procedures when they carry on their daily work. Moreover there is also an absence of documentation of their process methods. We found this somewhat strange and when we investigated this in more detail, we found that the organizations culture affected their performance. These factors combined make it hard for the organization to create any standardization.

Standardized processes would lead to an achievement of continuous flow through the production process, which would make it easier to identify problems and wastes. Strålfors Svenska Card has to embrace the importance of standardization and understand the significance of the implementation of standardization. However, the organization has to identify the right activities to standardize and to understand why they are important. Bellgran & Säfsten (2005) mention that through active participation in the standardization implementation the process of accepting the standard will facilitate. It is essential that the production management lets the operators participate and to be involved when the standards are developed.

We got the question why standardization is important? According to Liker (2004) standardization should be seen as a means of stability. When analyzing the theory and the empirical data, Likers vision is in line with our thoughts. Standardization creates stability due to the fact that if an organization has clear guidelines it will create a stable environment. Everybody will know what to do and there will not be any confusions. The deviations will be minimized and the employees will get the feeling of working together towards the same goal.

## **5.5 Soft Issues**

Lean emphasizes the importance of developing a culture that creates a learning organization, thus constantly learning new things in order to continually improve current processes. In order for Strålfors Svenska Card to implement this approach, a supportive leadership that allows the problems and flaws to be converted into common learning and provide opportunities for improvement is required. The leadership style has to be changed and it requires that the leaders lead the way by making active choices and provide support. According to Larsson (2008), as an aid to management and directors, employees can be selected as guide. These people serve as an

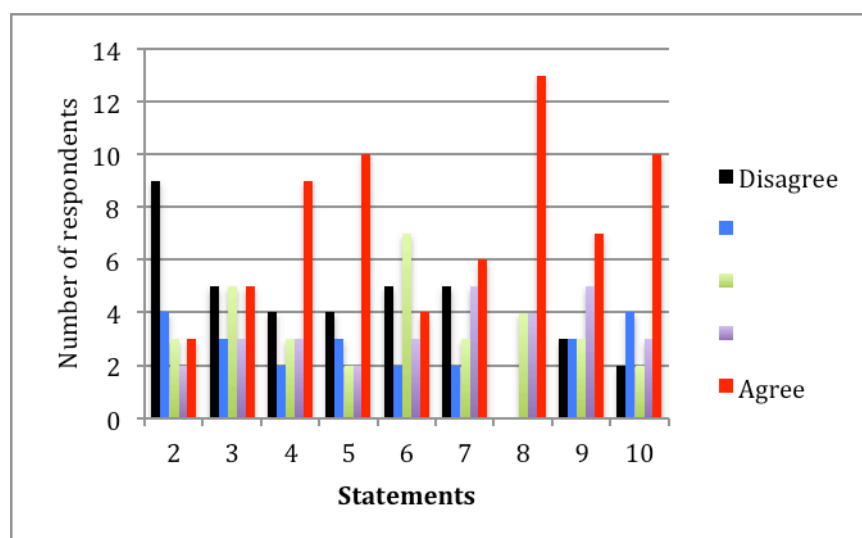


example and inspiration to other workers and should be balanced, developing interested, senior, communicative, and have a natural authority.

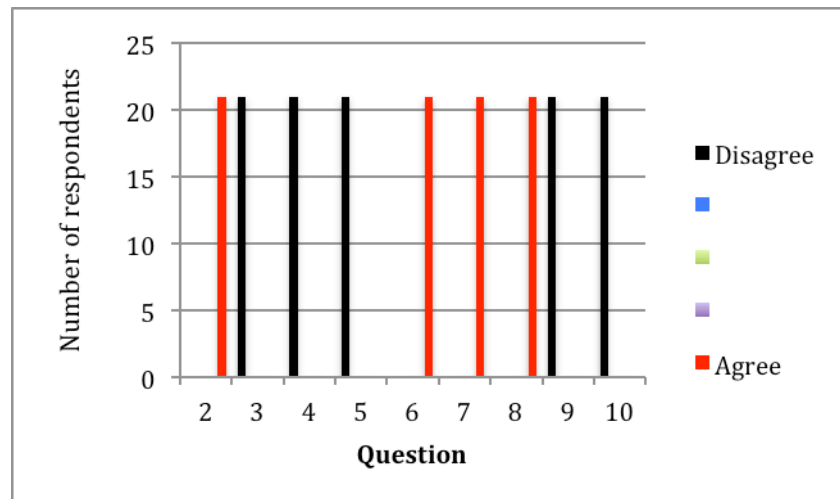
The strategies and objectives of the Business area Information are not appropriately communicated. All employees at Strålfors Svenska Card do not know the goals of the organization. This means less understanding of one's role in the business process and creates confusion among the employees.

In Strålfors Svenska Card case the leadership is important and the fact that they plan the production as efficient as possible is essential in order to be structured and productive. New clients are often recruited and this disturbs the production and very often the employees have to change their daily work and their procedures when a new client is recruited. However, in the current situation Strålfors has not got a planned production that is visible. The employees produce the products based on their intuitions rather than directives from the production management. In order to be successful with their lean implementation the leaders have to assume more responsibility and be more directly active. The organization has to erase the culture of shared responsibility and instead the production management should take the initiatives.

Comparing to the result in Figure 7, which were presented in the empirical research, Figure 8 shows the “right” results based on the literature regarding lean production. Apart from statement number 8 the employees' answers did deviate significant from what the literature says. This shows that the employees at Strålfors Svenska Card have a different view on the purpose, methods and processes of production comparing to the literature about lean production. Lean production advocates that an item that is produced too early is as bad as if would be produced too late. An organization should have low inventory levels due to the fact that it is good for the business and the restricted capital is lowered. An employee should not spend more time then necessary on each product in order to enhance the quality beyond the level that the customer requires and it is not good for those who work faster to build up buffer and make time for an extra break. Furthermore, if an employee has thoughts about tasks or the environment at their workplace, there are good and encouraging ways to express them. When an employee discovers an error they should "alarm" it so that they can identify how the error occurred and make changes in production and it is not profitable that a truck drives up a large box of materials but instead fills small boxes seven times a day.



**Figure 7. Summary of survey in Appendix 1 – the answers that the respondents declared based on the statements from Appendix 1.**



**Figure 8. Answers based on the literature** – the “real” answers of the survey in Appendix 1 based on lean principles and philosophy.

Bakka et al (2006) stresses the importance of organizations managers to reduce the resistance within the organization in order to have a successful lean implementation. There are various approaches to overcome the negative resistance that can occur and Strålfors has to embrace them in order to succeed with a lean implementation. The importance lies among the employees to understand why change is necessary and how they can benefit of it. Furthermore, it is also important that the production management tries to get an understanding of the resistance present and then to develop strategies to reduce resistance.

One of the biggest issues is the lack of communication among the operators and between different business units in the production. Strålfors has built up a culture where operators work individual, which leads to the fact that the values differs from one operator to another. To succeed with a lean implementation Strålfors Svenska Card has to align the employees and create a culture that will enhance their work. A culture that combines the values of the employees into one and the same values for strive of achieving continues improvements.

In section 3.2.3, Principle 5 in the 4 P model urges that organizations have to build a culture of stopping the processes in order to fix the problems, as a mean to get quality right the first time. By building into the culture the philosophy of stopping or slowing down processes to get quality right the first time, it will enhance Strålfors productivity in the long run. The organization would learn to produce in the right way by minimizing waste and smoothen the production flow.

## 5.6 Resistance

According to Bourne et al. (2002) the degree of how successful an implementation will be depends on the objective. In Strålfors Svenska Cards case it is essential that the production management communicate the purpose for a lean implementation. They have to explain that the purpose is to improve the internal processes and to focus on their core business, in order to fulfil their customers' requirements.

"Lean? What is lean? Production is about to produce as much as possible".

According to Bourne et al (2002) cases where change process aimed at improving the organization's performance directly often tend to fail and cases where organizations aimed at managing their processes more effectively based on evidence showed success to a greater extent. The main reason is that employees of organizations that openly communicate the purpose of the implementation more easily embrace the changes, taking it as something positive. The probability that resistance can occur in Strålfors Svenska Card is high because the employees do feel as they are forced to give up old routines for the new. It is important that the production management understand the importance of giving time and being patient towards the employees.

### **5.7 Waste Reduction**

As mentioned earlier very often the finished goods are produced ahead of time and this results in high stock levels of finished products. This is seen as a waste in lean and Strålfors Svenska Card has to minimize this waste by having a production schedule that is appropriate and developed processes that produce the right quantity at the right time.

Within lean production there are seven wastes that have been identified as the most common ones. In order to follow the principles of lean it is important that organizations strive towards minimizing these wastes, according to (Liker, 2004). The waste of overproduction tends to lead to excessive lead and storage times. As a result defects may not be detected early, products may be impaired and false pressures on work rate may be generated. In addition to this, overproduction leads to excessive work-in-progress, high stocks, and poorer communication. As a direct result of overproduction is unnecessary inventory, such as the temporary stocks identified by the VSM, and the end result of having unnecessary inventory is: Increased lead times, occupied floor space, delayed identification of problems and prevented communication. In order to correct the waste and the upcoming problems it is essential that Strålfors Svenska Card achieve a smooth flow in the production.

Moreover, due to the functional layout in the production that Strålfors has got inappropriate processing occurs. Previous or following operations are located far apart from each other. Subsequently, Strålfors culture has encouraged high asset utilization, leading to over-production and the transportation of products and goods in the production is complex.

Another observation that was made is, when high volumes are to be produced, the stress factor increased due to the unorganized work place. Operators had to look for the products they needed and this was time consuming and in turn the operators became stressed, which infected other employees and created a stressful environment. A better communication and planning by the production management can eliminate this waste and make the production less stressful.

Seppälä & Klemolas (2004) description of lean, "lean is a goal that one has to work towards, like a vision", explains in a good way how Strålfors Svenska Card should approach their lean implementation. The organization should not rush the implementation and the changes, instead it is important that they understand what they need to do and how they should do in order to achieve their objective. According to Shah & Ward (2007, page 791) "lean production is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability". In Strålfors Svenska Card's case lean production should be seen as the tool/philosophy to use in order to reduce the wastes and improve their production. It is important to understand that the wastes that Strålfors has got are common and that other manufacturers face the same problem. With regard to the definition by Shah & Ward, Strålfors has focus on the internal variability mainly in order to reduce their wastes in the production.



## 6. Conclusion

*This chapter presents the conclusions based on the information from the theoretical framework and the empirical research, which is discussed in the analysis.*

---

Based on the information provided from the theoretical framework and the experimental case study, the researchers found that, in Strålfors Svenska Cards case, there were four main barriers for a successful lean implementation. These barriers are essential to consider and to adjust in order for Strålfors Svenska Card to succeed with their future lean implementation. Process methods, performance measurements, standardization and culture and values were identified as the main barriers from the initial identification part conducted in the research.

The analysis shows that each of these four general barriers contains risks identified by theoretical and empirical study of impeding a successful lean implementation. The researchers believe that many risks have arise due to the fact that no new ideas and approaches have been introduced and due to the fact that improvements have not been supported earlier. Conclusions that can be drawn from the analysis is:

- RQ1: The present process methods in the organization are mature but they are not as developed as they need to be. Strålfors Svenska Card has fallen into the trap of working with same routine year after year because it is comfortable. However, the organization has managed to increase their profit even though no changes have been made. This has contributed to the fact that no effort have been made in order to change their processes. In order to succeed with a lean implementation Strålfors Svenska Card has to re-arrange their processes and develop them towards being more suitable for a lean work. The implementation requires that the organization follow the philosophy and principles that lean advocates.
- RQ2: Strålfors Svenska Card has focused on measuring performances that are superficial and short-term and not performances that will help them in the long term. The focus on measuring the production quantity each month gives them misleading data and it does not reflect how the production is led, the difficulties faced and efficient the production is. Moreover, the positive thing is that the company documents the error that disturbs the production and the fact that they are divided into errors caused by the production and those that are caused due to poor quality of the product delivered from their suppliers. They only complaint is that the company should use the data in a better way and take advantage of it. In order to overcome this barrier it is important that Strålfors Svenska Card implements performance measurements that measure relevant data and more specially, data that is important in order to work in line with lean production.
- RQ3: Standardization is a good method to use in order to be assuring that one is working in a systematic way without any major deviations. The literature pinpoints the importance of having standardization in order to be able to work in line with lean production. Standardization plays an important part in lean and the philosophy requires that companies standardize their working habits and processes in order to succeed with their lean work. From our survey regarding standardizations in Strålfors Svenska Cards production and from our observations we found that Strålfors Svenska Card did not have any standardization in the different working areas. They lacked standardization regarding how often the working area should be cleaned, where to place the used tools, how to cooperate when a mechanical breakdown occurs and how the working procedures look like. When lean is being implemented in Strålfors Svenska Card it is important that the company has standardized their work in order to prevent that they will fail with their lean implementation.

- RQ4: It is important that a company's values and culture is aligned with the philosophy of lean. Moreover, it also has to be aligned with the company's own strategies. The management in Strålfors Svenska Card has to adapt to the culture that lean emphasises and more important, they have to communicate it to all the employees in the organization in order to assure that everybody has understood it. The concept of lean is fairly complex and diffuse, which puts a great importance that the leaders advocate the importance of lean. As the situation looks like today, Strålfors Svenska Cards culture and values have to be changed in order to understand the concept of lean, which plays a major roll in the implementation phase.

Moreover, it is impossible for Strålfors Svenska Card to achieve the perfect state with zero perfection. The organization will have some of the wastes present, such as the temporary stocks, as this is a natural part of an organization. The importance is that they create a new habit of working standard and focus on continuous improvement and problem solving. The chosen research question are aligned and connected to each other. Standardized tasks and processes are the foundation for continuous improvement and employee inspiration. This due to the fact that if processes and tasks are standardizes it is much easier to detect if there are some deviations that could impede the quality, which is made of measurements. In order to sustain lean principles and philosophy the culture holds together all the parts and makes it possible to work with lean production.

## **6.2 Limitation**

A limitation has to do with the employees' loyalty to the company and their motivations to respond truthfully. Since the results of the surveys are depending on the employees' answers their capability to maintain trustworthiness was important. However, as a mean to overcome this uncertainty the employees were promised anonymity.

Furthermore, in this research only the authors participated in the identification of the barriers for a successful lean implementation. This resulted in an in-depth picture of Strålfors Svenska Cards processes, culture and routines for the researchers. However, in order to make the research valuable for the employees, some were offered to participate in the operation and process mapping in order to gain the same in-depth knowledge as the researchers.

## **6.3 Future Research**

Lean implementations usually follow several steps, from an initial identification of the problems, to implementation, monitoring and evaluation. Due to the fact that this research has been delimited to the initial identification step, it would be appropriate to conduct a future research on the following steps. Most natural is thus to follow during the implementation part and the evaluation of this.

When Strålfors Svenska Card has fulfilled the lean implementation in their production, it would be appropriate to also look at the processes before and after the production. In order to have a complete and cohesive lean implementation all the areas included in the supply chain have to be considered. With this study as a basis, one could make similar process mapping on the Purchasing and logistics area in order to reduce wastage and to get a complete lean implementation throughout the whole supply chain.

Furthermore, all departments within the business area Information would be interesting to map in the same matter as in this research, if this has not previously been made. This would provide a

clear, solid description of all the activities within the business area. To implement lean production in all departments, it is important that the communication between the departments work accurately. During the study, the researchers observed that the communication between the different departments in Strålfors Svenska Card had major flaws. For example, there is a lack of interest on putting an effort and informing each other when changes occurred in the warehouse stock or as the purchasing department acquired customers without checking with the production if they had the capacity or the possibility to produce more then in present time.

## 7. Generalization Possibilities

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*In this chapter the possibility whether the results in the research conducted can be generalized or not is discussed.*

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How the results of this research can be claimed for other companies and organizations is an important issue to discuss. It is reasonable to assume that the results presented to some extent may also be appropriate for other companies in the same industry, due to the fact that the processes in the production are very similar. Furthermore, when contacting other companies in the same industry in order to get a picture how many of them that had embraced lean production and its philosophy, only one out of five companies answered that they had implemented lean production. The remaining companies had not taken any initiative to work with Lean. Hence, the results from our research have the potential to be generalized and applied on other companies in the same industry if they would like to implement lean production.

By carrying out direct observations, participant observations, interviews and connecting it to the scientific knowledge about lean production, all companies and organizations can identify barriers that are necessary to consider when implementing lean production. This is not specific for Strålfors Svenska Card or for their industry. The most essential and important thing is to work in a systematic way throughout the initial identification part of the identification of the barriers. Moreover, the selected barriers are chosen based on the literature and other companies may need to consider the same barriers when implementing lean production.



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# Appendix 1

## Survey regarding the employees believes of production

Apart from Question 1, we will make a number of statements that you pinpoint a figure for each statement in a five-digit scale. The number 5 means that YOU agree with, while the number 1 means disagree. The purpose of this survey is to get a clearer picture of how the employees at Strålfors Svenska Card experience the purpose, method and process of production.

Thanks in advance!

1. Have you heard of Lean Production?

YES              NO

If yes, write down a brief description of what lean production is for you.

.....

.....

.....

2. "To produce something too early is as bad as producing it too late"

1              2              3              4              5

3. "To have high inventory levels is good for the business"

1              2              3              4              5

4. "It is good if employees do a little extra time on each product to enhance the quality beyond the level that the customer requires"

1              2              3              4              5

5. "It is good for those who work faster to build up buffer and make time for an extra break"

1              2              3              4              5

6. "If I have thoughts about tasks or the environment at my workplace, there are good and encouraging way to express them"

1              2              3              4              5

7. "When I discover an error I will "alarm" it so that we can identify how the error occurred and make changes in production"

1              2              3              4              5

8. "On a workstation, any tools and materials should be arranged in order of magnitude so that even new employees can find what they need"

1                      2                      3                      4                      5

9. "It is good that some employees can work faster than others and thus create a buffer"

1                      2                      3                      4                      5

10. "It is better that a truck drives up a large box of materials than to fill small boxes seven times a day"

1                      2                      3                      4                      5

## Appendix 2

## Survey regarding standardization

Hi,

We would like you to answer a few questions in order to get your opinion on how the current situation looks like in your working area, and also what areas of improvement that are available. The survey is completely anonymous.

1. How clean/organized do you experience your workplace?

1

2

3

4

5

Bad

Really good

2. How often do you clean your workplace? (e.g. sweeping the floor, cleaning the machine)

...../week

3. How often is there machine maintenance on your machine?

...../month

4. How good order do you have on the tools used in your workplace?

1

2

3

4

5

Bad

Really Good

5. Are there tools that are used less than one time/month

Yes

NO

If JA, then what?

Do you have all the tools necessary to quickly adjust the machine?

YES

NO

If NO, then what?

6. Are tools accessible (within 2 m radius from the machine)?

YES

NO

7. How high is the frequency of breakdowns in your workplace? (Stop longer then 10 min)

-----/week

What does these stop depend on?

---

---

8. Do you have a good collaboration with your co-workers when machine breakdown occur?

YES

NO

9. How often does the quality of the products leads to a stop?

-----/Shift

10. How often do you adjust the machine?

...../ Shift

11. How long does it take on average until the process has stabilized after a stop, or start in the morning?

...../ Minutes

12. Is there anything specific that makes work more slowly than necessary at your work (do not have the right tools, you need to change about the files, etc.)?

YES

NO

If yes, then what?

---



13. Have you made any improvements to reduce the stop and get a faster throughput for the products in your workplace?

YES

NO

If yes, then what?

---

14. Which areas for improvement in your workplace are possible, so that your work should run more smoothly?

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## Appendix 3

### Interview protocol - support for the semi-structured interviews

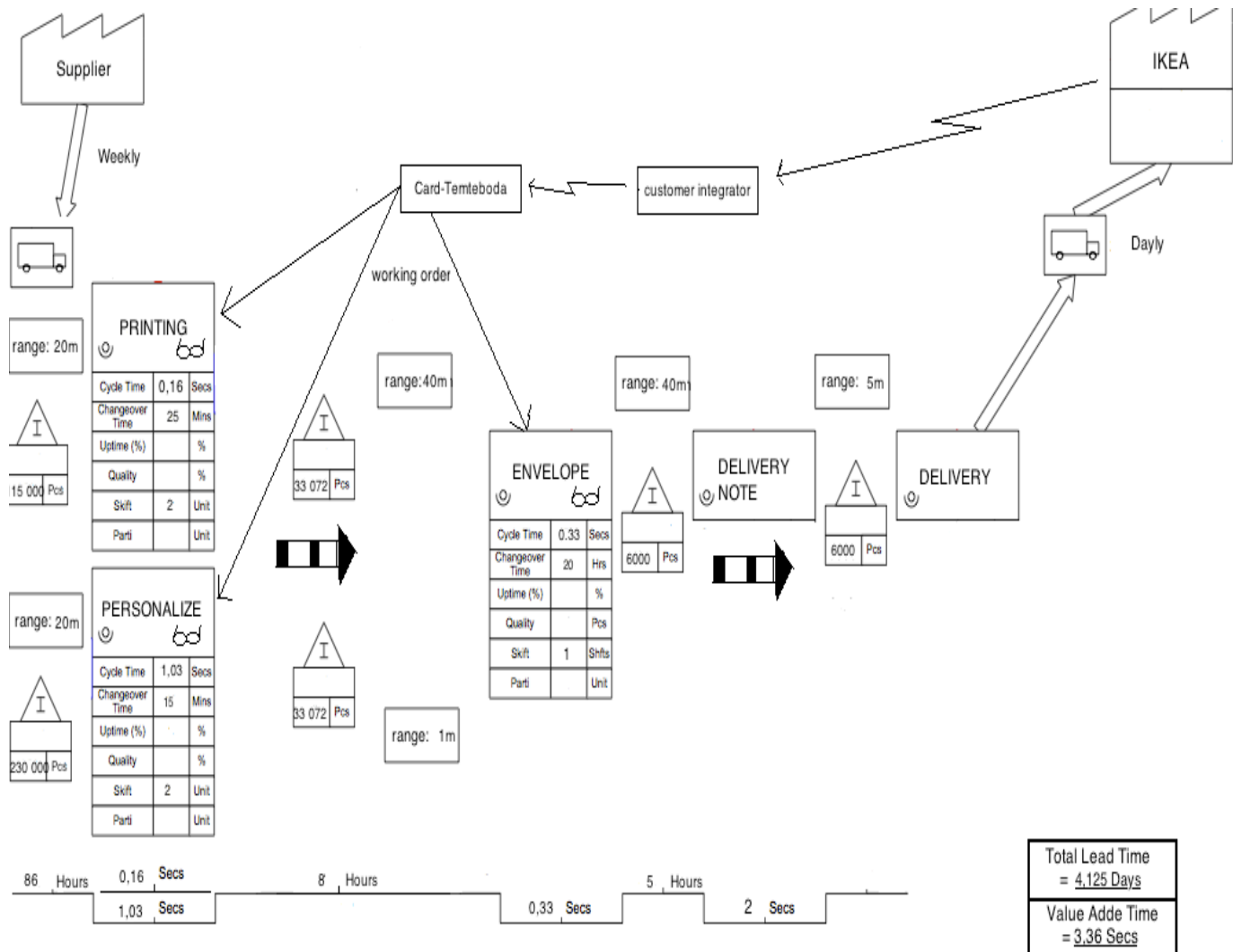
1. How does your organization create its value?
2. Your organization's culture best fit this/these type of employees?
  - Coherent thinker
  - Instinctive thinker
  - Steady worker
  - Organized worker
3. Which of your customers' needs are your products designed to meet?
4. How does your performance measurements look like? What is being measured?
5. Your organization's management expect employees to be good at the following?
  - Producing high volumes
  - Quickly adapting to make different products or deliver different services
  - Understanding how to make many different types of products or deliver many different types of services
  - Using their competence and experience to create unique solutions for customers
6. The processes in our organization is primarily designed to create the following:
  - Productivity
  - Effectiveness
  - Flexibility
  - Uniqueness
7. Regarding your organization's strategy, do you agree or disagree with the following statements?
  - My organization's values and culture are coherent with its strategy.
  - My organization's strategic plan is clear.
  - My organization's values and culture are frequently discussed.
8. How does your organization's strategy regarding its customer's look like?
9. Regarding your organization's leadership, how strongly do you agree or disagree with the following statements?
  - The management in my organization encourages the person who has the best skills and knowledge to do the job.
  - Management rewards employees who take risks to better serve customers.
  - Employees are rewarded for meeting customer satisfaction goals.
  - Employees are empowered to use their own judgment to meet customer needs

- Employees believe that their behaviour affects the organization.
- My immediate supervisor understands the strengths I bring to my job.

10. How would you, in brief and very general features, describe your organization and your workplace?


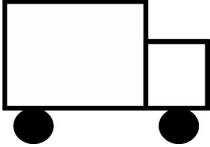
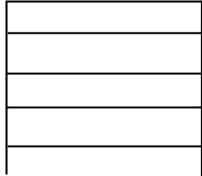
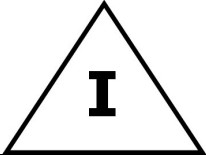
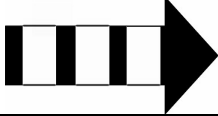
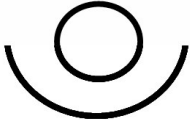



## Appendix 4

### Value Stream Mapping - An illustration over the current situation of the IKEA family card flow



## Appendix 5

### Value Stream Mapping Symbols

|   |                        |
|---|------------------------|
|    | External Resources     |
|    | Transportation         |
|    | Data Box               |
|   | Inventory              |
|  | Push                   |
|  | Staff Member           |
|  | Manual Information     |
|  | Electronic Information |
|  | Manual Monitoring      |