A SET-UP FOR OPERATING CONTINUOUS IMPROVEMENT IN ORGANIZATION PRIORITIZING FLOW EFFICIENCY

A Qualitative Case Study of PIM RBS Kista Ericsson

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ABSTRACT

Objective – The objective of this thesis is to provide a set-up for operating continuous improvement (CI) in organizations prioritizing flow efficiency.

Design/Methodology/ Approach – The set-up was created by an elaboration on by literature identified critical factors for successful CI. Empirical findings were collected through a qualitative case study, including semi-structured interviews, observations, and document analysis.

Findings – This research has shown that organizations prioritizing flow efficiency should form their improvement efforts around processes. Three different levels of CI have been suggested, each formed around the process and sub-processes being improved. The lowest level (local improvement teams) builds the foundation for CI, as it represents people performing the tasks being improved. The other two levels include forums with the purpose to involve management, link sub-processes, prioritize improvements, and make decisions regarding bigger improvements. Roles and responsibilities have also been identified. To maintain involvement for CI, it is suggested that each level should decide their own goals and priorities by involving executives, managers and workers. Further, it is essential that the operation of CI efforts have an integrated and standard methodology for driving CI, as it eases cross-functional interactions and communication. It is important that this integrated methodology is seen as a process/cycle and can be used in a dynamic way, demanding rather high knowledge and thus training amongst workers.

Empirical Contribution – this paper provides recommendations for practitioners prioritizing flow efficiency that want to operate CI in their organizations.

Theoretical Contribution – a theoretical contribution has been made, firstly by identifying important areas of critical factors to elaborate on in organizations prioritizing flow efficiency. Secondly, by elaborating on identified areas, difficulties and facilitators, together with potential solutions to the difficulties, could be identified. Thirdly, this thesis has contributed to useful and usable theories that help organizations make proper decisions when operating CI by suggesting a set-up for operating CI.

Key-words: Continuous Improvement, Flow Efficiency, Critical Factors

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En Set-up för utförandet av Ständiga Förbättringar i Organisationer som Prioriterar Flödeseffektivitet

En Kvalitativ Fallstudie av PIM RBS Kista Ericsson

Marcus Mildenberger

Anton Welin

Godkänt 2014-06-10	Examinator Jannis Angelis	Handledare Caroline Munthe
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SAMMANFATTNING

Syfte - Syftet med denna avhandling är att föreslå en set-up för att driva ständiga förbättringar (CI) i organisationer som prioriterar flödeseffektivitet.

Design / metod / angreppssätt - Denna set-up skapades genom en utveckling av, genom litteraturen identifierade kritiska faktorer för CI. Empiriska data samlades in genom en kvalitativ fallstudie, bestående av semistrukturerade intervjuer, observationer och dokumentanalys.

Resultat - Denna forskning har visat att organisationer som prioriterar flödeseffektivitet bör utforma sitt förbättringsarbete kring processer. Tre olika nivåer av CI har föreslagits, där varje nivå är formad kring den process och underprocess som förbättras. Den lägsta nivån (lokala förbättringsgrupper) bygger grunden för CI, eftersom dessa utgörs av människor som utför de uppgifter som ska förbättras. De andra två nivåerna inkluderar forum med syftet att involvera ledning, länka delprocesser, prioritera förbättringar, och fatta beslut om större förbättringsaktiviteter. Roller och ansvar har också identifierats. För att upprätthålla engagemang för CI, föreslås att varje nivå bör bestämma sina egna mål och prioriteringar genom att engagera chefer och arbetstagare. Vidare är det viktigt att utförandet av CI har en integrerad och standardiserad metodik, detta eftersom att det underlättar tvärfunktionella interaktioner samt kommunikation. Det är viktigt att denna integrerade metod ses som en process / cykel, och kan användas på ett dynamiskt sätt. Detta kräver ganska hög kunskap och därmed utbildning bland arbetare.

Empirisk bidrag – Denna avhandling erbjuder rekommendationer för utövare som vill driva CI i organisationer som prioriterar flödeseffektivitet.

Teoretisk bidrag – Ett teoretiskt bidrag har gjorts, dels genom att identifiera viktiga områden för kritiska faktorer i organisationer som prioriterar flödeseffektivitet. Genom att utveckla dessa identifierade områdena, har svårigheter och möjliggörare, tillsammans med potentiella lösningar på de identifierade svårigheterna, kunnat identifieras. Vidare har denna avhandling bidragit till nyttiga och användbara teorier som hjälper organisationer att ta rätt beslut i utförandet av CI.

Key-words: Ständiga Förbättringar, Flödeseffektivitet, Kritiska Faktorer

FOREWORD

This master thesis was written at the department of Industrial Engineering and Management at Royal Institute of Technology, Stockholm. The thesis was a 30 credit university course and was conducted from January 2014 to June 2014.

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Thank you!

Stockholm, June 2014

Marcus Mildenberger & Anton Welin

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1. INTRODUCTION

This chapter will introduce the phenomenon under investigation. Both in terms of what general problem the thesis aims to solve, as well as what specific research questions to be answered. Also delimitations and structure of the thesis are presented.

1.1 BACKGROUND

Since the early 1970s, Western management scholars and industrialists alike have become ever more interested in the elements that make many Japanese companies so successful (de Lange-Ros & Boer, 2001). One dominant topic aiming to explain their success over the past decades is the Japanese superior production organization and management systems (Liker, 2004). An important component of that is the concept of Continuous Improvement (CI) (Sanchez & Blanco, 2014). Indeed, the concept has received so much currency that CI is referred to as the key to Japanese companies' competitiveness in the last three decades of the twentieth century (Suárez-Barraza, et al., 2011). Today, CI can be described as "the planned, organized and systematic process of on-going, incremental and company-wide change of existing practices aimed at improving company performance" (Boer, et al., 2000, p. 1). More, it is considered an important element in achieving business excellence (Sanchez & Blanco, 2014), and a key element of operations seeking long term competitive advantage (Angelis & Fernandes, 2012).

As understood, CI is powerful and might unlock a neglected source of organizational innovation, but its operative success depends upon the creation of an enabling context within the organization (Bessant, et al., 1994). Many companies are well aware of this emphasized importance of CI, but find it difficult to operate successfully (Oprime, et al., 2012). This implies that most publications about CI do emphasize on the importance of CI – however, they do not provide useful and usable theories that help organizations make proper decisions when operating CI (Sanchez & Blanco, 2014; de Lange-Ros & Boer, 2001). Therefore, this has to be developed further. To do so, it is relevant to understand what makes CI successful. Several researches have focused on identifying critical success factors for CI (Bessant, et al., 1994; Atkinson, 1994; Youssef & Zairi, 1995; Bessant & Caffyn, 1997; Bond, 1999; Caffyn, 1999; Savolainen, 1999; Bessant & Francis, 1999; Kaye & Anderson, 1999; Harrison, 2000; Hyland, et al., 2000; Beckett, et al., 2000; Terziovski & Sohal, 2000; Bessant et al., 2001; Delbridge & Barton, 2002; Terziovski, 2002; Murray & Chapman, 2003; Lee, 2004; Davison et al., 2005; Abrahamsson & Gerdin, 2006; Fryer et al., 2007; Oprime et al., 2012; Quesada-Pineda &

Madrigal, 2013). However, despite the wealth of knowledge concerning factors that potentially impact CI, few detailed studies on this topic can be found (Magnusson & Vinciguerra, 2008). Therefore, further qualitative empirical research has to be conducted to go deeper into the factors that are considered contributing to the success of CI efforts (Oprime, et al., 2012); and thus elaborate on how organizations operate CI within such critical factors.

Before digging deeper into potential factors, it is important to understand that there is no universal solution for successful CI (Bessant & Francis, 1999). CI activities can either be implemented as a part of production systems (Oprime, et al., 2012) – or it can be applied to other divisions of business performance (Bessant, et al., 1994), as an independent program that produces cumulative improvements in the organizational performance indicators (Oprime, et al., 2012). Hence, organizations have different objectives in what they are continuously improving towards, and the factors that need to be elaborated on are therefore somewhat dependent on what context one looks at. The focus of this thesis is on organizations operating CI as a part of their production systems based on flow efficiency. This implies that the organization is prioritizing flow efficiency over resource efficiency. With a focus on resource efficiency a company's resources should always be utilized, whereas the ideas of flow efficiency rather focuses on managing the customers' needs as fast as possible, and that the time spent should always add value to the customer (Modig & Åhlström, 2012).

In other words, this thesis looks closer at how organizations prioritizing flow efficiency operate CI. More specifically, it elaborates on how such organizations operate the concept of CI within the factors that is considered important for successful CI in such case. To do so, a qualitative case study of the Ericsson site: *PIM (Product Introduction and Maintenance) RBS (Radio Base Station) Kista* was investigated.

1.1.1 PROBLEM STATEMENT

Many companies are well aware of the importance of CI, and are therefore willing to adopt the concept (Sanchez & Blanco, 2014). This provides an opportunity for scholars to contribute with important information regarding how to do so. However, despite its apparent simplicity, CI efforts are difficult to operate in an effective way (Oprime, et al., 2012) and are particularly hard to sustain in the long-term (Caffyn, 1999). Meaning that today there is no go-get-to approach of how to operate this concept in an adequate way.

Problem Formulation

Useful and usable theories that help organizations make proper decisions when operating CI are incomplete (Oprime, et al., 2012; de Lange-Ros & Boer, 2001). In order to provide such theories critical factors can be evaluated. However, despite the wealth of knowledge concerning factors that potentially impact CI, few detailed studies on this topic can be found (Magnusson & Vinciguerra, 2008; Oprime, et al., 2012).

1.2 OBJECTIVE & RESEARCH QUESTIONS

The objective of this thesis is to provide a set-up for the operating of CI efforts in organizations prioritizing flow efficiency. The set-up is created by an elaboration on by literature identified critical factors for successful CI. Not only will this contribute to a deeper conceptual knowledge of critical factors for successful CI, but also, this objective aims to contribute to the creation of useful and usable theories that help organizations make proper decisions when operating CI efforts.

The starting point was thus to investigate how organizations prioritizing flow efficiency operate CI; providing the main question:

RQ: How do organizations prioritizing flow efficiency operate continuous improvement efforts?

To go into more depth of this question, and hence the areas of critical factors important for organizations prioritizing flow efficiency, it is appropriate to investigate what difficulties and facilitators such organizations face in their operation of CI. Hence, this was approached by first asking what factors hindered successful CI in the operating of CI efforts; providing sub-question 1:

Sub-question i. What difficulties are faced when operating continuous improvement?

Only considering the difficulties does not provide the whole picture of the evaluation of the critical factors. It is also relevant to investigate what aspects contributed to successful operating of CI; providing sub-question 2:

Sub-question ii. What facilitates successful continuous improvement?

1.2 DELIMITATIONS

The research enquiries are delimitated to some extent, hence this section establishes the scope of the research (Collins & Hussey, 2009). The delimitations are presented both in terms of empirical- and theoretical delimitations.

3.2.1 EMPIRICAL DELIMITATIONS

One may approach a problem from three different perspectives: individual, functional, or industrial (Blomkvist & Uppvall, 2012). The focus differs depending on the scope of the investigation. This study emphasizes on the functional level within PIM RBS Kista, a site incorporated in the large multinational organization, Ericsson. The site consisted of several functional units and employees. Using a functional perspective means that the investigation concentrates its empirical investigation on how PIM RBS Kista handled CI internally within its own organization – not on how individuals solved it, nor in what way CI was handled towards external parties. Still, the individual and industrial level is of course also affected and therefore the consequences need to be taken into consideration. However, such consequences are only covered by secondary sources.

3.2.2 THEORETICAL DELIMITATIONS

Since difficulties connected to CI were partially investigated, Change Management theories could have been used to tackle such difficulties. However, this was out of the scope of this research. Further, the areas of critical factors elaborated on are merely based on theories of CI and Flow Efficiency.

1.3 DISPOSITION

The thesis contains six chapters in total: (1) Introduction; (2) Theoretical Framework; (3) Methods; (4) Case Organization; (5) Findings & Analysis; and (7) Conclusion, see *figure 1*.

Figure 1. The structure of the thesis

In the already presented chapter: **'Introduction'**, an introduction to the phenomenon under investigation has been presented. This together with the overall research problem, the objective of the thesis, research questions to be answered, as well as delimitations, has provided a foundation of understanding to be carried on into the following chapters.

In the next chapter: **'Theoretical Framework'**, the theoretical knowledge needed to understand the reasoning behind the upcoming analysis, discussion, and final conclusions, are obtainable. Also, the areas of critical factors to be elaborated on are presented as an outcome of previous research on CI and flow efficiency.

In the **'Research Method'** chapter the research method is described with justifications of the methods used, together with the actual employment of the methods. Also, validity and reliability of the thesis is discussed.

In the **'Case Organization'** chapter, PIM RBS Kista's current structure for operating CI efforts is shortly described. This provides a holistic picture on how the organization works with CI, and will help to understand the upcoming analysis.

In the **'Findings & Analysis'** chapter, findings regarding operating of CI efforts are analyzed relative a synthesis of the literature covering the scope.

The **'Conclusion'** chapter will serve as a conclusion of the findings, and the thesis. Empirical- and theoretical contributions, together with the limitations and further work are discussed.

2. THEORETICAL FRAMEWORK

This chapter will first explain the concepts of flow efficiency and continuous improvement. These explanations together with critical factors for continuous improvement are then used to identify the areas of critical factors important to elaborate on in organizations prioritizing flow efficiency.

2.1 FLOW EFFICIENCY

Sörqvist (2013) describes a 'Flow' as something that consists of natural working flows, i.e. the movement of products, material, knowledge, and information etc. Such flows are present in all organizations, and are based on interactions between departments, units, and individuals (Modig & Åhlström, 2012). A common question when talking about flows and processes is what seperates them. With the upcomming description of a processes one can argue that nothing seperates one from the other. However, many organizations have defined processes as the flows they decide to describe their activities from; this to avoid confusing employees when talking about processes in different ways (Sörqvist, 2013).

Processes builds a network of activities that co-consists and most of the flows in organizations can therefore be described as processes (Sörqvist, 2013). A process have also been described as a specific way of doing something, including several operations or steps (Robson, 2010), and can be seen as the procedure from which a customer's need is identified until it is satisfied (Sörqvist, 2013), see *figure 3*.

Figure 2. A process as the procedure from which a customer's need is identified until it is satisfied.

2.1.1 FLOW-FOCUS

Differences between a flow-focused way of working compared to a resource-focused way of working have been explained by several scholars; often in an example of a patient getting treatment for an illness (Womack & Jones, 1996; Modig & Åhlström, 2012). In a resource-focused way of working, the doctor takes a call from a patient and decides a time for a meeting, which can be weeks ahead from the call. Before the patient meets the

doctor at the apointed time the patient often has to wait in a waiting room and when the patient meet the doctor, the doctor makes a judgement on the patient's illness. The patient is then sent to a speciallist, quite possibly several days ahead. When the specialist has examined the health of the patient, it often takes additional days until the patient gets the results. After the patient receives the results, it is time for the treatment, which can include a visit to the pharmacy or a new meeting with speciallists. If the patient is unlucky, he/she can enter a system with several specialists and different disconnecet processes, implying a lot of waiting for the patient. To shorten the waiting time and to increase flow efficiency these scholars argue that focus most be put on the flow unit, i.e. the patient, instead of the resources, i.e. the doctor and speciallists. Thus, to enable organizations to increase flow efficiency it is important to have a focus on flow units and processes.

2.1.2 CONTINUOUS AND STANDARDIZED FLOWS

Liker (2004) argue that to avoid the earlier mentioned waiting time that is present due to disconnected processes, organizations need to create a standardized and continuous flow. He concluded that to create a continuous flow, organizations should minimize their batch sizes as much as possible and adopt a customer-focused mindset. In other words, not creating anything until the next-in-line customer asks for it. This customer-focused mindset also suggests that organizational as well as external customers, should be involved when deciding goals and priorities for organizational actions (Murray & Chapman, 2003). Further, the continuous flow should be standardized – meaning that teams work in the same way every time – allowing organizations to measure and improve the continuous flow (Sörqvist, 2013). By creating standardized processes, workers that make changes in the process will feel empowerement and self-confidence as other workers in the process will follow the new standard, and thus the improvement (Liker, 2004). Furthermore, the creation of continuous and standardized flow will help detect deviations and therefore lays the ground in CI (Petersson, et al., 2012).

2.2 CONTINUOUS IMPROVEMENT

CI has its origin before the industrial revolution even started (Bhuiyan & Baghel, 2005; Schroeder & Robinson, 1991). The modern concept however, as used in this thesis, originates from the Japanese term Kaizen and was initially developed and spread by Masaaki Imai – see *Kaizen: The Key to Japan's Competitive Success* (Imai, 1986) – who is known as the father of continuous improvement (Sanchez & Blanco, 2014). Since then, Kaizen has become a big part of the Japanese manufacturing system and has contributed vastly to their manufacturing success (Singh & Singh, 2012). Indeed, the concept has

received so much currency that Kaizen is referred to as the key to Japanese companies' competitiveness in the last three decades of the twentieth century (Suárez-Barraza, et al., 2011).

In his book, Imai (1986) describes Kaizen as a compound word, including the two concepts: Kai (change) and Zen (to improve). Although he provided a definition of Kaizen, articles by scholars and experts in the field of CI display a certain degree of ambiguity and inconsistency (Singh & Singh, 2009). Therefore, based on previous definitions, Sanchez and Blanco (2014) identified the following characteristics of CI:

- CI is a cycle; it is not a single act. Hence, it is a constant activity that must be done over time. It should not be an independent activity.
- All employees within the organization should participate in the CI cycle.
- The CI aim is, precisely, to improve. To do so the organization should emphasis on eliminating wastes and pinpointing new areas of improvement.

Likewise, Bessant and Caffyn (1997) concluded that different definitions demonstrate the importance of involvement of the highest number of people possible in the organization. These people should contribute with incremental improvements in products and processes and share experiences, knowledge, and learning with their co-workers.

Research shows that companies pass through several developmental stages, or levels of CI maturity (Caffyn, 1999). To illustrate these, Bessant et al. (2001) defined five stages of CI in organizations. These stages range from 1 to 5, where the first one (pre-improvement), occurs when the organization introduces the concept of CI without inducing organizational performance. In the final level (overall continuous improvement), the whole organization is participating in improvement activities connected to incremental and radical innovations. At this stage, sharing knowledge and experiences also occurs – making it a model of organizational learning. These stages do not only function to identify the current level of maturity in an organization, rather they should also guide the organization to express strategies to improve its abilities and to reach higher levels of maturity (Oprime, et al., 2012). Also, CI is a strategic process that needs to be managed focusing on the long-term gain (Bessant, et al., 1994).

2.2.1 CRITICAL FACTORS FOR CONTINUOUS IMPROVEMENT

Brotherton and Shaw (1996) define critical factors as essential aspects that must be achieved by the company or the areas that will produce the competitive advantage. They emphasize that critical factors are not objectives, but are the actions and processes that can be controlled/affected by management to achieve the organization's goals.

Between 1992-1997 the CIRCA (Continuous Improvement Research for Competitive Advantage) team, at the University of Brighton carried out practical, action-oriented research with a set of industrial collaborators drawn from the manufacturing sector (Caffyn, 1999). A major outcome from this work was the CI Capability Model. This model describes critical factors for CI in terms of core abilities connected to a set of key behaviors or behavioral routines which appear to be essential for long-term success with CI (Bessant & Caffyn, 1997). Including: (a) The ability to link CI activities to the strategic goals of the company; (b) The ability to strategically manage the development of CI; (c) The ability to generate sustained involvement in CI; (d) The ability to move CI across organizational boundaries; (e) The ability to learn through CI activity; (f) The ability to articulate and demonstrate CI values (Caffyn, 1999). Further, CIRCA members also proposed a framework for successful CI, consisting of six critical organizational factors (Bessant, et al., 1994). The factors included are:

(1) A clear strategic framework, to focus improvement efforts: clear strategic targets, communicate the targets and where the organization is going;

(2) A careful strategic management of CI programs: short-term targets, measurement and display routines, regular inputs of training and infrastructure development;

(3) A supportive culture, to make CI part of the organization's shared values and beliefs: understanding the value of small steps, believe that everyone has the creative potential (decision making in all groups), and attitudes towards mistakes (also giving employees responsibility);

(4) An enabling infrastructure, in terms of organizational mechanisms to facilitate and operate continuous improvement: organizational structure, communication and decision-making, level of teamwork, team constellation, integration in inter-functional relations, and identify and facilitate CI-vehicles;

(5) A strong attention on managing continuous innovation as a process: it is important to see improvements as a process, more specific as a learning cycle.

(6) A set of adequate tools to facilitate CI activities: suitable CI-tools and training in these tools.

Several other studies have also focused on identifying critical factors for CI, resulting in both similar criteria (Quesada-Pineda & Madrigal, 2013; Abrahamsson & Gerdin, 2006; Murray & Chapman, 2003; Terziovski, 2002; Bessant, et al., 2001; Hyland, et al., 2000; Kaye & Anderson, 1999); as well as other elements such as:

- *Leadership,* which is related to cultural aspects, and is a part of a social process that involves new relationships, roles, sustaining motivation, encouraging participation and responsibility, as well as methods of cooperation and control structures that can facilitate activities of continuous improvement (Oprime, et al., 2012; Fryer, et al., 2007; Bessant, et al., 2001; Harrison, 2000; Hyland, et al., 2000; Terziovski & Sohal, 2000; Kaye & Anderson, 1999; Youssef & Zairi, 1995; Atkinson, 1994);
- *Measurement & Feedback Systems,* which involves formal and informal rewards, communication to employees, and measurement of improvements (Davison, et al., 2005; Hyland, et al., 2000; Bessant & Francis, 1999; Quesada-Pineda & Madrigal, 2013; Atkinson, 1994; Lee, 2004; Caffyn, 1999; Beckett, et al., 2000), and;
- *Employee Empowerment & Participation,* which stresses the importance of involving as many people as possible in the organization, and that employees should be the ones carrying out the improvements (Delbridge & Barton, 2002; Kaye & Anderson, 1999; Terziovski, 2002; Bessant, et al., 2001; Murray & Chapman, 2003; Bessant & Caffyn, 1997).

2.3 AREAS OF CRITICAL FACTORS WHEN PRIORITIZING FLOW EFFICIENCY

By comparing the previously identified critical factors for CI with the ideas of flow efficiency, we have chosen the areas of critical factors we believe are important to elaborate on. Since flow efficiency is created in processes it is important to have an operative infrastructure that supports this, hence critical factors connected to the area of operative infrastructure are one of the aspects to elaborate on. Also, to provide improvements that will help the organization become more flow efficient it is important to investigate critical factors connected to the areas of methodologies and tools. To reach the new mindset that is flow efficiency, enhancing such culture becomes important. Hence one of the most important areas to elaborate on is critical factors connected to the area of leadership and management commitment, since leaders and managers play an important role in such enhancement. Consequently, the three areas of critical factors to be elaborated on are: Operative Infrastructure, Methodologies & Tools, and Leadership & Management Commitment.

2.3.1 OPERATIVE INFRASTRUCTURE

This area includes; Decision Making Structure, CI in Different Levels, Lateral Structure for CI routines.

Decision Making Structure

Traditionally, actions of middle and front-line managers have been dictated and planned with a top-down approach to ensure that they are well suited for organizations' strategies and targets (Tyler & Blader, 2005). These types of top-down approaches to strategic planning are not suited for organizational learning and the organizations dynamic capabilities (Pfeffer, 2005; Tourish, 2005). Anand et al. (2009) identified three main reasons for this misfit: (1) information needs to pass through several levels and slows down the speed and lowers accuracy of the communication, (2) different levels in the organization is affected by their own environments which makes it difficult for senior management to keep track of each level, (3) bottom-up communication about environmental changes and consequently organizational learning is hindered by top-down structures. This implies that a bottom-up approach to CI, with decentralized decision-making, is needed for a learning organization.

CI in Different Levels

In a broad sense, CI can be divided into different levels of execution. Although Imai (1986) does not refer directly to guiding principles – he indicates that continuous improvements can take at least three forms: management-, group-, and individual-oriented improvements. Management-oriented CI is considered to be the most important one as it focuses on the company strategy (Suárez-Barraza, et al., 2011) and involves everyone in the organization (Bhuiyan & Baghel, 2005). Group-oriented CI focuses on improvement teams (Imai, 1986) and/or quality circles (Bhuiyan & Baghel, 2005). This require employees to form a team or a circle with the goal of finding and solving problems faced during their day-to-day work without any interference from management (Suárez-Barraza, et al., 2011). Individual-oriented CI is derived from the concept of bottom-up design, in which the worker makes a recommendation to the problem encountered (Imai, 1986). This has been very successful in the Japanese industry (Suárez-Barraza, et al., 2011; Bhuiyan & Baghel, 2005) since it is the worker who is on the shop floor and typically knows the best solution to an existing problem (Imai, 1986). Similarly, Sörqvist (2013) concluded that CI needs to be possible to drive in four different levels in organizations:

(1) By **individuals**

(2) In **local groups**

(3) In **cross functional** projects

(4) In **cross organizational** projects

Individual improvements builds the foundation for improvements in organizations and should involve all individuals (Liker, 2004), but such improvements suggestions can sometimes be suboptimal for the process and should therefore be lifted to local improvement groups before carried out (Sörqvist, 2013). Bigger improvement often demands resources from different departments and organizations, which calls for a more structured execution (Snabe, et al., 2009) and are often driven by project leaders with sufficient knowledge and experience in problem solving (Sörqvist, 2013). Also, as bigger improvements often span suppliers and customers (Ward, 1994); these improvement activities are more easily carried out if suppliers and customers use the same methodologies and tools for CI (Sörqvist, 2013).

Lateral Structure for CI Routines

Organizations need to increase cross-functional cooperation to be able to drive improvements in the different levels, to do so they can adapt a lateral structure for CI (Anand, et al., 2009), organizing CI in a way that fuels lateral communication and co-operation (Abrahamsson & Gerdin, 2006). To foster a lateral organization, it is important to have routines that are formed around lateral processes; this will link critical activities across functions, combine lateral and hierarchal information transfer, force contact between different functions in organizations, and provide learning opportunities for individuals (Joyce, et al., 1997). Consequentely, to ease local, cross-functional, and cross–organizational improvement activities with the purpose to increse flow efficiency, organizations need to form their improvement routines around their lateral processes (Ward, 1994).

Researchers suggest that people doing a certain work task are best suited for improving that work task (Keatinga, et al., 1999; Deming, 1986; Ishikawa, 1985). Also, aligning CI meetings and routines with processes, and people working in these processes, have resulted in higher participation in comparison with organizations running sporadic improvement activities carried out by specialists from different functions (Delbridge & Barton, 2002). This suggests that in organizations prioritizing flow efficiency, CI should be formed around processes and include persons working in these processes.

2.3.2 METHODOLOGIES & TOOLS

Since the objective of this thesis is to suggest a set-up for CI in organizations prioritizing flow efficiency, process improvement methodologies will be included. Before organizations decide to choose specific process improvement methodologies they need to be carefully examined; as it is easy to just choose one or two that the organization is familiar with (Uday-Riley & Guerra-Lopez, 2010). Some of the methodologies that can

be used in connection to CI are: Lean, Six Sigma, Total Quality Management, World Class Manufacturing, and ISO 9000 or other standards, (Snabe, et al., 2009). In later years, the most frequently used methods for processes improvements are Lean and Six Sigma (Drohomeretski, et al., 2014). Lean brings out openings to increase performance in processes (Ediz & Girenes, 2013) and to tackle inefficiency in those processes (Drohomeretski, et al., 2014). Six Sigma gives quality and a structured and statistical approach to eliminate errors, lower variability (Ediz & Girenes, 2013), and decrease ineffectiveness in processes (Drohomeretski, et al., 2014). The synergy between Lean and Six Sigma enables slower processes to speed up and become continuous flows (Brett & Queen, 2005), which is essential for organizations prioritizing flow efficiency (Liker, 2004). Hence, we will further explain these two methodologies along with Lean Six Sigma (LSS), a combination of Lean and Six Sigma (Drohomeretski, et al., 2014).

Lean Thinking

Lean is a concept established in a comparative study between U.S., Japanese, and European automotive industries and its purpose is to identify value-adding activities, line up those activities, and perform them more and more effectively (Womack, et al., 1990). However, it is important to not see Lean as a bundle of resources that is thought to banish waste, but as a model that helps organizations have a clear vision for improvements (Holweg, 2007).

One of the starting points in Lean is value stream mapping (VSM) (Drohomeretski, et al., 2014). Value stream mapping gives a holistic view over the flow of the value adding processes - providing an understanding of the flow – enabling management and improvement of processes (Hines, et al., 2004).

Lean was studied as a part of MIT international Motor Vehicle Program, led by Daniel Roos and James Womack. In 1990, they published the book *'The Machine that Changed the World'* (Womack, et al., 1990). A book they later on developed into another book called *'Lean Thinking'* (Womack & Jones, 2003). They identified five main principles for a lean organization:

- Elimination of waste
- Accomplishment of flow through processes
- Identification of value stream
- Pull signals sets the pace
- Striving towards perfection

Six Sigma

In 1987, Motorola launched a process improvement program called Six Sigma, which was the reason for them winning the 'Malcolm Baldrige National Quality Award' and achieving gains of 2.2 billion dollars between the 80s and 90s (Drohomeretski, et al., 2014). Snee (2004) identified Six Sigma as a business improvement methodology that, with a focus on customers, identifies and eliminates sources for errors and defects. To successfully implement Six Sigma in organizations some key components have been recognized and are related to: top management commitment, supporting infrastructure, statistical tools, culture, and proper training (Hilton & Sohal, 2012; Sambhe & Dalu, 2011; Vijay, 2007).

An important method in Six Sigma is DMAIC (Define-Measure-Analyze-Improve-Control) (Brook, 2006), and is illustrated in *figure 3*.

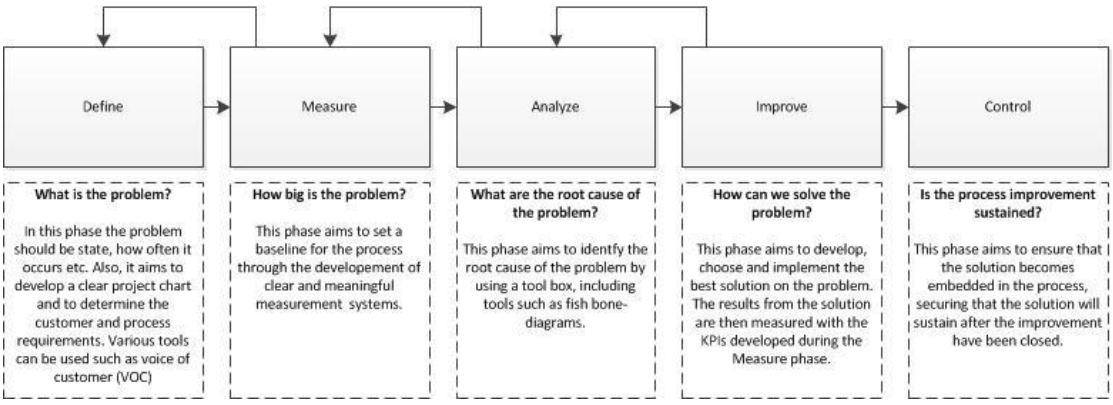

Figure 3. The methodology of DMAIC (Antony, et al., 2012; Snabe, et al., 2009; Brook, 2006)

DMAIC is used for implementing Six Sigma in process improvement projects (Andersson, et al., 2006), and is best suited for more complex problem solving, while more local improvement projects is better executed with a leaner and more 'just-do-it' approach (Snabe, et al., 2009; Brook, 2006),

Lean Six Sigma (LSS)

According to Drohomeretski et al. (2014), LSS have emerged as a combination of Lean and Six Sigma, with the aim to reduce waste, variation, cycle time, and non-value added work. Lean emphasizes on the importance of improvements and Six Sigma provides a structured way of improving (Sörqvist, 2013). LSS have also been described as the methodology that eliminates waste (Lean), decreases variations (Six Sigma) and follows the DMAIC process (Salah, et al., 2010). Research data have shown that improvements are performed with less speed without a Six Sigma structure (George, 2002). Six Sigma

has a unique ability to link different improvement tools and make them suitable for an overall approach (Snee, 2004). Salah et al. (2010) argued that the most successful approach to the combination of Lean and Six Sigma is to integrate them; with Six Sigma as a structure integrated with tools, principles and thoughts from Lean.

The main objectives of Lean and Six Sigma are aligned, to seek and improve processes (Snee, 2010). However, the tools that Lean and Six Sigma use to accomplish these objectives are not the same. *Figure 4* illustrates some Six Sigma tools, some Lean tools, and some common tools.

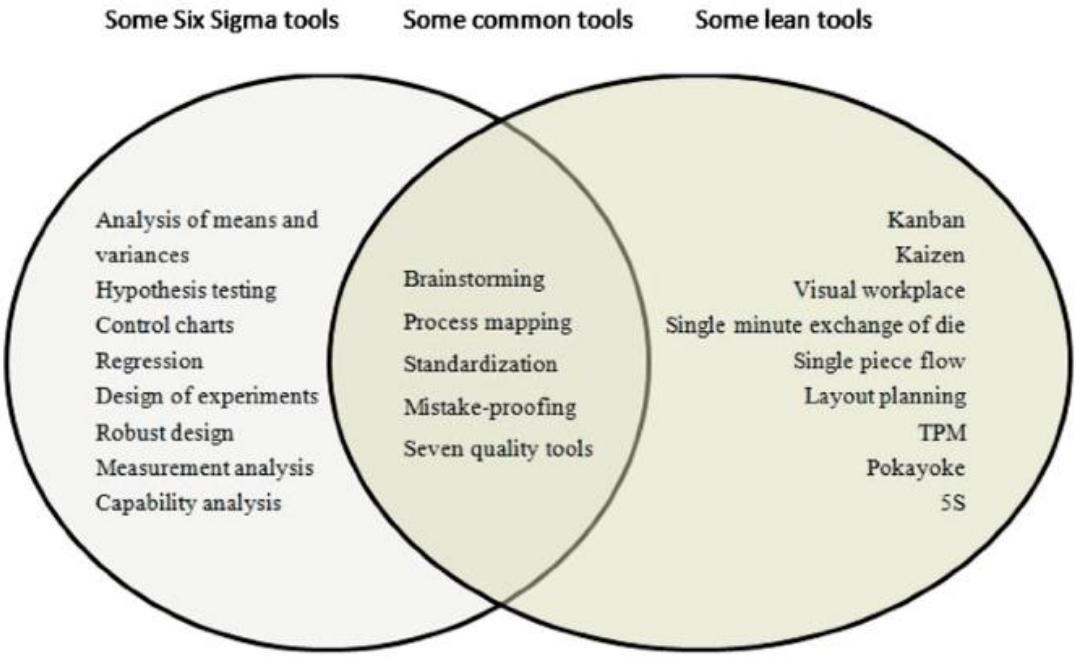

Figure 4. Example of tools used in Lean, Six Sigma, together with some common tools, used to improve processes (Drohomeretski, et al., 2014)

2.3.3 LEADERSHIP & MANAGEMENT COMMITMENT

The idea of CI in organizations prioritizing flow efficiency is indeed that all processes must be inspected and continuously refined. Still, it is important not to view CI as a program to be implemented, but rather as a new way of thinking (Liker, 2004). Every mind must be taught for situational understanding and instinctive efficiency (Marksberry & Hughes, 2011). This implies that the ability to adopt and teach the methodologies used to achieve such understanding and efficiency becomes a huge part of leadership in CI efforts (Modig & Åhlström, 2012); both for managers and executives (Marksberry & Hughes, 2011), but also for leaders in general (Savolainen, 1999). In fact, CI cannot be successfully operated in organizations prioritizing flow efficiency without executives, managers, and leaders in general leading the way (Atkinson, 1994; Youssef & Zairi, 1995; Oprime, et al., 2012; Marksberry & Hughes, 2011).

New Mindset

As long as parts of the organization can be improved, it is the role of the executive to take responsibility and make certain the corporation is truly changing for the better (Marksberry & Hughes, 2011). Still, many businesses only want to do enough to get by, where some executives and managers do not care enough to find problems in their organizations as long as they are having mild success (Imai, 1986). However, some businesses strive for excellence in every category (Marksberry & Hughes, 2011), and this is the mindset needed in CI efforts (Modig & Åhlström, 2012). This implies that instead of maintaining the mentality that everyone makes mistakes and that perfection is impossible, managers and executives should instead strive for perfection, by systematically eliminating waste from all of their processes, so that flow efficiency can be increased (Imai, 1986). To do so managers need to be fully aware of the long-term strategies and have suitable, measurable goals, both for themselves and their teams (Kaye & Anderson, 1999). Therefore, if CI is to be successful, executives must vocalize the goals of it (Terziovski & Sohal, 2000) and exemplify the strategies through organizational principles and values (Womack & Jones, 2003); so that managers and leaders in general can use them (Liker, 2004). Indeed, the idea of flow efficiency and CI cannot be forced upon from the outside, but must occur naturally; and only an executive has the influence to plant the seeds deep enough (Marksberry & Hughes, 2011). With a new mindset to be integrated in the organization, leadership style becomes essential for the success of CI efforts (Womack & Jones, 2003).

Leadership Style

As a role model for CI and flow efficiency, the leaders at Toyota are expected to lead by example (Imai, 1986). This implies that leaders should know their situations comprehensively (Liker, 2004), invest in other employees (Imai, 1986), and operate out of a core set of values rather than follow a list of rules that they do not fully understand (Marksberry & Hughes, 2011). Hence, a leader must be able to identify problems in the organization, based on values of flow efficiency (Liker, 2004), before attempting to implement solutions (Sörqvist, 2013).

Kaye & Andersson (1999) suggest that leaders should take a coaching approach when operating CI, and Petersson et al. (2012) extends this by emphasizing on the importance to angle the coaching towards ways of working, rather than the actual results. This does not mean that the results are not important; it is just another view on how good results are created (Modig & Åhlström, 2012). With this coaching approach leaders (foremost managers) need to communicate, support, and plan CI efforts in a way that encourages

people to use their capabilities (Sörqvist, 2013); hence promoting empowerment and freedom (Hyland, et al., 2000). Certainly, enhancing this needed commitment (Bessant & Caffyn, 1997) is dependent on the effectiveness of management (Angelis, et al., 2011). Therefore, to involve as many as possible in the change towards flow efficiency, managers need to be committed, willing, and able to break down the barriers of change (Mccreary & Preston, 2010); implying that management participation and support through all levels is required (Fryer, et al., 2007; Savolainen, 1999).

As understood it is amongst a leader's responsibilities to get as many creative ideas as possible from all workers (Bessant & Caffyn, 1997), and one of the more prominent ideas in achieving this, is that managers and executives should spend a significant amount of time on the floor rather than tucked away in an office (Sörqvist, 2013; Liker, 2004). This level of involvement is often what sets the truly successful businesses apart (Marksberry & Hughes, 2011), as the executives and managers actually take the time and initiative to visit the most basic levels of their organizations to observe and improve (Imai, 1986). Psychologically, this involvement shows the employees how seriously all leaders take efficiency, leading to much greater effects than most people would realize (Van Dun & Wilderom, 2012). However, Marksberry & Hughes (2011) also point out that it is important to realize that one should not fall into micromanaging, i.e. always on the floor. Executives and general managers may be in favor of spending time on the floor, but they still have specific duties that no one else in the company can do, and they must be "in the office" to accomplish some of their more organizational and directional tasks.

Handling the Cycle of Change

During the constant change that is CI, managers also need to be familiar with the processes of CI development, and that CI efforts evolve in a company-specific way (Bessant, et al., 1994). The implication is that when the CI implementation cycle moves to the phase of stagnation, and being drained of ideas, leaders should not give up but rather pursue the reinvigoration of the development process and search for a new drive (Savolainen, 1999).

2.3.4 SUMMARY OF THEORETICAL FRAMEWORK

This chapter has provided understanding of how flow-efficiency is created, namely in flows and process, and through continuous and standardized flows. A literature review of CI and critical factors for CI have been presented and three important areas of critical factors have been derived for organizations prioritizing flow efficiency, namely Operative Infrastructure, Methodologies & Tools, and Leadership & Management Commitment.

These areas have been further investigated and theories and critical factors within each area have been combined, building a framework for this research to help answer the research questions and to fulfill the objective; to suggest a set-up for CI in organizations prioritizing flow efficiency.

3. RESEARCH METHOD

In this chapter the research method is described with its approach and procedure. The approach justifies the choices made, whereas the procedure provides an understanding of the actual employment of the methods. Also, validity and reliability are discussed.

3.1 RESEARCH APPROACH

The starting point in research design is to reflect over the research paradigm – the philosophical framework that guides how scientific research should be conducted (Collins & Hussey, 2009). Once this is done, one can start thinking about the research design, i.e. what kind of approach to have towards the process of the research, including a group of methods (Yin, 2009).

One can say that research methods are methods for creating knowledge (Svensson, 2004). Therefore, the interpretation of what kind of knowledge to be obtained by the methods is fundamental for the examination and evaluation of the research methods to be used. This thesis elaborates on the factors that are considered contributing towards successful continuous improvement (CI) in organizations prioritizing flow efficiency. This was done by investigating how such organizations operate CI the areas of critical factors identified in the theoretical framework. When collecting this kind of data, there are basically three major research approaches: qualitative, quantitative, or a combination of the two. In this research it was more suitable to collect qualitative data. This since qualitative research is by definition investigative, and is used to go deeper into issues of interest and explore distinctions related to the problem (Collins & Hussey, 2009). Several methods can be used to find data for qualitative analysis. Examples include action research, case study research, ethnography and grounded theory (Cassell & Symin, 2004). This thesis aims not only to explore a certain phenomenon, but also to understand it within a particular context. Hence, a case study was conducted (Yin, 2009). A case study is an ideal methodology when a holistic, in-depth investigation is needed (Feagin, et al., 1991). Also, a case study is especially relevant in efforts to study broad and difficult initiatives (Yin, 2013), which the set-up for operating CI can be seen as.

3.1.1 QUALITATIVE CASE STUDY

When collecting data it is important to determine how, where, and when to collect it (Yin, 2009). The methods used in case studies include, e.g. documentary analysis, interviews, observations, diary methods, focus groups, and grounded theory (Collins &

Hussey, 2009). In this research, data was collected from primary sources both through primary data (Collins & Hussey, 2009), in terms of: *semi-structured interviews* and *observations*, as well as secondary data (ibid) in forms of: *company document analysis*. This was done to strengthen findings by supporting them with different methods (Ammenwertha, et al., 2003).

Semi-Structured Interviews

The foundation of the empirical data in this thesis is based on interviews, as requested by previous studies (Oprime, et al., 2012). This provides detailed and robust data that also gives immediate opportunities for confirmation (Denscombe, 2009), which is good in this type of research, since elaborations on the answers are needed (Yin, 2009). Moreover, interviews can be described within a continuum ranging from unstructured till structured, where the difference is based on the openness of the questions, i.e. whether you discuss the answers and have a strict manuscript of questions (Collins & Hussey, 2009). There are strengths and weaknesses with both of them. The former strives to give in depth answers with probes and open-ended questions (Schensul, 1999). However, this could lead to that the same questions are not asked to all interviewees, hence providing different scopes (Collins & Hussey, 2009). The latter is more standardized, ensuring that each interview is presented with exactly the same questions in the same order (Schensul, 1999). In this research a combination was used, 'semi-structured interviews' (Collins & Hussey, 2009). This provides a time effective structure through preparation of topics, at the same time as the interview is open, allowing new ideas to be brought up during the interview as a result of what the interviewee says (Denscombe, 2009).

Observations

When using observations as a data collecting method it is important to consider what to be examined, and then decide whether to collect data using a laboratory- or a natural-setting observation (Collins & Hussey, 2009). As the context is important for the phenomenon under investigation, the observations in this thesis were carried out in a natural setting (Schensul, 1999). A natural setting observation heightens the understanding of procedures and provides understanding of the behaviors, motives and values of those being observed (Clancey, 2006).

Company Documents

In practice, many qualitative methods concentrate on the interviewees' imagination rather than their actual performance (Rolf, 2004). It is therefore vital to distinguish actual from

fictitious actions and that normal source criticism is used to critically review the information given (Yin, 2013). Therefore, contents of the interviews and observations were complemented and controlled with analysis of company documents and databases. This helps to distinguish between methods providing information about how the organization solves problems, and how particular individuals solve problems (Rolf, 2004).

3.1.2 COMPLEMENTARY INTERVIEW STUDIES

Apart from the main case study, two smaller, one-day-complementary interview studies were conducted in other organizations. The same approach was used as in the main case study. These interview studies were taken into consideration to provide a broader perspective - by the contribution of knowledge from organizations that have been operating CI for a longer period of time. This also heightens validity and reliability (Riege, 2003), which is discussed more in detail later in this chapter.

3.1.3 ANALYZING DATA

Data that have been collected from the main case study and the complementary interviews need to be analyzed. This since, the analysis of data is fundamental to deliver quality of any kind of investigation as raw data has little value on its own (Andersson, 2004). To enable continuous reduction of unwanted data, which can be a challenging and time consuming activity (McCutcheon & Meredith, 1993), the collected data was restructured and fitted into categories. The categories were chosen in accordance with the prior theoretical framework, presented in chapter 2. Further, continuous reduction of unwanted data sharpens, focuses, and discards data in such way that common conclusions can be drawn (Collins & Hussey, 2009).

3.2 RESEARCH PROCEDURE

To provide a more describing picture of the actual employment of the methods presented above, an explanation of the actual employment of the methods is presented hereunder.

3.2.3 MAIN CASE STUDY

The main case study was conducted at PIM (Product Introduction and Maintenance) RBS (Radio Base Station) Kista; a site incorporated in the global organization Ericsson. The organization itself is presented more in detail in the chapter 4.

Overall, the interviews throughout this study were held in three cycles, in which the degree of structure varied. Also, since successful continuous improvements include entire

workforces (Prado, 2001), employees from different departments and positions were interviewed. During the two first cycles, approximately ten interviews were held per cycle, whereas the last cycle only included four interviews that were meant to give closure to some ambiguities. All interviews were held by two interviewers to ensure that the problem under investigation would be fully explored (Yin, 2009), and that nuances and gestures would be noted (Collins & Hussey, 2009). To assure that all information were contained the interviews were recorded and transcribed. Further, observations have been carried out on a continuous basis during the study, including several informal conversations, all in which notes were transcribed. The observations were conducted on improvement meetings and activities, and in total we have been to 38 meetings, spread over approximately twenty weeks. In the beginning, the observations helped creating an understanding of present procedures of improvement activities. Later, they focused more on providing data regarding specific behaviors. In parallel to interviews and observations, company documents have been reviewed throughout the project.

The different interview cycles is used as time phases when explaining the actual employment of methods in more detail:

Phase One

To learn about the case organization and their ways of working, the research started with an introduction week, with informal conversations and observations. Short thereafter we started to go through company documents, as well as prepare interview questions. Together this helped us picture how PIM RBS Kista worked with CI. In the first cycle of interviews the questions had a more structured character, with general formed questions regarding the different departments work with CI. Six Improvement Managers (IMs), one vicarious Improvement Manager (v.IM), one process engineer (PE), and PIM RBS Kista's Lean program manager (LPM), were approached during one hour interviews to provide factual information regarding the organization's work related to CI. The same questions were asked to all IMs (including the vicarious IM) to minimize the risk that the scope of the data collected from different interviews would vary (Collins & Hussey, 2009). However, the questions to the LPM and PE were more open and general.

As the picture of PIM RBS Kista's work with CI became clearer, different departments' activities connected to CI were mapped. This enabled for non-participating observations during these occasions, usually with informal conversations afterwards. An overview of the interviews and observations performed during this phase is illustrated in *table 1*.

Table 1. Overview of interviews and observations performed during phase one.

INTERVIEWS

Department	Unit	Role	Time
Operations	-	IM	1h
Engineering	-	IM	1h
Special Product	-	IM	1h
SPM Digital	-	IM	1h
SPM Filter	-	IM	1h
Project Office	-	IM	1h
Test development	-	V. IM	1h
Lean Program	-	LPM	1h
Site Support	-	PE	1h

OBSERVATIONS

Department	Unit	Type/ Occasions
Operations	First line support	Improvement meetings/2
PIM RBS	-	VMS Site/2

Since only some of the departments have a structured way of working with CI (as will be showed in chapter 4) more focus were put on these from now on. Further explanation of the different departments and units are presented in chapter 4, hence we will only use abbreviations for the units to provide a holistic picture.

Phase Two

The objective of this report includes an elaboration on the factors that contribute to successful CI in organizations prioritizing flow efficiency. Thus, the second cycle of interviews started after the literature study on critical factors for CI was finalized. To determine the areas of such critical factors, the data collected from the case study that far was analyzed and combined with original models and up-to-date articles relevant to the subject. The reason for enfolding the literature and combining it with empirical data was to build internal validity and raise the theoretical level, as well as sharpening generalizability and improve construct definition (Eisenhardt, 1969). The questions in cycle two were thus formed around the areas of critical factors presented in chapter 2, and had less structured approach. This implies that not all questions were the same;

rather the questions depended on who was interviewed. By interviewing persons from different hierarchical levels, e.g. LPM, managers, operators, quality engineer (QE), process engineer (PE), strategy manager (SM) etc., see *table 2,* we could understand both how the activities were perceived, as well as how it actually works according to the employees. Also, similar to the first cycle, people from different departments were interviewed to understand how the differences and similarities between different workgroups contributed to success, as well as what the obstacles were.

Observations continued, and similar to the interviews, this time with a lens of presented areas of critical factors. See *table 2* for units of observations.

Table 2. Overview of interviews and observations performed during phase two.

INTERVIEWS

Department	Unit	Role	Time
Operations	-	IM	1h
Operations	MH	Manager	1h
Operations	SMA	Manager	1h
Operations	Filter	Operator	1h
Operations	FLS	Manager	1h
Operations	FLS	QE1	1h
Operations	Log.	Manager	1h
SPM Filter	-	IM	1h
Lean Program	-	LPM	1h
Site Support	-	PE	1h
Site Support	-	SM	1h

OBSERVATIONS

Department	Unit	Type/ Occasions
Operations	First Line Support	Improvement meeting/8
Operations	Filter Production	Improvement meeting/4
Operations	Logistics	Improvement meeting/2
Operations	Material Handling	Improvement meeting/2
PIM RBS	-	VSM Site/8
PIM RBS	-	Cross-functional project/4
PIM RBS	-	Cross-functional team/1
SPM Filter	-	Improvement meeting/1

Phase Three

In the third cycle of interviews the questions were again more structured in its character. These interviews were conducted to verify and add factual and precise information regarding the phenomena discovered and examined in the second round that had not been clear. See *table 3* for the interviewees and units of observations.

Table 3. Overview of interviews and observations performed during phase three.

INTERVIEWS

Department	Unit	Role	Time
Operations	Logistics	Manager	30min
Operations	FLS	QE2	
Lean Program	-	LPM	1h
SPM Filter	-	IM	30min
Project Office	-	IM	30min

OBSERVATIONS

Department	Unit	Type/ Occasions
Operations	First line support	Improvement meetings/2
PIM RBS	-	VMS Site/2

3.2.4 COMPLEMENTARY INTERVIEW STUDIES

Two complementary interview studies were conducted at Scania Chassis and Ericsson Supply Site Katrineholm (ESS Katrineholm), each during a one-day-trip.

Scania Chassis

Scania is a worldwide manufacturer of heavy trucks and busses (Colledani, et al., 2010). The organization has worked with continuous improvements based on the Scania Production System (SPS) – a Lean influenced system. This program has successfully involved employees in continuous improvement activities (Eklund & Berglund, 2007), and have contributed to a high flow efficiency in their production. The study has provided information regarding difficulties and success factors when operating CI.

Written questions were asked in emails prior the interviews, which built a foundation to enable a more structured approach to the interviews, providing more factual information (Collins & Hussey, 2009). The visit started with a round trip to understand the workflows, as well as how the organization practically worked with continuous improvement along with informal conversations. Later, we had a two-hour interview with one of the production managers (PM), where more in-depth questions were asked. Also, a one-hour interview with one of Scania's SPS Coordinators was held over the phone one week after the visit.

Ericsson Supply Site Katrineholm

The site manufactures and industrializes nodes and printed circuit boards. A node is a unit in the radio network system, enabling the communication in the ether. Examples of nodes are radio base stations, radio network controller or media gateways. These nodes have different hierarchic roles controlling the radio network and distribution of bandwidth to specific areas. The main purpose of the production is to supply design projects or foremost internal customers with end products for verification of software and hardware.

Written questions were asked in emails prior the interviews. Also, the agenda was somewhat similar to the visit at Scania, but with some differences. This visit included more interviews, with employees from different departments and hierarchical levels. In total four people were interviewed, as can be seen in *table 4*. Also, informal conversations were performed periodically between the different interviews.

Table 4. Overview of complementary interviews at ESS Katrineholm.

INTERVIEWS			
Department	**Unit**	**Role**	**Time**
Lean Office	-	Operational Excellence	1h
Dimensioning & Planning	-	N/A	1h
LMDM	-	Project Manager	1h
Production	-	Operator	30min

3.3 VALIDITY & RELIABILITY

The validity and reliability of case study research is a key issue for academics (Riege, 2003). A high degree of validity and reliability provides not only confidence in the data collected, but most significantly it creates trust in the successful application and use of the results to managerial decision-making (Yin, 2013). According to Gibbert et al. (2008), a case study must be rigorous in its design to allow for conclusions, and therefore recommendations to be relevant. In his research, Riege (2003) presented some relevant tests and techniques for establishing validity and reliability in case study research,

involving discussions of internal-, construct- and external- validity as well as reliability. These tests and techniques have been used in our evaluations.

3.3.1 INTERNAL VALIDITY

Internal validity is primarily referring to the data analysis phase of a case study (Yin, 2013). In particular, this measure assesses the causal relationship between variables and results (Gibbert, et al., 2008).

Evaluating this study, we argue that internal validity has been enhanced through the complementary interviews, thus being able to see some cross-case patterns (Riege, 2003), as well as the use of multiple sources, as recommended by (Yin, 2013).

3.3.2 CONSTRUCT VALIDITY

Construct validity is primarily referring to the data collection phase (Yin, 2013), and refers to the degree to which a study examines what it claims to investigate (Gibbert, et al., 2008).

Strengthening the construct validity of this study, we have sought to establish a clear evidence chain (Riege, 2003) and used several data collection methods as a mean to verify data (Yin, 2013). That is, research method and empirical data has been elaborated and a number of data sources have been used (Riege, 2003). In particular, data from a large number of non-participating observations, interviews, and company documents has been compared to enhance validity (Collins & Hussey, 2009). Also, the report has been continuously reviewed by our supervisor as well as discussed during seminars with the examiner, which was requested by Riege (2003). To further review the progress, meetings with case organization representatives have been carried out every second week.

3.3.3 EXTERNAL VALIDITY

Finally relating to the validity, limitations in regards to external validity or 'generalizability' should be considered (Gibbert, et al., 2008).

Given that the study primarily investigated one research object the possibility to verify the generalizability of the empirical contribution is probably low (Collins & Hussey, 2009). However, somewhat enhancing the external validity, the case study context has been rational and clearly described, thus allowing the reader to evaluate the conclusions themselves (Riege, 2003). Also, delimitations are presented in the 'Introduction' chapter. Furthermore, two complementary interview studies were conducted, which allowed us to some extent replicate logic between the studies (Yin, 2013).

3.3.4 RELIABILITY

As described by Collins and Hussey (2009, p. 64), "reliability refers to the absence of differences in the results if the research is repeated".

In this study, transparency has been enhanced by carefully accounting for the research procedure (Riege, 2003). Also, the interviews were held in three cycles but did not proceed until after a research foundation had been built. This increases the reliability of the case study, as it enables more structured questions, which in turn provides the investigation with factual information (Yin, 2013). To further strengthen the reliability, all interviews were recorded, and findings of observations were written down (Riege, 2003). The secondary sources in terms of articles and books used represent some of the more respected journals and publications, which make the content trustworthy. Also, a combination of original models and up to date sources are used to further increase the trustworthiness of the paper.

4. CASE ORGANIZATION

In this chapter the case organization will be introduced, in terms of context, as well as how the organization is operating continuous improvement efforts.

4.1 INTRODUCING THE ORGANIZATION

PIM (Product Introduction and Maintenance) RBS (Radio Base Station) is a function within Ericsson's[1] BNET (Business Unit Networks) Supply Radio & Core organization with industrialization and maintenance responsibility for radio products into the supply chain. With a complete product life cycle management responsibility the organization is responsible for the performance of the products within the global supply chain through their lifetime. Responsibility areas of the function include test development, NPI (New Product Introduction), production, inbound material, engineering, projects as well as requirement handling. The organization consists of several departments, as can be seen in *figure 5*.

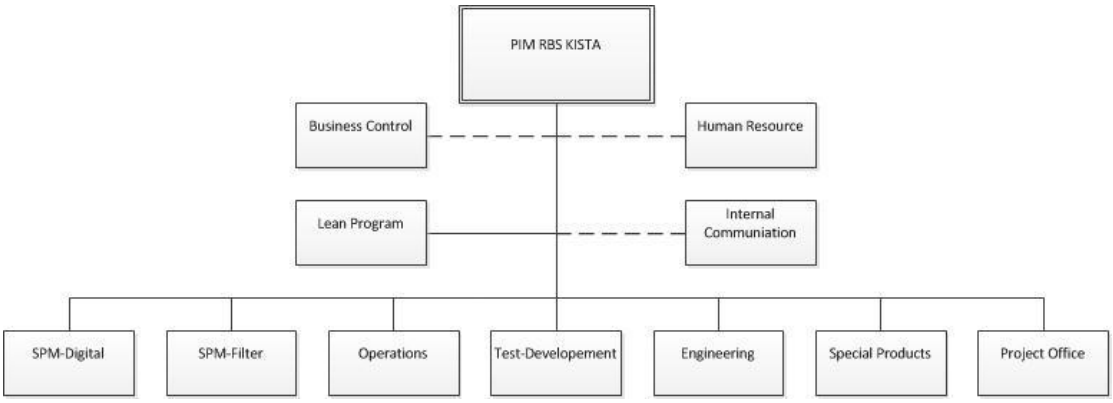

Figure 5. Organizational chart for PIM RBS Kista

4.1.1 INTRODUCING THE DEPARTMENTS OF INVESTIGATION

The primary focus of this thesis has been on the operational departments: SPM (Supply Product Management) Digital, SPM Filter, Operations, Test Development, Engineering,

[1] *Ericsson is a world-leading provider of telecommunications equipment and related services to mobile and fixed network operators globally. Over 1,000 networks in more than 175 countries utilize their network equipment and 40 percent of all mobile calls are made through their systems.*

Special Products, and Project Office. This since these departments were a part of the overall CI structure at the case organization, as will be shown later in *figure 8*.

SPM Digital

The SPM Digital department was accountable for the performance of the Digital Unit products within the global supply chain, through their lifetime ensuring that the supply chain meets the capacity, flexibility, quality and cost requirements.

SPM Filter

The department was accountable for the performance of the Radio Filter products within the global supply chain, from customer order to delivery, through their lifetime ensuring that the supply chain meets the capacity, flexibility, quality and cost requirements. The supply product life cycle management accountability also incorporated management of pre study and building practice, product introductions, maintenance and product substitution/phase-out, in and related to the supply chain.

Operations

The Operations department was responsible for NPI production of Filter modules, production capabilities for Special Products and Advanced Engineering together with other potential future assignments. Another responsibility was material procurement for products managed by the PIM RBS organization. Further, they managed suppliers and product quality through robust processes related to global component procurement throughout the product life cycle. Their responsibility also included development and follow-up of key performance indicator measurements for the inbound area to provide the PIM RBS organization with accurate feedback from the inbound supply process.

Test Development

Test development's main responsibility was to secure production test of Filter modules/sub-modules, meaning they are responsible for developing Filter test systems for high volume production. The department also did Filter and Digital pre-development activities and Advanced Engineering studies.

Engineering

The Engineering department was responsible for the development and support of product-unique production processes that enable supply of existing and new products. The responsibilities include both technology and quality aspects of the production processes for products part of PIM RBS Kista's scope.

Special Products

Assigned product areas were verification and customized products, mechanics, and site solutions. The organization was accountable for the performance of the products within the global supply chain through their lifetime, ensuring that the supply chain meets the capacity, flexibility, quality and cost requirements.

Project Office

The Project Office managed all product related projects in PIM RBS Kista. Project Office could also support with project managers for operational development- and improvement projects/programs.

4.2 IMPROVEMENT METHODOLOGIES AT PIM RBS KISTA

During some years PIM RBS had gone through some major changes, including reorganizations and downsizing, and the site was introducing flow efficiency as one of their strategic focus areas. Hence, PIM RBS Kista was in the beginning of a Lean journey. They had a Lean coordinator and a Lean roadmap (illustrated in *figure 6*). The Lean roadmap presented planned activities for 2014, indicative activities for 2015, and a wanted position in 2016. The emphasis was on e.g. defining flow efficient processes, establishing routines and ways-of-working for CI and also working with their' values and principles. As they were in the begging of their Lean journey, PIM RBS Kista provided all their employees with a shorter education in Lean. Amongst other activities, the education included workshops and a Lean-exam.

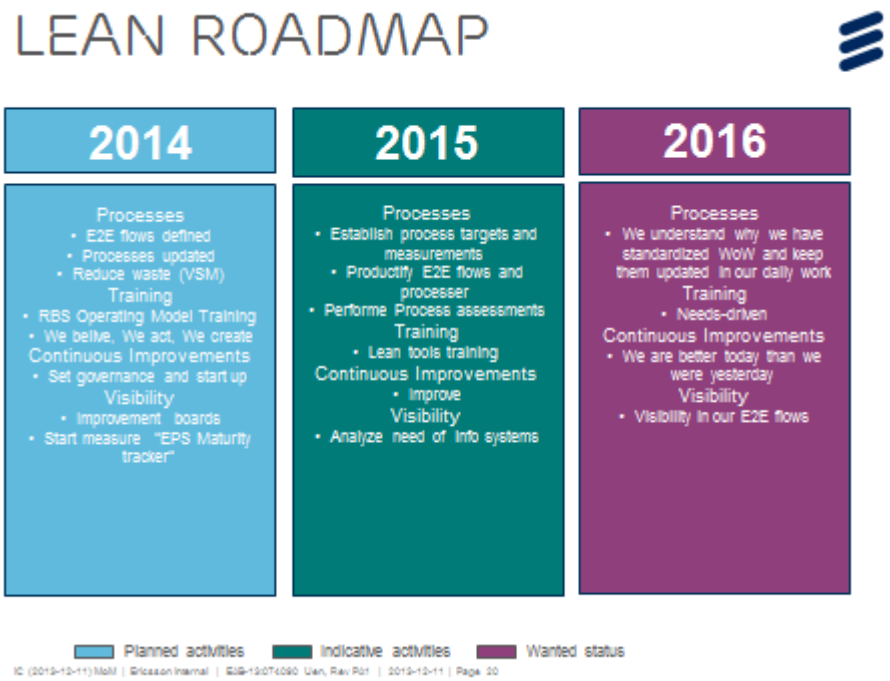

Figure 6. Lean roadmap at PIM RBS Kista (presented 2013-12-11)

Apart from Lean, Six Sigma had been implemented at PIM RBS Kista as a tool for driving and suggesting improvements. The DMAIC (Define, Measure, Analyze, Improve, Control) methodology was set to be used in all departments and every department had their own DMAIC improvement board (further explained and illustrated in chapter 4.4). Further, 11 individuals had Black Belt[3] and 48 had Yellow Belt[4] in Six Sigma. Still, the DMAIC methodology was not fully adopted by the organization. Only two local improvement teams within one department (Operations) used the board on a regular basis. In general, the DMAIC methodology was not used in improvement projects.

4.2.1 TOOLS FOR CI

Three main methodologies/tools are used at PIM RBS Kista to drive improvements:

SF – a web-based improvement model built upon the idea that individuals in improvement groups (a minimum of 3 persons) come up with smaller improvement suggestions. The nearest manager makes a decision whether to carry out, decline or investigate the improvement activity.

3-3-6 – a planning tool, used to plan improvement activities, both with a short (3 weeks), middle (3 months), and long term (6 months) view.

[3] Black belt means that a person is well educated in Six Sigma and can lead DMAIC projects
[4] Yellow belt means that a person has basic education in Six Sigma

- 6-month view: activities of the type focus areas[5]
- 3-month view: focus areas are broken down to activities
- 3-weeks view: concrete activities are added

DMAIC-board – was used to give a process for improvements. Basically, individuals write down problems and improvement suggestions on a scrap of paper. Suggested improvements are prioritized and moved on the board according to different steps: Define, Measure, Analyze, Improve, and Control. The boards and scraps of paper are designed from a standard, illustrated in *figure 7*.

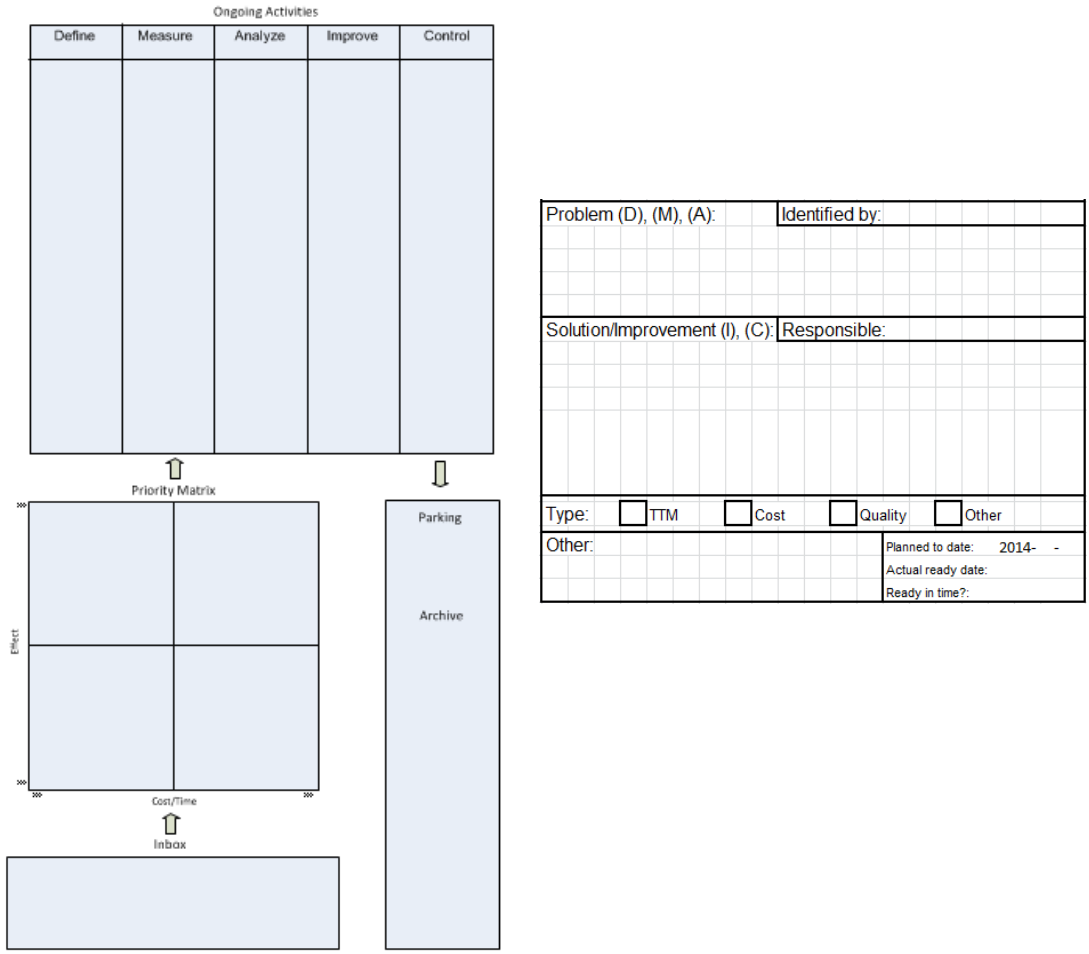

Figure 7. Improvement board (left), and improvement note (right) at PIM RBS Kista

[5] Focus area: each department decides strategic areas that are important for them. How these areas are chosen differs between departments

4.3 PIM RBS KISTA'S STRUCTURE FOR CI

The general CI structure of PIM RBS Kista is presented in *figure 8*.

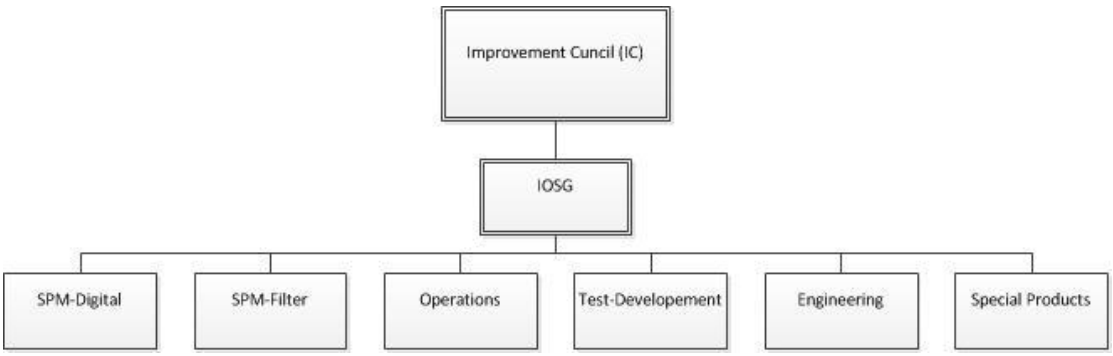

Figure 8. General structure for CI in PIM RBS Kista

As is illustrated in *figure 8*, the CI activities at PIM RBS Kista were structured in a linear and functional manner and in accordance with the organizational structure. When bigger improvements were suggested by departments they were set to follow this structure. First, suggestion had to be underlined with a business case in the preparative IOSG (Improvement Operational Steering Group) forum, mainly consisting of improvement managers (which role is further explained below) from the different departments. Decisions regarding such improvement suggestions are taken in the CI-council, consisting of executives from different departments. The CI-council had meetings every 6 weeks.

Further, PIM RBS Kista classified their improvement activities in three different levels. First, the organization used smaller improvements that were suggested and implemented by individuals. Then they had improvement projects, which can be seen as activities that require more resources and, in many cases, include different departments. Lastly, they had improvement programs, which had a larger scope and required more resources. Such programs included many people and different departments.

To support these improvements, each department had an improvement manager and different ways of working with CI. The idea of the improvement manager according to company documents is to:

- Act as change leader by identifying, initiating, managing and supporting programs, projects and other activities that contribute to increased value and reduced waste.
- Drive the local unit improvement program and Lean implementation.
- Coordinate and drive the work with the unit's tactical plan.

- Together with the line managers and process owners operate and coordinate improvement efforts by developing and implementing, procedures, processes, methods and tools.
- Represent the unit in cross-functional improvement activities and forums within PIM RBS and other units within Supply and in external interfaces towards e.g. supply sites and sourcing.
- Work with business intelligence and benchmarking and build relationship with external contacts to take advantage of good ideas and turn these into business and organizational development.
- Coordinate analysis and monitoring of the unit's balanced score card (BSC) and ongoing activities to fulfill BSC targets.
- Drive Ericsson Group Management System[6] alignment and secure local content.
- Plan, drive and follow up local management reviews, audits and assessments.

To get a deeper understanding of how improvement activities were carried out in PIM RBS Kista a more detailed investigation was carried out in each department. The findings are built on interviews with IMs (improvement managers) from each department, briefly described below. As the IMs had the main responsibility for driving improvement activities they could provide a relevant overview of how the different departments operated CI. It is important to understand that this section represents general structure and routines for CI in the departments and neglects improvement activities that do not have a structure or routines.

4.3.1 SPM DIGITAL

At SPM Digital they use the 3-3-6 tool to plan and visualize improvement activities. Further, three improvement programs were ongoing at SPM Digital; product lead, supply chain lead, and supply preparation.

4.3.2 SPM FILTER

SPM Filter used the 3-3-6 tool to visualize improvement activities. The department had meetings once a week with their steering group, including approximately ten persons. At

[6] EGMS shall manage the quality of products and services by way of describing roles and responsibilities, organization, processes and other characteristics vital for operational excellence. EGMS shall also support the fulfillment of business targets and should be kept updated and aligned with actual business focus as well as with organizational and managerial changes

these meetings a plan is set for what improvement activities to be fulfilled. In addition to the 3-3-6 meetings, SPM Filter had process teams that worked with improvements, but not with any particular method or routine.

4.3.3 OPERATIONS

The Operation department consisted of five different units: Inbound, Filter- and SMA (Surface Mounting Assembly) Production, Material Handling, First Line Support, and Logistics. The units within Operations had different routines for CI; hence the units will be explained one at a time.

First Line Support

First line support (FLS) used the DMAIC board to visualize and help drive their ongoing CI-activities. Members in the improvement team had partly designed the board.

Meetings were held in front of the board twice a week and were 15 minutes each. During these meetings FLS's manager was present and acted as a coach. The team consisted of approximately 10 people and one of the members was driving the meetings.

NPI-Production

NPI-production was parted in two different production lines, Filter and SMA. Both of the production lines had an improvement board. The SMA production-line did not have any time set for handling improvements, while the filter production line had set time for improvement meetings in front of a DMAIC improvement board once a week (15 minutes). During those meetings the whole production line was supposed to attend, which include approximately 20 people and an informal leader.

Material Handling

Material handling (MH) used the SF-tool. During the week, individuals came up with suggestions and logged them in the SF-tool, then waited for a decision from their manager before carrying out the improvement. Once a week these improvements were presented and discussed during a meeting held by the manager.

Logistics

Within the logistics unit there were different roles and responsibilities. People with the same roles and responsibilities had weekly meetings with their manager to discuss and

drive CI. An Excel-document was used they write down improvement suggestions they come up with during the week.

Inbound

The inbound unit was supposed to use the DMAIC board to drive improvements. For different reasons, e.g. their manager quit the job; these meetings did not take place.

4.3.4 TEST DEVELOPMENT

Test developments have 4 communities that work with CI. These communities consisted of people from different work areas. However, there was no standardized way to carry out or identify improvements possibilities in these communities. Test development differed from other departments when they worked with improvements as they used Agile management as a development methodology. However, is not covered in depth in this thesis.

4.3.5 ENGINEERING

At engineering there was no structured work with CI. However, many improvement projects were carried out in the department but not in a structured way or in a specific forum.

4.3.6 SPECIAL PRODUCTS

Assigned product areas were verification and customized products, mechanics, and site solutions. The organization was accountable for the performance of the products within the global supply chain through their lifetime, ensuring that the supply chain meets the capacity, flexibility, quality and cost requirements.

4.3.7 PROJECT OFFICE

Project office did not have any specific methods or tools for identifying or carrying out improvements. However, sometimes they participated in improvement projects.

5. FINDINGS & ANALYSIS

In this chapter the research questions are answered and analyzed, i.e. empirical findings are discussed in relation to the theoretical framework. Each of the three areas of critical factors will first be investigated separately, and is later on summarized in a reflection of the analysis.

To answer the main question, *'How do organizations prioritizing flow efficiency operate continuous improvement?'* we will divide this chapter into sections represented by the three areas of factors chosen to elaborate on:

- Operative Infrastructure
- Methodologies & Tools
- Leadership & Management Commitment

Also, to go into more depth of the main question we will also answer the sub-questions in parallel:

Sub-question i. *What difficulties are faced in the operation of continuous improvement efforts? How do organizations overcome such difficulties?*

Sub-question ii. *What facilitates the operation of successful continuous improvement efforts?*

5.1 OPERATIVE INFRASTRUCTURE

This section will have a similar structure as in the theoretical framework for Operative Infrastructure. Theory and empirical findings regarding: decision making structure, how to align continuous improvement (CI) with company strategies, and how an organization can be formed to enable a successful CI will be presented.

5.1.1 DECISION MAKING STRUCTURE

PIM RBS had a hierarchal decision making structure, described in chapter 4 and illustrated in *figure 8*. In short, the decision making approach that was used had a top-down characteristic. People in the organization experienced that this approach slowed down CI in the organization. In interviews with improvement managers (IMs) at PIM (Product Introduction and Maintenance) RBS (Radio Base Station) Kista regarding the current structure of CI, different opinions were expressed on how the current top-down decision-making approach worked:

"There is a gap between IOSG[7] and IC[8] and it takes time to get decisions regarding improvement activities."
– Improvement Manager, Project Office

"People that come with suggestions experience that it takes to much time."
– Improvement Manager, Special Products

"It never worked well with this system, as it takes to much time. Also, IOSG is an instance without resources and necessary overview of the organization."
– Improvement Manager, Operations

The difficulties expressed by the IMs strengthened Anand et al's (2009) identification of misfits for a hierarchal approach to organizational change and dynamical capabilities, since:

- It slowed down speed, as information had to travel through different levels in the organization
- Focus was only put on the most prioritized improvement suggestions, missing out on several suggestions that may have been important for the organization
- Lack of organizational overview made it hard for top management to make decisions regarding different departments and units in the organization

A decentralized decision making structure will also increase employee empowerment as it makes employees responsible for their own processes, which is essential when creating a culture where employees prioritize flow efficiency (Zarbo, 2012).

5.1.2 ALIGNING CI WITH STRATEGY

The explained CI structure at PIM RBS Kista was introduced to prioritize and align improvement projects with organizational strategies and goals. In interviews with IMs and the lean program manager, it was stated that this structure was not followed, as people went directly to members in the IC (improvement council) for decision making and allocation of resources. As a result, there were many improvement activities ongoing at the same time, even to an extent that they exceeded the available amount of resources for CI. This can be seen in *figure 9*, a company document from PIM RBS Kista, describing available resources for CI and used resources for CI.

[7] IOSG is a cross-functional and preparative forum, mainly consisting of improvement managers
[8] IC (Improvement Council) consisting of executives from the different departments

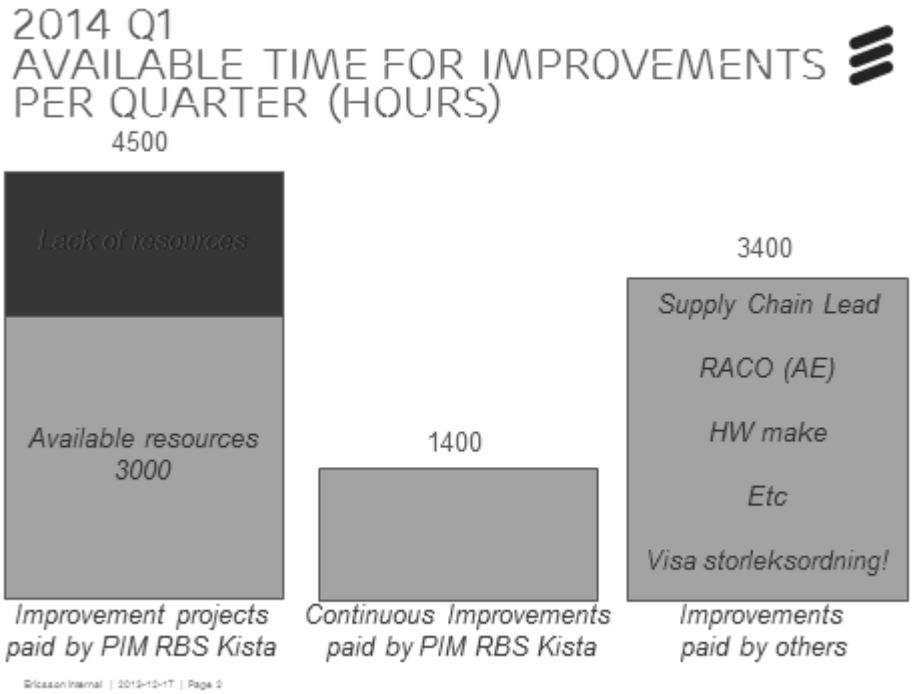

Figure 9. Available compared to used resources for CI

Also, in an interview regarding the current structure, the Lean program manager at PIM RBS Kista stated that:

"There are many improvement projects ongoing at the same time, but they do not have a clear target."

"Sometimes improvement projects can be suboptimal as there are many projects ongoing at the same time."

To avoid overload of improvement activities that are suboptimal, organizations can communicate their strategies and goals to the organization – providing individuals and improvement teams with the adequate knowledge to prioritize and make proper decisions regarding improvement suggestions (Bessant & Francis, 1999). This was also strengthened by the production manager from a complementary interview at Scania, who argued that by providing CI teams with strategic awareness they could prioritize improvement suggestions in their improvement teams. One way of doing this is to link improvement activities to scorecards (Kaplan & Norton, 2001). To keep involvement throughout the organization, scorecards could be co-developed, involving both local teams and executives when deciding goals for the teams (Dabhilkar, 2003).

5.1.3 AN ORGANIZATION THAT ENABLES CONTINUOUS IMPROVEMENTS

This section will be structured according to the organizational levels that Sörqvist (2013), and Imai (1986) argued to be vital when operating successful CI. It will go deeper into how organizations prioritizing flow efficiency can enable CI in the individual, local, cross-functional and cross-organizational levels.

Local and Individual Improvements

PIM RBS Kista had a similar approach to improvements as many scholars have argued being the most important in CI, where improvements that are suggested and implemented by individuals are the most important and should build the foundation for CI (Liker, 2004; Bessant & Caffyn, 1997; Womack & Jones, 1996)

As was explained in chapter 4.3, different departments and units in PIM RBS Kista used different routines and methods to suggest and implement individual improvements and in many departments and units there were no routines for improvement suggestions. Consequently, many individual improvements were carried out without discussing them in groups. However, individual improvements are often sub-optimal and therefore decrease flow efficiency (Sörqvist, 2013), and problem solving is better carried out in groups (Laughlin, 2011; Stasser & Titus, 1985). Further, findings from the complementary interviews at Ericsson Supply Site (ESS) Katrineholm suggested that individual improvements contribute the most if they are brought up in improvement teams. Otherwise changes are often made by individuals but not informed to others working in the process being improved.

> *"Many improvements are made each day, but as these improvements are not brought up in the team, everyone performs their tasks in their own way"*
> - Dimensioning and Planning, ESS Katrineholm

Consequently it becomes hard to have common way of working, which is vital to enhance a continuous flow (Liker, 2004) and therefore flow efficiency (Modig & Åhlström, 2012). During observations and interviews it was evident that people at PIM RBS Kista felt that individual improvements hindered the organization to become flow efficient. Individuals chose to perform their work tasks in ways they experienced most efficient, causing problems for other individuals affected by these changes. This was expressed during several local improvement meetings in the Logistics unit at the department Operations. One of the local improvement members stated:

"Many people that are a part of the same work team perform their tasks differently, resulting in difficulties when I perform my tasks."
- Local improvement team member, Logistics

This further strengthens the importance of bringing up individual improvements in local improvement teams (Sörqvist, 2013).

Local Improvement Teams

At PIM RBS Kista, different departments and units had different routines for CI and many had no routines, see chapter 4.3. This could therefore result in the earlier mentioned individual improvements, which were sub-optimal and not informed to other individuals. By having local improvement teams with routines for CI, sub-optimal changes can be reduced (Sörqvist, 2013) and create the important culture for CI (Bessant, et al., 1994). Routines for CI have been one of the success factors for the Japanese industry and companies as Toyota; such routines set a culture for CI (Bessant & Caffyn, 1997).

The department that had come furthest in the establishment of routines was Operations. However, in operations, improvement teams were mainly formed according to their unit in a functional manner. One example of this is how first line support had formed their improvement team, illustrated in *figure 10*.

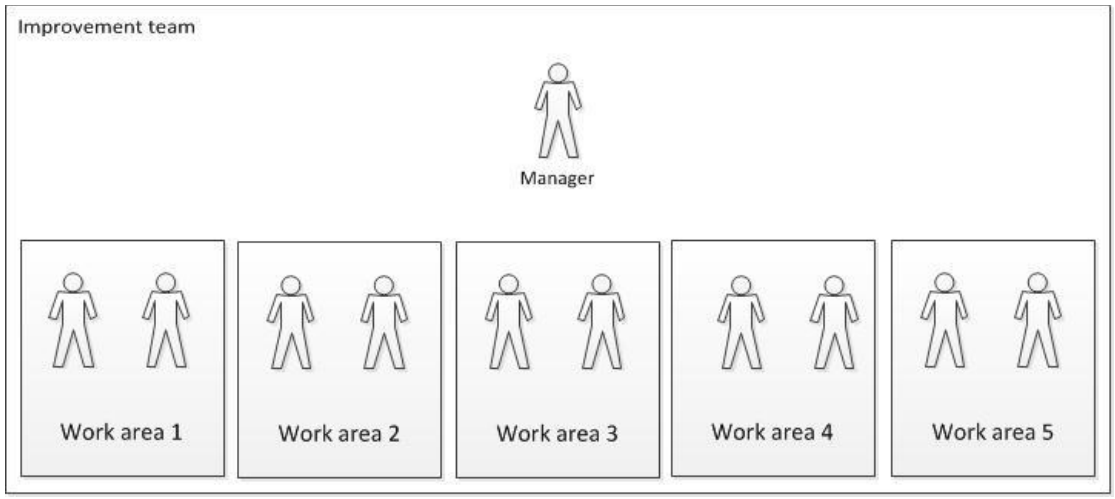

Figure 10. First line supports formation of their improvement team

Consequently, these types of teams consist of members with varying working tasks, making some members' knowledge irrelevant for other members' suggestions. During observations, members discussed how they could prioritize suggestions and contribute to the solution to other members' suggestions. One improvement team member stated:

"How am I supposed to prioritize improvements that I do not have relevant knowledge to make decisions about."

- Local improvement team member, First Line Support

During these discussions frustration amongst improvement team members have been noticed. This can be avoided by including members with the same working tasks in these local improvement teams, as they are best suited for improving their own working tasks (Imai, 1986). Furthermore, in the complementary interview with the production leader at Scania Chassis, it was stated that one of the most motivational parts of CI amongst employees was to get a chance to improve once own work tasks. This will make members feel empowerment (Bessant & Caffyn, 1997) and thus participate more in CI (Liker, 2004; Delbridge & Barton, 2002). The functional formation of local improvement teams at PIM RBS Kista also opposes the lateral structure that fuels organizational change and learning (Anand, et al., 2009; Abrahamsson & Gerdin, 2006). Instead, local improvement teams should be formed around processes, as it will have a lateral structure and include people with the same working task (Ward, 1994).

One could argue that cross-functional teams are better suited for CI in organizations prioritizes flow efficiency, as they have the ability to cut lead times and combine different departments (Denison, et al., 1996). However, as cross-functional teams are fit to solve particular problems (Sörqvist, 2013) such teams would not be suited to be permanent, unless they are a part of the same process team. Without permanent teams, it is harder to have CI-routines.

Number of Members in Local Improvement Teams

The local improvement teams at PIM RBS Kista consist of approximately 12 people, which have made the contribution per member rather low. However, all employees within the organization should participate in CI (Sanchez & Blanco, 2014), as well as contribute with incremental improvements and share experience, knowledge, and learning with their co-workers. Also, it has been stated in an interview with one of the managers at PIM RBS Kista, that larger groups makes it harder for some individuals to come with suggestions:

"It feels like few people dare to stand in front of a large group and suggest improvements."

- Manager, SMA-production

In the complementary interview at Scania, the production leader explained that lowering the amount of members from 10-15 to 5-7, heightened the involvement amongst individuals in local improvement teams.

"When the team was larger, there were often 5 or less people who carried the whole group by providing most suggestions."

"With smaller improvement teams, it does not work with having two people just sitting by. It is also easier to get your voice heard when you are not just one in the crowd."

This indicates that smaller teams are better suited for CI in organizations prioritizing flow efficiency, as CI in these organizations should be built on smaller incremental changes improving the flow (Imai, 1986; Liker, 2004).

Roles in Local Improvement Teams

A majority of the local improvement teams at PIM RBS Kista had no pronounced roles and responsibilities. Through observations at improvement meetings, some major difficulties were noticed. These difficulties, along with facilitators found in theory, are combined to suggest roles and responsibilities that can attend to the issues presented.

- Without high knowledge in problem solving, local improvement teams did not have a structured and efficient approach towards more complex problems. By having a manager with sufficient knowledge in improvement methodologies and tools that can support improvement teams such difficulties can be avoided (Sörqvist, 2013).
- Improvement teams that did not have managers that expressed the need for CI and flow efficiency did not have as many suggestions as the teams that had managers expressing this need. This implies that managers play an important role when it comes to motivation of improvement team members (further explained in chapter 5.3).
- Improvement teams that included a driver had more structured and efficient meetings compared to teams that did not. Thus, without a driver responsible for routines, improvement meetings were shown to be less structured and inefficient. To overcome difficulties with the teams that do not follow routines, and the suggestions that managers should have a somewhat different role in CI in organizations prioritizing flow efficiency (see chapter 5.3.1), a non-managerial, but leading role is suggested.

- Improvement teams had problems to identify what they needed to improve in order to increase flow efficiency, and merely improved through gut feeling. Since continuous flows is created through pull-systems (Liker, 2004), and thus flow efficiency (Modig & Åhlström, 2012) such problems can be avoided by including a role in those teams that represents the next-in-line customer as they are supposed to help decide goals and priorities for organizational actions (Murray & Chapman, 2003).
- Improvement team members had often a result focused mindset, whereas they did not focus on improving the methods i.e. their processes. To create such culture, where focus is on processes, members need to feel ownership of their own processes (Zarbo, 2012). A member will feel ownership if the work standard that the rest of the group is following is changed as a result of the member's improvement suggestion (Liker, 2004). Therefore, a role called improvement standardizer is suggested; this role has the authority to make changes suggested by the local improvement team in their working standards.

Obviously, local improvement teams need to have people carrying out improvements. These people's roles together with the roles that the theoretical facilitators suggested are presented hereunder and visualized in *figure 11*:

- **Improvement manager:** well-trained problem solving specialist that supports changes in the organization and thus the teams. (Not permanent role)
- **Manager:** The manager do not participate in improvements but functions as a coach and show interest in the local improvement teams (Not permanent role)
- **Improvement leader:** works in the process that the team is formed around and is responsible for controlling that the team follows routines as well as leading during these routines. This person is not a manager. (Permanent role)
- **Improvement identifier:** works in the next-in-line process and gives suggestions on improvement opportunities. (Permanent role)
- **Improvement executer:** Individuals that work in the process being improved and are responsible for identifying, prioritizing and executing improvement suggestions. (Permanent role)
- **Improvement standardizer:** Have the knowledge and authority to make changes in the process the team is working in. (Permanent role)

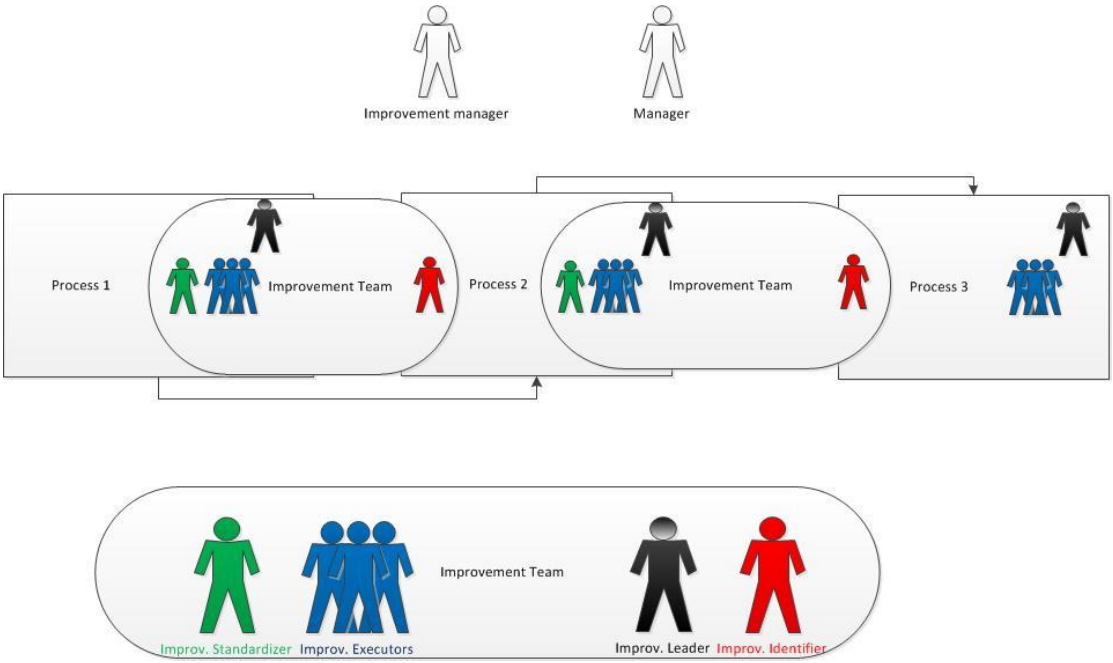

Figure 11. Improvement teams and different roles in organizations prioritizing flow efficiency

Linking Local Improvement Teams

Improvements that are made in one process can sub-optimal for another (Petersson, et al., 2012), something that was noticed in complementary interviews at Ericsson in Katrineholm. An operator stated that changes often affect other parts in the production line in a negative way. To increase the important linkage between processes (Petersson, et al., 2012) team leaders for the different processes should interact; this can be done through meetings including improvement leaders from different processes and the manager responsible for the processes, illustrated in *figure 12*. In this paper these improvement forums are called improvement forum level 1.

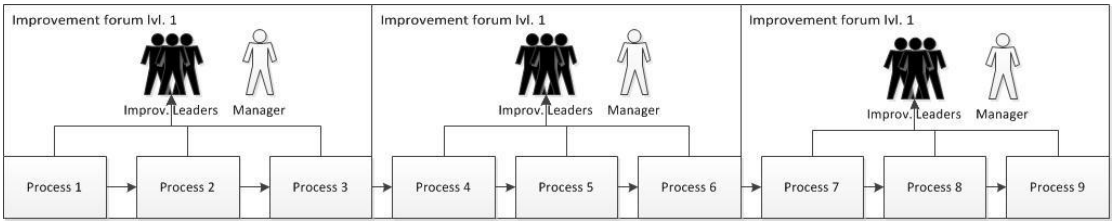

Figure 12. How improvement meetings with improvement leader and their manager creates linkage between processes

Inter Functional Improvements

During observations at improvement meetings and projects at the case organization, 4 major difficulties were noticed when improvement suggestions involved several departments:

- Communication between units since there was no structured way of informing other units
- Problems often got solved by people that did not work in the process being improved and did not have relevant knowledge
- The same people were involved in many projects, as they were the most engaged people in the organization
- Improvement activities demanded too many resources and did not have a clear direction.

These difficulties imply that organizations prioritizing flow efficiency would benefit from having a structured way of operating suggestions including several departments (Bessant, et al., 1994). As cross-functional improvement teams are set to solve particular problems (Sörqvist, 2013), they are not well suited for this permanent structure. One way to create such structure, without having a permanent cross-functional improvement team, is to have an additional improvement forum. In order for the forum to attend to the earlier mentioned difficulties, the structure should stimulate communication between departments (Hyland, et al., 2000), include people that are a part of the process being improved (Ward, 1994), help the organization involve people with relevant knowledge in improvement activities (Delbridge & Barton, 2002), and secure that improvement activities have a clear direction (Bessant, et al., 1994).

Thus, these improvement forums should not have a functional structure (Ward, 1994) with many levels (Anand, et al., 2009), but should rather be formed around the flows being improved (Ward, 1994). These decision-making forums should therefore consist of managers and executives in the process being improved, as they have relevant knowledge and together have necessary end-to-end overview of the processes (Petersson, et al., 2012). Therefore, the improvement forums can look like improvement forum level 2, illustrated in *figure 13*. By introducing an improvement forum such as improvement forum level 2, including managers from improvement forums at level 1 and executives and improvement managers in the flow being improved, organizations can overcome the earlier mentioned difficulties.

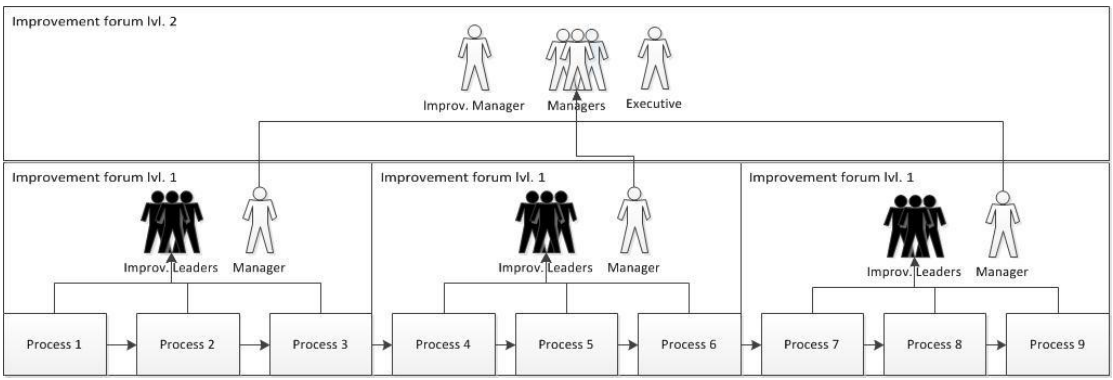

Figure 13. Improvement forum 2; meetings including improvement managers, managers, and executives that are a part of the flow being improved

Inter-Organizational Improvements

Improvement projects that involve/affect other organizations but improvement activities have not been synced with those organizations. The Lean manager at PIM RBS Kista stated:

"Our work with improvements is not synced with other organizations, we do not know what information they want and need."

"Our set-up for continuous improvements does not fit with other organizations' forums."

To ease inter-organizational improvements, it is important to have the same principles and methodologies for CI (Sörqvist, 2013). PIM RBS Kista has chosen to work with Lean and Six Sigma to improve their processes. Therefore, if organizations interact with PIM RBS Kista uses the same tools and methodologies; they could easier break down existing barriers.

During observations at improvement meetings and projects one main difficulty regarding interaction with other organization were noticed. Other organizations that were a part of the process being improved did not listen to/accept improvements suggested by PIM RBS Kista. This implies that organizations that prioritize flow efficiency need to have routines that link them with other organizations that are a part of their flow; otherwise it is problematic to increase flow efficiency (Modig & Åhlström, 2012; Ward, 1994). Since the main purpose of this thesis was to study the functional level in organization, such routines will be left to other researcher to examine.

5.2 METHODOLOGIES & TOOLS

In PIM RBS Kista, different tools and methodologies were used to drive improvements in different departments and levels but there was no standardized way of working with improvements. During observations at cross-functional and local improvement meetings the absence of a standard method to drive improvements across department was noticed as something difficult. For example, in an improvement meeting at the department SPM Filter, one improvement team member stated:

"Other departments do not listen to our suggestions and it is hard to communicate suggestions to them."
- Improvement team member, SPM Filter

This was also underlined in an interview with a manager in the Operations department:

"It is hard for our improvement team to communicate with other teams as they do not work in the same way as we do with improvements."
- Manager, First Line Support

The lean coordinator at PIM RBS Kista had similar thoughts, in an interview she stated:

"Collaboration between units in the organization would benefit from using the same methodologies and tools."
– Lean Coordinator

Also, structured organizational learning requires process improvement activities to follow some standard steps (Forrester, 2000; Spear & Bowen, 1999). Also, standardized method for driving improvements endorses common understanding of the basis on which improvements are made, and the knowledge created when implementing the improvement is not limited to individuals or improvement-teams as it can be exploited organizational-wide (Anand, et al., 2009). One can argue that a standardized method for CI is extra important for organizations prioritizing flow efficiency, as CI will be driven in processes, which often reaches over departments (Sörqvist, 2013).

3.2.5 INTEGRATING DIFFERENT METHODOLOGIES INTO A STANDARD

If organizations decide to work with different process improvement methodologies they need to be integrated and widely used (Drohomeretski, et al., 2014; Salah, et al., 2010). As Lean, Six Sigma, and Agile management were implemented at PIM RBS Kista, these methodologies needed to be combined in a standard method for driving improvements (Anand, et al., 2009). Lean Six Sigma (LSS) with the DMAIC method has a unique ability to link Lean and Six Sigma improvement tools and make them suite an overall approach (Snee, 2004). Also, Morris (2012) argues that Agile and LSS DMAIC have similar objectives, to continuously improve processes. Agile focuses on improving software development processes whilst LSS DMAIC has a broader purpose – to improve manufacturing and business processes. By integrating Agile methods and tools into the LSS DMAIC approach, it will allow improvement teams to increase morale, quality and productivity whilst they function more efficiently. Hence, in organizations like PIM RBS Kista, where different departments used different methodologies and tools from Lean, Six Sigma, and Agile, they can benefit from using an LSS DMAIC methodology as a broad and standardized method for driving improvements.

LSS DMAIC Methodology as a Cyclic Process

PIM RBS Kista used different methodologies when carrying out improvements. Many methods/tools used in the organization (see chapter 4) did not have a process/cyclic

view of improvements, as it only provided a planning phase and then an execution phase. For example, at 3-3-6 meetings in different departments, it was common that improvements were not followed up, and it was therefore hard to decide whether changes were improvement or not (Deming, 1986). This was articulated by one of the interviewed quality engineers:

In interviews at Scania on the other hand, both with the production leader and SPS-coordinator, the importance of seeing and treating improvements as a cycle was stressed. The importance of driving improvements as a cycle has also been underlined by many scholars (Makoto & Jun, 2013; Bessant, et al., 1994; Deming, 1986). With a process/cyclic view of CI, organizations can make the improvement circle smaller and smaller, like a spiral, until they reach a desired state of an improvement (Sokovic, et al., 2010).

Even though some local improvement teams had implemented the DMAIC process through the DMAIC improvement boards, the cyclic view was not fully adopted and the different phases in the DMAIC process were not utilized. Hereunder, an example will be given of how an improvement activity followed the DMAIC processes on a DMAIC improvement board and how it skipped going through different steps in the DMAIC process. After that, an imaginary example will be presented; where the analyze phase will be utilized more strictly and an imaginary solution to the problem will be presented. The purpose with this example is to show the difference between an improvement process that do not go into depth in the analyze phase and an improvement process that does, and thus showing the importance of following a process when improving (Bessant, et al., 1994).

Example: First line support found a problem with a broken cart that was used to bring material to the production line. It broke due to overload, a problem that had occurred before. The improvement team used a DMAIC board to drive improvements, hence they wrote down the problem on a scrap of paper (see description and design of DMAIC-boards in chapter 4.3 and *figure 7*). In this case, as in most cases at local improvement teams at PIM RBS Kista, the solution to the problems was written down immediately on the scrap of paper. This was done without discussing the problem with the team before coming up with a solution. See process in *table 5*.

Table 5. Example of how a solution was found to a problem without analyzing the problem

Problem	**Solution**
Broken cart	Set signs for maximum loading weight

When deciding on a solution immediately, the improvement team missed the important process/cyclic view of improvements (Deming, 1986) and they could not be sure that the root cause of the problem was found:

"We only make temporary solution and therefore problems reoccur."
- Quality Engineer, First line support

Finding root causes of problems is argued to be important for successful CI (Brook, 2006; Liker, 2004). Instead of finding the problem at once, improvement teams that use an LSS DMAIC approach can find the root cause of the problem with, for example the Lean tool '5 whys' (Liker, 2004). Also, the team should not be satisfied until they have controlled that the change was a sustainable improvement and thus not risk that the same problem would appear again (Deming, 1986). Imagine if the local improvement team instead of writing down the solution immediately, used the 5 whys tool on this specific problem. The process of finding a solution with the 5 whys methodology could then look like the example in *table 6*.

Table 6. Imaginary example of how a solution can be found to a problem when analyzing the problem using 5 whys

Problem	**Solution**
Broken cart	Fix the cart
Why? One of the wheels broke	Buy new wheel
Why? Overload	Set signs of maximum load on carts
Why? The carts are filled with too much material	Material handling provides the production line with much material
Why? Wrong way of working with material handling	Change the process of material handling
Why? Wrong policy amongst process engineers	Change production process policy amongst process engineers

Just to be clear, this is an imaginary solution and not empirical data. Hence, it illustrates how it could look like when a root of a problem is examined further.

Proper Training in Methodologies and Tools

Similar to the example above, observations at different improvement meetings have shown that most of the improvements carried out at PIM RBS were not seen as cycles.

Also, the root cause of problems was often not examined. Even teams that used the DMAIC board did not treat improvements as cycles; it was evident that such teams did not know what approach they should have towards the DMAIC structure. This implies that the knowledge about how to carry out improvements needs to be increased (Drohomeretski, et al., 2014; Dibia & Onuh, 2012). Further, the DMAIC structure should be used with a dynamic approach, i.e. followed more in detail for complex problem solving and less strictly for simple problem solving (Snabe, et al., 2009; Brook, 2006).

When comparing improvement teams using DMAIC-boards at PIM RBS Kista it showed that the team that had a person with Six Sigma education (yellow belt) had a more structure and effective problem solving approach. Antony (2011) concludes in a study with Lean and Six Sigma professionals and academics that more training and investment is required to implement Six Sigma than to implement Lean. Thus, if a standardized LSS DMAIC structure is used for problem solving in organizations prioritizing flow efficiency training in this structure, especially in the DMAIC methodology, is important.

5.2.1 IDENTIFICATION OF IMPROVEMENT OPPORTUNITIES

At PIM RBS Kista, different things triggered improvement activities but there was no structured way to find improvement opportunities. CI should be a part of individuals' daily work - with standardized methodologies and tools for improving processes (Sörqvist, 2013) and identifying problems (Liker, 2004). In the existing forums for improvement suggestions, CI-team members come with suggestions they believe will improve their/others working tasks. A team member in an improvement team stated:

"The main reason for improvement, in my case, is when I see something that needs to be changed."
–Improvement team member, First Line Support

Similarly, another team member in another improvement team stated that the main reason for improvements in his group was:

"Simply if you want to change something."
– Improvement team member, Filter production

This type of improvements is also encouraged by managers, where it has been articulated that the amount of suggestions is the most important, even though some are just brought up to bring up the number of suggestions. During observations team members have stated things like:

"If we come up with some suggestion then we will have more suggestions than group X."
- Improvement team member, Material Handling

"Someone put in another suggestion, so we will have X many suggestions per person."
- Improvement team member, First Line Support

Of course, this might be a good way to initially create a culture for CI (Detert, et al., 2000), and as one of the managers stated:

"If you bring up the numbers, you will find a golden egg hidden somewhere."
- Manager, SMA Production

Still, it is important to recognize that this kind of CI, which is based on good ideas, is very different from CI driven by deviations. Sure, a lot of good can come from it, but it's a big risk that this kind of approach only leads to changes, not improvements of the organization (Petersson, et al., 2012). In order for CI to spring from deviations, organizations need to have a standard state (Liker, 2004).

A Standard State for CI

Although CI is not carried out from a standard state at PIM RBS Kista, they are aware of the importance of setting a standard state for their processes. In the Lean roadmap presented in chapter 4, PIM RBS have planned activities for 2014 that include process definition, elimination of waste, and process update. This is something that Womack & Jones (2003) stress as important since the creation of a standard state and thus making teams work in the same way, allows for organizations to measure and continuously improve processes.

In Scania's SPS (Scania Production System) house, a standard state and standardized working tasks builds a foundation for CI, see *figure 14*.

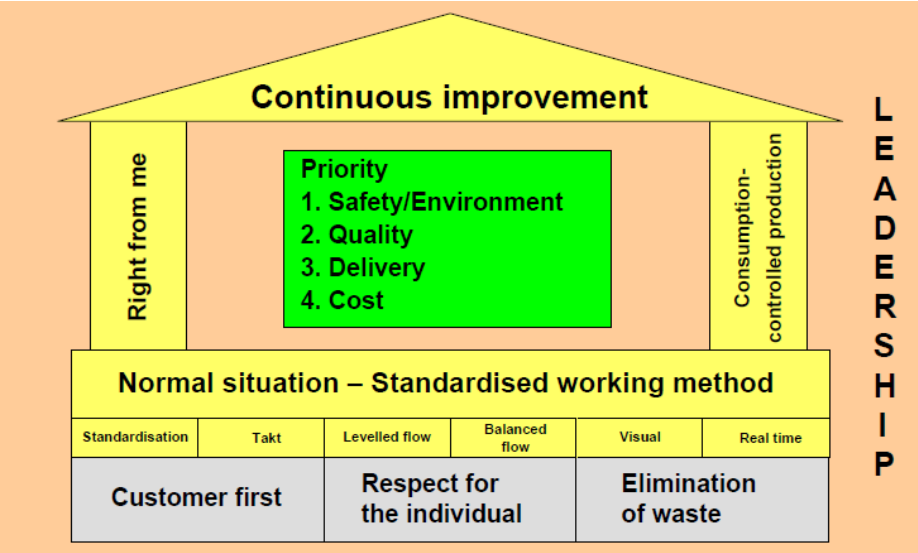

Figure 14. SPS (Scania Production System) house

Also, in an interview with an SPS-coordinator at Scania she stated that:

"Identifying a standard state is the first step when driving improvements."

However, since there was no explicit standard state at PIM RBS Kista at the time this investigation took place; three main issues were identified related to absence of a standard state. Firstly, improvement teams could not measure if changes were improvements (Snabe, et al., 2009). Secondly, it was hard for team members to feel empowerment and ownership for process (Hyland, et al., 2000). Thirdly, it was hard to detect deviation (Petersson, et al., 2012). When creating a standard state (normal situation) and starting with CI, organizations need to identify activities that add value (Womack, et al., 1990). Process mapping enables such identification and can therefore be used to eliminate non-value adding activities, reduce complexity of processes, and increase customer focus in processes (Soliman, 1998). One tool that can be used for this purpose is value steam mapping (VSM) (Snabe, et al., 2009). Moreover, standardizing working tasks, whether it is administrative work or production, lays the ground for CI (Liker, 2004). When a standard state has been set, it is easier to find improvement opportunities, both in form of deviations and waste (Petersson, et al., 2012). If organizations use the LSS DMAIC methodology for more complex improvement projects, process mapping is integrated in the DMAIC process, both in the Define and Analyze phase (Snabe, et al., 2009). In the Define phase it is briefly describing the process to easier define the problem and plan the project and in the Analyze phase more advanced process mapping is used, with tools such as VSM (Brook, 2006).

Visualizing Improvement Opportunities

At Scania Chassis, deviations are seen as the main source for improvements and focus is put on detecting deviations and visualizing them. For example, Scania Chassis had visualization boards on which deviations were written down immediately when they occurred. Also, in a company document it was stated:

"Deviations will always be there but we need to identify them and react on them."

From interviews with members in local improvement teams at PIM RBS Kista, that used DMAIC-boards conclusions can be drawn that the visualization of the improvement creates ownership of the improvement and forces people to react on the identified problems. Local improvement team members stated:

"Visualizing the improvement puts pressure on the person responsible for the suggestion."
– Local improvement team member, First Line Support

"By visualizing improvement suggestions, they do not fall between the chairs."
– Local improvement team member, Filter production

"When problems are visualized it creates ownership and changes are made."
– Local improvement team member, First Line Support

At ESS Katrineholm, a similar approach as the DMAIC improvement board meetings used at PIM RBS Kista; where improvement teams stand in front of a board and try to come up with suggestions for improvements. This approach was not successfully implemented in ESS Katrineholm as individuals felt that it was not a part of their job and now they have an approach where they try to make improvements a part of their daily job. In an interview with the leader for one improvement team in Katrineholm, he stated:

"Now we have a tool for identifying improvement opportunities that we can integrate in our daily work. We write down a deviation in a document as soon as we identify it. This works much better than the old way of working."
- Project Manager, Local Master Data Management

At PIM RBS Kista, one improvement team which had introduced an excel-file where improvement opportunities were written down as they appear, an improvement team member stated:

"It is really beneficial to type down improvement opportunities immediately in the excel file, it is then visualized and during weekly meetings one member is assigned the responsibility to solve the problem."
- Improvement team member, Logistics

These findings strengthened by Hyland et. al (2000) who, in a study that compared the success of CI in Australian firms, concluded that problem identification tools/checklists showed to be the most important tool for CI, supporting our findings that visualization of deviations is vital for CI.

However, one cannot neglect that these improvement opportunities must float to the surface before they can be identified. As Liker (2004) concluded; organizations should minimize their batch sizes as much as possible - nothing should be produced until the "next-in-line" customer asks for it. This makes deviations float to the surface and visualizes them, forcing people included in the deviation to solve it.

5.3 LEADERSHIP & MANAGEMENT COMMITMENT

Many of the interviewees have expressed the importance of leadership in CI.

"Leadership among managers is of course very important, because if the managers do not believe CI to be important, the concept will not be used in the managers' surroundings."
– Lean Coordinator

"Leadership in CI is of course extremely important."
– Operator, Production

"It is extremely important. Leadership shows that this is what we do now, which is hard to get from below."
- Manager, First line support

"Without leadership, continuous improvement efforts will not succeed."
-Lean Office, Katrineholm

"Leaders are one of the most important factors in continuous improvement efforts."
- Manager, Scania

Leaders do not have to be a formal manager, but could be anything from executives to informal leaders (Marksberry & Hughes, 2011; Petersson, et al., 2012). Therefore, the roles of managers and executives as well as the leadership style in general will be analyzed.

5.3.1 THE ROLE OF EXECUTIVE

As it is evident that CI cannot be ingrained in an organization, and thus cannot be fully effective, unless the importance of it is stressed by executives (Oprime, et al., 2012), it is important that executives expresses the need for CI and flow efficiency, so that the seed gets planted deep enough (Marksberry & Hughes, 2011; Savolainen, 1999). PIM RBS Kista has tried to communicate the importance of CI and flow efficiency. For example, higher executives talked about this importance during the first quarter meeting of 2014. At this meeting examples of successful improvement projects were presented, which shows progress in CI (Bessant, et al., 1994) and thus enhance motivation (Liker, 2004). Still, even though this is a good example, the importance has to be emphasized by executives on a regular basis (Marksberry & Hughes, 2011). The following statement from an interview with an operator shows that the seed has not been planted deep enough at PIM RBS Kista.

"Many people do not think about CI, we are not pushed to do so. I know that it is a priority but it is not something that you hear too often."
- Operator, Filter production

Indeed, there are improvements to be made simply by employing some tools and practices, but without an executive leading by example and motivating managers and employees to higher standards of performance and efficiency, any enhancements that happen will not stand the test of time (Bodek, 2008).

3.2.6 THE ROLE OF THE MANAGER

Understanding the vital role of the executive, we will now zoom in, and analyze two kinds of managers connected to CI within the case organization; namely improvement managers and managers closest to the group.

Improvement Managers

Today, there are a total of seven appointed 'Improvement Managers' (IMs) in PIM RBS Kista, each responsible for one functional area. It is evident from the interviews that the IMs have somewhat different perception in what they, as an IM should do, as well as how their department works with CI. When asked (1) what their role includes and (2) how their department currently works with CI, responses differed. It is therefore relevant to reflect over the fact that one reason for the lagging of an organized work setting in some parts of the organization might be due to that some IMs have not understood, or taken responsibility for their part in the operation of CI. The reason for this is not

necessary ignorance in this case, but could rather be an effect of resent downsizings, meaning that some of the managers are new in their positions.

"We have only worked with the new ways of working for half a year, due to that much focus has been put on the downsizings during 2012/2013."
- Improvement Manager, Special Products

"I am quite new in this role; I have only been doing this for two months. So I am still trying to find my place in the organization."
- Improvement Manager, SPM Digital

Still, what are important to conclude from the IMs' statements, are the factors that is somewhat similar to what Andrew (1996) observed as the leadership side of operating CI. He states that leadership is about (1) creating awareness and understanding…

"I am supposed to act as a project manager, i.e. lead activities. As much as I am supposed to create awareness and act as a catalyst to make things happen, I am supposed to be a facilitator. Sometimes I should act as a coach, sometimes to assist with my network of resources."
- Improvement Manager, Operations

…(2) providing hope through a vision, aligning people through direction and engagement…

"My main responsibility is to make sure we execute our strategy, and aim for our wanted position, so that we will get there by 2016.
- Improvement Manager, SPM Digital

"Right now different parts of special products work differently, and it has become my job to get all parts to work in the same way. It is about making special products a unit, not a jumble.
- Improvement Manager, Special Products

…and (3) communicating in a way that stimulates progress and enhances people's capabilities through freedom and self-direction…

" It can be everything from creating structures and frames for how CI should be operated, till driving projects myself. I should work as a mechanism for the department, so that everyone can pursue improvements and support them in their improvements."
- Improvement Manager, Engineering

Even more important, if successful CI is truly desired, IMs should not just know these things, but act upon them and hence lead by example (Liker, 2004). Further expanding on the leadership perspective, Hyland et al. (2000) stated that the management perspective of the issue is not to be neglected. The management perspective should go beyond simply communicating. It is also about planning an effective change process, organizing and directing the effort, monitor progress against a plan, and ensuring that the desired results occur. To be able to lead by example and fulfill the management perspective superior knowledge in the improvement methodologies used is essential. However, according to PIM RBS Kista company documents, only one of the seven appointed IMs had higher education in Six Sigma.

While we can see that some IMs have started the process of establishing organized CI; groups within e.g. Operations have adopted CI differently, as can be seen in the chapter 4.3.3. We argue that this might be due to two different reasons. The first one is based on the argument that executives needs to plant the seed of flow efficiency and CI deep enough (Marksberry & Hughes, 2011). Implying that if the seed has not been planted deep enough the IM might have too little authority, meaning that the management part discussed earlier does not provide enough power. The second aspect worth reflecting over is the role of the managers closest to the improvement teams, which is analyzed further hereunder.

Managers Closest to the Improvement Team

It is evident from observations during improvement meetings that the group with the most organized and functioning CI, in terms of participation and amount of suggestions, is the one with the most involved manager closest to the group. In contrast, in some of the groups that have not adopted the idea of organized CI, our interpretation from interviews is that some managers do not believe in the way they are supposed to work, or the methodologies they are supposed to use, e.g.

"Basically it is forced upon to work with improvement boards, just because it is a concept that exists. Therefore, it feels obtrude."
- Manager, Material Handling

"It is an engineer's way of working, not an innovator's."
- Manager, SMA Production

This strengthens Savolainen's (1999) evidence of that if advocates do not exist or support cannot be found on the superior level that is closest to the group in question, the

CI efforts tend to be abandoned. Indeed, management participation and support through all levels is required for successful CI (Fryer, et al., 2007).

It is evident from informal conversations and interviews that not all managers at PIM RBS Kista seemed to know what the goals of the CI efforts are. This is something Kaye & Anderson (1999) stress as important. Managers should be fully aware of the long term strategies, and have appropriate measurable objectives for themselves and their teams. As PIM RBS Kista's Lean coordinator and one of the managers puts it:

> *"A strategy is unnecessary to have, if we did not work towards it. The strategy should tell us what direction we should take. If we do not have any direction or knowledge of where we are going, it is like asking: when are we there – well it depends on where we are heading."*
> - Lean Coordinator

> *"By linking the suggestions towards the strategy, you get a straighter road to the goal.*
> - Manager, SMA Production

However, just knowing these strategies is not enough; leaders also need to motivate teams and individuals within a business to adopt them (Sörqvist, 2013), together with the organizations principles and values (Marksberry & Hughes, 2011). The need for the latter can be exemplified by the following statements from an interview with one of the operators in Filter Production:

> *"You have to sit down with people that you know are experienced and possess knowledge, and ask them why they do not provide any suggestions for improvements. You know that they have worked here long enough to know things that need to be improved. In other words it does not come naturally for everyone."*

> *"One can see, black on white, that there are things to be improved, but many employees do not believe in the concept. People do not bother to be engaged."*

It is therefore a vital task for the managers, not only closest to the group – but on all levels (Fryer, et al., 2007), to create an improvement culture in the organization where as many as possible, hopefully all, continuously question how the organization works and how it can be improved (Liker, 2004). To create such culture Petersson et al. (2012) stress that organizations need to remove the managerial behavior where leaders momentarily cancel agreed time for improvement activities, due to that the organization is currently feeling high workload. Something we have experienced happen in PIM RBS Kista, as well as been told happen in ESS Katrineholm:

"We skip CI activities when the organization is feeling high workload, which is more often than seldom."
– Dimensioning & Planning, Katrineholm

"The workload has to be in equilibrium for people to dedicate time to CI efforts."
– Operational Excellence, Katrineholm

It is important not to ignore the power of routines when it comes to CI, since this is what sets the culture (Bessant & Francis, 1999).

To get the above analyzed aspects across, the leadership style is essential for success (Bodek, 2008; Liker, 2004; Kaye & Anderson, 1999; Womack, et al., 1990).

5.3.2 LEADERSHIP STYLE

PIM RBS Kista's Lean program manager (LPM) states that a manager's leadership style should:

(1) *"first and foremost act as an example, and be a part of an improvement team.";*

(2) *"know how we work with CI, and know the governance for it";*

(3) *"be helpful, push for CI and encourage employees";*

(4) *"request improvements, and check how the team is doing. By doing this, the managers show that it is ok to put time and effort into this; and*

(5) *"initiate improvements."*

To fulfill many of these attributes, it is important to have a blame-free approach (Angelis, et al., 2011; Jabnoun, 2001; Bessant & Caffyn, 1997), something interviewees further strengthen.

"Often the employees have good suggestions, but sometimes I can see that it is not going to work. But it is important to let them see that for themselves, and that leaders do not blame them."
- Manager, Scania

"Maybe the employee come up with a degradation, but it is important be positive, so that employees feel that it is safe to come up with suggestions. The organization benefits from this, since the employees will think differently the next time."
- Manager, Scania

"There are good and bad suggestion, but one should probably not call them bad, since this could make people unsecure when posting suggestions.
- Quality Engineer, Operations

Both the LPM's statement and the latter statements can be exemplified by the leadership style of the manager of the 'most successful group' (as mentioned earlier). He is not in charge of the improvement meetings in that sense, but he is participating and showing the employees that he cares, and are encouraging them. He concludes that:

"It is important that I show up at the meetings and express the importance for CI and show my encouragement for it. I believe it to be necessary that I, as a manager, provide positive feedback on the fact that the employees put up suggestions."
- Manager, First Line Support

Kaye & Anderson (1999) further stress on the coaching aspect of this, as one of the best practices identified in their study. Here, successful leaders do not tell what other people should do nor how to do it; instead individuals should identify and solve problems themselves (Sörqvist, 2013).

"The goal is of course that the group should be self-sufficient, I am just coaching and helping them to succeed."
Manager, First Line Support

To be able to have such coaching approach, the leader needs to have good knowledge in both how the organization operates (Petersson, et al., 2012), as well as regarding how flow efficiency is created (Modig & Åhlström, 2012). This is something that the production leader in Scania Chassis also highlighted in an interview.

"If you have an organization that do not understand flow efficiency, focus will be put on results rather than methods"

At PIM RBS Kista, the IM of project office pointed out that generally too much focus was put on results rather than ways of working. Something he experienced as a difficulty. Therefore, Petersson et al (2012) conclude that a successful leader thus should focus his/her leadership towards questions related to the ways of working, rather than the actual results. This does not necessarily mean that the results are not important; it is just another view on how good results are created.

Level of Participation

According to the production leader at Scania Chassis, managers used the kind of leadership explained above. However, they did not participate in any improvement teams as earlier requested by PIM RBS Kista's LPM:

"First and foremost act as an example, and be a part of an improvement team."

…rather the managers encouraged and made sure employees got seen.

"The trick is to have some sort of thought behind the improvements, and then let the group do the work themselves. Managers just check on how the groups are doing."
- Production Leader, Scania Chassis

However, in the case organization, which can be seen as less mature in terms of CI (Bessant, et al., 2001), we asked one of the operators in Filter Production if there was a difference if managers were there, and he answered:

"Yes there is a difference. The meetings are more serious, less talk about irrelevant things, only improvements. Otherwise it has a tendency to become unserious. It does not have to be a manager; usually it is enough with a team leader."

Hence, in such cases, the participation part of PIM RBS Kista's LPM view of what managers should do, in the beginning of this section, is important. However, as the statement from the operator implies, the permanent participation is not necessary the role of the manager, but the one of any leader. Further, it is important to understand that usually it is the employees that have the best knowledge about their process and how it actually works (Imai, 1986). Therefore, as discussed before, the participation part should not be in the sense that the leaders solve the problems; rather they should teach and coach the employees. This creates a sustainable source of incremental innovation (Petersson, et al., 2012).

By having leaders that participate, in terms of coaching, it sends out signals to the employees that it is ok to put time and effort into CI (Imai, 1986); as also is evident from observations and interviews at PIM RBS Kista.

"By having leaders that see what we do as a group, as well as encouraging us to participate in CI meetings, I know it is ok to put time and effort in CI."
- Quality Engineer, Operations

"When managers are encouraging the group, people know it is ok to spend time on improvements."
- Operator, Production

Empowerment of Employees

The manager of the earlier mention 'most successful group' tried to involve his group in designing their improvement board, which can develop pride and ownership in the employees' work (Suzaki, 1987). However, it is not necessarily the designing part that is the key here, but the feeling of empowerment (Petersson, et al., 2012). By inviting employees to participate and hence increase their opportunity to affect, one can create commitment (Bessant & Caffyn, 1997). This engagement might provide both well-being and lead to sustained improvements (Petersson, et al., 2012). However, just to be clear, in the designing of the methodologies and tools, it is important to understand that it is the role of managers to determine which ones are most appropriate to use, not the employees (Marksberry & Hughes, 2011), since manager often have superior knowledge in the methodologies used (Petersson, et al., 2012). Still, one have to bear in mind that to achieve the goals, companies must select the tools and methodologies that suit the people within the organization (Hyland, et al., 2000). That is managers select tools that employees can use and understand, so that individuals are fully aware of how they are helping to improve the overall performance of the organization. Therefore, involving improvement team members when designing improvement boards, might be a good way to create empowerment, however, as mentioned in the 'Methodology & Tools' discussion it is important that the employees involvement do not include too customizeddesign, as a standard and clear structure is important for driving improvements in CI (Petersson, et al., 2012). By not involving members at all, the methods can be perceived as forced upon, as one of the managers pointed out:

"I have been feeling pressure from my unit, regarding that it feels like a forced upon way of working. Of course it should not be like that, the improvement boards do not hinder innovation, but crassly it feels like that. If you implement a regimented methodology in a group of reflecting people, you will encounter some resistance."
- Manager, Material Handling

If successful CI is truly desired, managers need to be committed, willing, and able to break down the barriers of change (Mccreary & Preston, 2010). Also, resistance against improvements methods might be due to lack of understanding. This could be due to that the leader has not explained the methods well enough (Petersson, et al., 2012).

5.4 REFLECTION ON ANALYSIS

What is important to mention is that the above proposals reflect what are believed to be characteristics of successful CI. However, their interconnection should be highlighted; it is not sufficient to enable some of the suggestions. For example, to provide a refined toolset and facilitation without clear strategic direction or in an un-supporting organizational infrastructure is likely to result in limited success and long-term abandonment of the efforts. CI surely offers considerable temptations in terms of its low cost, the easy absorption of solutions identified, and the unlocking of neglected potential within the organization. But its successful exploitation requires careful management across a broad front; it should not be a fashion idea but one which becomes a key feature of the organization in the long term. This calls for attention to each of the above elements.

5.4.1 PROPOSED SET-UP FOR OPERATING CONTINUOUS IMPROVEMENT EFFORTS

By analyzing the three areas of critical factors for CI, and hence identifying difficulties and facilitators to successful CI in the case organization and in the complementary interviews at Scania Chassis and ESS Katrineholm, we can fulfill the thesis objective by suggesting a set-up for CI in an organization prioritizing flow efficiency.

In organizations prioritizing flow efficiency, improvement teams and forums should be formed around processes and flows. In accordance to earlier research, which argues that CI needs to be driven in different levels (Imai, 1986; Sörqvist, 2013), three main forums for prioritizing, making decisions, and driving improvements are suggested. First, as individual improvements often are sub-optimal but should lay the ground for successful CI (Imai, 1986), and the persons working with the task being improved is best suited for improving it (Liker, 2004), local improvement teams lay the ground for CI. For organizations prioritizing flow efficiency, such teams should be formed around processes, illustrated in *figure 15*. The roles and their responsibilities are explained further down.

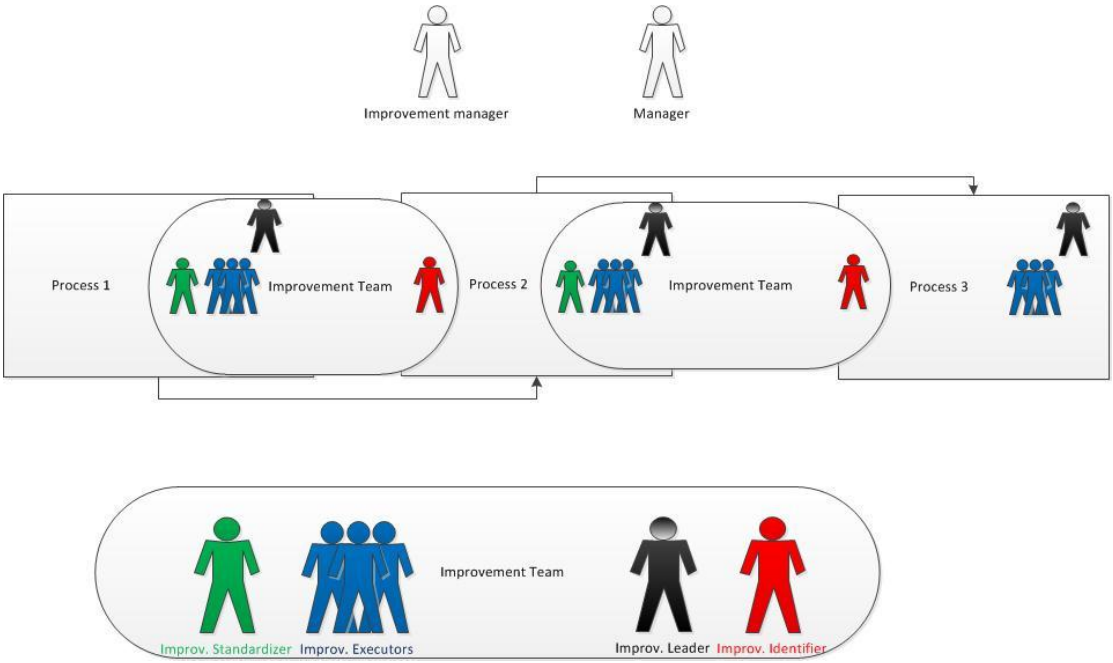

Figure 15. Local improvement teams for organizations prioritizing flow efficiency

To make the important linkage between these processes, managers and improvement leaders provides an end-to-end perspective by having routines/forums where they discuss improvements made in different processes in the flow. We call them improvement forum 1 and 2, illustrated in *figure 16*. However, since problems should be solved by employees performing the task being improved (Liker, 2004), it is important to understand that these two forums are not set to solve problems. Their purpose is rather to provide the improvement teams with strategic awareness, link sub-processes, and to prioritize and decide upon bigger improvement activities that demands resources from several departments.

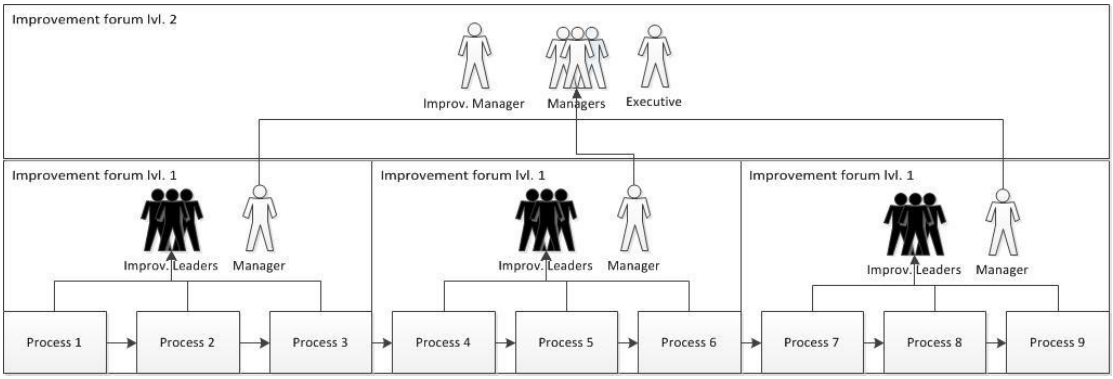

Figure 16. Improvement forums level 1 and 2. Consisting of improvement leaders, managers, improvement managers, and executives

Roles and responsibilities in the forums and in the local improvement teams are further explained below. These roles are adapted to CI in organizations prioritizing flow efficiency:

- **Executive**: have the authority to make decision regarding improvements suggested in the flow. Executive should lead by example and motivate managers and employees to higher standards of performance and efficiency. Further, it is important that higher executives express the need for CI and flow efficiency, so that the seed gets planted deep enough.
- **Manager:** not a part of local improvement teams but needs to show interest and visit improvement meetings, with a coaching approach. Indeed management participation and support through all levels is required for successful CI. Managers should create an improvement culture in the organization where as many as possible, hopefully all, continuously questioning how the organization works and how it can be improved. Managers have a permanent role in both of the forums suggested.
- **Improvement manager:** well-trained problem solving specialist that supports changes in the organization and thus the teams. If the LSS DMAIC approach is used, improvement managers should have a high knowledge of this method. They should create awareness and understanding, provide hope through a vision, align people through direction and enragement, and communicate in a way that stimulates progress and enhances people's capabilities through freedom and self-direction. There is also a management perspective of the issue that should go beyond simply communicating. It is about planning an effective change process, organizing and directing the effort, monitor progress against a plan, and ensuring that the desired results occur. The only permanent role the improvement manager has is in improvement forum 2, but supports local improvement teams and forum level 1.
- **Improvement leader:** are a part of the improvement team and works in the process that the team is formed around and is responsible for controlling that the team follows CI routines as well as leading during these routines. A successful leader should focus his/her leadership towards questions related to the ways of working, rather than the actual results. He is also responsible for bringing up improvement suggestion affecting other processes in improvement forum 1.
- **Improvement identifier;** works in the next-in-line process and gives suggestions on improvement opportunities.

- **Improvement executer;** the rest of the individuals that work in the process being improved and are responsible for identifying, prioritizing and executing improvement suggestions.
- **Improvement standardizer:** Have the knowledge and authority to make changes in the process the local improvement team works in. (Permanent)

In order for these teams and forums to make changes that improve the organization, they need to have a structured way to identify and react on deviations, especially the local improvement teams. The deviations should be visualized from a standard state, and the identification of improvements should be a part of daily work (Liker, 2004). Moreover, when improvement possibilities have been identified organizations should have a structured and standardized method to handle these improvements, and it is important that this structure includes a process/cycle. This analysis shows that a LSS (Lean Six Sigma) DMAIC (Define-Measure-Analyze-Improve-Control) structure is particularly suitable for organizations prioritizing flow efficiency.

To ease communication between local improvement teams and improvement forum 1 and 2, we suggest that the same methodology should be used organizational wide. Depending on the degree of complexity of the improvement activity, the LSS DMAIC structure should be used with different accuracy; for more complex problem solving it should be used with a structured approach and for less complex problem solving a leaner approach (Snabe, et al., 2009; Brook, 2006). To be able to have a dynamic view, organizations need to increase the knowledge about the chosen improvement tools/methodologies.

6. CONCLUSION

In this chapter the thesis is summarized, and empirical – as well as theoretical contributions are discussed and justified for. The limitations and suggestions for future research are also discussed.

In general, many companies are well aware of the importance of continuous improvement (CI), but find it difficult to operate successfully. Therefore, the objective of this thesis has been to provide a set-up for the operation of CI efforts in organizations prioritizing flow efficiency. This set-up has been created by an elaboration on by literature identified critical factors for successful CI, as requested by scholars. The areas of critical factors elaborated on were Operative Infrastructure, Methodologies & Tools, and Leadership & Management Commitment. Not only has this thesis contributed to a deeper conceptual knowledge of critical factors for successful CI, it has also contributed to useful and usable theories that help organizations make proper decisions when operating CI.

To provide a set-up we have investigated how organizations prioritizing flow efficiency operate CI efforts:

RQ: How do organizations prioritizing flow efficiency operate continuous improvement efforts?

This question was answered trough a case study of PIM (Product Introduction and Maintenance) RBS (Radio Base Station) Kista Ericsson together with two complementary interview studies at Scania and ESS Katrineholm (Ericsson). Elaborating on how organizations actually work within the chosen areas of critical factors, allowed us to answer the sub-questions:

Sub-question i. *What difficulties are faced in the operation of continuous improvement efforts? How do organizations overcome such difficulties?*

Sub-question ii. *What facilitates the operation of successful continuous improvement efforts?*

6.1 EMPIRICAL CONTRIBUTION

Many companies are well aware of the emphasized importance of CI, but find it difficult to operate successfully. This thesis has grouped critical factors for CI efforts, important for organizations prioritizing flow efficiency, into three main areas. By elaboration on these areas of critical factors at the case organization, together with the complementary interview studies, this paper provides recommendations for practitioners prioritizing flow efficiency, that want to operate CI in their organizations.

This research has shown that organizations prioritizing flow efficiency should form their improvement efforts around processes. Three different levels of CI have been suggested, each formed around the process and sub-processes being improved. The lowest level (local improvement teams) builds the foundation for CI, as it represents people performing the tasks being improved. The other two levels include forums with the purpose to involve management, link sub-processes, prioritize improvements, and make decisions regarding bigger improvements. Roles and responsibilities have also been identified in mentioned process-oriented forums. To maintain involvement for CI, it is suggested that each level should decide their own goals and priorities by involving executives, managers and workers.

It is essential that the operation of CI efforts have an integrated and standard methodology for driving CI, as it eases cross-functional interactions and communication. It is important that this integrated methodology is seen as a process/cycle and can be used in a dynamic way, demanding rather high knowledge and thus training amongst workers. Consequently, this implies that practitioners need to put significant effort in training employees in a standardized and organization-wide improvement methodology. Further, this paper shows that identification and visualization of improvements that spring from a standard state are extra important for organizations prioritizing flow efficiency. Therefore, practitioners should make identification of deviations a part of workers daily tasks, making it easy to visualize deviations and thus improvement opportunities.

To increase involvement and understanding for CI, leaders and managers play an important role. We suggest that leaders and managers should have a different role than in traditional Western companies. Instead of having a steering role, they should have a coaching approach and show interest in the team, to make them succeed. Indeed, if advocates do not exist or support cannot be found on the superior level that is closest to the local improvement team in question, the CI efforts tend to be abandoned. Hence, managers also need to create an improvement culture in the organization where as many as possible, hopefully all, continuously questioning how the organization works and how it can be improved. Consequently, in the suggested set-up for operating CI, managers and executives are not a part of the improvement teams. Instead managers and executives are involved in setting goals, securing strategic direction, showing interest, promoting a culture, as well as prioritizing and making decision regarding bigger improvement activities through the forums.

6.2 THEORETICAL CONTRIBUTION

Several researches have focused on identifying critical factors for successful CI. However, despite the wealth of knowledge concerning such factors, few detailed studies of this specific question can be found. Therefore, additional qualitative research was requested to go deeper into the factors that are considered contributing to the success of CI efforts (Oprime, et al., 2012). Thus, a theoretical contribution has been made:

(1) By identifying important areas of critical factors to elaborate on in organizations prioritizing flow efficiency, namely *Operative Infrastructure, Methodologies & Tools,* and *Leadership & Management Commitment* ;
(2) By elaborating on named areas, difficulties and facilitators, together with potential solutions to the difficulties, could be identified.
(3) It was evident that most publications about CI did not provide useful and usable theories that help organizations make proper decisions when operating CI (Sanchez & Blanco, 2014; de Lange-Ros & Boer, 2001). Therefore, this thesis has contributed to such theories by suggesting a set-up for the operating of CI efforts in organizations prioritizing flow efficiency.

6.3 LIMITATIONS AND FURTHER WORK

The company of investigation is operating in a specific industry, and is situated in Sweden. Therefore, the paper provides a deeper understanding within a specific industry and geographical area, but may limit the generalizability of the findings in this manner. However, ideas of the solution might be applicable to a wider audience, since the addressed problems probably are generic to some extent. The case study context has been clearly described, which allows the reader to evaluate what suggestions can be applicable to their situation.

Since this research focused on three areas of critical factors there are still other areas to examine. This thesis elaborates on areas related to and in the context of flow efficiency, thus other context could be interesting to elaborate on. Also, it could be interesting to investigate, from a change management perspective how to practically implement the changes suggested.

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