

# CHALMERS



## Improvement Strategy Based on Assessment Data

A Case of Volvo Group

*Master of Science Thesis in the Master's Programme Quality and Operations  
Management*

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*Division of Quality Sciences*

CHALMERS UNIVERSITY OF TECHNOLOGY

Gothenburg, Sweden 2013

Master's Thesis E2013:054



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## ABSTRACT

Becoming lean is a long journey. For improvement and development, it is crucial to learn about the current state of the organization to be able to define the future state as well as the way to get there. In order to map the current state, Volvo Group has performed assessments in its local organizations; both in the product development and the production processes. The assessment results are until now analyzed in a local perspective for each organization and the results are presented to the assessed organization in assessment reports.

In this study the assessment reports were analyzed in a global perspective to find major characteristics of the worldwide company. In the analysis a cause-and-effect diagram was used to identify major root causes and symptoms. Then, the major characteristics were analyzed according to existing literature by looking from different perspectives in order to define the causes behind the weaknesses stated in the assessment reports. After identifying the causes an improvement strategy is proposed.

It was seen in this study that the employees' current behaviors are hindering the company to reach its ambition of "always moving forward to reach even higher goals". The employees' behaviors are shaped by drivers (KPIs, leaders and incentive systems) together with the ethical norms. The drivers and ethical norms are in turn steered by the company focus, which according to the assessment reports was identified as "short-term result orientation" together with "insufficient customer focus". Consequently, changing behaviors requires changing the employees' focus. Since focus is one of the core values defining the company culture, there is a need to change a part of the company culture, through an evolutionary change process.

Key words: assessment, cause-and-effect, company culture, core values

## **Preface**

In this study, reports of assessments have been analyzed to find major characteristics, strengths, weaknesses or opportunity areas in product development and production processes of Volvo Group. Then, improvement strategy has been proposed based on empirical findings from assessment data. This thesis study has been carried out from January 2013 to June 2013 at the Operational Development and Volvo Production System Group Function in Volvo Group Trucks Operations, Sweden. This thesis work is financed through Volvo Group.

This thesis study has been carried out with Handan Kalkan and Jonna Nygren as master students in Quality and Operations Management programme in Chalmers University of Technology, Sweden as well as Professor Sverker Alänge as supervisor from Chalmers and Mats Lejon Olsson as supervisor from Volvo Group. Mats Lejon Olsson and Sverker Alänge are highly appreciated for their help during the thesis study. A special thanks to Anders Dyne for introducing us to the mysterious world of Volvo Group processes. We would also like to thank Christ De Baere, Malin Hane Hagström, Tor Wendel, Angela Karlsson and Per Erlander for their co-operation and involvement.

Finally, it should be noted that the assessments could never have been analyzed without the sense of high quality and systems thinking.

Gothenburg, Sweden June 2013

Handan Kalkan

Jonna Nygren

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# **1 Introduction**

When developing an organization, knowledge about the current state is the key. Knowing the current state and the desired future state is a prerequisite for finding out how to proceed to reach the goal. In Volvo Group the current state is mapped in assessments, which are performed in all production sites and product development organizations. The assessments are analyzed and discussed for each site or organization, and this thesis work analyzed them on a global perspective which is not performed before. Knowledge about the current state in the whole company is a foundation for finding a strategy for improving the organization.

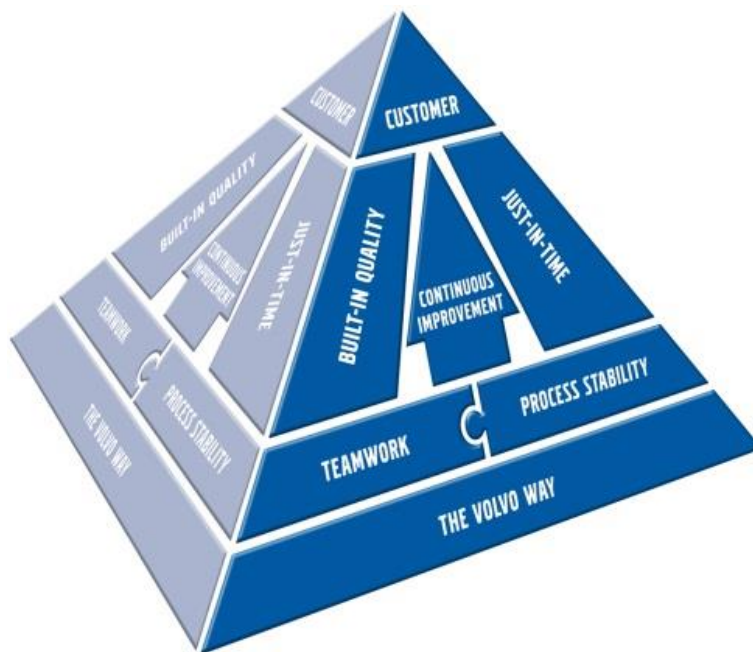
## **1.1 Background**

Volvo Group is a multinational corporation producing mainly trucks, buses, construction equipment, and marine engines. The products are produced in nineteen facilities around the world and sold in 180 markets. Volvo was founded in 1927, grew both organically and through acquisitions. Today, approximately 115 000 employees work for Volvo Group (Volvo Group, 2013).

The Volvo Group's vision is to become the world leader in sustainable transport solutions. This will be achieved by for example; creating value for customers, pioneering products and services, driving quality, safety and environmental care as well as work with energy and passion. In the document called the Volvo Way there are definitions of what the company stands for and aspires to be in the future. The company's mission written in the document is "By creating value for our customers we create value for our stakeholders" and the customer focus is stated as "to meet the customer expectations today and long-term requirements for the future" (Violin, 2012). Each strategy of the Volvo Group, for example marketing strategy, product development strategy etc., can be viewed as map that guides everyday work and decision-making to realize the vision. There are long-term plans defining direction for 5-15 years including for example a product plan, technology plan, industrial plan and a HR plan (Violin, 2013 B).

### 1.1.1 Volvo Production System (VPS)

Volvo Production System (VPS) is the lean concept of the Volvo Group introduced in the production sites in 2007 as it is illustrated in *Figure 1*. Lean is a philosophy that defines value from a customer point of view, and all activities not adding value from a customer perspective are considered waste and should be eliminated (Rother & Shook, 1999). VPS Order to Delivery Process (OtD) is the process from external customer's order, through production until delivery (Volvo, 2013). Since this lean initiative was perceived as successful it was as well introduced in the Product Development area, where the model was modified into Volvo Production System Product Development Process (VPS PDP) (Violin, 2013 C).



*Figure 1- Volvo Production System (Violin, 2013 C)*

The ultimate goal with VPS PDP is to create customer value and the customer is placed on the top of the pyramid that visualizes the model in *Figure 1*. The Volvo Way is the foundation and includes values connected to leadership, safety, health, and environmental care that should be deployed through the whole organization. Between the Volvo Way and the customer the pyramid consists of the principles; built-in-quality, just-in-time, process stability, teamwork and continuous improvement (Violin, 2013 C).

### **1.1.2 The OD/VPS Group Function of Volvo Group**

The OD/VPS Group Function of Volvo Group has a mission to support the Volvo Group to meet customer needs by providing the knowledge, methods and tools for a total operational excellence solution, using the Operational Development (OD) and Volvo Production System (VPS). This group contributes with arenas for learning around operational excellence, as well as promotes networking, collaboration and commonality for effective utilization of competence and resources. Furthermore, the group function also coach, support and challenge people and organizations to build capability in operational excellence striving towards world class level (Violin, 2013).

OD/VPS has made assessments on how the VPS PDP and VPS OtD are used on different sites and organizations globally. Some of the assessments are made on sites and some of them in a global organization. They are all made by discussions with the managers in the processes. Each assessment is analyzed and there are reports written on the result for each assessment. This thesis is taking it further by trying to make the results usable for the whole Volvo Group as well as in different processes.

## **1.2 Assessments as a Tool for Development**

Sobanski (2009) states that assessments of the company processes will lead to a better understanding of the performance, identifying made progress, and help determining those facilities, functions and lean principles in need of added support. The assessment promotes organizational learning and provides a roadmap for further improvements. Furthermore, it could facilitate internal and external benchmarking. By identifying gaps in specific principles or practices, activities for improvement could be defined. The information from the assessments should foster organizational learning, sharing of best practices and better decision making for resource allocation and further implementation (Sobanski, 2009).

To improve the product development process in the organization, assessments may be done to analyze the current practice and identify suitable improvements as well as measure if the deployment of the improvements was successful. Improvements in product development should not only lead to improved practices but likewise improve product success. The requirements for the results of assessments in product development are visualizing bottlenecks and product development performance, case

specific improvements, improvements in line with strategic goals and clear metrics for guiding process and product improvement (de Graf, 1996).

Volvo Group's internal certified assessors conduct the assessments for the product development and production processes. The assessors are employed by the entity of Volvo Group Trucks Operation's OD/VPS Group Function in Gothenburg. There are official assessments as well as internal assessments to support the local site's lean transformation journey. All assessments are requested by the local organization. The goal of the assessments is to provide input on the current state, by stating strengths and weaknesses. If requested the OD/VPS Group Function will help management to gain understanding on the current state, provide input on where improvement focus should be, help out to reach targets and coach during implementation of changes (Violin, 2012 B).

As commented by Olofsson & Sandquist (2012) it is important that the collected information in the Volvo Group assessments is used, to understand the current state and ensure support for future improvements. Olofsson & Sandquist (2012) also explain the lack of information on assessments and its usage for improvements in existing research. This study is one attempt to fill this gap by using the information in the assessment reports to create an improvement strategy.

### **1.3 Aim of the Study**

The aim of this study is to analyze the assessments conducted in production and product development processes of the Volvo Group in a global perspective; this analysis enables finding common characteristics and proposing an improvement strategy based on the empirical findings.

### **1.4 Problem Analysis and Research Questions**

Volvo Group is a large company with different operations. The product development and production processes are supposed to be standardized all over the company but the processes are not executed in the same way. Various products and cultures lead to different applications of the processes in organizations across the world. The assessments are performed and reported locally but not analyzed globally. This is the knowledge gap this thesis aims to fill. When it comes to improving the overall performance of the company, the global perspective is useful since it enables to see

the company as a system which is composed of different organizations. Seeing the company as a system minimizes the risk for sub-optimization and increases the communication level.

With the problem analysis and purpose in mind the following research questions was formulated.

1. What major characteristics, strengths and weaknesses can be found globally in the product development and production processes in Volvo Group?
  - How can the empirical findings be prioritized for product development as well as production areas?
  - What are the overlapping findings between the product development and production processes?
2. Which type of change is needed to resolve the major causes behind the weaknesses found in the product development and production processes?

## 1.5 Delimitation

When assessing the organizations, specialists of Volvo Group collect different types of data such as assessment data (qualitative and quantitative), interview data and questionnaire data. The focus of the thesis is on the qualitative data from the assessment reports.

## 1.6 Thesis Outline

In the next chapter literature from the areas of lean philosophy, change management and company culture are presented. There is also a description on systems thinking, since that is the base for the analysis tools that are used when analyzing the assessment reports.

The methodology used to conduct this study is presented in chapter 3 Methodology. After framing the scope and defining the aim for this thesis study in Workshop I, the research procedure contained five sequential phases while analyzing the assessment reports. Then, the second workshop was arranged in order to present, prioritize and validate the empirical findings. Thereby, the first research question is answered and its answer is presented in chapter 4 Empirical Findings. There are information provided on major characteristics found globally in the product development and

production processes in Volvo Group, as well as prioritization and overlapping areas between the findings in both processes.

After that, the second part of the analysis begins; analyzing the empirical findings (which contains the answer of the first research question) according to the literature presented in chapter 5 Analysis, in order to answer the second research question. In chapter 5, the answer of the second research question is provided; regarding the proposal of change type to resolve the major problems found in the product development and production processes. Finally, the Discussion and Conclusions, reconnecting to the aim of this study, are presented in chapters 6 and 7, respectively. Ideas for further studies in this area are elaborated upon in chapter 8 Future Research.



## 2 Theory

This chapter begins with information to introduce the concept of systems thinking since it is used throughout the study. The assessments analyzed in this study are performed as a part of the lean initiative of Volvo Group. Hence, the following sub chapter aims to make the reader familiar with lean production and the lean philosophy as well as lean product development to give the reader an understanding of the lean concept. Subsequently there is theory on change management to present types of organizational change, and what is needed for making change in an organization. Then, academic information regarding the cultural aspects of the organization are introduced such as ethics, value systems and corporate culture, which is used later when analyzing the empirical findings and proposing an improvement strategy.

### 2.1 Systems Thinking

A system is defined as a collection of components, people or entities. This collection is organized and the parts interact with each other through following specific rules. The aim of the system is to together accomplish tasks that any of its components cannot perform by themselves (Dällenbach & McNickle , 2005). According to Checkland & Scholes (1990), two pairs of ideas; emergence and hierarchy together with communication and control are required in order to have complete picture of a system. These are considered essential elements of a system for survival in a constantly changing environment. Other essential elements of a system are; containing communication channels as well as controlling in its structure to be able to survive in dynamic environment. The mental usage of this complete image of the system is possible through systems thinking (Checkland & Scholes, 1990).

Systems thinking is defined as a perspective of looking at a system as a whole rather than focusing on its component (Vanguard Scotland Ltd, 2012). It is considered as a process to understand how the parts interact with each other and how a part influences other parts as well as whole system. In many areas, a systems thinking approach can be applicable; such as in seeing the entire business processes as a system, sustainable development, management, manufacturing, organizations etc. For example, when systems thinking is applied in a management context, it promotes waste elimination in

processes and adaptation to changing environment through creating common sense thinking (Vanguard Scotland Ltd, 2012). Furthermore, it is also considered as an approach to implement in problem solving through perceiving the problems as a part of the entire system rather than fixing one or more parts (Aronson, 1996). In addition to this, Aronson (1996) discusses some areas where systems thinking are seen really valuable. Examples of these areas are complex problems, recurring problems, issues in which an action influence the natural or competitive environment surrounding the issue and problems whose solutions are not explicit (Aronson, 1996).

A limited perspective of processes is perceived through silo thinking or mass production thinking in traditional management methods. Being one-step beyond these traditional methods, systems thinking can provide the whole image which effectively supports organizations in order to increase customer satisfaction and performance, to reduce costs, absences and staff turnover (Vanguard Scotland Ltd, 2012). Managers that use traditional management methods enforce conditions which constrain or control the behaviors of employees in ways that end up in sub-optimization. The sub-optimization (breaking organizations into functions, setting targets for each function and managing them) leads to worse performance. In order to understand this and make the processes better, managers need to have a system view since it provides seeing the entire system and managing the flow rather than each function (Rodgers, 2008).

According to Rodgers (2008), organizations that internalize systems thinking should have three operating principles. The first principle is that continuous improvement becomes an integral part of operational way of the business. The aim of this principle is to provide consistency between employees' thinking and behaviors as well as their actions which are done on the system to improve performance. Namely, thinking influence whole system and in turn, system affects performance of organization. The second principle states that it is important that to ensure all employees have the tools and perspectives required in particular situations. This principle enables both delivering better service and getting things right easily since quality is integrated into system from the start. The third principle is about eliminating any kind of resistance to change in organizations. In order to achieve this, firstly, an analysis of current system is required to understand how people think, behave and contribute to the system to improve the status quo through making change (Rodgers, 2008).

### 2.1.1 Reductionist and Cause-and-Effect Thinking

Ackoff (1973) known as a philosopher, operational researcher and systems thinker explains that there are two main ideas which form the base for the intellectual foundations of the traditional scientific model of thought. The first idea is reductionism; the second one is the cause-and-effect thinking. According to reductionism, it is possible to reduce every knowledge and experience, briefly everything in the world, and to disassembly them into simple components which are non-divisible. Reductionism further includes that understanding and explaining the behaviors of those simplest parts and bringing these explanations together provide enough information to understand and explain the entire system's behavior. But in reality, the sum of the solutions in part level does not necessarily enable an optimal solution for entire system (Ackoff, 1973)

According to cause-and-effect thinking the second basic idea is that it is possible to explain everything through cause-and-effect relationships (Ackoff, 1973). It can be insufficient to search for the cause-and-effect relationships one by one since some new relationships can arise only through interaction of components, which Checkland & Scholes (1990) called emergent relationships or properties. Moreover, one of the key characteristic of cause-and-effect relationship is two way relationships through mutual causality or feedback. Being able to look at it from both angles provides more effective and further development. But, in order to get right image, it is important to search systemic roles of the components in the system. In other words, in order to have effective actions in system as a whole, just usage of reductionist and cause-and-effect thinking by studying the each component separately will not be enough for decision making in the entire system (Ackoff, 1973).

Consequently, these both approaches can create value when they are considered as complementary. The details of each part are noticed through reductionism while the roles of these parts within the system are observed thanks to systems thinking (Dällenbach & McNickle , 2005). Dällenbach & McNickle (2005) exemplify this by mentioning the learning process of driving a car. Starting the motor is considered as example for reductionist thinking while pressing the brake pedal to slow down is stated as example for cause-and-effect thinking (Dällenbach & McNickle , 2005).

### 2.1.2 Cause-and-Effect Diagram

Even if cause-and-effect diagram was developed as early as 1963 by Maruyama, it is still commonly used in systems thinking. In some articles and books, it is called influence diagrams and it is used in system dynamics in order to gain understanding of the feedback loops as parts of the system (Pidd, 2003). Cause-and-effect diagrams enable mapping the structural and cause-and-effect relationships between parts of the system as well as the behaviors of complex systems. Since this diagram is supposed to be used in understanding the general image of the system rather than detailed, it is better to keep it simple (Dällenbach & McNickle, 2005; Pidd, 2003).

The behavior of the parts that belong to a system demonstrates mutual causality. For instance; while part X is affecting part Y, in turn, part Y is affecting the part X. This is called feedback loops. Feedbacks can be direct or indirect and also the arrows inside feedback loops depict the direction of influence relationships. For example, within a feedback loop, X affects Y, Y affects Z and in turn Z affects X. There is direct feedback between X and Y while between X and Z, the feedback is enabled via Y as indirect feedback (Dällenbach & McNickle, 2005).

## 2.2 Lean Production

In the 1980s it was found that the productivity in lean car assembly was doubled from other car assembly plants. This was due to increased productivity in the plants by reducing lead times, staff costs and material while quality was increased through lean practices (Lewis, 2000). Today lean is accepted as pivotal paradigm for operations and its effect can be found generally in both manufacturing and service strategies (Womack & Jones, 1996). Womack et al. (1990, p.7) states that “We've become convinced that the principles of lean production can be applied equally in every industry across the globe and that the conversion to lean production will have a profound effect on human society- it will truly change the world”.

In many parts of the world, the interest for lean production has increased recently because of the success stories of factories implementing lean production tools or methods. Toyota and its production system is a good example since this is the place where lean production arose (Bergman & Klefsjö, 2010). Taiichi Ohno, founder of the

Toyota Production System, explained the basis in the following way in Liker (2004, p.7):

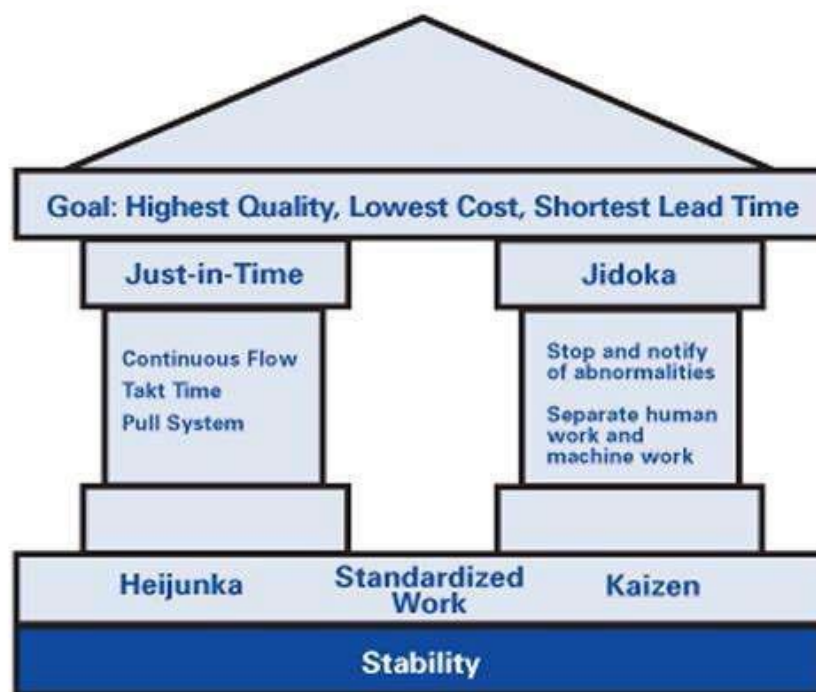
*“All we are doing is looking at the time from the moment the customer gives to an order to the point when we collect the cash. And we are reducing that time line by removing the non-value-added wastes.”*

Lean production is generally described in terms of the practical perspective as a set of management tools, techniques or practices that could be directly observed (Shah & Ward, 2003) or in terms of philosophical perspective regarding guiding principles as well as overarching goals (Womack & Jones, 1996). Conceptually, lean production is defined as an integrated socio-technical system. The fundamental aim of this system is to eliminate waste by simultaneously minimizing supplier, customer, and internal variability (Shah & Ward, 2003). Womack et al. (1990) defines that lean production compared to traditional production requires the usage of half as many resources in the factory such as half the human effort, manufacturing space, and investment in tools as well as half the engineering hours for development work in half the time. It requires half the inventory level, resulting in producing greater and ever growing product kinds as well as fewer defects (Womack, et al., 1990). Moreover, according to Hopp & Spearman (2004), lean production achieves minimal buffering costs in production of both goods and services as an integrated system. As a result of lean initiatives, customer satisfaction should be greater and this enables companies to gain a higher market share than its competitors (Katayama & Bennett, 1996).

According to Shook (2009) the methods and techniques used by Toyota Production System (TPS), the first described lean initiative, constitute a system. Well-established management principles based on a specific business philosophy are the key of this system (Shook, 2009). Liker (2004) defines waste elimination as the heart of Toyota Production System. In this respect, all activities are regarded as value added and non-value added activities. The activities adding value is defined as value-added activities while if it is not adding value for the customers it is defined as non-value added activities. Everything that is not creating value for the customer, which the customer is not willing to pay for, now or in the future is considered waste. There are basically seven types of waste defined; defects, unnecessary movement, waiting, over production, over processing, excess inventory, and unnecessary transport. In addition

to this, the waste types are usually denoted as 7+1. The plus one is accepted as unused creativity (Liker, 2004).

TPS is illustrated with the “house” shown in *Figure 2- Toyota Production System “House”* (Joshi, 2013, p.4). The “TPS house” is one of the most well-known symbols in modern production. The house is strong when the foundation, pillars and roof are strong. The starting point of the TPS house is the roof that includes its goals; best quality, lowest cost and shortest lead time. Then, there are two pillars which are Just In Time (JIT) and Jidoka (Liker, 2004).



*Figure 2- Toyota Production System “House” (Joshi, 2013, p.4)*

Just-in-time denotes removal of inventories used to buffer operations through the aim for prevention of conflicts in production. The meaning of Jidoka is avoidance of defects for next processes and making the machines work automatically with human touch. Furthermore, the foundational components of the TPS house are Heijunka, Kaizen, Standardized Work, as well as stable and reliable process. Heijunka is defined as a technique in order to have stable process, to minimize the inventory level as well as to level out the schedule for production in terms of diversity and volume. Improvement work is driven through Kaizen which is another foundational element for better production and continuous improvement. Moreover, to have a high degree

of stability is important for the system to continuously work. In order to achieve this maintenance becomes crucial; to learn how to perform cleaning and inspection as well as maintenance of both equipment and machines. TPS places people into the center of the system since the required stability can be achieved thanks to continuous improvement. Employees can notice waste and find solution for problems by looking at the root cause of problems rather than fixing them through training and coaching (Liker, 2004).

## 2.3 The Toyota Way

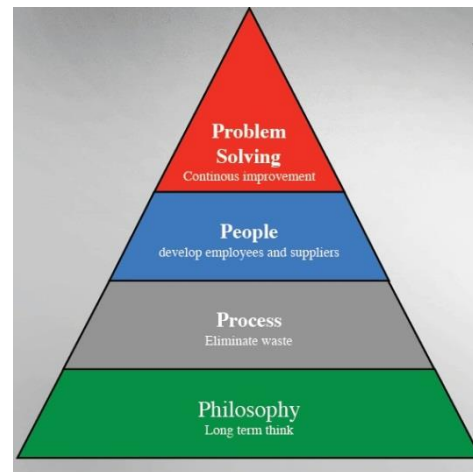
According to Fujio Cho, the chairman of Toyota Motor Company since 2006, The Toyota Way is more than tools and techniques. The main idea behind their success and competitive advantage over the years is that the business practices and activities are based on the core principles, beliefs, business methods and value system. Partly implementing the lean principles makes it possible to achieve short-term goals such as usage of lean tools. Understanding and living all lean principles can bring sustainable success and competitive advantage for organizations. Unfortunately, most organizations think of the lean concept as just implementing some set of tools in their process, which is the main reason of why they are not sustainably successful in their lean initiatives. The essence of lean thinking is developing the right principles that will fit into your organization in terms of culture, value systems, ethics and beliefs in order to be competitive and profitable as well as to achieve high performance (Liker, 2004).

Fujio Cho asked Taiichi Ohno, who is one of the inventors of The Toyota Way, within a personal interview to learn what was unique about the remarkable success of Toyota. Taiichi Ohno gave a simple answer by saying that;

*"The key to the Toyota Way and what makes Toyota stand out is not any of the individual elements. But what is important is having all the elements together as a system. It must be practiced every day in a very consistent manner—not in spurts."* (Liker, 2004, p.xv)

Taiichi Ohno's answer puts emphasis on the importance of systems thinking since just focusing on parts will not give the right insight regarding behaviors of the system (Liker, 2004).

Liker (2004) discusses about the issue why companies often think they are lean but they are not. Only usage of tools and techniques are not the key to Toyota Production System. The key point is the management commitment to invest in employees as well as secure a continuous improvement culture. The problem is that many companies confuse a set of tools with the deep “lean thinking” requiring a deeper cultural transformation. Liker (2004) believes that many U.S. companies focus on the usage of the lean tools without understanding what enables them to work together in a system as well as the continuous improvement culture required to sustain the lean principles (Liker, 2004).



*Figure 3- 4P (Liker , 2004, p.6)*

According to Liker (2004), most companies are dabbling at the “Process” in the 4P model in *Figure 3*. In order to be successful in lean initiatives by adopting a true culture of continuous improvement, it is pivotal to realize the other Ps which are “Philosophy”, “People and Partners” and “Problem Solving” (Liker, 2004).

### 2.3.1 The 14 Principles of Toyota

Liker (2004) defines the 14 principles of Toyota. The principles are as below and split into the four Ps; problem solving, people, process and philosophy, as illustrated in *Figure 3*. Explanation of each principle is provided in the A. Appendix.

#### ***Philosophy - Long-term Thinking***

1. Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals

#### ***Process - The Right Process Will Produce the Right Results***

2. Create continuous process flow to bring problems to the surface
3. Use “pull” systems to avoid overproduction
4. Level out the workload (Heijunka) (waste, unevenness, and overload)
5. Build a culture of stopping to fix problems, to get quality right the first time



6. Standardized tasks are the foundation for continuous improvement and employee involvement
7. Use visual control so no problems are hidden
8. Use only reliable, thoroughly tested technology that serves your people and processes

***People and Partner – Add value to the organization by developing your people and partners***

9. Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others
10. Develop exceptional people and teams who follow your company's philosophy
11. Respect your extended network of partners and suppliers by challenging them and helping them to improve.

***Problem solving-Continuous solving root problems drives organizational learning***

12. Go and see yourself to thoroughly understand the situation (Genchi Genbutsu)
13. Make decision slowly by consensus, thoroughly considering all options; implement decisions rapidly
14. Become a learning organization through relentless reflection (Hansei) and continuous improvement (Kaizen)

## **2.4 Lean Product Development**

Product development is the real key to success since it is the collective activities, or system, that a company uses to convert the ideas and technology into new products (Kennedy, 2003). The product development defines the customer value by defining physical appearance and the materials to use as well as constraining the set of production processes needed to manufacture the product (Hoppmann, et al., 2011).

There are three major dimensions in optimizing the product development processes; time, cost and quality. To reduce the development cycle times and minimize the time-to-market, the speed of innovation needs to be increased. In the cost area, the increased product complexity together with decreasing sales volumes for each product lead to a pressure to avoid an increase in development cost per sold item. The third part responds to shorten product life-cycles together with a decreased tolerance for

quality issues; failures and rework after market introduction are even less acceptable for products with short life span (Hoppmann, et al., 2011).

The objective of lean product development is to apply the lean principles to achieve a value-oriented, resource-efficient and fast product innovation process (Hoppmann, et al., 2011). Hoppmann et al. (2011) further states that there are still controversial ideas on how a lean production system should be organized. Lean product development was at first focused on reducing waste by eliminating the non-value-adding activities like lean is used in manufacturing, but that is only one part of lean product development (Kennedy, 2003). Reinertsen describes in Strategic Direction (2004) the large differences between production and product development are that while manufacturing is repetitive, sequential and producing physical objects where risk-taking is not a major mechanism for adding value, product development is non-repetitive, non-sequential and producing information and rational risk-taking is central to add value. This is why the lean principles should be used quite differently in the two areas (Strategic Direction, 2004).

Shaping a good flow is about working with the capacity and resources. If there are bottlenecks in the process, for example a specialist task, the variation in the flow will be amplified within the process. By having overcapacity or resource flexibility unnecessary variation will be eliminated. When looking for waste in product development one should have in mind the differences between production and product development; in product development expenses are low and cycle times are much longer than in production (Strategic Direction, 2004).

Ward et al. (1995) describe the product development process at Toyota as set-based concurrent engineering where the designers think about sets of alternative designs instead of iterating one alternative. The possible sets of solutions are explored in parallel for each subsystem. There are a large amount of prototypes and standardized documents with sketches and dimensions as a base for discussion and decision. About 100 participants from different parts of the product development, product planning and other functions are looking at the model and examine it from their perspective using their own white book with knowledge on for example interval of acceptable curvature radii for angles on the fender design. If there are problems the participants will suggest solutions for them and they are discussed until all perspectives are satisfied. A large difference between set-based and the conventional way is that in a

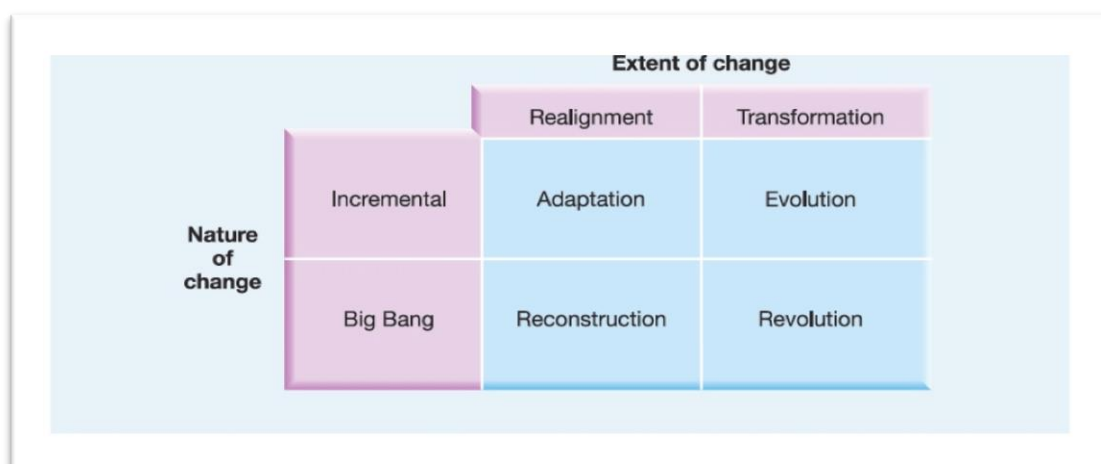
general project, when a change is made all earlier documents become invalid. In a set-based design all communication describes a set of possible solutions, when the set of possible solutions are narrowed down it will generate additions to the existing documents, but not make the old ones invalid. This promotes organizational learning since all designers are more willing to document since all the documents are valuable. Usually the designers are resistant to documenting since the documents become invalid after each change (Ward, et al., 1995).

## 2.5 Change Management

A definition of change management is given by Armstrong (2009, p.424) as; “the process of achieving the smooth implementation of change by planning and introducing it systematically, taking into account the likelihood of it being resisted” and he also states that “change is the only thing that remains constant in organizations”. The philosophy of change is tackled in terms of organizational change during this thesis study. Change initiatives of organizations are required to manage and in order to achieve this, understanding the types of change is pivotal at the first step (Armstrong, 2009; Johnson et al., 2008).

### 2.5.1 Types of Change

According to Johnson et al. (2008, p.520), there are four types of change with respect to the extent of the change as well as if the change initiative requires with/ or without any cultural change as it is illustrated in *Figure 4*.



*Figure 4- Types of Change (Johnson, Scholes, & Whittington, 2008, p.520)*

As a realignment of strategy regarding extent of change, adaptation and reconstruction; types of change do not require any change in current culture of the organization. Adaptation is considered the most common type of incremental change while reconstruction is regarded as a big bang style change. Moreover, a turnover situation can exist in reconstruction type of change and the turnover situation requires cost-cutting program or major structural change.

When the extent of change is transformational, there is a need for a cultural change. Evolutionary and revolutionary types of change constitute transformational change. Evolutionary change is explained with respect to learning organizations and requires that its strategy is continuously adjusted to changes in the environment. This type of change occurs incrementally when managers expect the need for transformational change. Furthermore, revolutionary change is the best option when an organization is insufficient to respond to changes in a competitive and dynamic environment. The revolutionary change is about the changing the strategy. The organization's needs are base for the selection of change type; if the change could be managed within the current culture or if a shift in the culture is needed (Johnson, et al., 2008).

### **2.5.2 Systems Thinking in Change Management**

According to Beer (2009), the base of the High Commitment, High Performance (HCHP) companies' success is their organizational system and culture which are hard to imitate in long-term and impossible to replicate in the short-term. Therefore, the portfolios of the assets, products and technology or best practices are not enough to sustain competitive advantages. When a problem occurs in the existing system, the main cause of it should be searched and experiments are required through change in some parts of the system (Beer, 2009).

Oshry in Beer (2009) discusses the organizations as a system by observing that managers have a tendency to see individuals as the reason for organizational failures rather than connect problems to system of practices, behaviors and policies. In this case, solution focus will be in the individual level such as firing the people or rotating them. But the focus when searching for a solution should be in the organizational level; seeing the organization as a system while reengineering or reorganizing (Beer, 2009). Beer (2009) discusses that total system perspective is essential because the

total system shapes the skills, behaviors and attitudes. Therefore, the tricky part which requires creativity to address these processes is to identify the mechanics of system of activities. In order to build an HCHP organization, leaders must look from a systems thinking perspective to guide diagnosis and redesign of the organization as well as consider a multilevel and multi-unit view of the organization (Beer, 2009). According to Beer (2009), organizations are open systems easily affected by environmental changes and they need to adapt to this dynamic environments in order to survive. Furthermore, such organizations can be in a complex structure which requires diagnosis and then redesigning the continuous problem solving process. In order to diagnose the organization, strengths and weaknesses must be found, and at the same time senior teams need to adopt systems thinking to see the entire picture and also perform root-cause analysis in the company. Then the senior teams develop optimal solutions for real root causes of low performance and low commitment (Beer, 2009).

In order to realize real transformation of the system, open and searching conversations are considered as a base (Beer & Eisenstat, 2004). Moreover, according to Beer (2009), being successful in systemic change is possible through a collective learning process based on truth which is obtained by seeing the whole system. Then it is possible to redesign organization consistent with the diagnosis since systems thinking and the truth will not let the senior team just pass over the aspect of the system. Additionally, systems thinking enables to define some levers at the same time, which is crucial because one design lever requires complementary redesign of other levers. The only possible way for connecting problems to some design levers is integrating systems thinking in change initiatives (Beer, 2009).

In order to survive in competitive changing business conditions, every organization is exposed to a changing process. Organizational decision makers should always bear in mind its corporate culture, value system and ethics.

### **2.5.3 Levers for Change**

When existing in a challenging evolving environment every organization has to change at times. There are successful and less successful changes to learn from. However, the only way to change an organization is to change the behavior of the people within the organization (Johnson, et al., 2008).

### **2.5.3.1 Thinking Long-term**

According to Kahneman (2002) there are two ways for the human brain to make decisions. Most behaviors as well as quick decisions are intuitive; they rely on automatic and rapid judgments and decisions without reflection. The deliberate process is slower and more controlled; governed by rules and using more effort. The deliberate process may compare different solutions and their characteristics to decide in favor for the one with the assumed largest success, while the intuitive is quick and not comparing (Kahneman, 2002).

Before changing it is important to diagnose the organization. Since it is a delicate activity many organizations rather take shortcuts than thoroughly diagnose the strengths and weaknesses of the current culture and behaviors. It is not always easy for managers to surface the truth and it is not unusual that lower levels do not tell senior management about dysfunctional patterns of behavior that blocks commitment or performance. Many leaders embrace quick-fixes since the fundamentals are more painful and difficult to map and change. The shortcuts could for example be engaging smart and expensive consultants or to perform management training and education to teach values and best practice. None of these will succeed if the current system is not thoroughly analyzed and the people engaged in continuous learning to validate if the changes are successful or not and then adapt the initiative over time (Beer, 2009). Result-oriented organizations often have measurable short-term performance goals, to achieve the long-term effort. The mood of such organizations is one of impatience; management wants to see results now even though the change is supposed to take long time (Schaffer & Thomson, 1992).

### **2.5.3.2 Motivation Needed for Change**

All organizations experience change since it is a way of developing the organization to create competitive advantage. One of the most classic views of change that has influenced many others was presented much earlier by Lewin in Nevis (2001) where change is described and divided into three important phases. Lewin described change as unfreezing the current state and to move and then freezing the new state when change has been managed. This model has often been misunderstood since it seems to be rather simple, but change never is (Nevis, 2001).

Change could be disruptive or incremental, but every change impacts the employees in different ways (Gilley, et al., 2009). Kotter & Cohen (2008) mean that performing organizational change is to change the people in the organization; their behavior is what needs to be changed to achieve a change in the organization.

When changing peoples' behavior motivation is the key, because generally motivation is what drives the organism to action, and is the cause and reasons of action and behavior. Work motivation should by the same logic predict work-related behavior, for example job performance and willingness to work or change. If the motivation for change is high the employees want to be a part of the change and drive it forward, which is a prerequisite for a successful change (Størseth, 2004). Garvin & Roberto (2005) states that persuasion is the most powerful tool in change since it creates a receptive environment; persuasion promotes understanding, understanding breed acceptance, and acceptance leads to action. Johnson et al. (2008) instead mean that education and communication to persuade people to change is less powerful than involving people in the activities of changing.

### **2.5.3.3 Urgency**

There are many things that can influence and affect the potential outcomes of a change depending on what actions and decisions that have been made during the change process. Change will affect people and organizations and to be successful there are some things that are critical and should be prioritized and some traditional faults. Kotter (1996) describes usual problems that results in unsuccessful changes and argues why they are important to remember and to handle right. Kotter (1996) argues that many changes are unsuccessful due to the lack of urgency or that there is too much complacency. Garvin & Roberto (2005) state that people are reluctant to alter their habits, they think what worked in the past is good enough. If there is nothing threatening a leading position, people or a crisis around the corner it can be hard to make people see the need for change (Kotter, 1996). If the change should stick there is a need for a persuasion campaign, starting before the actual turnaround plan is even set concrete. The change-averse employees need to be convinced that the new change plan differ from the earlier ones as well as being the correct one for moving forward to make them interested (Garvin & Roberto, 2008).

#### **2.5.3.4 Guiding Coalition and Vision**

The change leader must convince the employees through word and deed that they are the right leaders for the job and that their plan is the best one. Garvin & Roberto (2005) emphasizes the importance of framing a preliminary plan as well, getting feedback on it and announce the final plan for change. By asking for feedback the managers make the employees feel that the plan belongs to them, making them more committed to the change. It is important to create commitment in the organization because a usual problem in changes is that the employees are thinking “This too shall pass”, just waiting for things to blow over and not participating (Garvin & Roberto, 2008). Kotter (1996) emphasizes the importance of creating a guiding coalition to manage a change since a group of committed people is needed. Kim & Mauborgne (2003) takes it one step further when discussing that key influencers are important to find to spread the information to inspire the employees; they use the metaphor of kingpins in bowling, if you hit the right ones all the pins topple over.

Tichy (1999) argues that the teachable point of view is a good forum for teaching and creating leaders through communication of values, business goals and motivation issues etc. It works in that way that the top manager starts to tell the people working under him/her and then they continue doing this down through the hierarchy, ultimately this creates alignment in the management team (Tichy, 1999).

Tichy (1999) describes energy as contagious and that people are filled with energy if they can see the competitive context of their work. The energy becomes larger in the power of scale and speed, the energy is spread by the change movement (Tichy, 1999). In the same way Lewin, compares resistance to "bundles of energy" and that the change should be viewed as a dynamic state (Nevis, 2001).

Vision is a powerful tool when it comes to align an organization and to inspire individuals, it is a tool that leads the way and directs people (Kotter, 1996). Kotter (1996) describes that many attempts to change something will be followed by arguments and endless discussions without a clear vision and strategy to show the purpose. Garvin & Roberto (2005) mean that it is often hard to spot the resistance since many things happen under cover, some resistance is openly shown but other is not shown in meetings and open discussions, they are instead taken other ways to the top leading to meddling instead of open discussions on the subject.



### **2.5.3.5 Communication**

Communication is a tool to convince people change is needed or at least worth a try. When it comes to change it is important to have people convinced and that requires a lot of communication (Kotter, 1996). According to Gilley, Gilley & McMillan (2009) poor communication skills is a barrier to successful change together with inability to motivate others and failure of management to reward or recognize individuals who make the effort to change. Garvin & Roberto (2005) describes that the employees through communication from management must feel that their effort is worth it and their sacrifice was not in vain.

Lewis et al. in Gilley, Gilley & McMillan (2009) points out that communication during the change should be frequent and enthusiastic. Abundant and relevant information together with addressing questions from the employees increases acceptance and participation. Appropriate communication enables the personnel to make good decisions during the change as well as reinforce them (Gilley, et al., 2009). Garvin & Roberto (2005) add that the information should be carefully considered to find the appropriate note of optimism and realism together with the right timing, tone and positioning.

Schein in Weick & Quinn (1999) argues that dialogue and acquiring information lead to cognitive restructuring and that the most powerful change occurs in the everyday conversation, and the cognitive restructuring is needed to change the behavior of the employees. A good conversation in the context of strategic change is among other characteristics: rational and honest. The speech act of the change agents should be in many different ways depending on the objectives, for example directives and requests fit in different occasions (Weick & Quinn, 1999). Beer (2009) is even clearer on that the conversations must be two-ways to make all parts of the organization learn from each other. By an open and honest communication the senior teams can learn about barriers to effectiveness, and have a chance to manage them. Open and searching communication is the key to transforming the system; no rigid framework could simplify that task (Beer, 2009).

### **2.5.3.6 Resistance**

Resistance is mostly seen as behavior from someone who is unwilling to accept a change. Instead, it could be looked upon as a multidirectional energy or ambiguity, as

an appropriate protective reaction to potential damage to the person's integrity. It can be seen as if the resistant person has not collected enough counterforce change behavior. Managers who complain about not getting people to do what they want are often energetic and accomplishing; it is just that their energies do not point in the same direction as the complainants. Most resistance is emotional responses and seen through affective lenses, instead it should be seen through cognitive ones by looking at what is really happening. What is really happening is that information is processed. The resistance is often seen as a power-struggle with conflict, passive aggression etcetera, but should instead be discussed and put up in the open. In organizations where employees at all levels can say "no" and it is dealt with in a healthy, direct way it instead has a potential to be useful in the decision-making process, leading to better informed decisions as well as less face-saving activities. By embracing the resistance and take a great deal of time in making a decision premature pushes for action could be avoided. If the management instead pushes for outcome without allowing room for opposing forces, it will just solidify the resistance. The results-driven managers will have a hard time accepting the resistance; leading to enlargement of resistance by continuous attacks on the integrity or self-esteem of the targets of change (Nevis, 2001).

### **2.5.3.7 Reward Systems**

There can be forces trying to stop the new visions from getting real, which could be organizational structures or reward systems that are inconsistent with the new way of working (Kotter, 1996). During change the employees often experience a degree of job insecurity, i.e. feeling powerless to do anything about that their job or the positive aspects of the job are threatened. The job insecurity is associated with the employee's individual perception of change, why it is not always easy to predict when the employees will react and how the reaction will show (Størseth, 2004). The feeling could as well be triggered by a subjective anticipation of change (Størseth & Rundmo in Størseth, 2004), and this occupational stress causes high costs for the individual employee as well as the organization and social welfare system (Broers, Evers & Cooper in Størseth, 2004). Change takes time and it's therefore crucial to have milestones or short-term goals to fulfill and celebrate otherwise and risk is that the change will lose momentum (Kotter, 1996). Amabile (1998) describes resources as a

vital parameter that is hard to balance against the project or situation, the amount of time and money could spur or destroy the motivation.

As discussed above it is important to understand that people will be affected by any change, for good and bad, and to be prepared one must understand what creates motivation respectively resistance. According to Schein in Couto (2002) learning and the change coming with that process, is often more frustration than achievement for groups and individuals. Learning is not fun; it is most often radical relearning, which is a big change in the individual's behavior. Learning happens only when learning anxiety is smaller than survival anxiety, meaning that there are two ways of making it happen. Either to increase survival anxiety by raising the outside threats like losing jobs or rewards, or decrease the learning anxiety by making them understand the need for learning, and create a safe environment for unlearning and learning (Couto, 2002).

Since work is a big part of a person's life and could be seen as a part of one's identity the quality of work life is important. Weick & Quinn (1999) mean that persons change to a new position because they are attracted to it, drawn to it or inspired by it. The change agent is in this case the attractiveness, freedom of the change target and the chance to make your own choice in the transformational process (Weick & Quinn, 1999). Amabile (1998) states that the employees' motivation has to come from inside, being intrinsic, to get the most effect. To spur the intrinsic motivation employees need to have a working task that matches their expertise and contains the right amount of challenge. If the work task is perfectly matched to the employees their abilities are stretched, but it's important not to stretch too much or too little because that will create bored or stressed employees (Amabile, 1998). Another important parameter is the level of freedom given to the workforce, goals are important but detailed steering is not needed. Amabile compares organizational change to a climbing a mountain, explaining that the manager could point out what mountain to climb but not the details on how to climb it. If those affected by the problem are involved in diagnosing, planning and carries the change through as well as evaluating it, they become more committed to support the change. In these cases the change is perceived meaningful and the employees supports it both intellectually and emotionally which leads to that the change is perceived necessary and valuable (Choi & Ruona, 2011). The meaningfulness of the change is accurately what Kotter (1996) describes when discussing urgency.

Another way to create urgency is to use Key Performance Indicators, KPIs. These KPIs are according to Parmenter (2007) supposed to tell you what to do to increase the company performance dramatically. The organizational performance most critical for the current and future success should be focused upon in the KPI measures. The KPIs should be reviewed every day/week to be effective. To find good KPIs there are some characteristics that should be fulfilled; The measure should be nonfinancial, it should be measured frequently, it should be acted on by the CEO and senior management team, all staff should understand the measure and corrective action, it ties responsibility to the individual or team, it should have significant impact, and have positive impact on other performance measures. It is important that the KPIs drives the wanted behavior, since there are many examples on how the employees behave in an unwanted way while taking shortcuts to reach good results for the KPIs (Parmenter, 2007).

#### **2.5.3.8 Leadership**

Psychological safety is hard to reach, especially when the company is going through times of structural change, like reorganizing. A risk in increasing the survival anxiety is that if the last corporate change is just another case of crying wolf and, the employees settle in a wait-and-see mode. It is often the CEO and other executives that have the highest learning anxiety, since the new learning reveals their behavior to be dysfunctional. Schein in Couto (2002) means that the best way to create a psychologically safe environment for learning is to make the leaders genuine learners (Couto, 2002).

According to Beer (2009) the leader's largest challenge when conducting change is to adapt the organization's system of management without losing its soul. The relationships and decision-making processes are the very heart of the organization's culture. In larger companies there is often variability in cultures, companies growing by acquisition of the have more variability in culture than the organically grown ones. Top management could to some extent rely on itself to change the culture but the relationships between different parts of the organization and between different levels takes more to change. For sustainable success it is important to build the system on the company's strategy and values, not on charismatic leadership (Beer, 2009).

Prive (2012) discusses qualities that make a great leader. One of the important qualities that a leader needs to have is delegation of tasks to the appropriate departments. Another quality is good communication skills which are crucial to create healthy lines of communication. In other words, becoming a productive work place is possible through good communication and making team responsible by delegating the tasks (Prive, 2012). In addition to this, Grayson (2009) stated that leaders play an important role to establish meaningful engagement. In order to identify the purpose of change as well as how to manage the change in organization, stakeholders' interests need to be learned through stakeholder engagement which means a willingness to listen (Grayson, 2009).

Managers tend to fail in creating freedom in two specific ways, either to change goals too often or through poor definitions of strategic goals giving room for misunderstandings (Amabile, 1998). According to Garvin & Roberto (2005) the desired new ways of working need to be practiced repeatedly and personally modeled with coaching and support from leaders since this will lead to a change in behavior, not just a change in the ways of thinking. If the workers have the opportunity to try the new ways and be a part of the development; many irrational fears can be avoided (Garvin & Roberto, 2008).

Lewin in Frischer & Larsson (2000) describes the laissez-faire leadership not as a non-leadership but a leadership where the leader is still present but has abdicated from his or her responsibilities and duties. The subordinates expect for the leader to lead and solve problems but that is not happening. In Lewin's study children in school became dependent, aggressive and failed to learn when having a laissez-faire teacher. However, when the teacher left the room they took the initiative themselves and began to learn. When the teacher left the room there was instead a non-leadership which made the children actively take their own initiatives (Frischer & Larsson, 2000). Amabile (1998) has a different view and thinks that supervisory encouragement is something that is necessary. If employees shall be motivated in the long-term, they need to feel that their work accomplish something (Amabile, 1998).

### **2.5.3.9 Innovation and Criticism**

To make the organization innovative the employees need to be innovative. If employees on all levels are allowed to participate and be creative it will make the organization more creative as well as enhance the quality of work life (UK WON,

2001). Some organizations meet new ideas with criticism and evaluations, Amabile (1998) states that criticism often occurs due to the image that it gives the individual since critical persons often are seen as brighter than others. This in turn results in employees not sharing their ideas because they are afraid of criticism. Gestner in Garvin & Roberto (2005) describes the culture of “no”. In large organizations there is often a culture of saying no rather than yes to new ideas, since the subunit managers are unwilling to comply with directives from above, additionally saying no is avoiding risk taking (Garvin & Roberto, 2008). Instead of a critical environment the top management is responsible for creating a context where new ideas can bubble up from below in a surrounding of coherent ideas of the long-term goals. The fine balance between clarity of the future vision and specifying the strategies too much leading to constraints in the employees’ enthusiasm is important to keep innovative ideas coming for preserving competitive advantage (Johnson, et al., 2008).

#### **2.5.3.10 Organizational Learning**

Johnson, et al. (2008) describes a learning organization as having the capability of regenerating itself from within, using knowledge, experience and skills of individuals within a culture that encourages mutual questioning and challenge around a shared purpose or vision. The dynamic strategies are emerging naturally from within the organization. The collective knowledge of all individuals in the organization usually exceeds the organization’s knowledge and the formal structures often stifle organizational knowledge and creativity. To utilize most of the individual knowledge Johnson, et al. (2008) states that management should aim for encouraging processes that unlocks all individuals’ knowledge and makes the individuals sensitive to changes around them leading to contributions in identifying opportunities and required changes (Johnson, et al., 2008).

To develop a learning organization the management should facilitate rather than direct, the information flow needs to be lateral as well as vertical, and all ideas and views should be welcomed, surfaced and the base of a debate. Furthermore, ideas should be tried out in action and experimented on to become a part of the learning process (Johnson, et al., 2008).

Argyris (1977) points out two factors inhibiting learning; they are the same for individuals and organizations. One is if the decision makers get enough and valid

information to use to monitor the effectiveness of their decisions, the other one is the receptivity to corrective feedback of the decision-making unit (Argyris, 1977). Different authors referred to in Argyis (1977) state that distortion and manipulation of information together with lack of debate is the largest problem when trying to develop a learning organization. When learning does not question the fundamental design, goals, and activities of the organization, Allison et al. in Argyris (1977) name it single-loop learning and most organizations and groups learn this way. The same authors mean that double-loop learning only takes place when participants ask questions about changing fundamental aspects of the organization.

In the single-loop learning the problem solving is rather ineffective, since top management control and demanding loyalty will make the employees agree with top management views. The double-loop learning model does instead emphasize variables like valid information, free and informed choice, and internal commitment. This is not opposite to single-loop but in the double-loop learning organizations the questions and ideas are openly discussed. All ideas are seen as interesting since they come from within the organization and probably is the best idea from the position that employee has in the organization. Things can be seen from different perspectives and must be discussed to base decisions on most possible amount of facts. It is crucial that self-gratification and face-saving is not given space in this kind of discussions and decision-making. The degree of defensiveness in individuals, within, between, and among groups tends to decrease and free choice tends to increase resulting in increased feeling of commitment. In the end of the day, the result should be better quality of decision making and policy making, in monitoring of decisions and policies and in the probability of errors and failures would be communicated openly so actors can learn from the feedback (Argyris, 1977).

Regarding organizational learning, Mahajan (2010) emphasizes the importance of incident reporting to improve safety in industries as well as to enhance learning about causes of incidents through analyzes. In addition to this, he also stated that incident reporting improves learning about systemic changes which prevent incidents to reoccur. Moreover, significant problems regarding local and global incident reporting system are due to poor safety culture in an organization and lack of understanding of how the reports will be reported and analyzed to improve safety (Mahajan, 2010).

Grusenmeyer (2003) discusses the positive role of Standard Operating Procedures in organizational learning process. Since comprehensive knowledge regarding processes are required in order to write Standard Operating procedures, writing these procedures leads people to learn more about details of the processes and in turn, this will provide opportunity to define improvement areas (Grusenmeyer, 2003).

## **2.6 Cultural Aspects of Organizations**

Culture is defined by Kotter & Heskett (1992, p.141) as: ‘Culture represents an interdependent set of values and ways of behaving that are common in a community’ (Kotter & Heskett, 1992). Culture plays an important role in corporations in term of employees, groups as well as organizational effectiveness. Every corporation has its own unique culture. Three fundamental factors are considered when it comes to organizational culture; first, the work patterns and behaviors that people can observe; second, the describable symbols such as person, object, etc. and third, values and assumptions which influence behaviors (Shani, et al., 2009).

According to Stieber & Alänge (2013) Google is documenting its core values in writing to have sustainable culture through culture teams in each country. As long as people stick to the core values, subcultures are allowed to exist in Google. Internalizing the importance of their core values by all employees is crucial for Google and this is one of the major reasons behind its success even if it is exposed to a changing environment. Furthermore, Steiber & Alänge (2013) found that Google’s core values could be classified according to four dimensions; “ethics”, proposing to achieve good results for society; “behavior”, being fast and scalable as well as openness; “ambition”, thinking big; “focus”, focus can be data driven focus or first users, then money or great individuals with passion (Steiber & Alänge, 2013).

### **2.6.1 Value System**

The definition of the value concept by Kluckhohn (1951, p.395) is that “A value is a conception, explicit or implicit, distinctive of an individual or characteristic of a group, of the desirable which influences the selection from available modes, means and ends of action”.

Every person has its own personal values which are constituted by the influence of cultural origin, age, gender, educational level, genetic properties, political view and



religion. These subjective values have a great impact on corporate values and personal behavior in company (Shani, et al., 2009). According to Shani et al. (2009, p.152), values at work can be categorized into work ethics, outcomes of work, context of work, work process as well as interpersonal relationships. Since companies develop a pattern of values and belief systems over time, in terms of business values and their importance it is pivotal that employees who work in same company understand the business values and their importance in order to work in the same direction. Furthermore, when developing the pattern of the value and belief systems, organizations need to make sure that this pattern represents the fundamental operating philosophy and cultures of the company (Shani, et al., 2009)

### **2.6.2 Ethics**

Dällenbach & McNickle (2005) define the concept of ethics as the codes of moral principles and values. Moreover, since the society where people live judges what is right or wrong, the behaviors of people are shaped by ethics. Different ethical standards exist in different groups or societies and there is always discussion about what forms ethical principles and how to decide if a behavior is acceptable in an environment. In addition to this, there are different codes of ethics in different surroundings; one code of ethics is handled in interaction with family, friends and relatives; another one is interaction with people in general and yet another one when interacting with tax authorities. Following these accepted different kinds of ethical codes are considered as moral obligation. (Dällenbach & McNickle , 2005).

The relevancy of ethical considerations in decision making process is suggested in terms of two aspects. As the first aspect, decisions are made based on ethical consideration without saying. According to second aspect, decisions made without following the ethical principles become tainted since the decisions are based on self-interests of the people and can be destructive for all stakeholders. Moreover, some grey areas and conflicts exist in ethical considerations (Dällenbach & McNickle , 2005). Jackson (2000) argues that the clarity level of corporate attitudes towards these grey areas in ethics is different and these grey areas affect managers' behaviors when they are making ethical decisions.

### **3 Methodology**

This is a qualitative study, looking into data from assessment reports on product development and production in Volvo Group. The study investigates a single organization to make its unique features explicit. It is qualitative and the organization is studied and conclusions are drawn from the data, why it is what Bryman & Bell (2011) refers to as an inductive approach. Since it has an inductive approach to theory and treats a single case it is according to Bryman & Bell (2011) a broadly ‘relevatory’ case study (Bryman & Bell, 2011).

#### **3.1 Workshop I – Framing the Scope**

To frame the scope of this study and secure interest of the customer, the OD/VPS Group Function of Volvo Group, a workshop was held in the first week of the study. The participants from product development, production and operational development of the OD/VPS Group Function were first informed about the researchers and their background as well as the topic of the thesis. They were then asked to individually describe what outcome they wanted from the topic if they could wish freely. Their wishes were written on post-it notes and presented to the group. The post-it notes were grouped on a board in the room and the participants were given ten points each to distribute on the most interesting or important wishes. This workshop led to framing the scope by finding the expectations and needs of the customer, the OD/VPS Group Function of Volvo Group.

The most prioritized topic from the participants view was to find global results of assessments, finding general strengths and weaknesses, describe the global improvement areas important for success and analyze the major weak areas. Next topic was the links between product development and production processes, are there overlapping, conforming or contradicting information from the assessment reports? Other interesting topics are if the results in assessments are correlated to the business results and if the Volvo Group cornerstones correspond to the results as well as topics about the assessment method.

### 3.2 Data Availability

Since the aim of this thesis study is to analyze existing assessment reports. Assessors in product development and production conduct the assessments for each organization of Volvo Group. Then they analyze assessment locally and present the assessment results for the local organization. Therefore, the assessment reports were already available. Due to this, there was no need to collect data. According to Bryman & Bell (2011), when data has already collected by an organization and researchers that perform analysis are not part of this data collection process, the data is called as secondary data.

However, the assessments are performed by different departments and by that there are differences in the data from product development assessments and production assessments. In the product development assessment reports, data are classified according to the two criteria strengths and weaknesses, while in production the criteria are strengths and opportunities.

### 3.3 Literature Review

Literature on the subject of product development, production, change management, systems thinking as well as data handling and analyzing methods /tools were read from several databases. The literature is searched both before the thesis study actually starts as well as throughout of the study to make for a smoother start-up phase.

The literature reading was based upon searches for keywords and then later selected according to content and relevance to the phase of the thesis study and the need of information currently available.

### 3.4 Data Handling and Analysis

The data handling process for assessment results are composed of phases according to the *Figure 5- Analytical Framework of Study*, data handling process starts with phase 1 and follows the sequential order until end of the phase 5. The output of the phase 5 was prioritized during Workshop IIA and Workshop IIB and constitutes the answer for the first research question and its sub questions. The answer of the first research question is used as input to answer the second research question. The first five phases were performed on product development data and production data separately, while

the analysis in the sixth phase was done with a system view by including both processes. The phases for data handling are described below.

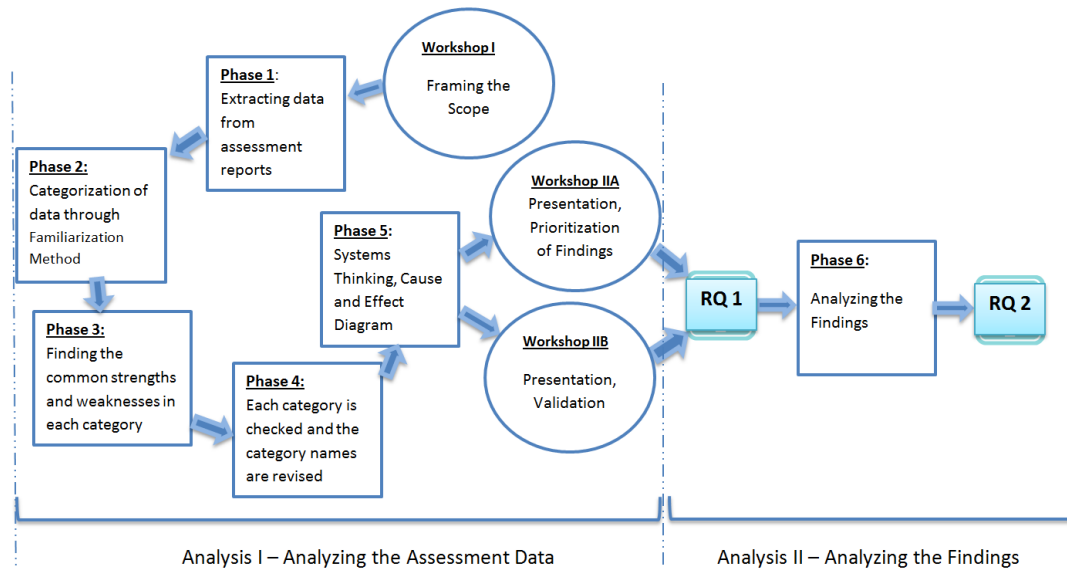


Figure 5- Analytical Framework of Study

## Phase 1

Extracting data from assessment reports to excel sheets for product development and production respectively. The data was ordered according to the VPS sub-principles. Thus, it was possible to see the entire assessment results for all companies under each VPS sub-principle in the same sheet. Examples for the VPS sub-principles in the Process Stability principle is; Standard Way of Working and Extended Value Chain. The next step in this phase was to find common strengths and weaknesses of all companies presented from each sub-principle of the VPS principles as it is seen in *Figure 1- Volvo Production System*.

## Phase 2

In the second phase the data were categorized by using the method of familiarization. According to Ritchie & Spencer (1994) familiarization is when the researchers immerse in the data, to find hunches about key issues and emerging themes. This is done by going through the material finding key ideas and recurrent themes to set up a framework for sifting and sorting the material. At this stage the process of making an

index of the data will be logical and intuitive. Connections between ideas as well as meaning and relevance and importance of issues are evaluated (Ritchie & Spencer, 1994). In this case the data was categorized without considering the principles and its subgroups. The familiarization was done in the product development data first since the assessment reports were provided at first for the product development. When the production data being familiarized the product development categories formed the base, but some were not used and others were added.

### Phase 3

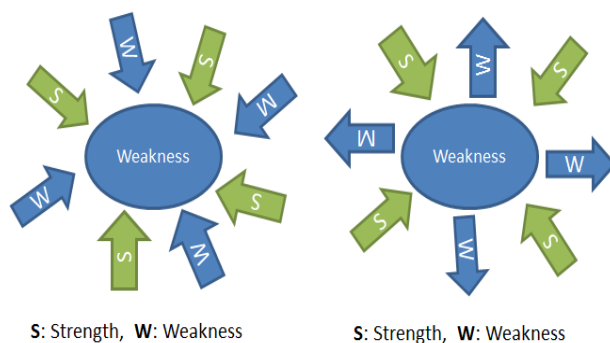
The version of the data obtained from the phase 2 was handled again by finding the common strengths and weaknesses/opportunities in each category. This phase aimed to reduce the amount of data in each category.

### Phase 4

As a validation the data under each category is checked and the names are revised to have right category name that denotes the relevant data connected to it. After phase 4, data handling process continues with the data analysis in order to answer research questions as it is explained above in *Figure 5- Analytical Framework of Study*.

### Phase 5

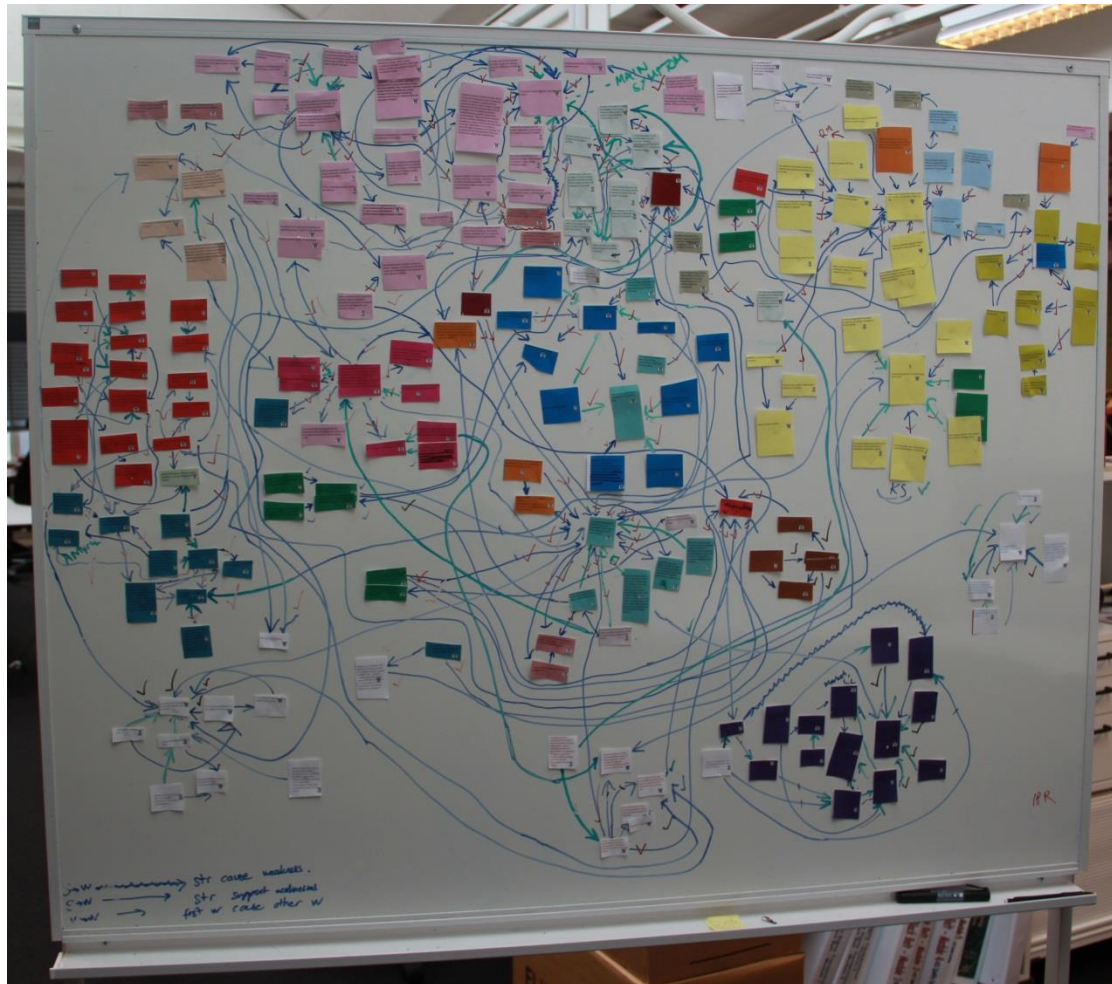
To further process and analyze the data; in this phase systems thinking is applied to find interrelations between different comments from the assessment data. In this area the literature study was started with Management Science: Decision making through systems thinking (Dällenbach & McNickle , 2005) and Tools for thinking (Pidd, 2003). Since the found strengths and areas of improvement are related, the relations must be found before discussing improvement strategies. At first the properties of the whole is described and then the behaviors or properties of the functions or roles within the whole (Güven, 2011).



*Figure 6- Symptom and Root Cause*

In this case the cause-and-effect diagram was used; it is a common tool in systems thinking since it provides to see interactions from both mutual causality as well as feedback perspectives.

Through cause-and-effect diagram, both strengths and weaknesses are tackled simultaneously in order to look from a system approach. Generally when arrows come from one weakness to other weaknesses, it is identified as a “root cause”, but if it is vice versa, the weakness is depicted as a “symptom” as shown in *Figure 6*.



*Figure 7- The Cause-and-Effect Diagram for Product Development Process*

As illustrated in *Figure 7*, different colors represent the different categories found in the earlier phases. Each note is an issue in which some organizations have strengths or weaknesses in their usage of the product development process. The cause-and-effect Diagram was also conducted for the production process. Systems thinking approach was used to see strengths and weaknesses about each issue. Therefore, some strengths were directly correlated to weaknesses stated in other organizations since the strengths are considered as good practices. In other words, the strengths are connected to symptoms or root causes in order to see the best practices about area that the symptoms or root causes state. Through this approach, it became possible to see how

one issue affects others as well as whole system. Furthermore, at this stage the familiarization method was reused in order to make categories out of the notes on the board having five or more nodes to it. Findings for both product development and production processes were obtained through this approach. Finally, this method enabled the researchers to see that all major symptoms have interaction with other major symptoms. Hence, when developing an improvement strategy for one major symptom, it is important not to disregard the influences of the other major symptoms.

### **Workshop IIA – Presentation and Prioritization of Findings**

After analyzing the assessment data there were another workshop performed with participants from the OD/VPS Group Function groups for product development and production. The findings were presented and discussed and thereafter the participants were asked to prioritize the topics. The prioritization were performed in the same way as in Workshop I, where all participants got individually ten points for product development and ten points for production to vote for the most important ones. It was a good discussion is provided through Workshop IIA and the time planned for the workshop nearly was doubled since everyone had so much to discuss. One thing that became very clear to the participants was how closely connected many of the topics are. The results from Workshop IIA are presented in chapter 4.3 Prioritization.

### **Workshop IIB – Presentation and Validation**

The results of Workshop IIA were presented to other participants from the OD/VPS Group Function that they were not able to participate in Workshop IIA. There were again interesting discussions on the findings and the analysis and conclusions were shortly discussed. This could be seen as a form of validation since the participants was agreed on the prioritization from Workshop IIB.

## **Phase 6**

After agreeing on the empirical findings, literature was used to analyze the findings. The information found has been used to elaborate on improvement strategies.

## **3.5 Data Validity and Reliability**

The data used in this study originates from assessment reports from product development and production in Volvo Group. The assessments are performed by teams, which according to Denzin (2009) is called investigator triangulation and

increases both validity and reliability of the data (Denzin, 2009). When using secondary data it is always a risk for misinterpreting the data, but in this case we had access to the people collecting the data and had many questions for them during the first phases when getting familiar with the data. Discussion with the people collecting and analyzing each assessment provided more understanding about the situation in the organization behind the assessment reports. Performing the workshops IIA and IIB with several participants from each area provided discussions upon results from assessment reports. The discussions with the people collecting the data minimize the risk for non-detected misunderstanding as well as validation for the answers to the first research question.

### **3.6 Ethics and Confidentiality**

Since none of the discussions in the workshops or presentations is published with names or personal information, no impact on the answers were anticipated. The aim of the workshops was to define the phenomenon from the participant's perspective. The workshops included several employees from the same departments to not only further increase the data collection but also to reduce the risk of exposure for any of the employees.

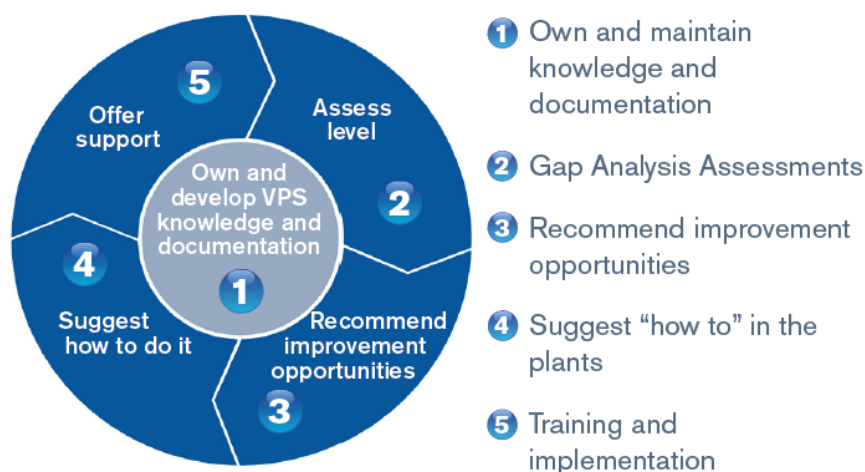
The purpose of the researchers was to hear the voice of the participants. Field & Morse (1992) defined emic perspective as researchers' interpretations of these experiences that are obtained during listening of the voice of participants or observing them. This means that researchers observe that employees who attend workshops are autonomous people who share knowledge willingly (Bryman & Bell, 2011). Field & Morse (1992) mean that trust and awareness of ethical issues are encouraged by a balanced research relationship. In this study, a balanced relationship was established by daily direct contact with the persons who performed the assessments in early phases of analyzing the assessment data. Furthermore, during this thesis work there was a continuous communication with the company to assure that confidential information are not expanded from the researchers.

### **3.7 Reflection**

There is a difference between the product development data and the production data from the assessment reports when defining the weaker parts; the product development



states weaknesses while production states opportunities, written as recommendations for action. This is due to that the assessments are made from different teams of the VPS/PD Group Function. By presenting it as recommendations there are steps missing in the analysis. There are many recommendations in the assessment reports that there should be a root cause analysis performed on all problems, but the recommendations in the assessment reports are not built on root cause analysis. They are instead built on the assessors using their experience and previous knowledge to find a best practice from another part of the company. This is not ensuring that the recommendation is the best possible solution for the root cause of the symptom found in the assessment process. By walking the talk and define the problem as well as performing a root cause analysis the quality of recommendations could increase. In the assessment process seen in *Figure 8* the recommendation and implementation steps should be performed after the assessment results are presented, if the organization requests it.



*Figure 8- The VPS Assessment Process (Violin, 2009)*

The purpose of the assessment reports is to present the assessment results on each assessed site. Because of this, they are written with the intention to facilitate change; to create urgency for change and state some strengths to build the change upon. There are fluctuations in how strong the stated strengths are, depending on how mature the organization is in its lean initiative. In less mature sites things stated as strengths could be new initiatives, not mature and ready but on the right track to become a strength in the future. There are as well differences in the wording; some words can mean different things in sites of different maturity. The different wording and big

amount of data (approximately 3000 qualitative comments) makes it difficult to use the result from this thesis as a global average of Volvo Group. However, it could be used as an overview of the current state for identifying improvement areas as well as using examples from this study when training leaders to make them aware of current behaviors.

The comments on leaders could be questionable since the leaders are asked to assess themselves. In the assessment process there are also surveys where the employees are asked about the performance and where this issue is covered. Double-checking with the employees is not included in this study since the study is delimited to use only the qualitative assessment reports. When analyzing the data from the assessment reports there were in some areas not exact data, but there were many indicators that made us notice that there were common characteristics. When analyzing the common characteristics by using theory it became clearer what is missing in the company, for example, not communicating the customer needs into the product development process. It is stated in the assessment reports that the customer needs are collected in a good way, but elaborating upon the weaknesses made it possible to see how these weaknesses results from not communicating the customer needs.

The analysis combined data from product development and production processes. When starting the analysis it quite soon emerged that there were common reasons for the behaviors in both areas and by this reason they were analyzed together. If they were analyzed apart the result could have been different. Since the production assessment is tool-oriented that would have been seen in the analysis for that area. Also the fact that there are 'weaknesses' stated in the assessment reports for product development while there instead are 'opportunities' presented in the reports from production is one reason for the limitations in combining the data from the two processes.

A lot was learned about the Volvo Group and their processes through analyzing the assessment reports. Since the researchers have not seen the product development and production processes in real life they only know it through the assessors' eyes. The cause-and-effect diagram is hence that based on the researchers' interpretation of the comments in the assessment reports. The result of the cause-and-effect diagrams are as well colored by the researchers' background from studying Quality and Operations Management. If another method should have been used to find the major

characteristics of the product development and production organizations of Volvo Group; there could have been different results. The researchers believe though that the system perspective is valuable and seeing all the operations as a system enhanced the quality of analysis.

## **4 Empirical Findings**

After the assessment data from product development and production respectively were analyzed in the cause-and-effect diagrams, the assessment comments with five or more nodes were selected for further analysis. These were assigned into categories and are presented in this chapter with common findings from each area. The categories will be presented in this chapter with common assessment findings from each area. The product development and production data is separated since they are collected from different processes and collected by different groups.

### **4.1 Product Development**

In the Product Development area there were ten different areas recognized. They are presented below with common strengths and weaknesses from the assessments. The strengths are described in the first paragraph and the weaknesses in the second one.

#### **4.1.1 Knowledge capturing, sharing and reuse**

Some of the organizations have strengths in knowledge capturing, sharing and reuse. Examples of strengths in the sharing experience area is sharing best practices, feedback lessons learned during concept phase, sharing to newcomers, spreading information and other learning such as the content of the white books, and sharing experiences from projects and production to design practices as well as between organizations.

But, in other plants, there is no structured way for capturing knowledge or global structured approach or standard templates for sharing experience. Examples of weaknesses in capturing experiences are during AE (Advanced Engineering) phase, from external AE activities, collecting information to the CMT (Customer Management Team), not putting all knowledge into the white book and that it is hard to find time for reflection.

#### **4.1.2 Sustainable Continuous Improvement**

In some organizations, OD is implemented to involve all employees in setting direction and continuously improve.

In other organizations, there is no systematic approach for sustainable continuous improvement. At some sites the global best practices are hard to combine with the local ones. The time allocated for process improvements is in many cases not used due to high workload.

#### **4.1.3 Proactive Testing**

DFMEA (Design Failure Mode and Effect Analysis) is applied and the verification leader formally requests simulations to be performed before physical testing. Other strengths are that the HIL and SIL (Hard respectively Software in the Loop) tests are performed for simulation and verification purposes and that some tools are used for validation and verification (such as recycle tool which is used in Verification and Validation process and DVG, Design Verification Guidelines, used for Assured Start of Production).

The lack of proactive testing causes many weaknesses; one example is that testing often is done independently without overview. Another weakness is that feedback from proactive testing is not fully utilized for product risk analysis and other activities. There are as well limited validation of simulation models and results connected to the unclear strategy for use of calculation/simulation tools in concept and test evaluations as well as creating knowledge by tests synthesis through analyzing and comparing virtual testing results with physical testing.

#### **4.1.4 Project Portfolio Management**

Some product development organizations have a structured procedure for performing project portfolio risk management, including a risk and opportunity register and reviewing the portfolio and its risks monthly.

Other organizations have no clear control of inflow of projects into the project portfolio. There is a need for a formal description for the product plan (PPL). The PPL defines the overall need for projects but the transparency between the product plan and the technology plan is weak. Additionally, the project portfolio is not balanced based on available resources. When planning the products and portfolio there are no common principles and strategies for facing out existing products, reuse of parts and reduce new parts creation. Furthermore, there is no formal description on how to reprioritize when a change in one project affects other projects or a product change affects other products, when leading to portfolio adjustments. Connected to the

portfolio management is that there is no IPR (Intellectual Property Rights) strategy to keep competitive advantage and protect intellectual property rights, even though some organizations have patent specialists.

#### **4.1.5 Voice of Customer**

This category is divided into two topics since there are different characteristics in the two topics.

##### **4.1.5.1 Capturing and Analyzing the Voice of Customer**

Some organizations have strengths regarding voice of customer in terms of capturing both spoken and unspoken customer needs and how they change over time. In addition to this they are good at capturing how the customer uses the product and how to prioritize conflicting customer needs. In order to contribute to the product development process, collaboration between product development and aftermarket, and the direct dialogue with dealers and customers are important.

##### **4.1.5.2 Communicating the Voice of Customer and aftermarket knowledge into the Product Development Process**

Communication of obtained knowledge regarding Voice of Customer into the Product Development process is pivotal since only capturing knowledge is not enough without transferring them to the relevant departments. There is a need for improving communication between different functions by documenting and spreading the knowledge in a formal way. This weakness leads to weak PPL (Product Planning) which in turn leads to bad planning of AE (Advanced Engineering) projects since the PPL should define the gaps for AE to fill. Furthermore, other weakness is that respect internal customers.

#### **4.1.6 Monitoring the Process**

Some organizations have comprehensive and visible KPI (Key Performance Index) structures.

Several organizations do not have a structured way to measure how the processes are followed. The KPIs are not used to improve the process in a structured way. There is also lack of target setting; both project and product cost targets as well as delivery time targets are needed to drive improvements.

#### **4.1.7 Resource allocation and competence development**

As strengths, there are different pipelines in place for project leadership, management, and technical specialists. When unplanned work peaks occur, resources could be borrowed from other projects, line organization or other sites.

On the other hand, continuous resource allocation throughout the project is a common weakness. When borrowing from other parts of the organizations it entails a risk for slowing the project down when transferring knowledge to the new participants. Additionally there is no systematic approach to promote different competence development methods (ex: role-specific training, individual competence development, 3C-training).

#### **4.1.8 Suppliers**

In the suppliers area there are many strengths and weaknesses, many of them about the same topic from two sides. Strengths in this area are following the global sourcing process and that there is a concept for development of suppliers. The relationships with the suppliers are long-term and built on trust and transparency. Furthermore the suppliers are involved in the product development process and data as well as information is transferred systematically. In order to ensure supplier quality, tools and methods are available such as process audits, problem sourcing coaching, advanced product quality planning, and quality assessment for Request for Proposal. Some organizations collaborate with suppliers to help the supplier reaching the cost targets set by cost engineering and purchasing. In others there are Business package teams who develop and maintain suppliers' roadmap.

On the other hand the global sourcing process takes long time and does not assure quality and aftermarket needs. Additionally there is a need for a strategy to improve suppliers' quality. Other weaknesses are limited capturing of suppliers' knowledge and not involving the suppliers enough in product development projects.

#### **4.1.9 Concept selection**

The deliverables are well defined in each gate and strong milestones between the gates.

There is need for a structured process for concept selection and evaluation and all concerned stakeholders need to be engaged from early phases. Other improvement

areas are using the concepts across different projects, capturing knowledge from unselected concepts, incentives for using carry-over parts and testing the concepts before selection.

#### **4.1.10 Project Delivery**

PULS meetings are a strong tool to follow-up on deliveries and escalation getting a good overview of all projects.

Nevertheless, the project delivery is not fast enough for the customer. There is need for systematic approaches for reprioritization as well as communication when changes are made that demands adjustments in the PPL (Product Planning) and portfolio.

## **4.2 Production**

The production data is different from the product development data since it is composed of strengths and opportunities. There were eight areas emerging from the production assessment data. The areas are presented below; the first paragraph of each section describes common strengths in the area while the second describes the opportunities.

### **4.2.1 Systematic Problem Solving Instead of Quick-fixing**

At some sites the daily quality discussions in cross-functional teams at the production line are a good structure for escalation since management is involved in prioritized areas. Moreover, root cause analyses are performed on team level in some organizations in order to avoid recurrence of breakdowns and severe problems.

One opportunity is to ensure effective problem solving by focusing on the problem descriptions and root cause analysis rather than fixing symptoms. Furthermore, usage of systematic problem solving is required when addressing quality problems and ensuring the quality of Quick Response Problem Solving at team level.

### **4.2.2 Improvement Work**

The idea generation is in some sites driven by employees, and the organizations and management are willing to improve and drives change. There is different maturation in many areas since the same topic is a weakness in some organizations while being strength in others. Examples for this are clear targets on improvements, time available for improvements, usage of Value Stream Mapping to find optimal layout and value-



added respectively non-value added time, problem solving methodology and competence as well as having good leadership and management commitment.

In the weaknesses we find the need for speeding up improvement work and increase the number of improvements per employee. To make sure the improvement areas are prioritized correctly there is a need for improving the cascading process with alignment, breakdown and communication of KPIs from plant level to team level.

#### **4.2.3 Employee Safety**

In some sites there is a good safety system is in place with high participation from employees by using methods such as robust safety management process, work place ergonomics, and safety risk analysis.

In other sites, there are opportunities like shaping a vision for future Health and Safety targets in order to strengthen the safety culture for all employees, use the safety pyramid for preventative work on safety, and integrate safety in all teams' everyday work. Encouraging incident reporting and analyzing major safety hazards like incidents, unsafe acts and conditions are other opportunities in the safety area. An example here is reducing forklifts in the assembly area by for example expanding the trigger train. Implementing preventative safety and health procedures merging the health risk assessments with safety assessments would as well improve the safety. The adherence to PPE-rules (Personal Protection Equipment) needs to be improved by a better structure, clarity and visualization of policies.

#### **4.2.4 Process Stability and Standardized Work**

Many production sites have a strong level of understanding in standardized work. Good SOPs (Standard Operating Procedures) and Poka Yoke are implemented in many sites to achieve stable processes, and PFMEA (Process Failure Mode and Effect Analysis) are used for risk analysis.

On the other hand, opportunities exist in other plants. To achieve a stable process zero defects is one of the prerequisites; eliminating defects by for example Poka Yoke (devices for mistake-proofing) or detected as early as possible, preferably at the source. Poka Yoke is an opportunity in many sites even if other ones use it in a good way. Takt with Andon (a button where all employees can stop the line if there are

problems) will surface the problems when the cycle times in assembly are challenged but Andon is not widely used.

#### **4.2.5 Training and Coaching**

Strengths in this area are: that the VPS support Organization has good VPS knowledge and train it to all function members, the professional training school to support off-the job training, and that management supports the shop floor teams in a coaching program.

Opportunities are to use skills matrix to identify competence gaps and define training. Furthermore, there is a need to secure training and coaching the employees for continuous improvement regarding both theoretical and practical job competencies, for example on asking the right questions and detect unsafe conditions and acts.

#### **4.2.6 Visualization of KPIs and Performance**

Some organizations have strengths regarding visualization of KPIs and performance. For instance, there are good visualization of performance on standardized team boards on daily basis and good deployment and clarity of KPIs for new product and support functions.

In other sites there is a need to improve the KPI results by making the teams responsible and communicating gaps. The KPIs should motivate and guide employees to change and improve. In order to realize this purpose, the KPIs follow-up and visualization should be strengthened in the regular meeting place. Other opportunities to visualize are takt and line balancing.

#### **4.2.7 Data collection**

Many organizations are good at data collection, for example quality log of sampled deviations. The use of EWOs (Emergency Work Order, a structured way to analyze incidents with definition and root cause analysis) is driving data collection and analysis.

To address the right problems knowledge the opportunity is to collect the right data and stratify it. In the maintenance areas there is a need for using more metrics and visualize trends to follow-up and drive improvement work. Metrics could for example be collecting data of system downtime and uptime as well as MTBF (Mean Time

Between Failures) and MTTR (Mean Time To Repair). Another opportunity is the mapping of critical systems and machines to prioritize maintenance and improvements as well as further develop autonomous maintenance by creating frequency and inspection charts for operators.

#### **4.2.8 Ergonomics**

Some plants have strengths regarding ergonomics. For example driving improvements by using lean metrics related to 5S (a way of organizing the workplace for efficiency and effectiveness) program, such as % parts in green zone, walking distance, number of accidents, etc. Other strength is the introduction of kitting, which is based on business needs, and has given a very good material and tool presentation, as well as reduced the line side inventory levels.

In several plants there are opportunities like; strong improvement focus is required on tools and material handling, ergonomic training, green zone in assembly area and design of Poka Yoke devices. Recommendations for improvements are reducing walk distances and human errors, aim for "one motion" for part retrieval, moving racks to kitting and standardized work. Material presenting to the operator could in these sites be improved by kit feeding, ergonomic considerations and material size to avoid forklift usage in the assembly area.

### **4.3 Prioritization**

The findings presented above were presented to some of the employees in the OD/VPS Group Function in Workshop IIA. The participants are performing assessments in product development respectively production. There were a discussion on each area and what came clear to the participants during the discussion was that all areas were interrelated, like a system. After the discussion the participants were asked to individually prioritize which of the areas that was most important or urgent.

#### **4.3.1 Product Development**

As seen in *Table 1* the Knowledge capturing and reuse were seen as most important in the product development followed by Sustainable Continuous Improvement They are quite closely interrelated since the improvement work is depending on learning from earlier experiences and using the knowledge that already exists in the organization.

1	<i>Knowledge Capturing, Sharing and Reuse</i>
2	<i>Sustainable Continuous Improvement</i>
3	<i>Proactive Testing</i>
4	<i>Project Portfolio Management</i>
5	<i>Voice of Customer</i>
6	<i>Monitoring the Process</i>
7	<i>Resource Allocation and Competence Development</i>
8	<i>Suppliers</i>
8	<i>Concept Selection</i>
8	<i>Project Delivery</i>

*Table 1- Prioritized Findings in Product Development*

In the middle zone of product development the Proactive Testing, Project Portfolio Management, and Voice of Customer are seen together with Monitoring the Process. In the last zone there are Resource Allocation and Competence Development, Suppliers, Concept Selection and Project Delivery. Many of these are interrelated due to the proactive way of working. Proactive Testing, Project Portfolio Management, Resource Allocation and Competence Development, Concept Selection and Project Delivery all depends on planning the products and projects and besides that include the anticipation and handling future risks in the planning. Monitoring the process is about controlling if the project follows the plan while working closer with the suppliers should ensure quality of incoming material. The Voice of Customer is the groundwork of planning; knowing what the customer needs is the foundation for planning future products and projects.

#### **4.3.2 Production**

The results of the prioritization in the production area are seen in *Table 2*. In production the Systematic Problem Solving Instead of Quick-Fixing were voted for as the most important followed by Improvement Work and Safety. The interrelation between Systematic Problem Solving Instead of Quick-Fixing and Improvement Work is strong since solving problems in a structured way, taking care of the root cause instead of quick-fixing a symptom is a base for improvements. Safety is related to them both since a mind-set of structured problem solving, taking care of the root causes together with Improvement Work are a strong base for improving in the safety area.

1	<i>Systematic Problem Solving Instead of Quick-fixing</i>
2	<i>Improvement Work</i>
3	<i>Employee Safety</i>
4	<i>Process Stability and Standardized Work</i>
5	<i>Training and Coaching</i>
6	<i>Visualization of KPIs and Performance</i>
7	<i>Data Collection</i>
8	<i>Ergonomics</i>

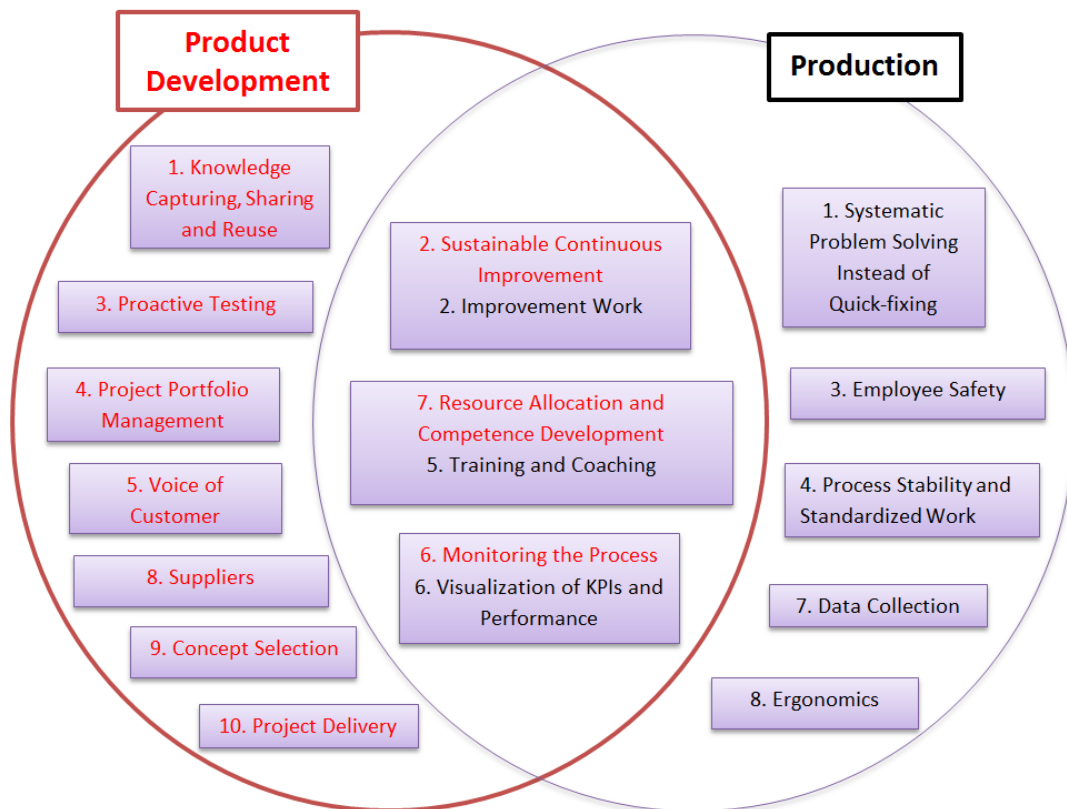
*Table 2-Priorized Findings in Production*

The middle zone of production contains Process Stability and Standardized Work, Training and Coaching, and Visualization of KPIs and Performance while Data Collection and Ergonomics were put in the last zone. The logic for putting them last were that the participants thought they somehow were already included in other topics. The Ergonomics is incorporated in both safety and Standardized Work since safety is a part of the Ergonomics and a part of the reason of Standardized Work is making everyone perform the task in the most ergonomic way, together with this the 5S is about having the things you need where you need them leading to having the most used tools and material in the green zone around the operator. To motivate the teams to perform good the KPIs should be visualized close to the work station, showing trends of performance. Training and coaching has the same goal, to motivate and make employees perform even better. The training is a part of Safety as well a part of the Systematic Problem Solving Instead of Quick-Fixing – giving the employees the tools for structured problem solving to improve in that area and getting the knowledge and mind-set for finding safety risks and change to a more safe behavior.

#### 4.4 Overlapping Area

As illustrated in *Figure 9*, the overlapping area denotes that production and product development have common factors which are similar in both processes. These common categories for product development and production processes are located in the overlapping area.

Other factors are located outside the overlapping area, in product development or production. That is because those factors are only relevant in one of the processes.



*Figure 9- Overlapping Area of Product Development and Production*

The first factor in overlapping area is the correspondence between Sustainable Continuous Improvement and Improvement Work. Since continuous improvement is pivotal in lean initiatives, it is important for all processes of a company.

The second factor is Resource Allocation and Competence Development together with Training & Coaching. Both of these include competence development activities in theoretical and practical job competencies. Resource allocation is about having right competence in the right position at the right time. After identifying the competence gaps through the usage of relevant tools/methods such as skill matrices; competence development is required in the defined gap areas to have a smooth process in resource allocation. These areas are important since securing employees' competence is a key to for example continuous improvement.

The third factor is the correlation of the topics Monitoring the Process in product development and Visualization of KPIs and Performance in production. Visualization of KPIs and Performance is regarded as one way for monitoring the process, why they are closely correlated. Visualization and follow-up of KPIs and performance should

be strengthened even if some of other monitoring ways are utilized at some plants such as internal audits.

In the following chapter the empirical findings will be further analyzed using theory and research in the found areas.

## 5 Analysis

In this chapter the findings from chapter 4 Empirical Findings will be analyzed according to available literature. The aim of this chapter is to propose an improvement strategy based on the empirical findings by analyzing it towards existing research.

The first part is an analysis of the empirical findings, which are regarded as behaviors. The analysis continues with what is driving the behavior. Knowing what drives the behaviors provides an opportunity to steer them for sustaining success in long-term.

### 5.1 Perspectives for Analysis

When analyzing the empirical findings according to theory to state the real problem behind the symptom, some themes emerged. They are by the researchers perceived as key points needed for successful lean initiatives. Some of the themes correlated to some of the Liker's (2004) 14 principles of the Toyota Way, so some of them are inspired from that source. Since there are not facts on all of the lean principles in the assessment data, not all of them are used in this analysis. The six perspectives used are presented in *Figure 10*, and are the ones that emerged from the data while analyzing the empirical findings with theory. As illustrated in *Figure 10*, all perspectives interact with each other and there is a need of considering all perspectives in the analysis of the empirical findings.

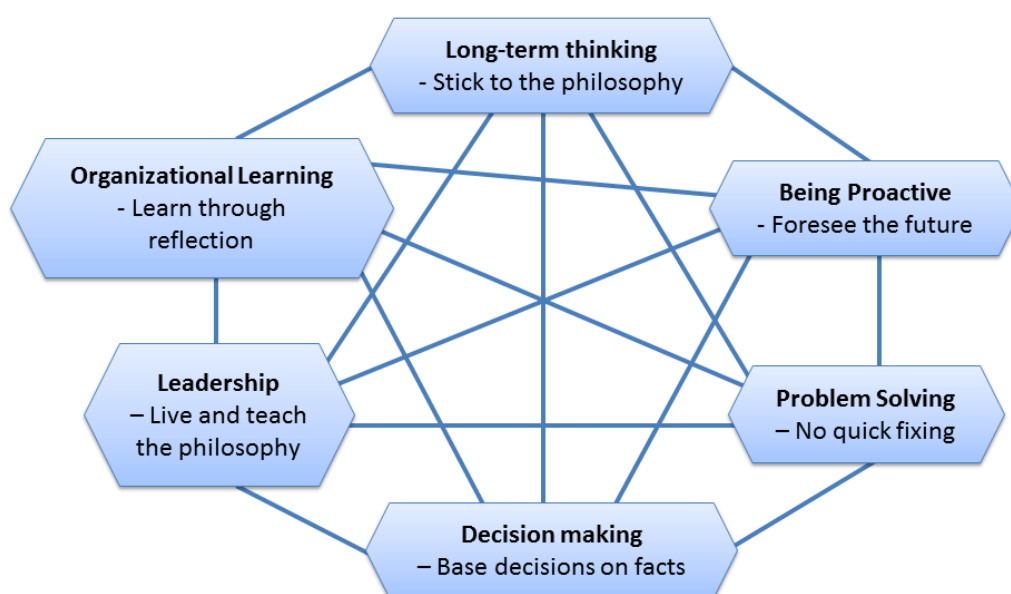


Figure 10- Perspectives for Analysis



### 5.1.1 Long-term thinking - Stick to the philosophy

For continuous success in a changing environment it is typically important to think long-term to keep competitive advantage. The long-term objective is not only to satisfy the customers but to amaze them. Following the company vision and thinking of the company as a system will align the short-term decisions with the long-term philosophy.

In a company with a lean philosophy all activities should be performed to create value to the customer since that is the foundation for success (Liker, 2004). In the Volvo Way it is stated about customer focus that “We are dedicated to meeting their high expectations today and their long-term requirements for the future” (Violin, 2012, pp. 10). Many of the assessed organizations are good at capturing customer needs both spoken and unspoken and how they change over time. However, the data shows that knowledge about the customer needs are not communicated in a structured way into the product development process which means it is not fully utilized for learning about customer needs presently and in the future. The long-term plans of Volvo Group define the direction in a 5-15 years period (Violin, 2013 B); in a few assessment reports there are comments on not connecting the product plan to the technology plan. This connects to what Dällenbach & McNickle (2005) discuss on systems thinking, the system should be considered as a process to understand how the parts influences each other. In the example from data about not connecting the product and technology plans; the product plan cannot be realized if the technology needed is not in place which makes them a system with parts influencing each other. The conclusion on creating value for customer in a long-term perspective is that capturing the knowledge is not enough; it has to be communicated to create real value when planning products and satisfying the customers.

There are data in the assessment reports showing the lack of long-term focus in the everyday work. In production, the mindset for continuous improvement needs to be improved since the data shows lack of systematic problem solving including root cause analysis to prevent recurrence. There are as well comments in the assessments on that there is a need to speed up the improvement work in production. Liker (2004) states that all management decisions should be based on the long-term philosophy, no short-term financial goals should be allowed to override the long-term philosophy. According to Liker (2004) there should be no fixing of problems, there should instead

be root cause analysis made on all problems. In the assessments there is lack of target setting; to drive long-term improvements long-term goals are needed. Good examples in the long-term thinking are 5S programs in the production for long-term improvements in the working environment and the long-term relationships to suppliers built on transparency and trust. In this area, the deduction is that there are good examples in ergonomics but the root cause analysis as a long-term strategy is missing in many production sites. Speeding up improvement could in worst case lead to that less root cause analyses are made, if the company culture drives the decision making for short-term winnings instead of aligning the everyday work with the long-term vision.

### **5.1.2 Being Proactive - Foresee the future**

In general good planning of the operations is the key to align all company activities. The company can be handled as a system for minimizing the sub-optimization and enhancing success. Getting things right the first time is important in all parts of the organization.

In the data there are symptoms indicating that the organization is not proactive enough; not planning all activities in beforehand. As seen in chapter 5.1.1 Long-term thinking - Stick to the philosophy; there is a need to capture and communicate the voice of customer to be able to prioritize plan long-term to work in a proactive way to satisfy customers. Not knowing what the customer need could be the reason of that there is no clear control of inflow to the project portfolio. There is as well seen in the data that the portfolio is neither balanced according to available resources. When resources are not balanced throughout the project resources are borrowed from other organizations which lead to slower progress during the learning period. Not searching for root causes as well as not testing properly before making decisions all show that many activities could be seen and performed as stand-alone activities instead of as a part of a system. Aronsson (1996) describes that seeing how all parts of the process interact and influence each other is essential to survive in a constantly changing environment. Furthermore, Aronsson (1996) means that problem solving of recurring problems and waste reduction will be enhanced by thinking of the problem as a part of the system. Rodgers (2008) mentions the problem of sub-optimization; by applying the systems thinking there are a higher possibilities to minimize sub-optimization if

employees have the appropriate perspective in all situations. However, FMEA and a risk register are used proactively for risk management. Conclusion in this area is that proactively planning the project portfolio as well as the balance the portfolio according to available resources are important ways to minimize recurrence and fixing of problems.

In result-oriented organization the mood is often impatient, and management expects and demands results now (Schaffer & Thomson, 1992). The symptom from product development of not having to follow the process as long as you deliver could be caused by a result-oriented culture. Testing independently without overview and not fully utilizing the feedback from testing could show a culture of quick delivering without proactive thinking of the future. The data as well indicates that concepts are not tested before selection. Liker's (2004) principle about only using reliable thoroughly tested technology and the discussion of Ward et al. (1992) on set-based product development both demands only using well tested technology where Ward et al. as well emphasizes the importance of testing before designing. All these symptoms could be caused by that the organization is result-oriented, demanding quick results instead of working proactively.

Knowledge reuse is a way to use current knowledge to prevent unwanted outcomes. Liker (2004) describes that all learning should be passed to colleagues. By learning from others' experiences you do not need to do all mistakes yourself, which goes also for organizations. Liker (2004) also mentions that relentless reflection on the process helps to provide the most stable process. In production the flow is important and data shows that the number of defects is decreased by the strong usage of good Standard Operation Procedures and Poka Yoke devices. Some of the assessed organizations are using Poka Yoke in a good way while others are not as strong. The Standard Operation Procedures are a good way to share knowledge and improve since the description of the standardized way to perform each task is a good base for discussion.

### **5.1.3 Problem Solving – No quick fixing**

In this area it is important to surface all problems so they cannot stay hidden or unknown. When problems arise it is crucial to solve them in a structured way to find and solve the root cause instead of fixing the symptom.

To enhance performance in long-term the root cause of the problem has to be found in order to avoid recurrence of breakdowns and severe problems. Liker (2004) states that the continuous flow with visual control should help surface all problems. The visual control should help the operators to detect when they deviate from the standards (Liker, 2004). In the empirical data there are sites using Andon for surfacing problems, not many sites have a good usage of the Andon methodology, why it is needed to improve it. In the production data there is a need described for encouraging reporting and analyzing safety hazards. When having found the problem it needs to be defined and described. According to Liker (2004) the best way of defining the problem by understanding the situation is to go see it yourself in the process to get a good picture of the problem. Furthermore, data should be observed, verified and reflected upon to find the right solution (Liker, 2004). Many of the assessed production sites are good at collecting the right data for problem solving, but the systematic problem solving is an opportunity. The deduction of this is that there is a need for enhancing the ways of finding all problems, both the ones that lead to problems and the ones that not yet caused any problems.

The empirical data shows that there is no structured way for reprioritizing properties or adjusting the project portfolio when a change in a project or product affects other products or projects. As mentioned in chapter 5.1.2 Being Proactive - Foresee the future 5.1.2 above; there are facts indicating that the culture seen in this case could be results-oriented not fostering systematic problem solving. Liker (2004) means that continuously solving the root causes and considering all solutions eventually will get quality right the first time and drive organizational learning. Seeking the root cause and stopping the problems fixing should be integrated in the culture (Liker, 2004). In the future all changes have to be brought up and discussed to find the best possible solution for the problem.

To become a good problem solving organization it is as Argyris (1977) means important to discuss problems and ideas openly to find the best solution without sub-optimization. As Argyris (1977) points out; if one employee should solve the problem he will find the best solution from his own perspective, the position he holds in the company. Making decisions by consensus is a way to ensure everyone is involved and all possible facts considered (Liker, 2004). Aronsson (1996) states the importance of seeing the system as a whole and perceive problems as a part of the entire system

instead of fixing one or more fragments. In the empirical findings it is stated that the time allocated for process improvements is not used due to high workload. It could be dangerous to not include all involved stakeholders in the discussion since all views and standpoints will not be represented in the discussion. If the result-oriented culture strives for fast results and the time allocated for improvements are not used there will be decreased quality on the problem solutions. When needed employees are not participating in the discussion it is as well a risk for only taking care of a fragment of the problem.

Leaders' commitment is described as strong in many production sites. Lewin in Frischer & Larsson (2000) describes the importance of leadership, either for the leader to be present and interacting or to leave the group to their own problem solving, if the leader is there but not involved; nothing will be done because the employees are waiting for the leader to initiate the activity. By involving the employees in diagnosing, planning and carrying the change out they will be more committed to accomplish it (Choi & Ruona, 2011). When changing the way to solve problems a change in the employees behavior and mindset are needed. Schein in Couto (2002) describes the change as a process where learning and change must be preceded by an understanding of the frustration during the change. The committed leaders are a strong asset in problem solving by motivating the employees to use a structured problem solving methodology.

#### **5.1.4 Decision making – Base decisions on facts**

Generally, basing decisions on facts by involving the right people is crucial for all operations. All decisions should be aligned with the company philosophy and drive the company forwards. Making sure all employees are familiar with the company philosophy will enhance the quality of decision making.

The starting point of all decisions should be creating value for customer, society and the economy (Liker, 2004). Even if the Volvo Group vision emphasizes this (Violin, 2013 B), the empirical findings show that many organizations are not communicating the voice of customer into the product development in a structured way. Conclusions from this is that if the customer needs are not communicated they will not be used as a base for decisions on product planning as well as advanced engineering projects and prioritization of conflicting customer requirements. Furthermore, the customer needs

should point out the long-term goal and it is not easy to keep to the long-term philosophy if the philosophy is not stated or fitting to the customer needs.

According to Kahneman (2002) there are two ways for the human brain to make decisions; either intuitively relying on automatic and rapid judgment or deliberately by comparing different solutions by their characteristics. Argyris (1977) mean that all decisions should be based on the most possible amount of fact by seeing them from different directions and thoroughly discuss all options. Additionally, Liker (2004) states that only reliable thoroughly tested solutions should be used, otherwise it has to be rejected or modified. In this empirical case there are problems in structuring the decisions since there are many examples of not planning the decision making. The empirical data shows that there are no plans for facing existing products out, the concepts are not tested before concept selection and in other testing the feedback are not fully utilized to base decisions on facts. However, other organizations have a structured procedure for performing portfolio risk management; a risk and opportunity register reviewed monthly. The data about concept selection and testing here shows examples where decisions are not based on facts.

All decisions should as well fit all long-term goals, no short-term decision or short-term financial goal are allowed to override the lean philosophy because the foundation for future competitive advantage is the philosophy. All decisions should be made slowly by consensus, but implemented rapidly (Liker, 2004). Every idea that arises from an employee is probably the best one from the position that employee has in the organization (Argyris, 1977). In the data it is described how all stakeholders are not engaged at early stages in the concept selection phase and not balancing the project portfolio according to available resources. Another example is not connecting the long-term product plan to the long-term technology plan. In the next step this it could lead to less informed decisions when not all involved stakeholders are participating and in the worst case scenario the decision could override the philosophy even if all participators are trying to perform their best from their point of view. If decisions are made without reflection the philosophy is threatened, but if all facts are not put up on the table before decision making the decision could override the long-term philosophy without even intending it.

If individuals are face-saving or gratifying themselves in discussions and decisions they will be more defensive. Since this organization seems to have a result-oriented

culture it is probably hard to keep away from face-saving since there probably is urgency felt for blaming someone when the results are not the desired. Argyris (1977) means monitoring the effectiveness of decisions and learning from the feedback is important for learning for both individuals and organizations. If there is blame involved there are feelings hindering the learning from mistakes. Schein in Couto (2002) means that psychological safety is crucial for learning and the best way to create it is to make the leaders genuine learners. Argyris (1977) adds that receptivity to corrective feedback is inhibiting learning. This means that it is important to be allowed to reconsider bad decisions without losing the face. According to Beer (2009) the relationships and decision making are the very heart of the organization's culture. If the organization changes the process how decisions are made it will have an effect on the organizational culture (Beer, 2009). The conclusion in this area is that learning from former decisions and develop the skills of making good decisions are important and that the employees need to reflect on earlier performance in the area.

#### **5.1.5 Leadership – Live and teach the philosophy**

Leadership is one of the key factors to make changes in organizations. In order to have sustainable continuous improvement as well as to create a learning organization, it is important to grow leaders. As Liker (2004) defines in the 9<sup>th</sup> lean principle, leaders are the role models for the way business is performed and they represent the company's philosophy and teach it employees through having good detail understanding how daily works are performed as well as securing the involvement of people (Liker, 2004).

One strength in this area are the different pipelines that are in place for project leadership, management and technical specialists. Regarding this, Amabile (1998) discusses about sources for the two kinds of motivation; intrinsic and extrinsic. Leaders can be intrinsically motivated when their task matches their expertise and contains the right amount of challenge (Amabile, 1998). But it is also possible to motivate people extrinsically through extra salary, reward, etc. As a result, having different pipelines for leadership is an important strength since it drives leaders to be intrinsically motivated. For example, while one leader can be motivated by driving projects forward, the motivator for another leader can be leading a group in the line organization. Having different pipelines for project leadership can be one example to motivate the employees.

Furthermore, in concept selection, one weakness is that all concerned stakeholders need to be engaged from early phases. According to Grayson (2009), establishing meaningful engagement of stakeholders is one of the leaders' responsibilities. He also discusses that identifying the purpose of change in the organization is preferably done through learn about the stakeholders' interests through a willingness to listen (Grayson, 2009). As a result, this weakness regarding engagement of stakeholders in early phases of projects can be transferred to strength through a good leadership.

In production area, one of the strengths is that the daily quality discussions involves cross-functional teams at the production line and are a good structure for escalation since management is involved in prioritized areas. This strength area shows that the involvement of management contributes to the organization in a positive way since it provides a good structure for escalation. Involvement is important to build successful companies through coming up with ideas and take the initiative. Lewin in Frischer & Larsson (2000) discusses the laissez-faire leadership. If there is a leader present but not involved, it will lead to employees waiting for instructions and not take the initiative. Furthermore, some organizations show good leadership and management commitment for improvement work. Regarding this, Kotter (1996) discussed the importance of creating a coalition to manage a change since a group of committed people is needed to conduct change initiative. Therefore, the organizations which are strong in leadership and management commitment have good potential to be successful in change.

In terms of safety, in production, some organizations have strength that there is a good safety system is in place with high participation from employees. Regarding employee involvement, in product development, some sites also have strength that Operational Development (OD) is partly implemented to involve all employees in setting direction and continuously improve. According to Grayson (2009), leaders play an important role in order to establish meaningful engagement. Once the engagement is established, securing the involvement of employees will be easier in both setting direction for continuous improvement and having good safety systems. Consequently, establishing engagement should be considered as the first step to secure employee involvement. According to the assessment reports the employee involvement is secured in most organizations, due to this it could be possible to say that leadership works well to ensure the engagement and employee involvement.



Moreover, some organizations have strength in terms of training and coaching. For example, management supports the shop floor teams in the coaching program. But this is an opportunity area in other organizations. According to Garvin & Roberto (2008), it is an important responsibility of leaders to integrate the company's core values to people who work in the company. In addition to this, Liker (2004) stated that sharing experiences and best practices with employees as well as newcomers are crucial roles of leaders in order to make people live the company philosophy and share the organizations' goals, visions, values, beliefs and ethics (Liker, 2004). As a result, in order to create wanted behavior and in the way of thinking, leaders play important role to coach and support the employees

Furthermore, in terms of visualization of KPIs (Key Performance Indexes) and performance, there is a need to improve in KPI results by making the team responsible and communicating the gaps. In the discussion of Prive (2012) about qualities that make a great leader, it is emphasized that delegating tasks to the appropriate departments and teams is an important skill that a leader need to have. Furthermore, a great leader is also required to have good communication skills in order to create healthy lines of communication in the work environment, which is a base for a productive work place (Prive, 2012). As a result, making team responsible and communicating the gaps to improve KPI results are just two fundamental qualities that a great leader has, and that is needed for creating a successful organization.

#### **5.1.6 Organizational Learning - Learn through reflection**

Learning organizations are considered the foundation for sustainable continuous improvement. In order to create such organizations, it is important to have a corporate culture that motivates employees to think long-term through internalizing the company core values, philosophy and ethics. In learning organizations, knowledge, experience and best practices are captured and shared with colleagues in a culture that encourages mutual questioning and challenging for further development.

Product development has strengths such as usage of white books, sharing experiences with new employees as well as that some organizations share best practices. However, there is no global structured way for capturing knowledge or global structured approach for sharing experiences and best practices. For example, there is a need for capturing knowledge during advanced engineering and concept selection processes as

well as weakness in placing knowledge in white book. Furthermore, some organizations have a weakness in that the time allocated for reflection is not used. Liker (2004) stated that sharing lessons learned as well as communication and reflections are pivotal for improvement and learning as well as for standardization of the best practices. Besides having weakness in communicating lessons learned, some organizations are also weak in communicating the voice of customer into the product development process. In addition to the problems in capturing and communication knowledge, some product development organizations do not fully utilize the knowledge from proactive testing for product risk analysis and other activities. These weaknesses hinder Volvo Group to become a learning organization. Moreover, Liker (2004) emphasizes the importance of reflection to become a learning organization by suggesting the usage of Hansei (relentless reflection) which aims to develop countermeasures for not repeating the same mistake again. Trying to reinvent the wheel is more time consuming and costly than allocating time for relentless reflection (Liker, 2004). Consequently, in product development, the weakness that the time allocated for reflection is not used is one of the major obstacles to become a learning organization besides capturing, communicating and reusing the knowledge.

Not having a global structured approach for how to capture, communicate and reuse knowledge as well as lack of reflection of lessons learned hinders the organization to have sustainable continuous improvement (Liker, 2004). For example, Operational Development is partly implemented to involve all employees in setting direction and continuously improve. However, there is no systematic approach for sustainable continuous improvement. Eventually, in order to have a systematic approach for sustainable continuous improvement, as a first step, the organization need to have a structural approach for knowledge capturing as well as communication and reflections of lessons learned.

In production, some organizations perform root cause analysis on team level in order to avoid breakdowns and severe problems. However, other organizations are weaker, for example there is a need for systematic problem solving by focusing on the root cause of problems rather than quick-fixing. According to Liker (2004), the focus of Toyota's continuous learning system is to identify the root cause of problems and prevent them before occurring. Organizational learning is driven by solving root causes continuously.

Some organizations have a strength regarding the training and coaching activities. In others, there is a need for programs to train, coach and encourage the employees in order to ask the right questions, detect the root cause of problems and challenge current processes for further development and organizational learning. According to Liker (2004), there is a need for continuous learning in order to create an organization that improves continuously. One of the important parts of the learning process is asking questions. Therefore, in learning organizations, employees should ask questions about main aspects of the processes. This is called double loop learning since employees are questioning the main design, goals and activities of the organization (Argyris, 1977). Consequently, detecting the root cause of problems through asking questions about main aspects of the processes such as main design, goals and activities is a key for further development. Therefore, training and coaching activities should encourage and support employees in their questioning process to continuously improve.

Regarding safety, there is a need to encourage incident reporting and to analyze major safety hazards. Mahajan (2010) discusses that incident reporting improves safety and leads to enhanced learning about causes of the incident through analysis and solving the root cause, preventing incidents to reoccur. Furthermore, significant problems regarding incident reporting in both local and global level are the signals of having poor safety culture (Mahajan, 2010). Therefore, reporting plays an important role for being proactive as well as identifying the root cause of problems which drives enhanced learning and continuous improvement. Furthermore, areas can be prioritized in order to make further improvement for preventing the reoccurrences of accidents and incidents in future.

Furthermore, good Standard Operating Procedures (SOPs) are implemented in many areas to achieve process stability and standardized work. In some organizations, employees have also strong level of understanding and the right mindset for standardized work. According to Grusenmeyer (2003), writing SOPs require comprehensive knowledge about processes. Therefore, writing SOPs leads people to learn more about the process details. Gaining more knowledge about the processes in turn enables people to define improvement areas of the processes (Grusenmeyer, 2003). Therefore, creating and revising these SOPs enable learning more about the process, contributes to organizational learning and drives continuous improvement.

After analyzing the empirical findings and defining these six principles, the next chapter is dedicated to what is needed to change.

## **5.2 Company Culture and Core Values**

The characteristics seen in the empirical findings are the behaviors of the employees. The behaviors are what are assessed by the assessors and presented in the assessment reports. In chapter 5.1 Perspectives for Analysis the empirical findings are analyzed according to literature to find the real problem behind the symptom described. In this section it is analyzed what is driving those behaviors. It is essential to find the drivers because in order to change the behavior, there is a need for changing the drivers. Initially the company culture steers employees' behaviors, which is why the findings are analyzed from that point of view.

Company culture is defined by Kotter & Heskett (1992) as an interdependent set of values and ways of behaving that are common in a community. Shani, et al. (2009) defines the organizational culture as the observable work patterns and behaviors together with describable symbols as well as values and assumptions which influence behaviors. Steiber & Alänge's (2013) empirically generated a model where the company core values contain four elements; ethics, behaviors, ambition and focus. When trying this model out, the analysis shows that there are similarities in the cultural drivers of the behaviors described in the assessment reports which are described further in the next section.

### **5.2.1 Ambition**

In the Volvo Way it is stated that one of the organization's ambitions is always moving forward and reach even higher goals (Violin, 2012). The possibility to reach this ambition is highly affected by how the employees behave; this will be explained further in the next section.

### **5.2.2 Behavior**

Behaviors are driven by motivation; individuals' actions are influenced by motivation (Størseth, 2004). Parmenter (2007) stated that one driver of behaviors in companies is KPIs (Key Performance Indicators). In many cases there are KPIs with a good intention but they are allowing the employees to take shortcuts to reach good results short-term. The empirical findings show that behavior for short-term winnings instead

of for long-term results are common in the company. For example, by fixing a problem instead of performing a root cause analysis, the problem disappears in the short-term but will often reoccur. There are probably many occasions where the problem needs to be fixed immediately, but afterwards there should be a root cause analysis to make sure it will not reoccur. Another example is not involving the stakeholders from early stages of the project. The quality of the decision making depends on the quality of the facts coming up in discussions before the decision making. Decisions should according to Liker (2004) be made slowly and in consensus to make all participants involved. When all stakeholders are not involved early in the process, the decisions are not reaching high quality since they are not based on most possible amount of facts. These quick-fixes and less good decisions will lead to firefighting activities to fix other problems that come up due to not thinking of all aspects before making the decision or not finding the root cause of the problem.

Another driver for behaviors is rewards, both being rewarded by having attention from leaders or peers for good effort as described by Gilley, Gilley & McMillan (2009), and monetary rewards. The fact that there is no need to follow the product development process as long as you 'deliver' shows that you get rewarded by delivering instead of following the process. By following the process; quality is assured for all steps and since the Volvo Production System Product Development Process (VPS-PDP) is a lean initiative, it is driving the standardization of processes for continuous improvement. Therefore, if the process is not followed there is a clear risk of that improvement work is not of great value and the product quality is not ensured.

Leaders are a part of the culture and can drive behaviors, it is important for leaders to define clear goals to not give any room for misunderstandings (Amabile, 1998). Key influencers are persons who spread information and inspire the employees. They are together with the leaders a great asset for driving wanted behaviors (Kim & Mauborgne, 2003). One strength in the production area is that management is involved in the daily quality discussions including cross-functional teams. By participating, management shows the importance of the issue and motivates the employees to make an extra effort.

An example of behavior hindering organizational learning is that there is no global structured way for capturing knowledge as well as sharing and reusing experiences

and best practices. If knowledge is not captured, shared and reused, the wheel will need to be invented over and over again. This leads to inventing things that are already invented using resources that could be put to better use. There is also need for capturing knowledge during advanced engineering and concept selection processes as well as for putting the knowledge into the white books. The assessment reports did not include any comment regarding the usage of the white books. If the white books are not used sufficiently, adding knowledge into it does not create any value for the company.

Regarding time for reflection, in some organizations time is allocated for reflection and improvement but the time is not used since reflection is not prioritized due to high workload. In other organizations there is not enough time allocated for reflection. According to Liker (2004) the best way to improve is by relentless reflection. If the employees have time for reflection they have a possibility to surface risks, perform root cause analysis, and other improvement activities. As Schaffer & Thomson (1992) explain, it is usual in result-oriented organizations to have an impatient mode where results now is expected, not allowing change to take long time. The reason for not using the time allocated for improvement and reflection is a leadership and incentive system issue. If the behaviors leading to short-term winnings are rewarded they will grow stronger and remain in the organization.

### **5.2.3 Ethics**

The assessment reports did not provide any information expressed as ethical issues. Despite that, there are some ethical issues to discuss since the behaviors of the employees according to Dällenbach & McNickle (2005) are driven by ethical considerations. In the empirical findings it is seen that the culture says that the employees in product development do not have to follow the process as long as they deliver. In the ethics of the work place it is acceptable among colleagues to not follow the intended process and instead perform the work in another way as long as the end result is presented on time. Processes are in place for ensuring quality and planning of the operations, but as seen in previous chapter the quality cannot be ensured when sidestepping the process. Shani et al. (2009) states that it is important for companies to make sure that the pattern of value and belief systems represent the philosophy of

the company. In this case the ethical norms are not consistent with the wanted culture and way of working presented in the Volvo Way.

#### **5.2.4 Focus**

The KPIs and leaders drive behavior, but are driven by the company focus. There are examples in the empirical findings showing that the company focuses on short-term results rather than how the results are reached. Since KPIs and leaders are driven by the company focus, they drive behaviors according to the company focus. If the KPIs leave space for the employees to take shortcuts to reach results in improving the KPIs, the result are good in short-term but not necessarily for the long-term success. It is important to reward the wanted behavior; in this case the short-term result-oriented focus is driving the behavior that delivering is more important than following the process. When the short-term result-oriented culture demands quick results there are quick-fixes made on the symptoms instead of root cause analysis in the problem solving. The short-term result-oriented focus results in weaknesses such as insufficient long-term thinking, no structured global knowledge capturing process, not allocating or prioritizing time for reflection, not basing decisions on facts as well as a lack of root cause analysis. These are all needed for driving organizational learning through reflection and learning from each other's during for example root cause analysis and cross-functional discussions before decision making.

Planning is also an area where the focus is important. Having no clear control of the inflow to the project portfolio and not balancing the portfolio according to available resources are examples of short-term focus when planning the operations. This causes fire-fighting activities in terms of borrowing resources from other projects when the resources are not available when needed in the project. Borrowing resources in turn leads to delays in all involved projects, both the ones where new participants should be introduced and the ones getting short of employees.

When working proactively with a long-term focus it is important to see the whole product or organization as one system. In the assessments, it is seen that there are weaknesses in proactive testing. When the product is not proactively tested it could lead to decisions not based on facts as well as sub-optimization since the parts of the product must be optimized as a system, not each part by itself. The data from the testing is not used in a structured way which also shows the need of a more proactive

way of working. To improve and achieve even more in the future the focus needs to become more proactive and long-term in continuously improve the process and use the improvements.

To be successful in long-term and reach the ambition of always moving forward or the mission to create value for the stakeholders by creating value for customers, Volvo Group needs to know what the customer needs. The company captures the voice of customers but do not sufficiently communicate it into the product development process, as depicted in *Figure 11*.



*Figure 11- Insufficient Communication of Captured Voice of Customer to Product Development*

If knowledge about customers is not communicated sufficiently and is not used in product development, capturing the knowledge of customer needs will be regarded as waste of time. This will lead to not meeting customers' high expectations today and long-term requirements for the future, like the ambition of customer focus is stated in the Volvo Way. Being weak in communicating the voice of customer to the product development process also hinders creating value for the customers. If the focus was more long-term the customer needs would be communicated to the whole company to make sure that the customer expectations and future requirements were met.

### **5.2.5 Improvement Strategy**

Most of the empirical findings from assessment reports indicate actions; such as not following the processes, not involving to discussions in early phases of the project or making quick-fixes for the problems etc. Therefore, in this study the described actions



are regarded as employee behaviors. The analysis of the empirical findings shows that the employees' behaviors in their everyday operations are not consistent with the ambition "always moving forward" and the customer focus "to meet the customer expectations today and long-term requirements for the future", depicted in the Volvo Way as the approach to reach the corporate goals and the company vision. The Volvo Way is describing the wanted position, why it is not surprising that it is not yet perfectly realized in the organization.

According to the analysis results for product development and production processes in this thesis study there are two major parts of the focus that needs to be redirected. The first one is that the employees need to become more long-term result-oriented instead of looking for short term winnings. The second is that the customer focus needs to include not only capturing customer data but also communicating it to the product development processes.

Changing the focus of the employees is changing one of the core values that constitute the company culture. Changing a part of the company culture is referred to by Johnson et al. (2008) as evolutionary change. This change is already ongoing in the Volvo Group since the lean initiatives are launched and the existing long-term goals of the company are aligned with the lean philosophy.

Changing people can only be achieved if they are motivated. Motivated employees want to be a part of the change and drive it forward (Størseth, 2004). As Kotter (1996) described, creating urgency is the first step to motivate the employees to change. The urgency can be created through learning and reflection, when employees find better solutions and feel the urgency to change.

One way of creating urgency and motivate the employees for changing behavior is through the drivers; KPIs, incentive systems and leaders. By changing the leader's focus it is possible for the leaders to influence the employees to behave in a wanted way, through being role models and coaching towards the wanted behavior. The KPIs and incentive systems need to be revised, maybe there are different KPIs needed in organizations with different maturity. Since the employees find short-cuts that can even be opposite to the long-term goals, but anyway rewarded, there is a need to review the KPIs and incentive systems. Additionally, the ethical norms steer behaviors. It is difficult to change the ethical norms but they need to be discussed since the present ethical norms allow employees to make short-cuts.

Changing habits is difficult, according to Garvin & Roberto (2005) and Mashhadi et al. (2013), it is particularly difficult if people think the way they have worked in the past is good enough. In many changes the employees are thinking “This too shall pass”, and wait for it to blow over (Garvin & Roberto, 2005). By creating urgency and motivating the employees to participate in the change, there could be positive energy enough for changing the focus. The resistance to change should be taken seriously, but it is not always easy to spot since it often happens under cover (Garvin & Roberto, 2005). Most resistance is emotional processes while the individual is processing the information (Nevis, 2001). The results-driven manager is according to Nevis (2001) often not accepting the resistance, instead of embracing it by discussing and taking feedback they often enhance the resistance by attacking the employee’s integrity or self-esteem.

Dialogue and acquiring information lead to cognitive restructuring, which is needed for the change of behavior of the individual (Weick & Quinn, 1999). When changing an organization it is not enough to change each individual. As described by Johnson, et al. (2008), a learning organization has the capability of regenerating itself from within since dynamic strategies emerge from within the company. In a culture encouraging mutual questioning and challenge around a shared purpose or vision, all individuals’ knowledge, experience and skills are used for improving the organization (Johnson, et al., 2008). Finding the times and opportunities for learning and reflection is a challenge during improvement processes.

One opportunity for reflection and learning discussed by Mashhadi et al. (2013) is creating learning alliances with students and universities for making employees reflect upon their normal routines and ways of working. The alliances provide a possibility for joint learning since the students are learning from the engineers and the engineers are learning from the reflecting upon questions and knowledge of the students. This strategy is lowering the learning anxiety which increases the willingness to learn and change as well as creates reflection-in-action when students ask questions (Fazl Mashhadi, et al., 2013). There are at this time learning alliances between Volvo Group and universities, this is seen in the assessment reports as well as mentioned by Mashhadi et al. (2013).

Furthermore, it is according to Beer (2009) important to integrate systems thinking in the change, by for example defining how one part of the change initiative influences

other parts of the organization. Seeing the organization as a system would increase the long-term result orientation and proactive focus, aligning everyone with the Volvo Group ambition and mission. The journey of evolutionary change has started by defining the future state but there is still work to do in aligning the whole organization in always moving forward.

## 6 Discussion

The most important findings of this study connected to the first research question regarding finding the major characteristics in the processes are that Volvo Group has many different characteristics. At many times an issue that is weak in one part of the organization is a strength in another part. In other areas there are weaknesses not corresponding to strengths; for example that it is no clear control of inflow to the project portfolio in product development.

An unexpected finding was that the concept selection in product development reflected so many of the company's weaknesses. Since the concept selection phase is very well defined in the GDP (Global Development Process, the description of the product development process) it was not expected to display so many of the weaknesses. Many aspects of weaknesses were shown here; not being proactive enough by not testing the concepts before selection, not capturing knowledge from unselected concepts as well as not using the concepts across different projects to reuse knowledge, and lack of incentives for using carry-over parts for utilizing the advantages of modularization or standardized parts.

After finding the major characteristics globally in product development and production areas, next steps continued with the prioritization of the findings for each area as well as identification of similar findings between both areas for answering the two sub research questions. The prioritization performed in workshop II is presented in chapter 4.3 Prioritization. The two categories seen as the most important in product development are *Knowledge Capturing, Sharing and Reuse* and *Sustainable Continuous Improvement*. In production the areas considered as the most important ones are *Systematic Problem Solving Instead of Quick-fixing; Improvement Work* and *Employee Safety*. Some of the categories in product development and production describe the same characteristics, which puts them in the overlapping area given in *Figure 9*.

According to Kotter & Heskett (1992) the company culture is defined as an interdependent set of values and ways of behaving. We have analyzed the core values according to four elements described by Steiber & Alänge (2013); ethics, behaviors, ambition and focus. Since the culture defines the employees' actions through the core

values there is a need for changing a part of the culture to improve the overall performance.

The assessment data showed that even if all strengths for product development and production are put together some things are still missing in current state of the local organizations which hinder reaching the company ambition.

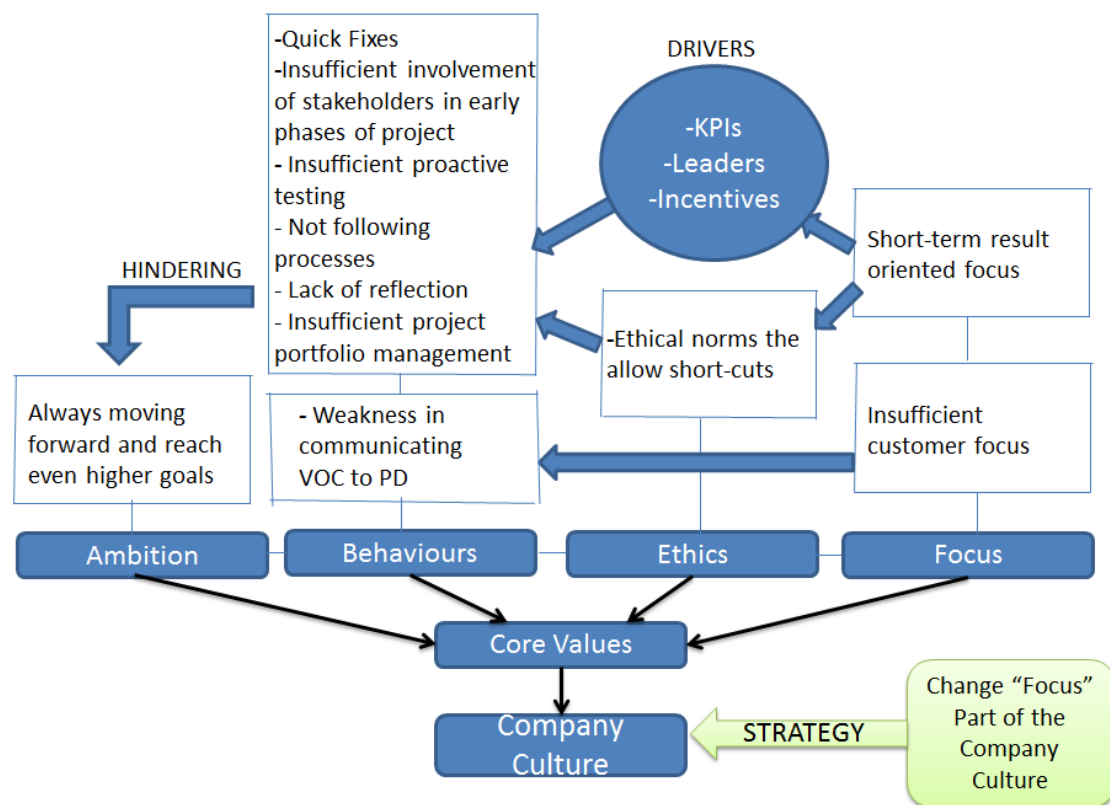


Figure 12- Base of Improvement Strategy

The findings from the assessment reports are regarded as employee behaviors. These behaviors are influenced by drivers and ethical norms, which in turn are driven by the focus, as seen in *Figure 12*. This becomes a causal chain where focus drives ethics and drivers, which in turn drives behaviors. To reach the company ambition the appropriate behaviors are needed, the current behaviors seen in the assessment reports of Volvo Group are hindering the company to reach its ambition of always moving forward and reaching even higher goals.

The two main points of the focus seen in *Figure 12* are not aligned with the company mission and vision. The first point is the short-term result-oriented focus which leads to drivers such as KPIs, leaders and rewards as well as some ethical norms that allow short-cuts, for example not following the processes, quick-fixes instead of searching

for the main cause and solving problem at its source as well as insufficient proactive testing etc. Schaffer & Thomson (1992) explain that the mood of result-oriented organizations where management wants to see results quickly is often one of impatience. The impatience drives the short-term result-oriented behavior by rewarding short term winnings even if they are not consistent with the long time goals (Schaffer & Thomson, 1992). The drivers and ethical norms in turn lead to behaviors, like for example allowing colleagues to not follow the process, which are hindering the company to reach its ambition.

The second point of the focus element is lack of customer focus. The paradox of Volvo Group is that the company is good at collecting customer data but is still not being able to utilize it. If the knowledge about customer needs is not appropriately used in product development, the customer focus is not strong enough. This also affects the probability of reaching the company ambition.

Consequently, the proposed strategy is to redirect the current focus, which is one of the company's core values. Focus is in this case the root cause of the behaviors hindering the company to reach its mission and vision, due to its influence on the ethical norms and drivers such as KPIs and leaders which in turn drives the employees' behaviors. By changing the focus part of the company core values, it will change the company culture since the company culture consists of its core values. One way of achieving this is to create a continuous learning process through learning alliances with universities as discussed by Mashhadi et al. (2013), which will provide opportunity to mutual learning while reflecting upon students' knowledge and questions. Learning and reflection will create motivation to improve and change. This is in line with Kotter's (1998) idea on that urgency is the first step of creating change.

The second research question about what type of change is needed to resolve the main weaknesses are answered by the last part of the discussion, as well as in 5.2 Company Culture and *Figure 12*. The figure represents a system which is composed of different units and subsystems such as core values and change principles all connected to each others'. The importance of a systems perspective when diagnosing and planning changes is discussed by Beer (2009), since the total system shapes the skills behaviors and attitudes.

The assessment data shows that in current state the focus is on results; this is indicated in for example the comment from product development stating that there is no need to follow the process as long as you deliver. Focus, which is one of the core values in the company culture, and changing the focus would be what Johnson et al. (2008) refer to as an evolutionary change since it is transformational and incremental. A focus redirected to become more long-term would help the organization to work more long-term by aligning all activities with the long-term goals, be more proactive as well as improve the mindset for structured problem solving and decision making. The organizational learning could also be improved through this change because a more structured and proactive way of working requires time allocated for reflection.

The assessment reports show that even if many tools are implemented efficiently the local organizations are not sufficiently living the lean philosophy. Finding this indicates that the assessments are performed in a good way since not living the lean philosophy would not be found without understanding the philosophy. Furthermore, it is noticed that the assessments conducted in the production process are tool-oriented since there are many comments on whether they are using the different tools or not. Additionally, defining opportunities stated as recommendations instead of expressing the weaknesses in production is not consistent with Liker's (2004) lean principle about continuously solving root-causes to drive organizational learning. In order to solve a problem; it has to be stated and its root-cause has to be defined to find the best solution. This requires defining the weaknesses before passing to recommendations for solutions.

Since the culture and values steers the behaviors we think it would also be beneficial to in some way assess the more soft issues such as motivation level or ethical considerations in both product development and production. As an example, the assessment data did not provide knowledge regarding motivation. When performing the cause-and effect-diagram for product development; we inserted an additional note regarding motivation since it was assumed to be the link between other comments. However, there can be some limitations in assessment methods since it is not possible to evaluate everything with assessments.

One of the key points when performing assessments is the reflection, leading to organizational learning. Bringing people together after the assessment, preferably from different sites, enables to create an environment where they discuss and reflect

upon their experiences. These discussions provide an opportunity to surface issues that are not handled in the assessments, such as the cultural aspects of the company. This could lead to better communication which also supports organizational learning.

Earlier studies on lean initiatives in different companies show not all of them reach success. According to Liker (2004) the reason of this is most often that the company's focus is on the tools and techniques attached instead of promoting a culture of continuous improvement and live the philosophy. Liker (2004) also states that many companies have mistaken a particular set of lean tools for deep lean thinking, the real lean thinking involves a far deeper and more pervasive cultural transformation than most companies can begin to imagine. The companies only using the tools will lag in performance behind those who adopt a true culture of continuous improvement. (Liker, 2004). Similar weaknesses as discussed by Liker (2004) exist within the Volvo Group where a focus on tools and short-term result orientation is identified in this study.

This study can be useful for other companies in industry to get inspiration for how to analyze their assessments. Since many companies according to Liker (2004) have similar problem areas, these ways of both analyzing the assessment data (Analysis I) and analyzing the findings (Analysis II) could be beneficial for companies that require an improvement strategy based assessment findings. In addition to this, people from academic side such as university students, researchers can meet with different approaches for analysis.



## 7 Conclusion

Volvo Group has conducted assessments in the product development and production processes. The assessments are performed in different sites or organizations of the company. Each site or organization is evaluated and a report on the findings is presented locally. In this thesis work, the assessment reports were analyzed on a global level.

The first aim of the study was to find major common characteristics from assessment reports. This aim was fulfilled by making a cause-and-effect diagram of statements from the assessment reports that were made in at least three sites or organizations. In addition to the second aim was to define the type of change needed to improve the total performance. By using systems thinking the total performance is in focus, seeing the company as a system to find the totally most advantageous solution instead of optimizing each part.

Two research questions and two sub-questions connected to the first research question were defined for this study. The first one was to find major characteristics, strengths and weaknesses, globally in the product development and production processes of Volvo Group. To find the major characteristics and their interrelationships a cause-and-effect diagram was performed. In product development the findings grouped into ten categories, including both strengths and weaknesses. In production there were eight categories of findings, but in this area besides strengths there were opportunities instead of weaknesses.

A workshop was arranged with the teams assessing product development and production processes to validate and prioritize the findings to answer the first sub-question connected to the first research question. According to the workshop participants; the areas most important to prioritize for improvement initiatives in product development are: *Knowledge Capturing, Sharing and Reuse and Sustainable Continuous Improvement*. In production there were *Systematic Problem Solving Instead of Quick-fixing; Improvement Work; and Employee Safety*. Even if these areas are the most prioritized ones, assessors also observed that all the findings in both product development and production are closely connected to each other's. The second sub-question connected to the first research question was to find overlapping areas between the product development and production processes. There are three

areas who are similar in both processes, they are; *Sustainable Continuous Improvement* together with *Improvement Work*; *Resource Allocation & Competence Development* together with *Training and Coaching*; and *Monitoring the Process* together with *Visualization of KPIs and Performance*.

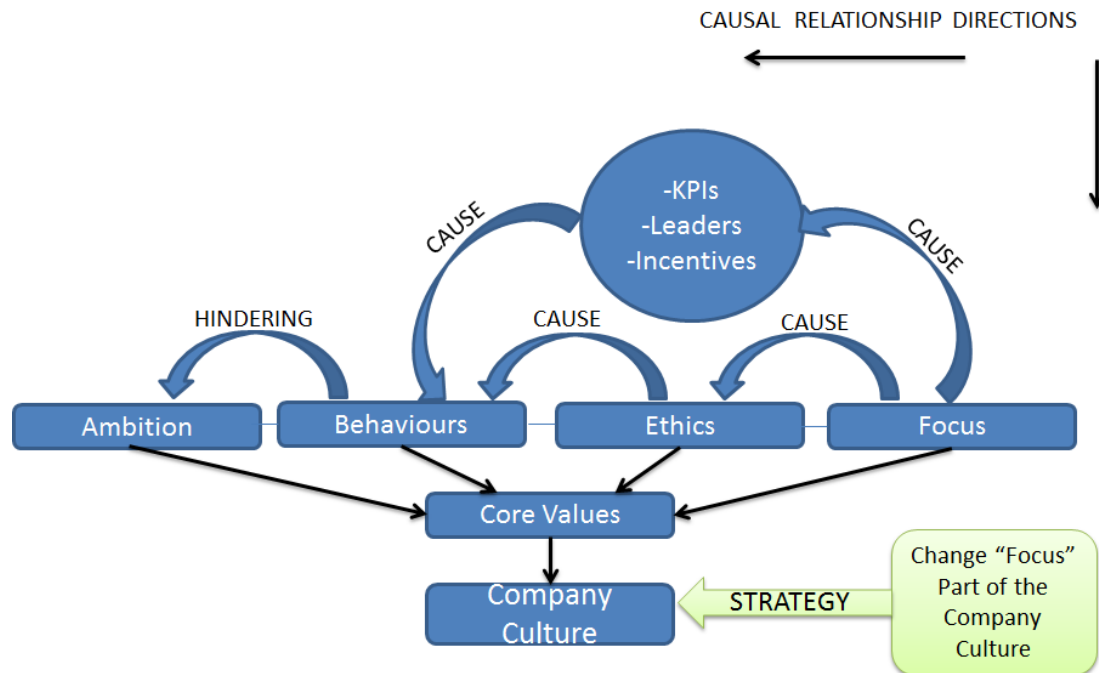
The second research question is about defining the type of change needed for resolving the major weaknesses found in the product development and production processes. The findings are analyzed according to theory to find why they occur and how the desired future state of that area should be. Some themes emerged during this analysis, why six perspectives for analyzing the behaviors seen in the empirical findings were used.

The perspectives are;

- *Long-term thinking - Stick to the philosophy* is about aligning the short-term decisions with the long-term philosophy is described in the principle
- *Being proactive – Foresee the future* discusses upon the importance of planning as well as finding risks before they become problems.
- *Problem solving – No quick-fixing* is about surfacing all problems and find their root causes in order to resolve problems permanently.
- *Decision Making – Base decisions on facts* states the importance of finding all facts and considering all options to base decisions on facts when making decisions.
- *Leadership – Live and teach the philosophy* contains discussions on that leaders play a crucial role in being role models as well as coaching the employees.
- *Organizational learning – Learn through reflection* argues that becoming a learning organization means putting emphasis on the process rather than the product.

After analyzing the empirical findings by using the relevant theories in each principle, the four elements of core values (focus, behavior, ambition and ethics) are elaborated to define if any of the weaknesses result from the company culture. It is seen that the company's present focus is result-oriented. Changing focus to a more long-term and proactive focus requires a good leadership and will improve the problem solving as well as the decision making processes, which in turn drives

the organizational learning. Consequently, as an answer for the second research question as it is illustrated in *Figure 13*; the focus part of the culture needs to be changed, which is referred to as Evolutionary change. The current employee focus is ‘short-term result orientation’ as well as ‘insufficient customer focus’.



*Figure 13- Improvement Strategy*

As a summary the recommendations are:

- The company mission, vision and ambition are well defined in the Volvo Way and reaching them is a long journey. To achieve the goals all employees' behaviors have to be consistent with the company goals.
- The employee behaviors are shaped through leaders, KPIs and incentive systems as well as ethical norms. The KPIs and incentive systems need to be revised in order to drive wanted behaviors and minimize the opportunities for short-cuts.
- The leaders play an important role in living and teaching the company philosophy, being role models as well as motivating and coaching the employees. The leaders in Volvo Group are committed and many of them are good at coaching. This should be used to drive the wanted behaviors.
- The ethical norms are presently allowing for short-cuts (for example allowing the colleagues to not follow the process); there is a need to put emphasis on the ethical norms.

These drivers and ethical norms are in turn driven by the employee's focus which is seen as root cause for the behaviors. The current focus of the Volvo Group employees is short-term result orientation and there is an insufficient customer focus. Therefore the current focus of employees needs to be re-directed.

## 8 Future Research

The focus of this thesis was to find major characteristics in a global level, therefore there were findings and conclusions on what needs to be improved and why. One topic for future work could be on how to implement the purposed strategy based on the empirical findings.

Since the quantitative part of the assessments is not discussed in this thesis, another topic for future research could be examining if there are correlations between the scoring in the assessments and other characteristics such as business results or quality.

Other interesting topics for future research could be to investigate if the assessment results are used for learning and improvement locally in each assessed organization. By looking into the aim of the assessments and its fulfillment, it could be found if there are possibilities in making the assessments more useful for improving the organizations by learning about the current state.

Another topic is about how the assessments are performed. Alternatives could be searched to create additional reflection and learning in the way of conducting the assessments.

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## **A. Appendix The 14 Lean Principles of the Toyota Way**

### ***Philosophy - Long-term Thinking***

#### **1. Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals**

Long-term thinking constitutes the foundation for all other principles and it is more crucial than making money. Creating value for society, customers and the economy is considered as the starting point for lean initiatives. Acting with self-confidence and accepting responsibility will provide opportunities to add value. Long-term philosophy overrides any short-term decision making (Liker, 2004).

### ***Process - The Right Process Will Produce the Right Results***

#### **2. Create continuous process flow to bring problems to the surface**

Creating fast material and information are important. The purpose of these flows is to link people and process together in order to surface problems right away. Besides this, it is a key to make flow evident throughout organizational culture to develop people and improve processes continuously. Work processes are redesigned to have better value-added and continuous flow. In order to have continuous flow, production is controlled by the demand (Liker, 2004).

#### **3. Use “pull” systems to avoid overproduction**

This principle emphasizes that it is important to capture voice of customers and use them in the production process. Furthermore, other important point is to be responsive to the dynamic changes in customer demands rather than relying on computer systems. In addition to this, the work in process and stock levels are minimized and restocking is performed according to what the customer takes away (Liker, 2004).

#### **4. Level out the workload (Heijunka) (waste, unevenness, and overload)**

Waste elimination forms the one-third of being successful in lean initiatives. Generally companies do not understand attempting to implement Lean principles (Liker, 2004).

## **5. Build a culture of stopping to fix problems, to get quality right the first time**

This principle suggests that the capability for detecting the problems and stopping itself should be integrated into equipment. Jidoka which is machines with human intelligence is very useful to build in quality. Furthermore, to improve productivity in the long run, stopping the fixing problems should be integrated into culture (Liker, 2004).

## **6. Standardized tasks are the foundation for continuous improvement and employee involvement**

This principle has two key points. Firstly, the usage of stable, repeatable methods everywhere to improve predictability; secondly, capturing the accumulated learning about process through standardization of the best practices so that next person uses it when one person moves (Liker, 2004).

## **7. Use visual control so no problems are hidden**

This principles includes that reduction of reports to one piece of paper if it is possible, avoiding computer screen from workplace when it affect people's motivation negatively. Furthermore, in order to support flow and pull, simple visual systems should be designed. Simple visual indicators should be used also to help people to see if they deviate from the standards (Liker, 2004).

## **8. Use only reliable, thoroughly tested technology that serves your people and processes**

In business process, product or manufacturing systems, before establishing a new technology, actual tests should be performed as well as a process should be worked out manually. If technology conflicts with the organizational culture or disrupts stability and reliability, it should be rejected or modified. When it is decided to adopt a new technology, it should be supportive to people rather than taking their job (Liker, 2004).

***People and Partner – Add value to the organization by developing your people and partners***

**9. Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others**

The preference should be growing leaders from the inside of the organization. Leaders should be considered as role models of the way that business is performed. Leaders should represent the company's philosophy and teach it employees through having good detail understanding how daily works are performed (Liker, 2004).

**10. Develop exceptional people and teams who follow your company's philosophy**

It is pivotal for each company to create a stable and strong culture where organizational beliefs and values are shared and lived over the years. Being hard working is key element to support culture continuously. Furthermore, there is a need for developing exceptional people to accomplish exceptional results. Teamwork has to be learned and cross functional teams should be used to improve quality, productivity as well as flow (Liker, 2004).

**11. Respect your extended network of partners and suppliers by challenging them and helping them to improve.**

The treatment towards partners and suppliers should be as extension of your business. Company should support its outside business partners to develop. Thanks to this, outside business partners will feel the value that you give them. Furthermore, clear targets should be set for partners to challenge them (Liker, 2004).

***Problem solving - Continuous solving root problems drives organizational learning***

**12. Go and see yourself to thoroughly understand the situation (Genchi Genbutsu)**

Problem solving and improvement of processes should be driven through individually observation and verification of data as well as reflecting upon the data verified. High level managers and executives should go and see the processes to have more real image of situations (Liker, 2004).

**13. Make decision slowly by consensus, thoroughly considering all options; implement decisions rapidly**

The essence of this principle is the requirement and importance of considering all possible alternatives before selection of one direction to go for it. Furthermore, a consensus process is needed to extend the search for different solutions and this can be time consuming part of decision making. However, when decision is made, rest of the process will be rapid. Nemawashi is the process where people discuss problems and create solutions as well as have consensus through getting agreement upon one direction (Liker, 2004).

**14. Become a learning organization through relentless reflection (Hansei) and continuous improvement (Kaizen)**

Root cause of problems and inefficiencies should be found when a stable process is established. Continuous improvement process (Kaizen) should be used for elimination when waste is exposed. Furthermore, as key milestones, usage of Hansei (reflection) is recommended through this principle since it is a way to develop countermeasures in order to not repeat the same mistake again. Since trying to reinvent wheel for each new projects and managers will be time consuming and costly, learning from the best practices standardized is crucial (Liker, 2004).