



**CHALMERS**  
UNIVERSITY OF TECHNOLOGY

---

# **A Qualitative Study of Operational Excellence at a Logistics Service Provider**

*Master's Thesis in the Master's Program  
Supply Chain Management*

NATALIA KOZAKOWSKA

HENRIK TÄLJEDAL

---

Department of Technology Management and Economics  
*Division of Supply and Operations Management*  
CHALMERS UNIVERSITY OF TECHNOLOGY  
Gothenburg, Sweden 2017  
Report No. E2017:139



MASTER'S THESIS E2017:139

# A Qualitative Study of Operational Excellence at a Logistics Service Provider

NATALIA KOZAKOWSKA  
HENRIK TÄLJEDAL

Supervisor, Chalmers: Martin Kurdve

Examiner, Chalmers: Carl Wörnström

Department of Technology Management and Economics

*Division of Supply and Operations Management*

CHALMERS UNIVERSITY OF TECHNOLOGY

Gothenburg, Sweden 2017

A Qualitative Study of Operational Excellence at a Logistics Service Provider

NATALIA KOZAKOWSKA

HENRIK TÄLJEDAL

© NATALIA KOZAKOWSKA, HENRIK TÄLJEDAL, 2017.

Master's Thesis E2017:139

Department of Technology Management and Economics  
Division of Supply and Operations Management  
Chalmers University of Technology

SE-412 96 Gothenburg, Sweden  
Telephone: + 46 (0)31-772 1000

Chalmers Reproservice  
Gothenburg, Sweden 2017

# Wordlist

*CI-tool* - System or methodology for facilitation of Continuous Improvement

*Continuous Improvement* - Incremental, ongoing efforts to improve processes, services or products

*Daily Control* - Methodologies for daily leadership to make, *e.g.*, necessary adjustments to achieve objectives according to plan

*Daily Control Board* - A visual board, often a whiteboard, located at the shop-floor for visualization of and interaction of daily production targets and information relevant to daily operations, among others

*Department* - A delimited, functional unit with unified operations, part of a production site

*External Benchmarking* - Benchmarking studies of sites not operated by LSP

*Flash Meetings* - weekly remote phone conference meetings between LSP's local site managers and representatives from top management

*Improvement board* - A visual board, often a whiteboard, for visualization of improvement work and related processes

*Information center* - A visual board for visualization of long-term performance data, updated weekly at LSP

*Internal Benchmarking* - Benchmarking studies of sites operated by LSP, other than LSP A and B

*Operational Excellence* - striving for continuous development of an organization and its processes to reach customer satisfaction. Progress should be reflected by measurable results such as production output, revenue/cost, time, and commitment

*Proactive Improvement* - Improvement actions based on a vision or increased customer satisfaction

*Reactive Improvement* - Improvement based mainly on problem solving or an explicit need

*Site* - Organizational business unit, usually a standalone production facility part of a larger business

*Value Adding Work* - Activities that are directly value adding for the customer and generates revenue

*Non-Directly Value Adding Work* - Activities that do not directly add any value to the customer, but may be necessary to facilitate long-term value adding activities

*Workplace Organization* - Philosophy or system for organizing the workplace by reducing wastes



# Abbreviations

*Company A* - External benchmarking company, manufacturer of industrial plastic material

*Company B* - External benchmarking company, manufacturer of industrial high voltage components

*Company C* - External benchmarking company, manufacturer of industrial hydraulic components

*EBA* - E-Business Retailer, customer to LSP D

*LCA* - Logistics Company A, customer to LSP A

*LSP* - Logistics Service Provider, focal company in the thesis study

*LSP A* - Logistics Service Provider site A, research object

*LSP B* - Logistics Service Provider site B, research object

*LSP C* - Logistics Service Provider site C, internal benchmarking object

*LSP D* - Logistics Service Provider site D, internal benchmarking object

*MoDP* - Manufacturer of Dairy Products, customer to LSP C

*VMA* - Vehicle Manufacturer A, customer to LSP B

*VMB* - Vehicle Manufacturer B, customer to LSP B



# Abstract

The current state regarding the utilization of daily control and visual management, workplace organization, and continuous improvement was studied at a logistics service provider, LSP. Site visits were conducted at two geographically remote sites, LSP A and LSP B, chosen as the main research objects for the study. In addition, site visits were conducted at two other sites operated by LSP (LSP C and LSP D) and three industrial sites operated by external organizations (Companies A, B, and C). The purpose of this thesis study was to present recommendations to achieve (1) service performance predictability, (2) stability and uniformity of operations, and (3) quality ensuring improvements at an organization such as LSP, within the scope of operational excellence. An analysis of the current state and the potential areas of improvements was then conducted for the sites LSP A and LSP B on the basis of findings from the site visits and literature review. Thereafter, recommendations based on the analysis were developed and presented and conclusions were made. During the site visits, empirical data were gained by semi-structured interviews of altogether 22 interviewees. Moreover, observations were conducted at each site, based on an *observer as participant* approach. Theoretical data were complemented with empirical data from the site visits (*e.g.*, existing reports and previous studies). All site visits were conducted during the early autumn of 2017.

The following recommendations are primarily proposed for LSP A, and LSP B: (1) establish targets and strategies to reach the LSP vision; (2) schedule time for activities and tasks that are long-term value-adding; (3) educate and initiate bottom-up involvement of local sites as well as of operators; (4) make daily decentralized controls and follow-ups; (5) establish formal communication between shifts; (6) create a visible system for continuous improvement; and (7) create and continuously renew training documents for new employees, with best practices for organizational learning. Three conclusions were made during the study. Firstly, restrictions identified by the logistics service provider LSP are not considered as hindrances for implementation of operational excellence (scarce time, budget, external ownership of site and products, and short contract periods). Secondly, there are, however, problem areas that result in negative effects on operational excellence and for these, the recommendations have been formulated. The consequential effects are low motivation, waste of time and resources, uncertainties, low effectiveness, and low transparency. Thirdly, there are direct and indirect relationships between organizational structure, systems for daily control and visual management, workplace organization, and improvement work. These relations directly affect the implementation of operational excellence initiatives.

*Keywords: Daily Control, Visual Management, Workplace Organization, Continuous Improvement, Operational Excellence*



# Acknowledgements

This thesis was written between September 2017 and January 2018, as the final part of the master's program Supply Chain Management at the Department of Technology Management and Economics, Chalmers University of Technology, Gothenburg, Sweden.

We want to thank all employees at the logistics service provider LSP in Sweden and Norway for their participation and contribution of information and experiences.

We would also like to thank the interviewees at the three external benchmarking companies for their willingness to help us in our work by letting us visit, observe and interview them at their workplaces.

Finally, we would like to direct special thanks to Martin Kurdve, our supervisor at Chalmers, for his support and guidance through the challenging journey of writing this thesis.

Chalmers University of Technology

Gothenburg, Sweden

2018-01-09

Natalia Kozakowska

Henrik Täljedal



# Table of Content

1	Introduction	1
1.1	Background	1
1.2	Purpose	2
1.3	Delimitations	2
2	Methodology	5
2.1	Empirical Data Collection	5
2.2	Literature	7
2.3	Research Approach	11
2.4	Quality of Qualitative Research	14
2.5	Ethics	15
3	Theoretical Framework	17
3.1	Operational Excellence	17
3.2	Lean Production	17
3.3	Daily Control and Visual Management	18
3.4	Workplace Organization	21
3.5	Improvement Work	24
3.6	Motivation	27
3.7	Loop Learning	28
4	Current State Description	31
4.1	The Operational Excellence Project at LSP	31
4.2	Site Descriptions	32
4.2.1	Organizational Structure	32
4.2.2	Daily Control and Visual Management	36
4.2.3	Workplace Organization	40
4.2.4	Improvement Work	43
5	Analysis	49
5.1	Organizational Structure	49
5.2	Daily Control and Visual Management	52
5.3	Workplace Organization	56
5.4	Improvement Work	58
5.5	Observed Roadmap for Implementation of Systems at Benchmarking Sites	65
6	Proposed Recommendations	69

6.1 Organizational Structure	69
6.2 Daily Control and Visual Management	72
6.3 Workplace Organization	77
6.4 Improvement Work	81
7 Discussion	87
8 Conclusions	93
Reference List	95
Appendix I - Interview and Observation Guide	i
Appendix II - Site Maps and Process Flowcharts	xi
Appendix III - KPIs Used by the Sites Studied	xv
Appendix IV - Daily Control Board Agendas	xvii
Appendix V - Summary of Problem Areas, their Consequences, and Recommended Solutions	xix

# 1 Introduction

The following chapter presents the background, purpose and research questions of this thesis. Two research questions were defined, which were subsequently answered by compiling the analysis of theoretical and empirical data to final recommendations and conclusions. Delimitations of the thesis are also discussed.

## 1.1 Background

As a consequence of increasing globalization, organizations worldwide are influenced by growing competition which requires production of services and products with higher quality, to lower costs, and with shorter lead times (Hatzichronoglou, 1996). Operational excellence as a philosophy and framework for sub methodologies, such as daily control and visual management, workplace organization, and continuous improvement, was found suitable for industrial organizations that are affected by increased pressure regarding quality, cost, and time aspects from their customers. Operational excellence involves the strategic concentration on value maximization of operations from the perspective of the customers, by achieving higher production efficiency, waste elimination, improvement of productivity, and a culture of continuous improvement, among other aspects (Ajoje, 2015). Operational excellence can also be described a continuous pursuit of improving processes and organizations in order to increase performance and financial results (Miller, 2014).

The main study object in this study, the company LSP, operates as a logistics service provider within the areas of third-party and fourth-party logistics, customs, consulting, port and terminal, as well as staffing and recruitment. The business encompasses local operations as well as support for global customers. As of September 2017, LSP operates five logistics sites in Sweden and one in Norway.

LSP offers logistics solutions with a number of value adding services, such as handling and refining of products and material, refrigeration, kitting and co-packing, installation, assembly, storage control. The company also generates value by providing customer logistics services such as outsourcing of warehouse and operations personnel, and by providing operations optimization by utilizing a warehouse management system. LSP generally charges its customers per operation by pre-defined costs for, e.g. items picked, items received, mass of materials or items managed.

LSP has identified a need for improvements within service performance predictability, stability and uniformity of operations, as well as quality ensuring improvements within operations. This has been considered important from the perspectives of both internal and external stakeholders, such as employees and customers. LSP has initiated an Operational Excellence project to improve company performance in these respects and to enhance customer satisfaction in parallel to this thesis study. Service performance predictability concerns the possibility of

decreasing the amount of customer claims (complaints) in the future, based on analyses of how they are handled today. Stability and uniformity of operation are about finding uniform ways of control working at decentralized sites with different conditions applying. Quality ensuring improvements are about the internal quality of operations and the improvement of processes.

## 1.2 Purpose

The purpose was to present recommendations for two sites at LSP, namely LSP A and LSP B, as well as for similar sites sharing the same situation and characteristics, targeted at improving (1) service performance predictability, (2) stability and uniformity of operations, and (3) quality assurance using methodologies within the scope of operational excellence. Recommendations are based on an empirical investigation and a literature review.

### 1.2.1 Research Questions

The sites at LSP are different from each other and do also work in various ways when it comes to performance. To be able to compare the sites, for LSP to govern them on relatively equal terms and reach operational excellence general systems for performance are needed. Two overriding research questions were therefore formulated:

1. How should a logistics service provider perform daily control, visual management, and workplace organization to increase company performance?
2. How should a logistics service provider implement and perform continuous organizational and process improvement?

Furthermore, the following additional questions were answered briefly:

1. What KPIs do the sites measure, how are they obtained, what are they used for, and how and to whom are they communicated?
2. How, where and when do the sites conduct, monitor and visualize daily control management and daily resource planning?
3. How do the sites organize, monitor, and influence operational quality?

## 1.3 Delimitations

The empirical data collected and documented in this report are limited to site visits conducted during the early autumn of 2017. The analysis and recommendations have not been adjusted to account for any changes that may have occurred at the sites after the visits. The research was limited to three variables relevant for operational excellence: daily control and visual management, workplace organization, and continuous improvement. The number of research objects was limited to the two sites LSP A and LSP B. According to the Project Manager of the Operational Excellence project at LSP, these had the least developed systems for daily control and visual management, workplace organization, and continuous improvement at the time of the observations. Visits for internal benchmarking were limited to two sites, LSP C and LSP D. According to the Project Manager, one of them had the most developed systems for

daily control and visual management, workplace organization, and continuous improvement. The other was chosen because it was the youngest of the sites and so had the least experience. Visits for external benchmarking were limited to three sites, Companies A, B, and C, that all had previous experience from working with operational excellence.



## 2 Methodology

This chapter presents the methods for acquiring the empirical and literature data, an assessment of data quality and validity, and a discussion of research ethics.

### 2.1 Empirical Data Collection

Empirical data derive mainly from first person observations and semi-structured interviews during site visits at LSP and benchmarking companies. In this segment, the methodology for observations and interviews are presented. Access to data previously compiled at LSP also helped to gain deeper understanding and a foundation for the interviews and observations. Examples of such data from the site visits were *e.g.* existing reports and previous internal studies.

#### 2.1.1 Observations

Current systems and routines for daily control and visual management, workplace organization, and continuous improvement from the perspective of service performance predictability, stability and uniformity of operations, and quality ensuring improvements were observed at the LSP sites and at the benchmarking companies. The observations at the research objects and benchmarking sites were based on the approach observer as participant (*cf.* Bryman & Bell, 2011), in order to obtain as much information as possible about how the sites work today without influencing while observing (appendix I). However, to understand the flows and processes, questions were sometimes needed.

Observations is a technique used to gather information in a systematic way while observing the natural state and behavior of the research object (Bryman and Bell, 2011). There are four different types of observational research: complete observer, observer as participant, participant as observer, and complete participant (figure I).

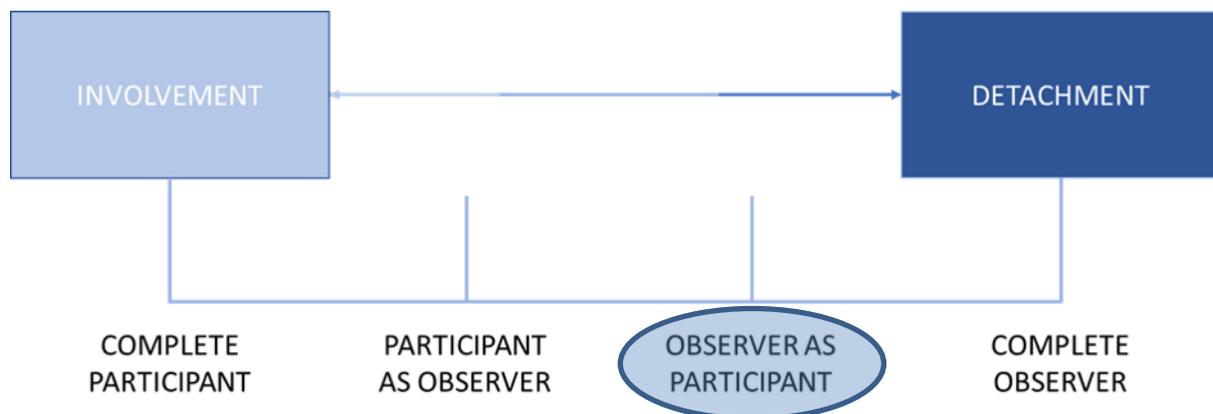


Figure I. Classification of different approaches to observe a current situation, with the approach used for the study, observer as participant, highlighted. Figure edited by the authors after the model by Bryman and Bell (2011, pp. 437).

The main difference between these observation methodologies is that a complete observer has complete distance to the object and its context, and so avoids any direct participation, whereas a complete participant adopts the role of participant while concealing the function of researcher (Easterby-Smith et al., 2015). Observer as participant type of research involves a passive way of interacting; the researcher asks questions to the participants, however without influencing the study (Bryman & Bell, 2011).

### 2.1.2 Interviews

In order to understand and gain opinions about the observed, interviews were conducted with representatives within the scope of operational excellence at the research objects as well as at the internal and external benchmarking sites. Qualitative methodologies such as interviews result in raw data that require processing, analyzing and interpretative understanding in order to yield conclusions on a higher abstraction level (Westlander, 1993). Observable patterns may then be obtainable by combining data from interviews with theoretical concepts and ideas from theoretical data within literature such as academic reports, specialist literature, and other relevant publications within the subject of interest (Lantz, 1993).

Three different, fundamental types of interview techniques exist: unstructured, semi-structured, and structured interviews (Wilson, 2014). Altogether 10 operators and 12 management representatives were interviewed at the 7 sites, see table I. The 22 interviews conducted in the present study were semi-structured in order to enable collection of relevant data within a certain scope from several sources and interviewees. It was considered important with a framework consisting of an interview guide with a set of interview questions, see appendix I, in order to accurately compare the answers from several sources. The possibility for interviewees to go off the tangent during the interviews was also considered important in order to maximize the value of collected data. The interviews contained questions regarding daily control and visual management, workplace organization, continuous improvement to promote the purpose of achieving service performance predictability, stability and uniformity of operations, and quality ensuring improvements at an organization such as LSP.

The semi-structured interview is based on a number of structured questions, which act as a guide during the interview session (Wilson, 2014). It is possible to go off tangentially and interject information outside the boundaries of the initial interview guide or questions. This possibility is important as it may tell the interviewer what subjects or information the interviewee considers to be the most relevant and what is less so within the area of interest. In contrast, structured interviews are based on fixed questions that are used in a standardized manner (Wilson, 2014). For comparison, unstructured interviews are described as close to a regular conversation, where the interviewer and interviewee talk rather freely about what comes to their mind regarding some general topics. Thus, the unstructured interview may take a different path than initially planned for, which might lead to unexpected findings as well as to a more complex analysis or loss of valuable information (Easterby-Smith et al., 2015).

<u># of Interviewees</u>	<u>Operators</u>	<u>Management</u>	<u>Total:</u>
LSP A	4	1	5
LSP B	5	3	8
LSP C	-	1	1
LSP D	-	1	1
Company A	-	3	3
Company B	1	1	2
Company C	-	2	2
<b>Total:</b>	<b>10</b>	<b>12</b>	<b>22</b>

*Table I. 22 interviewees, both operators and management, were interviewed at the seven different sites.*

## 2.2 Literature

Literature was used to develop both the research methodology of the study, and for the theoretical framework segment presented in the report. Literature used for establishing the research methodology were chosen by searching for the most cited textbooks in research methodology, found at the Chalmers library online service and Google Scholar, with search terms “research methodology”, “business research methodology”, “qualitative research methods”, “interview + research methodology”, and “observation + research methodology”. The chosen literature for research methodology was supported by studying previous master thesis reports published at Chalmers about similar research topics. Research methods suggested by the literature found in the literature search were compared to previously used methodologies found in similar thesis projects written at Chalmers. The relevance of the specific authors referenced to for research methodology was strengthened by that they were frequently referenced to by previous thesis projects. For the research methodology, the following 13 different literature sources were used:

### **Business research methods, interviews and observations**

Bryman, A. (2012), *Social research methods*, 4.th edn, Oxford University Press, Oxford.

Bryman, A., & Bell, E. (2011). *Business research methods*, 3d ed, Oxford: Oxford University

Bryman, A., & Bell, E. (2015). *Business research methods*, 4th ed, Oxford: Oxford University Press.

Easterby-Smith, M., Thorpe, R., & Jackson, P. (2015). *Management and business research* (5th ed.). London: SAGE.

Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students* (7.th ed.). Harlow: Pearson Education.

### **Scientific research methodology**

Achinstein, P. (2004) *Science Rules: A Historical Introduction to Scientific Methods*. The Johns Hopkins University Press.

Wallén, G. (1993). *Vetenskapsteori och forskningsmetodik*. Lund: Studentlitteratur.

Eriksson, L.T. & Wiedersheim-Paul, F. (2008). *Rapportboken*. Stockholm: Liber.

Douven, I. "Abduction", *The Stanford Encyclopedia of Philosophy* (2017), Edward N. Zalta (ed.). Received 2017.12.04. <https://plato.stanford.edu>

### **Interview methodology**

Lantz, A. (1993). Intervjumetodik. Lund: Studentlitteratur.

Wilson, C. (2014). Interview techniques for UX practitioners: A user-centered design method. Amsterdam;Boston;: Morgan Kaufmann.

### **Source criticism**

Thurén, H. (n.d). Källkritiska principer. Nationalencyklopedin. Received 2017.09.20  
[www.ne.se/uppslagsverk](http://www.ne.se/uppslagsverk)

### **Research psychology**

Ebbinghaus, H. (2013). Memory: A contribution to experimental psychology. *Annals of Neurosciences*, 20(4)

Westlander, G, (1993). Socialpsykologi: Tankemodeller om människor i arbete. Göteborg: Akademiförlaget.

The literature study for the theoretical framework involved theory within the areas of operational excellence, lean production, daily control and visual management, workplace organization, improvement work, motivational factors, and loop learning principles. An illustration of the chapter structure and how report segments are interrelated are presented in Figure III, linking the theoretical framework to the current state, analysis, and recommendation segments. The literature study was continued during the execution of the entire study.

The theoretical framework mainly provides information regarding the relevance and purpose of the areas studied, i.e. *why* to use methodologies such as daily control and visual management, and what benefits that can be achieved from using these in an industrial organization. Regarding *how* to implement and achieve optimal utilization of the methodologies described, some theory and methodologies are presented in the theoretical framework. However, the guidelines and steps for implementation of the various methodologies simultaneously is considered inadequate in the theory found and as a complement information gained from benchmarking site visits have also been used. Hence, data and information regarding *how* to optimally implement and utilize the methodologies and systems presented in the theoretical framework is mainly gained from benchmarking interviews and observations, and presented in the analysis and the recommendations.

Relevant literature for the theoretical framework were chosen by assessing the legitimacy and reviewing the accuracy of the source. Evaluation of sources have been done by identifying (1) the author, (2) the author's intention with the published literature and (3) the time and situation of publication. Scientific articles published in recognized journals have been prioritized when forming the theoretical framework, but other relevant literature such as textbooks and conference articles have also been used and referenced to. In total, around 100 literature sources were studied in total, among which 67 were used for the theoretical framework. Literature used for establishing the theoretical framework were chosen by selecting the most cited, but also the most recent, publications in the seven different areas studied. The number of citations served as a confirmation of the credibility of the referenced authors, and the date of publication

was used in order to find the most valid and contemporary information in the field. Literature was searched for at the Chalmers library online service and Google Scholar, by using relevant search terms related to each area. Relevant literature for the theoretical framework were also recommended and provided by our supervisor at Chalmers, Martin Kurdve. A selection of the references used for the seven different areas presented in the theoretical framework is presented in figure II.

Initial knowledge of subjects relevant for the research project was considered beneficial to help formulate a clear and structured problem, and to establish the foundational approach of the study (*cf.* Wallén, 1993). The literature search started with studying articles about operational excellence, as being the central concept of the study. From what was stated about operational excellence by Miller (2014), Ajoje (2015), and Jaegera et al. (2014), among other references used in this segment, sub-areas to operational excellence such as daily control and visual management, workplace organization, improvement work, motivation, and loop learning were found relevant why subsequent literature search was conducted for these areas. There are other, additional areas involved in operational excellence outside the scope of this study, that were left out after directives from representatives at the organization LSP. Lean production was included due to that it was found closely related to aspects of operational excellence, by studying, among others, Miller (2014), Ajoje (2015), and Jaegera et al. (2014). Lean production is not considered as a sub-methodology to operational excellence, but rather as a parallel umbrella term that was found relevant to include in the theoretical framework. Search terms used for the seven theoretical areas were operational excellence, lean production, daily control and visual management, workplace organization, improvement work, motivation, and loop learning. Other additional search terms such as “business”, “5S”, “Kaizen”, “double loop learning”, “operations excellence”, and “workplace motivation factors” were also used. The areas presented in the theoretical framework and choice of theoretical content to include in the report were inspired and motivated by previous knowledge from several courses taken by the authors during their studies at Chalmers. Theoretical areas to include in the study were also discussed with, and motivated by requests from representatives at LSP. Literature presented in the theoretical framework of this report are referred to also in the analysis segment to strengthen the validity of the analysis made, and to highlight similarities and contrasts between theory from literature and the current state at LSP.

Operational excellence was found to be a common term used in business related scientific reports, however an exact definition was not shared between the literature studied. Lean production was on the other hand considered as an area where the literature studied share the same general concepts. The same applied to the areas of workplace organization, improvement work, motivation and loop learning, where no major antagonisms were experienced regarding the foundational concepts. Daily control and visual management was the literature area that was considered the most diverse and in which there was the least consensus regarding the concept and its implications for an organization. As a direct consequence of this, the analysis and recommendations related to daily control and visual management relied more on findings from the benchmarking studies at Company A, B, and C, rather than on literature.

<b>Operational Excellence</b> <ul style="list-style-type: none"> <li>• Miller (2014)</li> <li>• Ajoje (2015)</li> <li>• Jaegera et al. (2014)</li> </ul>	<b>Lean Production</b> <ul style="list-style-type: none"> <li>• Liker and Meier (2006)</li> <li>• Rother (2013)</li> <li>• Slack et al. (2016)</li> </ul>	<b>Daily Control and Visual Management</b> <ul style="list-style-type: none"> <li>• Slack et al. (2010)</li> <li>• Ortiz and Park (2011)</li> <li>• Eaidgah Torghabehi et al. (2016)</li> </ul>	<b>Workplace Organization</b> <ul style="list-style-type: none"> <li>• Hirano (1996)</li> <li>• Fabrizio and Tapping (2006)</li> <li>• Smith and Peterson (1998)</li> </ul>
<b>Improvement Work</b> <ul style="list-style-type: none"> <li>• Liker (2009)</li> <li>• Karlsson and Åhlström (1996)</li> <li>• Jugulum and Samuel (2008)</li> </ul>	<b>Motivation</b> <ul style="list-style-type: none"> <li>• VandeWalle (1997)</li> <li>• Kaufmann and Kaufmann (2010)</li> <li>• Hackman &amp; Oldham (1980)</li> </ul>	<b>Loop Learning</b> <ul style="list-style-type: none"> <li>• Argyris (2002)</li> <li>• Jaaron and Backhouse (2017)</li> <li>• Ayham and Backhouse (2017)</li> </ul>	

Figure II. Illustration of a selection of the references used for the seven different areas presented in the theoretical framework.

	Analysis (chapter 5)	Proposed Recommendations (chapter 6)	Theoretical Framework	Current State Description
Organizational Structure	X.1.1 Targets or Strategies to Achieve Company Vision	3.2 Lean Production; 3.3 Daily Control and Visual Management; 3.6.1 Extrinsic Motivation	3.1 Operational Excellence; 3.2 Lean Production; 3.3.2 Visualization; 3.4 Workplace Organization; 3.5.1 Traditional Improvement System	4.1 The Operational Excellence Project at LSP; Organizational Structure
	X.1.2 Top-Down and Bottom-up Implementation	3.2 Lean Production; 3.5.1 Traditional Improvement System		
	X.1.3 Affiliation with Company Identity			
Daily Control and Visual Management	X.2.1 Communication and Control of Daily Production	3.3 Daily Control and Visual Management; 3.3.2 Visualization	3.2 Lean Production; 3.3.2 Visualization; 3.6.1 Extrinsic Motivation; 3.7 Loop Learning	4.1 The Operational Excellence Project at LSP; 4.2.2 Daily Control and Visual Management
	X.2.2 Performance Follow-Up	3.6.1 Extrinsic Motivation; 3.6.2 Intrinsic Motivation		
	X.2.3 Communication between Shifts	3.3 Daily Control and Visual Management; 3.6 Motivation		
	X.2.4 Time Horizons and Work Distribution			
Workplace Organization	X.3.1 Utilization and Perception of 5S/Improvement Work	3.4 Workplace Organization		4.1 The Operational Excellence Project at LSP; 4.2.3 Workplace Organization
Improvement Work	X.4.1 Approach to Improvement Work	3.5 Improvement Work; 3.5.3 Processes; 3.5.2 Continuous Improvement; 3.6.1 Extrinsic Motivation; 3.3.1 Effective and Efficient Information Flows	3.2 Lean Management; 3.3.2 Visualization; 3.5 Improvement Work; 3.7 Loop Learning,	4.1 The Operational Excellence Project at LSP; 4.2.4 Improvement Work
	X.4.2 Routines and Processes for Achieving Continuous Improvement	3.5.2 Continuous Improvement; 3.5.3 Processes; 3.5.4 Tools		
	X.4.3 Incentives to Engage in Continuous Improvement	3.5.2 Continuous Improvement; 3.6 Motivation; 3.6.1 Extrinsic Motivation; 3.6.2 Intrinsic Motivation,		
	X.4.4 Documentation and Analysis of Quality Deviations	3.2 Lean Management; 3.3.2 Visualization; 3.5 Improvement Work; 3.7 Loop Learning,		
	X.4.5 Organizational Learning	3.7 Loop Learning		

Figure III. An illustration of the chapter structure and how report segments are interrelated, linking the theoretical framework to the current state, analysis, and recommendation segments.

## 2.3 Research Approach

In this segment the methods are defined together with a step by step illustration of the employed research approach. Some comments are also made on ontology and general research methodologies, such as deductivism, inductivism, abductivism, and interpretivism.

### 2.3.1 Collection and Use of Data

Empirical data representing the current state were collected at two sites selected by LSP. The data collection began during an initial visit to LSP B in the second week of the project. LSP B was chosen as the first object for study because of its simpler layout and material flow as compared with LSP's other sites. This choice facilitated understanding the processes and finding a baseline for the study.

Empirical data were then also gathered during a second visit to LSP B and one to LSP A. This second step was performed as an iterative process. The number of interviews at each site depended on the outcome of the observations and the answers during the interviews. The approach employed is in line with the stage-gate model of iterative projects presented by Chao et al. (2014). The first visit to LSP B was less intricate, enhancing the learning curve for the thesis authors (*cf.* Ebbinghaus, 2013).

To explore best practices in the industry, identifying strength and weaknesses, benchmark studies were performed at the internal sites LSP C and LSP D, and at the external companies A, B, and C. We were introduced to the external companies with the help of our supervisor Martin Kurdve. They were chosen because they have been, or currently are, participating in the implementation of systems for daily control and visual management, workplace organization, and continuous improvement. Benchmarking data were compiled using the same methods as described above for sites LSP A and LSP B.

The findings from site visits at LSP were compiled and scored on a scoreboard assessment, see appendix I, developed based on characteristics identified as relevant for operational excellence at the benchmarking companies, that aligned with theory presented in the theoretical framework regarding daily control and visual management, workplace organization, and continuous improvement. The findings were further used to formulate and answer the additional research questions 1–3 (see, 1.2.1). Based on the analysis, recommendations were formulated to answer the overriding research questions 1–2 (see, 1.2.1) regarding factors influencing (1) service performance predictability, (2) stability and uniformity of operations, and (3) quality ensuring improvements at an organization such as LSP within the scope of operational excellence. The findings were analyzed focusing the characteristics of systems for daily control and visual management, workplace organization, and continuous improvement. Figure III illustrates the chapter structure and how the report segments are interrelated. Figure IV illustrates the relations between research questions, methods used, and the chapters presenting the results.

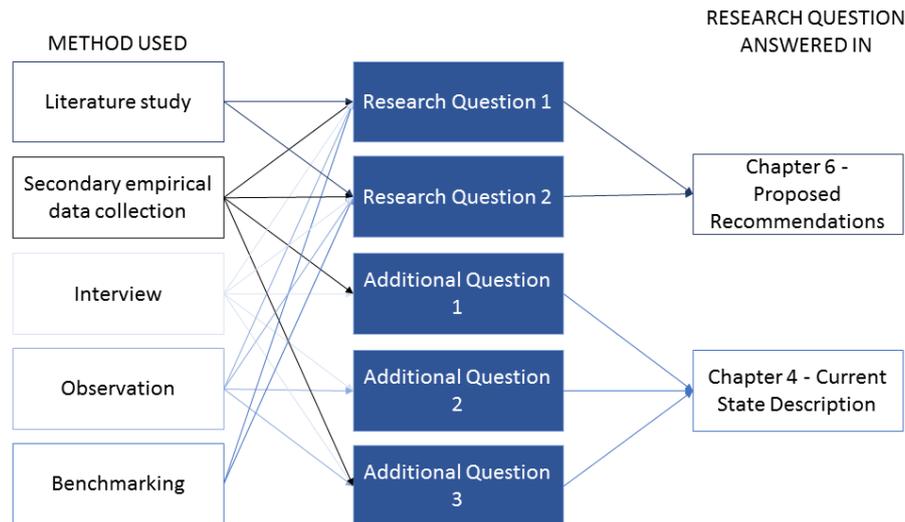


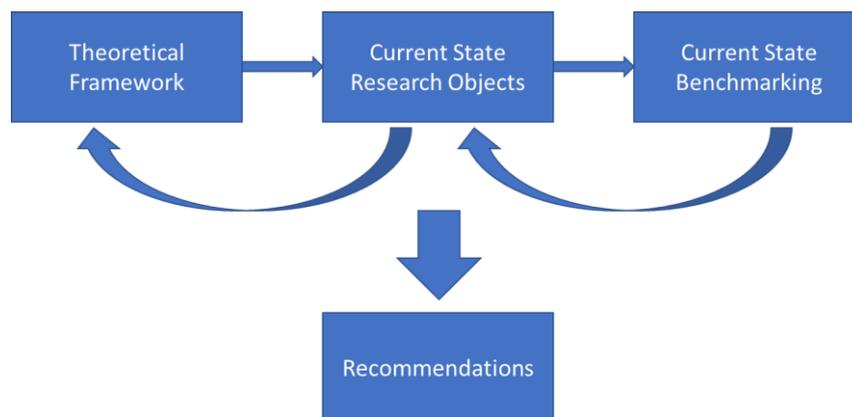
Figure IV. An illustration of the methodology used in the thesis study.

### 2.3.2 Comments on Methodology

A qualitative methodology was chosen for this study, as defined by Eriksson and Wiedersheim-Paul (2008), Easterby-Smith et al. (2015), and Bryman and Bell (2011). Those authors state that qualitative methodologies are relevant for analyzing and exploring complex phenomena and patterns. Bryman and Bell (2015) consider qualitative research a suitable methodology for business research projects. According to Eriksson and Wiedersheim-Paul (2008), personal or political values and power relationships behind organizational decisions are suitable objects for qualitative research. Operational excellence techniques are complex and sensitive to the subjective experiences of individuals, which motivates the use of qualitative data collection, as suggested by Lantz (1993). Moreover, qualitative methodologies are better suited for the creation and development of new theories. Negative aspects are that qualitative approaches may require more resources and longer time than quantitative methodologies, and that analysis and conclusions may become more complex and difficult to understand, develop and interpret (Easterby-Smith et al., 2015).

Qualitative research has been considered to enable greater nuances, although at the same time to limit unambiguous comparisons, in comparison with quantitative studies (Eriksson and Wiedersheim-Paul, 2008). Bryman and Bell (2015) state that qualitative research is sometimes mistaken to completely exclude the usage of quantitative measurements. The general approach for this study was a qualitative approach with some additional quantitative data. Qualitative data derive from findings in interviews and observations regarding the local usage and the interpretation of daily control and visual management, workplace organization, and continuous improvement. Quantitative measurements were used to compare, among others, factors used within the scope of the operational excellence project at the LSP sites, and for similar systems studied at the benchmarking companies, see for example tables II, III, IV, and V, and figures VI, VIII, and X. The strength of qualitative methodologies is that they provide an opportunity for the comprehensive understanding of the attitudes of individuals, and that the direction of research can be continuously adjusted (Easterby-Smith et al., 2015).

To provide basic knowledge of the current problem by identifying what, when, where, in what context, and how certain situations arise, the study was initially conducted exploratively (*cf.* Wallén, 1993). This exploratory phase aimed at developing a thorough understanding of which aspects of the subject could be usefully investigated and more deeply analyzed, and which aspects should be ignored. The study became explanatory when deeper understanding had been reached to recognize relationships and patterns between factors, information and data studied (*cf.* Saunders et al., 2016). Recommendations were developed for LSP A and B, and for other similar organizations sharing similar current state characteristics. As illustrated in figure III, the methodology for developing the recommendations was based on an iterative approach involving comparison of theoretical data with methodologies practiced at the internal and external benchmarking sites studied.



*Figure V. The Iterative Process of Developing Recommendations from Theoretical and Empirical Data.*

### 2.3.3 Deductivism, Inductivism and Abductivism

Douven (2017) defines three major research approaches: deductive, inductive, and abductive. Bryman and Bell (2015) state that these are suitable for qualitative and quantitative studies. The research approach of this thesis study, qualitative with some quantitative measures, has an inductive orientation, due to the characteristics of the complex environment and non-binary reasoning linkages likely to be observed in an organizational environment influenced by humans and possible personal and political agendas. An inductive approach was also considered favorable because it allows initial exploration and continuously permits observations to guide the further direction of the investigation and evaluation.

Induction can be seen as the drawing of general conclusions from specific empirical observations (Achinstein, 2004; Bryman and Bell, 2015) which is an approach opposite to the deductive one, to validate a specific theory by observations. Inductive premises are regarded as supplying trustworthy evidence, but the conclusion reached can at best be probable (Bryman and Bell, 2015).

## 2.4 Quality of Qualitative Research

A qualitative research study is of high quality if it is thoroughly and systematically conducted (Easterby-Smith et al., 2015). To evaluate a qualitative research study, two criteria are suggested, authenticity and trustworthiness (Bryman & Bell, 2015).

### 2.4.1 Authenticity

Authenticity mainly concerns the political impact in qualitative research (Bryman & Bell, 2015). In order for research studies to be authentic there has to be a fair representation of the study objects' diverse viewpoints. The study objects did receive an understanding of the study, to broaden their perspective of the subject, and to realize what could be changed in their existing environment. It was considered important to offer the right tools and steps for the study objects to be able to engage properly in the study. To maintain authenticity, as far as possible each site taking part in the in the present study has been observed during various times under different conditions, and interview subjects have been selected to represent various opinions, roles, and working hours at the companies. Moreover, upon arriving at a site, the investigators have given the interview subjects a brief introduction and a presentation of possible outcomes of the study.

### 2.4.2 Trustworthiness

Trustworthiness consists of four sub-criteria: credibility, transferability, dependability, and confirmability (Bryman & Bell, 2015). The criterion of credibility assesses whether the research is acceptable and credible to others (Bryman & Bell, 2015). Credibility requires that the studied environment has been understood correctly. To ensure credibility, triangulation and respondent validation should be used. In the present study, triangulation was achieved by reading more than one author for subjects studied in the literature, by interviewing employees with different roles, and by continuing the interviews until the answers received could be related to each other. Moreover, the site descriptions based on the research were referred back to the site representatives for affirmation. The relevance of the literature chosen was evaluated by assessing the legitimacy and accuracy of the sources (*cf.* Eriksson and Wiedersheim-Paul 2008). The sources were evaluated in accordance with Thurén (n.d.) who states that evaluating a source is to identify the author, the author's intention with the published literature, and the time and situation of publication. The closer a source is to present time, the higher is the trustworthiness according Eriksson and Wiedersheim-Paul (2008).

Benchmarking has been used in this study, which has gained a broader perspective and not merely a truth limited to the present research objects and literature. According to Bryman (2012) the results from a study have to be transferable, meaning that they should also contribute to environments and companies other than those investigated. This can, according to the author, be done by using benchmarking, as well as by generalizing the analysis and thus the solution.

To keep the study reliable, an auditing approach should be adopted (Bryman & Bell, 2011). This can be done by keeping complete records of the steps and phases of the study process,

records later to be audited by an unbiased peer review. To confirm reliability, the process of the present study has been documented both by photographing and by drawing processes and systems as well as by transcribing the 22 interviews. Two assigned opponents at Chalmers have audited and reviewed the report as an unbiased peer review group, involving review of the methodology, research approach and result of the study in general, however not including evaluation of raw interview and observation data.

A study has high confirmability if the research has been made in good faith (Bryman & Bell, 2015). In a qualitative research project like the present study, it can be challenging to remain completely objective. To rule out as far as possible that personal prejudice could affect the study, objectivity has been strived for by documenting and re-reading the findings and the analysis by two authors with different perspectives.

## 2.5 Ethics

The planning and performance of a research project should involve ethical considerations (Easterby-Smith et al., 2015). Bryman and Bell (2015) summarize the importance of ethics in four broad areas for consideration: any harm to the participants, invasion of privacy, informed consent, and deception. Easterby-Smith et al. (2015) define ten key principles for ethics in research. The two first concern the protection of the participants. They should be protected against harm, be treated with dignity, give informed consent, and have privacy protected (Bryman and Bell, 2015). Moreover, the confidentiality of data gathered during the study has to be ensured. In some cases, anonymity has to be protected for individuals, companies, or organizations (Easterby-Smith et al., 2015). In order to protect the integrity of the community, it is important to avoid deception regarding the aim or nature of the study and to declare any conflicts of interests. There should also be transparency and honesty in communications and information about the study. In the present study, correct ethics was aimed at both by informing the subjects in the research about the study, by sharing the findings, and by confirming that taking part in the study will not have a negative impact on the subjects or on the site where the subject is working. All interviews were anonymized. The same principles were employed for data containing company information such as statistics and matrices.



## 3 Theoretical Framework

The following chapter presents the theoretical framework used for the thesis study, including theory about operational excellence, lean production, daily control and visual management, workplace organization, and improvement work.

### 3.1 Operational Excellence

Miller (2014) defines operational excellence as the continuous pursuit of improving processes and organizations in order to increase performance and financial results. The author further states that operational excellence should not be considered as a methodology in itself, but rather as a mindset that must be present across the organization. Ajoje (2015) describes operational excellence as being in part an umbrella for several operational principles, such as daily control and visual management, workplace organization as well as continuous improvement. However, Ajoje (2015) does not consider operational excellence as merely involving the utilization of sub-methodologies, but holds that these, in conjunction with others, can be used together with additional activities in the name of operational excellence in order to achieve operational improvements and subsequently ‘excellence’ in an organization. Jaegera et al. (2014) criticizes the concept of operational excellence and regard it as a buzzword overused by experts and academics, who spend too much time on ‘jargon building’ and too little on the actual creation of substance relevant to operational improvement.

According to Ajoje (2015), implementation and exploitation of operational excellence principles will facilitate the improvement or optimization of the following areas:

- Waste elimination
- Improvement of productivity
- Higher production efficiency
- Increased capacity
- Teamwork promotion and advancement
- A culture of continuous improvement

Operational excellence involves the strategic concentration on operations value maximization from the perspective of the customers of the organization (Ajoje, 2015). Operational excellence should conduce to sustained and improved quality levels, cost effective services, and the ability to deliver remarkable value for the customer(s). These goals can be achieved by strong leadership, people empowerment, utilization of best industry practices, as well as the implementation of value providing technologies.

### 3.2 Lean Production

Lean production, focusing on continuous improvement, is a concept derived from the company Toyota with strong influences from Japanese culture (Slack et al., 2016). It is a further approach to operational excellence (Sarkar, 2008). The lean production system consists of six

cornerstones. Among these are customer focus and employee involvement (Dennis, 2015). Dennis (2015) describes customer focus as the main goal and focuses on eliminating waste in order to increase quality, decrease costs, and decrease lead time. Slack et al. (2016) categorize the activities of the operation in, among other things, value-adding, supportive, and non-value-adding activities. They identify value-adding activities as activities that create involvement of the employees by providing motivation and by encouraging flexibility and continuous improvement.

According to Liker and Meier (2006), the approach introduced and used by Toyota in Japan is not optimal for every company, because companies act in different environments under different conditions and with different processes. Therefore, when introducing lean production, it is not possible to achieve success by copying and implementing the visible practices. Rother (2013) argues that the outcome of copying is reverse engineering, as tools, objects, and strategies are taken apart to be inspected and replicated which is not a functioning method for implementation. Therefore, it is important to acknowledge the concepts of lean production as a theoretical foundation and use it in such manner that it can be applied to all processes and businesses of the company (Liker & Meier, 2006). Kurdve (2014) argues that usability, visualization and support of communication are some of the most critical factors to include in tools for improvement work, why a holistic perspective was considered as required for achieving successful results.

Moreover, lean production can be decomposed into the main ways of working, such as long-term thinking (Liker, 2009). Decisions should be based on long-term strategy and vision at the expense of short-term financial targets (Slack et al., 2016). Investments for the future have to be made for the current business to evolve (Liker, 2009).

### 3.3 Daily Control and Visual Management

Abernethy and Chua (1996) define the concept of an organizational control system as involving the control of human behavior, stating that “a combination of control mechanisms designed and implemented by management to increase the probability that organizational actors will behave in ways consistent with the objectives of the dominant organizational coalition” (p. 573). According to Chai et al. (2014), process control “should ensure not only controlled variables to follow their setpoint values, but also the whole process plant to meet operational requirements optimally (e.g., quality, efficiency and consumptions)” (p. 81) and should facilitate for operational efficiency to be continuously improved. Slack et al. (2010) pointed out some basic differences between controlling operations and the activities of planning. Plans are based on expectations, not reality. Control, on the other hand, is the activity of dealing with, for example, sudden changes, but also ongoing managing operations. Management control has been distinguished from strategic control, identifying management control as involving the control and management of the behavior of employees, rather than the planning of long-term goals (Merchant and Van der Stede, 2007).

In organizations with insufficient communication, decision-makers and stakeholders may not obtain correct and relevant information or directives before it is too late, if at all. In such cases it is hard to control that correct or adequate decisions are taken and optimal results obtained (Harris and Harris, 2012). Bell et al. (2013) state that during recent years, utilization of visual management tools in a broader business context have been increasing due to its potential of facilitating simple and effective communication flows. To present correct and well balanced information and instructions at the right time where the strongest and optimal impact is generated, and to make the best decisions for the optimal course of action, are important factors, yet difficult tasks for many organizations (Harris & Harris, 2012; Tezel et al., 2010). In organizations implementing a system for visual control, deliveries become more timely, operators get a more correct understanding of the processes and current state of production levels as they are more accurately and more frequently updated, performances in general improve, less material must be scrapped, and financial results increase (Ortiz & Park, 2011). More accurate, precise and timely information results in better decisions by individuals at the right time. A well implemented and well functioning visual management system is a complement to other methodologies but can also provide a competitive edge on its own (Ortiz & Park, 2011).

### 3.3.1 Effective and Efficient Information Flows

Visual management enables managing activities and tasks to be aligned with the strategic goals of a company and with the requirements from customers, as well as enables that the right values are generated and prioritizations optimized (Eaidgah Torghabehi et al., 2016). Effective and efficient information flows and follow up can be achieved by enhancing the communication of relevant organizational KPI-data and measures based on the short and long-term vision and goals of the business unit. Visual management can achieve accurate feedback to operators, process owners or other stakeholders regarding efficiency, performance levels, current situation data, or other metrics associated with important operative actions within the organization (Tezel et al., 2010). Visual management may further enhance transparency in an organization, as it is achieved within certain process groups or teams, horizontally between different hierarchical levels from operators to top management, and vertically between different functional groups (Eaidgah Torghabehi et al., 2016; Tezel et al., 2010).

Individuals and teams within organizations may have access to large quantities of raw data and unsorted information which is often unnecessary and hard to understand in one's specific context (Mckeown, 2013). It is therefore important for organizations to sort and simplify the communication to employees and teams. Tezel et al. (2010) state that organizations can utilize simple visual tools that are cognitively effective, in order to provide sorted information of high quality for their employees. As a consequence of the characteristics of visual management, it must be part of a more comprehensive management and performance plan in order for it to return its complete benefit (Eaidgah Torghabehi et al., 2016). Therefore, the visual management system should be closely coupled to a performance management program, but also linked to initiatives for continuous improvement (Eaidgah Torghabehi et al., 2016).

### 3.3.2 Visualization

Ortiz and Park (2011) argue that visibility generates understanding and awareness, which in turn leads to actions that implicate results that finally result in satisfied customers. According to those authors, it is important that metrics related to organizational performance are accessible to all employees, by posting it on a board located in the facilities where it is easily accessed and where employees naturally interact, for example in the lunchroom.

Daily control boards are used in order to manage activities and brief team members and leaders (Maskell & Kennedy, 2007), and were developed as a lean production management tool (Hirano, 1995). Bateman et al. (2016) consider daily control boards to have an expanded function as they also facilitate management processes for performance, such as coupling a company vision or organizational wide strategy to local, operational continuous improvement and activities. Visualization highlights potential deviations from best practice or target values, providing an opportunity for following up on problems and system errors in processes, otherwise depriving individuals or teams from achieving their objectives (Eaidgah Torghabehi et al., 2016). Liker and Meier (2006) state that by utilization of best practices and standards, productivity and quality can be improved simultaneously as costs and time spent on certain activities can be reduced. Daily control boards are thus an essential tool for achieving effective implementations and review of continuous improvement actions and practices (Eaidgah Torghabehi et al., 2016). In contrast to site comprising information centers, that contain more general company specific KPIs not relevant for short time production and process management, there are workcell and departmental performance information facilities (Ortiz & Park, 2011), below referred to as daily control boards. Bateman et al. (2016) state that these should be managed by production cell managers and team leaders in order to manage single production teams within separate work units.

#### The Content of Visual Boards

Visual boards are considered to improve operator engagement and lead to increased productivity. However, it is critical that the boards are used in a facilitating manner for information dissemination and transparency, and not the opposite, as too much information updated without consideration might create a feeling of confusion (Ortiz & Park, 2011).

Ortiz and Park (2011) suggest that information regarding sales, orders, profits, on time deliveries (OTD), quality, and other metrics of similar or higher importance should be available and easily accessible to all employees at the information centers. They conclude that daily control boards on the shop floor should visualize what should be expected from the work day, along with other information such as highlighting potential future improvements and the progress of previous suggestions for improvement. Information items relevant for a specific workplace, team or department within an organization are, among others, quality KPIs, production effectiveness, safety measurements, OTD KPIs, as long as the data are considered relevant within the specific unit for which the information is presented (Eaidgah Torghabehi et al. (2016). The boards should also visualize ideas, goals, targets, notices, and other information specifically important to the workers and team leaders active within the same unit (Ortiz &

Park, 2011). Regarding quality metrics of product and performance, quality factors are likely to improve through the visualization of errors, accidents or near misses (Ortiz & Park, 2011).

#### The Layout and Structure of Visual Boards

The physical dimensions of daily control boards should enable easy overview by everyone at a workplace (Rich et al. 2006). The boards are usually divided by tape or paint in squared areas for display of different operational or strategic data and information. The characteristics of daily control board depend on the size of the team that use the board but also on the number and complexity of information types that are presented (Greif, 1991; Jaca et al., 2014).

### 3.4 Workplace Organization

Visual management as a philosophy is closely interrelated to methodologies for workplace organization (Ortiz and Park, 2011). One common methodology for improvement of workplace organization is 5S, which is a system based on steps incorporating procedures to optimize the safety, comfort, performance, and cleanliness of the workplace (Smith & Peterson, 1998). The five commonly used steps are referred to as pillars by Hirano (1996), as each step is an element to support an entire system which is the improvement of the company. The five steps are sort, set in order, shine, standardize, and sustain. Hirano (1996) also states that the success of the implementation of 5S mainly depends on the first two steps, sort and set in order, making these the most important ones. According to Ortiz and Park (2011), 5S is a progressive system resulting in seven categories of benefits: visualized floors, aisles and shops, reduction of cycle times and downtimes, reduction of waste in motion and overproduction, and further increased environmental safety, available floor space and visibility of possible issues. In order to increase the likelihood of a successful implementation of 5S, Fabrizio and Tapping (2006) recommended that before starting with the first S, sort, two preceding activities should be performed: (1) project preparation and (2) complete workplace scan.

Management should be involved in project preparation to secure that both time and resources will be committed for the project and its phases (Fabrizio and Tapping, 2006). The same authors further state that the role of the management is to put the system into action and assign a project leader. The project leader should perform the project together with the management. Fabrizio and Tapping (2006) encourage that attention is paid to three specific aspects: 1) the improved profitability that will be achieved should be highlighted; 2) as each department and its employees are different, it is important that the right people be involved and together perform each task of the project; 3) it is vital to ensure the management involvement throughout the project. During this step, the project should also identify which areas to target by choosing what workplaces to start with, as it may be difficult to begin with all at the same time. A cross-functional team should be formed, with responsibility for the planning as well as for handling the implementation of 5S (Fabrizio & Tapping, 2006).

The second preceding activity before starting with 5S, complete workplace scan, is performed by selecting metrics and measurements that will be used for assessment of the 5S activities

(Fabrizio & Tapping, 2006). The measurements may focus on wastes and should be aligned with the strategy measures of the company (Agrahari et al., 2015). It is vital that the measurements are easy to collect and related to the performance improvement; baseline data for comparison are recommended (Agrahari et al., (2015). To ensure that the measurements used are correct, the team can ask four critical questions (Fabrizio & Tapping, 2006):

1. What waste is to be eliminated?
2. What behavior should be supported?
3. In what way should the measurements be used?
4. Whose viewpoint is critical?

All employees should know the method of measuring and the system should be standardized and include visualization of results (Fabrizio & Tapping, 2006). The same authors argue that using a top-down approach is discouraged as the management do not possess a deep understanding of the issues, and the method for collecting data can be misunderstood due to poor communication or development. Before performing any changes, the current state should be documented, e.g. by photographing the workplace (Agrahari et al., 2015). Documentation reveals the current conditions and issues and can later be used to show the development over time (Fabrizio & Tapping, 2006). However, there is no reason to exaggerate this step, by documenting too much. The documentation should be completed when the operation is running. At this point it is time to begin applying a scan checklist as well, that is to perform an analysis and conclusion of the current situation (Fabrizio & Tapping, 2006). The result should be scored and rated on a scale. It is what exists on the spot at the moment, and not what is supposed to be there, that should be included (Fabrizio & Tapping, 2006). This audit should be performed periodically. Lixia and Bo (2008) recommends audits to be performed once a week during the first six months and later once a month along with occasional unexpected audits. Besides rating the current situation, the audit is a guideline for how to continue with improvements and the result has to be visualized on a project storyboard (Ortiz & Park, 2011). The same authors further state that all employees interested should be able effortlessly to inspect the project and its processes. For educational purposes, the visualization of 5S status and progress should also be user friendly and updated.

#### Phase 1. Sort

Sort represents the first of the five S in 5S (Hirano, 1996). To begin sorting, two conditions should be met. Firstly, criteria for sorting have to be determined and, secondly, items that have been sorted should be assigned a specified area (Fabrizio & Tapping, 2006). The purpose is subsequently to present standards and instructions for how to perform sorting (Hirano, 1996). Smith and Peterson (1998) explain that sorting involves four activities, among others deciding how often each item in the workplace is used as well as relocating or disposing of items that are not used (Smith & Peterson, 1998). One way of doing this is to mark all objects at the workplace with red tape or similar, which is later removed from each specific object as soon as it is being used as part of workstation routines (Agrahari et al., 2015). Items where the tape is not removed after a certain time period are then disposed or moved from the workplace. Fabrizio and Tapping (2006) argues for a slightly different approach that involves sorting all

items in the workplace and separating those that are either unwanted or misplaced. Such items should be removed from the workplace and can temporarily be placed in holding areas before disposal, or reused for another purpose (Fabrizio & Tapping, 2006). Fabrizio and Tapping (2006) as well as Smith and Peterson (1998) recommend a method of marking all items that are not used. To succeed it is vital to keep all procedures and phases simple (Fabrizio & Tapping, 2006).

#### Phase 2. Set in order (and set limits)

Fabrizio and Tapping (2006) state that the setting in order consists of mapping the current state of the workplace. According to the authors, the value of the mapping is to locate each part and observe the workflow as bottlenecks may be discovered. Order is reached by creating appropriate locations for all remaining items, which should be clearly visualized (Ortiz & Park, 2011). Smith and Peterson (1998) recommend ordering items after frequency of use, which can be observed during the sorting. Work areas and aisles should be painted or taped (Ortiz & Park, 2011). The authors state that the same goes for machine shops, where all items should have its own address marked with a sign and each tool its assigned place, e.g. by using shadow boards. In all places where safety is at risk, there has to be a “Keep Clear” sign (Ortiz & Park, 2011). To ensure that the optimal location has been found for each item, the setting in order has to be performed as an iterative process (Fabrizio & Tapping, 2006).

#### Phase 3. Shine (by inspection and cleaning)

The criteria of what shine is has to be determined and a plan to evolve and implement shine has to be decided upon (Fabrizio & Tapping, 2006). The authors recommend that a checklist be used for achieving and maintaining shine. Shine ought to be part of the daily maintenance routines, as it incorporates cleaning the workplace (Hirano, 1996). The cleaning is not supposed to be intensive but it is rather about wiping surfaces, sweeping floors, clean tools and equipment, and refill fluids (Ortiz & Park, 2011), in other words to keep the workplace and entire factory clean (Hirano, 1996). By cleaning inside and out, the workplace is inspected and dust, dirt and other contamination eliminated (Fabrizio & Tapping, 2006).

#### Phase 4. Standardize (the conditions and share the information)

Standardize is a method by which the three previous steps are maintained. Standardization can be achieved by determining the ideal state of the previous steps and how to implement it (Hirano, 1996), whereafter visual control should be implemented to sustain it (Fabrizio & Tapping, 2006). The design of the visualization should be standardized and concise (Ortiz & Park, 2011). Smith & Peterson (1998) suggests a uniform format of labels to reduce the effort of scanning through them. The authors further state that shadow boards for the tools should have the same color and that the colors of the floor tape or marking should have defined purposes. Each purpose should have a designated category of item and color, e.g. fixed items, garbage containers, finished goods, part locations, thus making the location clearer and easier to recognize (Smith & Peterson, 1998). As mentioned by Hariano (1996), standardization is

also a means to maintain shine, and the standardization of shine with clean areas is reached after practicing shine a while.

#### Phase 5. Sustain (the benefits)

Sustain is where 5S as general training involves all employees and is being worked with and turned into a habit (Fabrizio & Tapping, 2006). The authors state that it is vital to keep it simple. Sustaining refers to the proper maintenance of the workplace procedures (Hirano, 1996). It requires self-discipline and that all employees contribute to the work with 5S (Smith & Peterson, 1998). As each company is different, the effort of sustaining will differ between companies. Nevertheless, Ortiz and Park (2011) suggest the following guidelines:

1. After each shift, the team leader should perform a daily walk through to verify the cleanup after all other employees have left.
2. The 5S audit sheet should be established as no system is ideal.
3. The system for 5S audit should highlight commitment from the management and the importance of 5S.
4. The system for 5S audits should include a form for 5S, a schedule for when to perform the audits, a schedule for rotation between a couple of decided auditors, and a tracking sheet for 5S to communicate the current status.

### 3.5 Improvement Work

Continuous improvement is often related to the Japanese word Kaizen, which is a part of the lean production philosophy where the essence is gradual changes over time (Manos, 2007). Improvement is strongly correlated with quality, and programs and routines can be used to reach the aimed standard (Manos, 2007). The programs contribute a foundation for creating a mindset focused on quality (Brue, 2015). Quality can be defined as measurable conformance to set specifications, or as conformance to customer requirement; the last-mentioned can be difficult to measure (Pries & Quigley, 2013). Continuous improvement will be described as philosophy, its processes, systems and tools. The aspects of leading change and loop learning will also be presented.

#### 3.5.1 Traditional Improvement System

Traditional improvements are characterized by being complex, technology heavy, resulting in a dramatic change due to a one time investment linked to high costs (Manos, 2007). It can be challenging to perform these more radical improvements, as changes on various levels of the organization are required (Bhuiyan & Baghel, 2005). Manos (2007) states that the aim is to revolutionize the organization, and as the implementation has a top-down approach it is difficult to ensure effectiveness of the outcome as the actual users of the change were not involved. Mika and Kovel (2006) further state that a traditional improvement is implemented when a need has been identified.

### 3.5.2 Continuous Improvement

Using Kaizen as an approach, the improvements are performed continuously in incremental steps involving participants (Setijono, 2010; Anand et al., 2009). According to Jugulum and Samuel (2008), the Kaizen mentality has to permeate the entire organization and be a part of the culture (Mika & Kovel, 2006). Kaizen is mostly an instrument to create growth (Mika & Kovel, 2006; Liker, 2009) and to never be satisfied with the current state of the organization regarding, for example, waste, output, quality, and costs (Nicholas & Soni, 2006). The effectiveness of the implementation is high as the ideas to be implemented come from the employees (Manos, 2007). Kaizen is not merely a tool but a culture, meaning that changes in philosophy are needed to a greater extent than physical changes (Mika & Kovel, 2006). Focus should be on improving processes and operations while decreasing waste (Nicholas & Soni, 2006).

Karlsson and Åhlström (1996) utilize a concretization of the otherwise general Kaizen perspective, often accomplished by implementing formalized quality cycles in contrast to the more traditional and passive way of collecting suggestions. The authors define quality cycles as formalized and systematized small group activities with operators at a predetermined time, where everyone has the possibility to come up with and discuss suggestions of how to improve the workplace. This approach has been shown to result in a distinct improvement of the number of suggestions and in the interest in making improvements (Karlsson & Åhlström, 1996).

Linked to the formalized quality cycles with operators are (1) an elaborative project plan used to realize the suggestions into implementations, (2) a reward system, and (3) a feedback system (Karlsson & Åhlström, 1996). Karlsson and Åhlström (1996) further specify three stages of maturity regarding Kaizen in a workplace:

1. There exists no specific organization meaning that employees can implement improvements to the systems based on mutual understanding
2. The company uses a structured approach with individual participation for suggestions on improvement
3. The company uses quality circles

Karlsson and Åhlström (1996) present two KPIs for measuring the progress of continuous improvement related work. These KPIs are (1) the number of suggestions per employee and year, and (2) the percentage of implemented suggestions compared with the total number of suggestions.

### 3.5.3 Processes

It has been stated that companies no longer compete with the processes they have but with their ability to constantly improve these processes (Anand et al., 2009). There is a strategy for the process of continuous improvement consisting of five steps presented by Jugulum and Samuel (2008). Firstly, the organization has to map the current situation and create a baseline. Secondly, a vision must be established. Thirdly, problems and opportunities have to be

identified and opportunities for improvement created. Fourthly, the changes should be implemented and waste eliminated from the system. Finally, the result should be evaluated and continuous improvement begun. The process of making decisions can instead be seen as an infrastructure and be categorized into three interdependent areas according to Anand et al. (2009): the purpose, the process, and the people. The authors describe that the purpose is to formalize the direction of the organization, stating a vision and goals. These may include both improvements of the current situation and innovation. The process is about implementing the culture of working with continuous change, using a parallel employee participation structure and standardized methods for improvement. The employees should be trained and have a career path to follow. They also need a support system for information during the process of continuous improvement (Anand et al. 2009).

### 3.5.4 Tools

There are various tools to be used for continuous improvement, and different companies use different tools (Sokovic et al., 2010).

#### PDCA

The Deming cycle, also known as the PDCA cycle, consists of the four-part Plan-Do-Check-Act (Sokovic et al., 2010). Start the process by recognizing an opportunity and Plan the changes that will lead to improvement; Do the change, preferably in small scale to test it; Check the result by reviewing, analyzing and finding learnings; Act on the basis of the result by either adopting or abandoning the change or going through the PDCA cycle once more (Moen & Norman 2006; Johnson, 2002). The Act part is the most vital stage. When PDCA is part of the lean production philosophy, the four steps are complemented with a fifth, Observe (Rother, 2010). The author explains it as inspecting the current situation. PDCA can be applied for both temporary and permanent solutions of problems, depending on the depth of analysis, and for both a sole assignment and entire programs; it is optimal for problems of medium size (Sokovic et al., 2010). PDCA is a tool for strategic learning processes (Pietrzak & Paliszkiewicz, 2015). By using PDCA cyclically, better or improved methods are continuously looked for, which has been shown to be more effective than trying to adopt the right solution at the first try (Sokovic et al., 2010).

#### Six Sigma

Six sigma is not a system with a set of tools creating the process for improvement (Tennant, 2001). The purpose is to identify and eliminate, or at least decrease, the causes of defects, variability and errors in processes (Brue, 2015). DMAIC is a data based tool used for Six Sigma projects based on a life cycle approach (Sokovic et al., 2010). It consists of five interdependent phases, which are Define-Measure-Analyze-Improve-Control. Shankar (2009) describes the phases in the following way. The first phase is about defining the requirements of customers and defining a target, ensuring that it is linked to the overall organizational vision. During the measure phase, a baseline is created by gathering current information and data about the area of improvement. The next phase is Analyze, where the purpose is to find and gain understanding of the cause-effect relationships of input and output in the process, covering all

aspects and identifying root causes. By first using test runs with appropriate tools, Improve those parts of the process that have been identified as weak with regard to the target for output. Finally, by implementing control systems, those input factors that have been identified as significant for the improved output must be controlled to ensure no deviations.

Six Sigma as method is more common in large organizations (Dusharme, N.N). Apart from being a part of Six Sigma, DMAIC is used as a gate stage in projects, where the project evolves into the next phase if the criteria of a reviewed phase are met (Sokovic et al., 2010). According to the authors, DMAIC is applicable as a tool for results-oriented project management and control. It is usually applied when problems are large and contain much data that need a statistical approach.

#### 4Q

4Q is an ABB standard based on four steps, quadrants (Jevgeni et al., 2014). The aim is to ensure that the processes are first mapped and correctly interpreted by gathering performance data, whereupon root causes are identified and improvements implemented into the current processes aiming at a long-term result (Lanczycki, 2015). In addition to a pre-assess step (to identify the current state), the four steps are: measure, analyze, improve, and sustain. Jevgeni et al. (2014) describe the steps as quadrants in the following way. The first quadrant, measure, is about defining opportunities and investigating the current state to understand the situation. The second quadrant, analyze, is about finding and verifying the root causes behind the problem. The third quadrant, improve, is about implementing solutions that will eliminate the identified root causes by first developing and later piloting the solution before implementing it. The last quadrant, sustain, is about maintenance. The improvement is maintained by finding standardization for processes and work methods.

4Q is suited for all types of improvement projects and requires a trained coordinator (Lanczycki, 2015). Jevgeni et al. (2014) states that the 4Q tool is rather a data driven process for identifying problems and solve these. The authors maintain that the tool is similar to both PDCA and DMAIC in focusing on process improvement.

### 3.6 Motivation

Motivation creates incentives to exert oneself and a desire to succeed (Alvesson, 2013). Increased transparency and enhanced information flows may improve motivation and discipline, provide a feeling of shared ownership of processes, and empower teams and individual team members to make better decisions and follow a better course of actions (Eaidgah Torghabehi et al., 2016). Motivation can be intrinsic or extrinsic (Deming, 2000), as explained below.

#### 3.6.1 Extrinsic Motivation

Extrinsic motivation is goal oriented (VandeWalle, 1997). Vision and goals should be used to inform relevant employees about what actions are required, making it easier for the employees

to decide and realize what is necessary in everyday work as each decision should be oriented towards achieving the targeted goal (Lind & Skärvad, 2004). In the long-term, extrinsic motivation leads to increased efficiency, why a central motivational incentive is to set goals and work towards them (Kaufmann & Kaufmann, 2010). To avoid disagreement, unclarity in work tasks, and conflicts within the department it is essential to ensure that all parties concerned agree upon the targeted goals, the level of ambition, and other restrictions that are relevant (Lind & Skärvad, 2004). To support employee performance, it is vital to work with specific instead of general goals (Kaufmann & Kaufmann, 2010). Challenging goals are preferable to simple goals in promoting motivation. Kaufmann and Kaufmann (2010) argue that using feedback as a tool for communicating the process of reaching the vision and goals increases performance, in comparison with excluding feedback. The authors mean that by receiving concrete feedback the employees are provided with descriptive guidance that is necessary to change behavior as well as to achieve continuous learning and create understanding. To be recognized is appreciated by all employees and has a motivational aspect that has been shown to be successful (Mika & Kovel, 2006).

### 3.6.2 Intrinsic Motivation

Intrinsic motivation is the urge to learn new things, be challenged, perform more autonomous tasks, and be motivated by the work (Ryan & Deci, 2000). Intrinsic motivation is achieved when there is a satisfactory relationship between the employee and the work task (Hackman & Oldham, 1974). The authors further state that to achieve intrinsic motivation it is essential to begin with the critical psychological states, which means that the employee has to experience responsibility for the outcome of the work and gain insight into what is required to reach the outcome. In order to experience responsibility for the outcome of the work, the employee must be allowed to make decisions regarding the scheduling of when and how tasks are to be performed (Hackman & Oldham, 1980). This autonomy, the authors argue, results in an experienced responsibility for the outcome, but feedback is required to gain insight into the result. Feedback results in knowledge about the outcome of the specific task as well as increased understanding of the entire outcome. If possible, feedback should be given directly to the employee (Hackman & Oldham, 1980).

## 3.7 Loop Learning

If an organization is to improve current systems and processes, and not only transaction issues, a deeper learning is needed (Argyris, 1977). Loop learning is a term describing how learning is detected and how errors are corrected (Argyris, 2002). The author distinguishes between single loop and double loop learning. Learning of the first type occurs without modification of the underlying guiding values, whereas the second type evolves from altering the values and consequently the actions. Hence, the model used for deciding is changed when using double loop learning, and deeper learning is achieved (Bochman & Kroth, 2010). Jaaron and Backhouse (2017) explained that double loop learning is essential for an organization's performance and requires a dynamic environment. However, single loop learning is more commonly used, because management is defensive about the way procedures are performed,

and so changes are averted if possible (Argyris, 1991). This action and mindset divides organizations between those that systematically solve their problems based on new knowledge and those who do not (Garvin, 1993).

According to Thomas (2014), individual experience can be transferred into organizational learning, where best practices can evolve regardless of e.g. a high employee turnover, otherwise implying that experience and learning are lost when an operator leaves the organization. Systems are however needed to ensure that new knowledge is adopted into the current model and procedures for decision making (Dahanayake and Gamlath, 2013). There is a system that has been based on the three steps check-plan-do, called the Vanguard method, introduced by Jackson et al. (2008). Check stands for analyzing what and why the current state system is the way it is. Plan is about evaluating various potential solutions to the identified wastes. Do regards the incremental implementation of the found solution, by first testing it. The method enables service operations to be redesigned in response to customer demands. Ayham and Backhouse (2017) explain the procedure as starting with forming a self-managing group to perform the change into operations by identifying the purpose behind the current service system and understanding it from the customer's viewpoint, which is time consuming. The aim is to define the request of customers and to categorize it into either valuables or failures (Seddon, 2003). A valuable demand is what creates value for the customer, whereas failure demands cannot be served because the organization lacks systems, operations, or information flow (Jaaron & Backhouse, 2017). The authors state that sole purpose of the method is to learn why failure occurred and to provide support for changing the current situation in order to prevent that the same decision making occurs again.



## 4 Current State Description

The following chapter presents the Operational Excellence project at LSP as well as site descriptions of the seven sites in the study. The subjects described are, in accordance with the method for this study and as defined in the theoretical framework, organizational structure, daily control and visual management, workplace organization, and improvement work.

### 4.1 The Operational Excellence Project at LSP

Sites involved in the Operations Excellence project are LSP A, B and D in Sweden, LSP C in Norway, and additional LSP sites not included in the study. Based on interviews and observations, the project is managed by a central project group responsible for planning and implementation of methodologies and systems, as well as for coordination between the different sites. The Operational Excellence project is managed by top down implementations. However, it is the responsibility of each site and the local site managers to adopt and utilize the methodologies initiated by top management, i.e. implementing information boards as part of daily routines, or developing, documenting and improving the daily routines and activities related to 5S. Follow up with top management is done once a week during telephone ‘flash meetings’ between site managers and top management, involving the project team and the operations management team. During the flash meetings, each site manager reports weekly about the current situation regarding performances KPIs, attendance, and incidents, as well as about operational excellence related progress or problems. At the end of the flash meeting there is an opportunity to share thoughts and ask for help and guidance from each other.

General progress of the Operational Excellence project is followed-up monthly during business review meetings, to ensure that all sites reach a predefined baseline regarding activities linked to initiation and improvements, according to the Project Manager. The Operational Excellence project was initiated in May 2017, and is currently encompassing the following areas:

- Action lists, all sites should utilize an action list - an excel based list where suggested improvements and actions should be documented.
- Quality requirements, each site should monitor the quality levels set by the customer and work actively to improve quality levels (monitored compared with a set service level).
- KPI data follow-up. The KPIs are developed for each specific site with involvement from the central top management, to achieve positive financial results. The KPIs are updated on a yearly basis, based on the required investments contra savings for the next year.
- Workplace organization, all sites have currently initiated some or several activities related to 5S. Most of the sites perform 5S audits.
- Information center, a visual board placed at a central place at each site to increase visibility and transparency. Includes the following areas:
  - General information about LSP
  - Safety and Health (the green cross)
  - Information related to 5S (statistics from audits)

- Continuous improvement (the action list)
- Quality (the service level)
- Local productivity

#### 4.1.1 Difficulties and Hinders

Four general site characteristics have been identified by the Project Manager as hindering adoption and implementation of new systems and methods that are part of the Operational Excellence project. These are lack of dedicated time, budget, external ownership of sites, and short contract periods.

## 4.2 Site Descriptions

This subchapter involves a summarization of the current situation of the research objects, LSP A and B. The information has been gathered through interviews, observations and empirical data gathering. Furthermore, as comparison, benchmarking studies are summarized from LSP C and D, and from external industrial manufacturing companies A, B and C.

### 4.2.1 Organizational Structure

General organizational and site specific characteristics are presented below for the main research objects and for the benchmarking sites. Table II presents a summarization of central factors from each of the sites.

#### Research Object, LSP A

Operations at LSP A are carried out in a warehouse terminal operated by a post and logistics company, Logistics Company A (LCA). The site is temperature controlled for refrigerated and frozen food supplies, see appendix II for site maps and production flow. LSP A is responsible for daily warehouse operations of products owned by one of the customers to LCA. Hence, for all physical handling and warehouse or terminal operations between inbound and outbound deliveries. Inbound and outbound transportations are managed and performed by LCA. Contract periods between LSP A and LCA is of one year.

Operations at LSP A are managed and performed by one site manager, three team leaders, five full time and permanently employed operators, five part-time and permanently employed operators, and about 15 part-time temporary operators. Team leaders are leading operators in their daily work, but are also responsible for administrative activities and tasks. Order picking and completion of customer orders are performed by single order picking operators working in parallel work cycle from receiving a picking list to placing a complete package for outbound deliveries. According to interviews and observations, there are uncertainties regarding defined and communicated local targets or strategies at the site for how to manage daily operations to maximize customer value and to optimally contribute to the company vision. The interviews further stated that new implementations of routines and methodologies are introduced by top management with low degree of initial local involvement. Operators further stated that they experienced low degree of local affiliation with a general company identity.

### Research Object, LSP B

LSP B handles industrial packaging, such as pallets, pallets collars, plastic boxes used by two separate vehicle manufacturing sites located in the same area as LSP B, Vehicle Manufacturer A (VMA) and Vehicle Manufacturer B (VMB), see appendix II for site maps and production flow. LSP took over the business and operations during 2013 when it was outsourced by VMA and VMB. The packaging material handled have previously contained inbound supply material sent to the two factories VMA and VMB from their respective suppliers. After being emptied and unloaded, the packaging containers and material are checked, cleaned and washed, sorted and assembled in bundles, and then sent back to the subcontractors for VMA and VMB. The subcontractors in turn send new material to VMA and VMB. Contract periods between LSP B and the two customers VMA and VMB is of five years.

The number of employees at LSP B is around 40, where the majority work as operators. There are further one site manager, one operations manager, and four administrators who alternates between office tasks and production related operations. Some of the operators are also active as technicians. There are three shifts, and operations are performed day and night, besides from during weekends when there is one shift during daytime. Interviews and observations showed that as in LSP A, there are uncertainties regarding defined and communicated local targets or strategies at the site for how to manage daily operations to maximize customer value and to optimally contribute to the company vision. Furthermore, implementations of routines and methodologies are also introduced at LSP B by top management with low degree of initial local involvement. Operators at LSP B also stated that they experienced low degree of local affiliation with a general company identity.

### Internal Benchmarking, LSP C

LSP C is located in Norway and is the newest of the LSP sites, operating since the early autumn 2017. The site manages logistics flows between a Manufacturer of Dairy Products (MoDP) and schools in Norway. Incoming materials are mainly dairy products in single serving packaging. Delivery takes place daily and is carried out by MoDP to local schools. In total there are around 40 employees at LSP C, working during one shift per day. The contract with MoDP is of three years, but may be revoked until six months prior to the start of a new school year, according to the Operation Manager. Systems within operational excellence are being introduced at the time of the site visit. According to the Site Manager it is mainly the site management that is involved in the implementation received from top management.

### Internal Benchmarking, LSP D

Operations at LSP D involve various warehouse and logistics related services for one customer that is a fashion E-Business retailer (EBA). LSP D performs daily warehouse routines such as handling of inbound logistics, storage, order picking, packaging, handling of preparations prior to outbound logistics. LSP D is responsible only for the daily operations at the site. Other activities are EBA's responsibility, that share the same office space as LSP D. Contract periods between LSP D and EBA is of five years. Around 300 employees work at LSP D, divided over three shifts. Professional roles within the organization are site manager, supervisors, group

leaders, HR-personnel and warehouse operators. The site is new and operations were initiated during early 2017. Compared with other LSP sites, LSP D is larger and more advanced regarding automatization but also adaption of operational excellence principles. The Site Managers stated that the general company vision has not been translated for local use. Hence, it is currently complex to develop long-term targets or to motivate a certain way of working.

#### External Benchmarking, Company A

Company A is an organization that is part of a multinational corporation. Company A manufactures plastic components and products in polymeric materials by utilizing their own standard machinery for plastic melting and pressing. Injection molds used are however customized and owned by the customers of Company A. Company A has around 100 employees in the factory and office where the observations took place, involving the CEO, a production manager, production leaders, and operators. There are three shifts during weekdays and one shift during weekends. Major operations processes are inbound delivery, manufacturing, testing, packaging and outbound delivery, as well as maintenance and development of injection molds. It was observed that Company A has developed systems for daily control and continuous improvement. 5S as workplace organization was partly used during the site visit but was going to be introduced properly in 2018. A majority of the employees have been educated about lean production by university courses for working professionals, and through internal education. According to the interview with the Production Manager, factors such as scarce time, budget, short contract periods, and external ownership of capital assets are experienced at Company A. However, these factors are not considered as critical obstacles for performing non-directly value adding activities, improvements and investments, due to the importance of a long-term perspective regarding optimization of future customer value.

#### External Benchmarking, Company B

Company B is a unit in a multinational corporation operating within development and manufacturing of components for high voltage applications. The department of Company B where observations took place has about 45 employees, working during one single shift per day. The different professional roles at Company B are site manager, operations manager, production manager, team leaders, technicians and operators. The contract period with customers varies, but in general Company B has agreements with customers for 2-6 weeks. The processes observed involve inbound delivery, manufacturing, testing, packaging and outbound delivery. Company B was considered to utilize mature, systematic and well functional systems for daily control, workplace organization, and continuous improvement. Company B has a stated vision that is further broken down into long and short-term targets. The Logistics Manager stated that targets are established from the vision and do also act as an influential factor for daily control measured by a set of KPIs, workplace organization and continuous improvement. General education of methodologies and systems is part of the training for new employees. Workshops and similar are performed to achieve understanding and continuous development of methodologies and routines, according to the Logistics Manager. According to the interview with the Logistics Manager, factors such as scarce time,

budget, and short contract periods are experienced at Company B. However, these factors are not considered as critical obstacles for performing non-directly value adding activities, improvements and investments, due to the importance of a long-term perspective regarding optimization of future customer value.

#### External Benchmarking, Company C

Company C is a unit within a corporation that produce and assemble application adapted systems and components for vehicle hydraulics. Company A has about 100 employees, involving operators, production leaders and top managers, and the workday consist of three shifts per day. The process observed consists of inbound delivery, assembly, testing, packaging and outbound delivery. The contract period with customers varies, but in general Company C has agreements with customers for 10 to 15 years involving e.g. spare part agreements and services. It was observed that Company C has systems for daily control and continuous improvement. At the time for the site visit, Company C was introducing 5S as a methodology for workplace organization. The site manager at Company C considered that education of the employees regarding new methodologies and routines is the most critical part when managing changes and introducing new systems. According to the interview with the Site Manager, factors such as scarce time and budget are experienced at Company C. However, these factors are not considered as critical obstacles for performing non-directly value adding activities, improvements and investments, due to the importance of a long-term perspective regarding optimization of future customer value.

#### Problem Identification

The following factors were identified as the most critical improvement areas at LSP A and B, see table II, and will therefore be discussed further in the analysis.

- No defined local targets or strategies to achieve company vision
- Top-down implementation of methodologies and systems
- Low local affiliation with company identity

Activity	Research Objects		Internal Benchmarking		External Benchmarking		
	LSP A	LSP B	LSP C	LSP D	Company A	Company B	Company C
# of Employees	30	40	40	300	100	45	100
# of Shifts	1	3	1	3	3	1	3
Contract Period	1 years	5 years	3 years	5 years	N/A	2-6 weeks	10-15 years
Production Ownership	Customer	Customer	Customer	Customer	Customer	Company B	Company C
Management Involvement							
Daily Control	Some	Some	Yes	Yes	Yes	Yes	Yes
Management Involvement							
Workplace Organization	Yes	Some	Yes	Yes	Yes	Yes	Yes
Management Involvement							
Continuous Improvement	Some	Some	Yes	Yes	Yes	Yes	Yes
Education	Some	Some	Some	Yes	Yes	Yes	Yes
Experienced scarce time and budget	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vision Used for Anchoring	None	None	None	None	Yes	Yes	Yes

Table II. A compilation of the current state regarding the organizational structure based on the scoreboard assessment (appendix 1).

#### 4.2.2 Daily Control and Visual Management

The following segment presents empirical findings related to how the sites work with daily control and visual management. A summarization of the findings and the identified areas of improvement are presented in table III.

##### Research Object, LSP A

Information exchange between the site manager, team leaders and operators takes place through informal and verbal communication, or through group meetings when considered needed. Meetings occur more seldom than weekly according to the Site Manager. Daily operations are mainly routine based with little interruption or active management from team leaders or the site manager, if there are no scheduled or sudden deviations from routines. The operators considered it as clear what was expected from them during a regular work shift, however, at the same time they mentioned that communication between operators and management was inadequate. Operators also stated that morning meetings were previously used at the site, but that this routine is no longer in use. Three whiteboards, two in the office and one at the beginning of the picking line, were mounted at the site, but were not updated with work information or considered relevant by local operators or managers. New initiatives for control will be initiated at the end of 2017, beginning with the LSP standardized information center replacing one of the boards in the office according to the Project Manager.

The planning period for production was frozen one day prior to outbound delivery. Production planning later than for the next day is subsequently forecast based. Quality control of outbound deliveries is performed by controlling random samples of outbound products, and by extra control of packages sent to customers who previously has reported claims regarding errors according to the Site Manager. KPIs documented by LSP A are presented in appendix III.

##### Research Object, LSP B

Communication occurs mainly through informal, verbal interactions between individual employees at the site. Weekly control meetings were introduced in 2013 when LSP took over operations at the site. Meetings are held for each shift, why there are a total of three meetings a week. Visual boards relevant for production include an LSP standardized information center, an operation prioritization to visualize what material and actions that are most critical to handle first in production to avoid backorders. Furthermore, general site information, and an agenda for what has been discussed during the weekly meeting is also visualized. There is also a board for line-up of the daily shift. The Operations Manager considered that operators at the site generally have a fundamental perception about what has been communicated through the prioritization board, but that he still has to ensure that all operators know about the prioritization order about three times every week, by walking around the site and talking with operators.

Shift handovers take place informally between operators and team leaders of the two shifts in the lunchroom on spare time, according to observations and interviews. Information sharing about production outcome and deviations between shifts are considered insufficient as uncertainties about what has been done during previous shift occur, according to interviews

with operators. The planning period for production was frozen one week prior to outbound delivery. Quality control of outbound deliveries is performed by extra control of packages sent to customers who previously has reported claims regarding errors. KPIs documented by LSP B are presented in appendix III.

#### Internal Benchmarking, LSP C

At LSP C, daily meetings are held every morning as a central function of daily control, to inform about current production targets and general information. Prior to the meetings, information related to production targets and previous outcomes are updated on a visual board located at the shop floor. Visualization of targets and actual production outcome is considered a beneficial and functional system that leads to turning individual employees into a team that strives for a mutual daily goal, according to the Site Manager. When production volumes are lower, the site proceed with the order list for the day after if possible, in order to even out daily fluctuations in demand. Within the facility, customer order lists are used for visualizing and initiating each separate customer order in production. Orders are handled by each operator who packages products in paper bags according to the order list, then an address label is attached to the bag. Step by step work instructions for all workstations and activities are accessible for operators and can also be used for initial training at the site.

Operators receive daily feedback on production efficiency in two ways according to the Operations Manager. The first is the team based result compared with daily production targets that are presented during the daily morning meeting. The other is continuous individual feedback communicated to operators by the site manager or team leaders, based on the individual production reports filled out by each operator during each shift. Quality control of outbound deliveries is performed by controlling random samples of outbound products, and by extra control of packages sent to customers who previously have reported claims regarding errors. KPIs documented by LSP C are presented in appendix III.

#### Internal Benchmarking, LSP D

The resource and production planning is forecast based, there is no applicable frozen period as orders are received as soon as they are placed by a customer via the online shop, according to the Project Manager. At the beginning of each shift employees gather around their specific department board, to check attendance and present the planned production for the day. Afterwards each shift has a daily control meeting per department, all employees at LSP D attend at least one meeting per day the local Site Manager stated, whereafter representatives join a common meeting. Afterwards, the management works daily to addresses the issues raised during the morning meetings of the departments. According to observations there exist at least one board for each department and more boards for the escalating meetings. The agenda for the meetings varied some between departments but the layout of the boards is similar, see appendix IV. LSP D began working with daily control in 2015.

Work instructions are visualized in brief on some of the daily control boards, according to observations. There are, as well, formal systems for feedback on performance, which is communicated to operators three times during each shift, according to the Site Manager. Many

of the initiatives come from within the site regarding introductions of new methodologies and updates, however, some implementations are required from top management at LSP. KPIs documented by LSP D are presented in appendix III. Control of products is made by an automated warehouse management system, the Site Manager stated. The result is printed by the group leader from which deviations and errors are presented to individual operators. It is through this system also possible to track the order and manage to solve deviations before outbound delivery.

#### External Benchmarking, Company A

Daily control involves informal startup meetings with all operators at each department at the beginning of each shift. These are followed by formal daily control meetings of five to ten minutes long, in front of separate, department specific daily control boards at each functional department. A joint pulse-meeting is held with one representative from each department in front of a joint visual management board, according to observations. The meetings are based on the current status for the production, and is not a meeting for debates or elaborations the Production Manager stated. Tasks and problems identified during the meetings are dedicated to a specific employee to solve during the meetings instead. Daily control was first introduced in 2012, but has evolved continuously since then. The processes are performed in independent cells and each workstation have its own work instructions which are also visualized by the station containing both pictures and descriptions. When introducing daily control at Company A, the company decided to enroll in a program covering all relevant subjects, including workshops and education, according to the Quality Manager.

The department specific daily control boards are used to go through a number of department specific factors which are also visualized on the boards and on an agenda, see appendix IV. The layout varied between the departments as it has been designed by the users themselves. It is the team leader or in some cases the production manager that is responsible for updating the boards according to the Production Manager. The Production Manager continued that it is the team leader's responsibility to pass the information on to the next shift. Each shift overlaps by about an hour, providing opportunity for information exchange, but also time for work that is not directly value adding to production, such as maintenance, and improvement work. The resource and production planning is forecast based, and there are no frozen periods according to the Production Manager. KPIs documented at Company A are presented in appendix III.

#### External Benchmarking, Company B

The resource and production planning is forecast based, frozen period is not applicable as customers can do changes during the entire process until delivery according to the Logistics Manager. Company B began working with daily control in 2012 and according to the Logistics Manager, every department has daily morning meetings of about 10 minutes followed by a joint meeting. These are held in front of digital and analog daily control boards. Each department has its own department specific board and agenda, see appendix IV, as a specialized board is better adopted by the operators compared to standardized boards, according to the Logistics Manager. It is the production manager and team leaders who are responsible for updating the boards on a daily basis and also making changes of the layout. The tasks and

problems identified during meetings are either dedicated to an employee within the department or lifted to the joint meeting.

By visualizing KPIs, metrics and process statuses on the daily control board, the efficiency of all employees have increased significantly as better understanding has been gained, according to the Logistics Manager. There are work instructions at all workstations, both digital and analog. The KPIs measured at Company B are those visualized on the boards, see appendix III. The most important KPI for Company B is on-time-delivery according to the Logistics Manager, this to avoid using KPIs that are influenced by more than the specific department of interest. According to the Logistics Manager quality control is performed at workstations and by sample checks. When it comes to the packing department, the process of handling orders does always include two operators to ensure quality by cross-checking, The Logistics Manager continued.

#### External Benchmarking, Company C

Resource and production planning is forecasted based and the frozen period is 24 hours according to the Production Engineer. Company C introduced daily control in 2014, and since then it has evolved continuously, being a core component of control according to the Site Manager. The structure for daily control at Company C consists of daily control meetings at each department that are about six minutes long at the start of each shift based on an agenda at the board, see appendix IV. This is followed by a pulse-meeting held in a separate room with a glass wall for transparency. Team leaders for each shift arrive 15-20 minutes before the start of the shift for a handover from the previous team leader. The daily control board is updated during the handover together with the two team leaders, it is also the team leader that is responsible for the visual board. Tasks and problems identified during the meetings are either dedicated to an employee or discussed during the pulse-meeting and dedicated during this meeting, according to the Site Manager.

Work instructions are presented with illustrations at the stations, but also digitally. Work instructions are updated and revised when considered relevant according to the Production Engineer. New machines have built in error proofing systems, such as poka-yoke methods of preventing human errors. There is also a software built in the machinery system documenting and reporting about e.g. downtime, stops and identification of problems that are encountered are logged.

## Problem Identification

The following problem areas have been identified in the above subchapter, see table III, and will be discussed in the following analysis:

- Informal and sporadic communication and control of daily production targets
- Informal system for individual and team performance follow-up
- Informal communication between shifts
- Short-term result focus and no assigned time for work tasks

Activity	Research Objects		Internal Benchmarking		External Benchmarking		
	LSP A	LSP B	LSP C	LSP D	Company A	Company B	Company C
Introduction of System	2017	2013	2017	2015	2012	2012	2014
Daily Control Board,	None	None	Yes	Yes	Yes	Yes	Yes
Safety			None	Yes	Yes	Yes	Yes
Quality			None	None	Yes	None	Yes
On-Time-Delivery			Yes	Yes	Yes	Yes	Yes
Attendance			None	None	Yes	Yes	Yes
Production Target			Yes	Yes	None	Yes	Yes
Daily Meetings	None	None	Yes	Yes	Yes	Yes	Yes
Daily Control Coordinator	None	None	Yes	Yes	Yes	Yes	Yes
KPIs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dedicating Tasks and Problem Solving	None	None	None	None	Yes	Yes	Yes
Gathering and Updating Information			Yes	Yes	Yes	Yes	Yes
Approach	top-down	top-down	top-down/ bottom-up	bottom-up	bottom-up	bottom-up	top-down
Shift Handover		None		Yes	Yes		Yes
Visualization of Work Instructions	None	Yes	Yes	Yes	Yes	Yes	Yes
Quality Control	Partial	Partial	Partial	Yes	Yes	Yes	Yes
Resource Planning,							
Forecast Based	Yes		Yes	Yes	Yes	Yes	Yes
Capacity Based		Yes					
Frozen Planning							
Period	1 day	1 week	1 week	Seconds	None	None	24 hours

Table III. A compilation of the current state regarding daily control and visual management based on the scoreboard assessment (appendix 1).

### 4.2.3 Workplace Organization

The interpretation and usage of 5S as methodology for workplace organization at the sites studied are presented in this segment. A summarization of the findings and the identified areas of improvement are presented in table IV.

According to the Project Manager, the implementation of 5S as methodology for workplace organization as part of the Operational Excellence project at LSP began with education of the local site managers during a one day session at LSP D. As part of the education, all 5S steps were performed at one workstation. Afterwards, each site manager was supposed to initiate routines for 5S at their local site. At present time, there are differences regarding how the 5S methods are utilized within the different sites, according to interviews and observations.

#### Research Object, LSP A

5S related methodologies are used at LSP A, but without systematized routines, audits or documentation. Observations showed that markings on floors, tools, machinery and racks have been implemented to improve visibility and navigation at the site. There were also instructions for cleaning of the site, which is performed on a regular basis at the end of each day. The overall impression from observations and interviews at LSP A was that the majority of the operators and team leaders have little or no knowledge about the concepts of 5S and workplace organization, or what type of benefits that may derive from it. The Site Manager considered that he alone had the full responsibility for 5S auditing and documentation at the time for the site visit. Furthermore, the 5S audit forms used were not considered optimal or appropriate for the local site according to the Site Manager. Documentation and audit results were visualized within the local management office.

#### Research Object, LSP B

At LSP B, 5S related initiatives have been initiated and a 5S coordinator has been assigned among the operators. However, without formal routines related to 5S, such as documentation, audits or follow-ups. The work with improving the workplace organization has been initiated at several occasions at the site, however a new initiation started during 2017. According to observations, workplace related implementations such as marking fixed inventory locations with tape and creating a number of informative signs in the facilities were identified. Some of the operators mentioned that 5S is related to removal of waste to create a better order at the workplace, to more easily find e.g. tools and other important work materials, showing that there are some understanding of the concept of 5S among the operators.

#### Internal Benchmarking, LSP C

At the time of the site visit the Site Manager at LSP C considered that some initiatives related to 5S have been carried out since the start in 2017 with the help of top management at LSP but not information about how to use it on regular basis. The Site Manager has been informed that 5S is to be broader presented and implemented at a later date. Initiatives seen during observation were among other things, marking on the floor for the location of goods wagons, materials and workstations. These marking have changed by iterative processes according to the Site Manager.

#### Internal Benchmarking, LSP D

5S as methodology for workplace organization is established and used at LSP D according to observations. Tools such as floor markings, dedicated storage locations, marked places for tools and material were utilized. Implementations of 5S started in 2015 in the previous warehouse, and routines and methodologies were later transformed to the new facility, according to the Site Manager. All the S in 5S are performed as part of workplace organization according to the Site Manager. Every department has an appointed 5S coordinator, who is responsible for leading and evaluating 5S related activities and statuses for each department. Who is responsible varies, and the appointed person is visualized on each department's visual board for daily control. 5S audits are carried out by managers continuously. Furthermore, when it

comes to cleaning routines of the workstations, the Site Manager stated that there are clear instructions including appointed operators who are responsible for cleaning of other areas, including the waste bins and shared shop floor locations. There is however some resistance experienced by the Site Manager from the customer EBA, regarding activities and initiatives within workplace organization as EBA is considered as restrictive regarding allowing LSP to make changes in the physical warehouse facility, of example using tape on the floor.

#### External Benchmarking, Company A

Multiple efforts have been made by Company A to introduce 5S as a workplace organization system, but without sufficient anchoring as part of daily routines according to the Production Manager. According to the Quality Manager, 5S is currently the formal system for workplace organization. However, implementation and utilization of the methodologies have come differently far at different departments. The next phase regarding 5S implementation is to focus on development and initiate routines at a higher level in the whole organization, which is also an important part of the corporate activity plan for the upcoming year, according to the Quality Manager. Initiatives such as floor markings, marked places for tools and material were observed.

#### External Benchmarking, Company B

Company B has worked with 5S as methodology for workplace organization since May 2015, with the aim of achieve a complete functional system of 5S, according to the local 5S Coordinator. There has been an earlier initiative to implement 5S that was not successful. According to the 5S Coordinator the current workplace organization is adopted to the environment of the various workplaces. The current focus for all departments is to work with the last S of 5S, sustain. 5S audits are performed by local managers weekly, and the result together with who was responsible is visualized on the daily control board. Observations further showed extensive usage of floor markings for workstations, storage locations and walkways, places for tools and material, and informative signs were mounted where considered relevant.

#### External Benchmarking, Company C

Observations and interviews showed that there were no routines or methodologies used for workplace organization at Company C during the time for the site visit. However, there were plans made for the future of implementing 5S at the site. Previous attempts of implementing 5S have been done, however without any sustained result. According to the Site Manager interviewed, the main reasons for the previous failed attempts were insufficient anchoring of the methodologies as part of daily routines, and insufficient education of operators. The first planned milestone for the new initiation of 5S is to create understanding of how 5S can benefit the local site and business. Observations showed usage of floor markings and markings for tools and material.

## Problem Identification

The following problem area has been identified in the above subchapter, see table IV, and will be discussed in the following analysis:

- Differences in utilization and perception of 5S between sites

Activity	Research Objects		Internal Benchmarking		External Benchmarking		
	LSP A	LSP B	LSP C	LSP D	Company A	Company B	Company C
Introduction of System	2017	Before 2013	2017	2015	N/A	Before 2015	Before 2012
New Try of Introduction Phase		2017			2018	2015	Future Plan
5S Interactive Board	Pre-phase	Pre-phase	Pre-phase	Sustain	Pre-phase	Sustain	Pre-phase
5S Coordinator	Partly	None	None	Yes	None	Yes	None
5S Audit and Visualization	Yes	None	None	Yes	None	Yes	None
Standardized Tools and Methods	Yes	Yes	None	Yes	None	Yes	None
	None	None	None	Yes	None	Yes	None
Approach	top-down	top-down	top-down	bottom-up	top-down/ bottom-up	top-down/ bottom-up	top-down
Visual Color-Coding	Some	Some	Some	Some	Some	Yes	Some
Ease of Navigation	Some	Yes	Some	Yes	Some	Yes	Some
Cleaning routines	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area Free of Unnecessary things	Some	Some	Some	Yes	Some	Yes	Some
Marked Aisles	Some	Some	Some	Some	Some	Yes	Some
Marked Tools and Machines	Some	Some	Some	Yes	Some	Yes	Some

*Table IV. A compilation of the current state regarding workplace organization based on the scoreboard assessment (appendix 1).*

### 4.2.4 Improvement Work

The interpretation and usage of methodologies for continuous improvement at the sites studied are presented in this segment. A summarization of the findings and the identified current problem areas are presented in table V.

#### Research Object, LSP A

LSP A began working actively with improvement work in 2016 when a suggestion form was added to the information board within the office, where employees could write down their ideas for improvements, according to the Site Manager. However, this list is not used by operators, and most suggestions for improvements are communicated verbally according to interviews. Operators stated that there are currently few reasons to coming up with and presenting improvement suggestions. The reason for this given was the perceived lack of interest or follow up after suggesting a proposed improvement. According to the Site Manager there are no scheduled time for implementation or evaluation of improvement ideas. Furthermore, there were no explicit targets or strategies for how to motivate, prioritize or perform improvement related work at the site.

#### Research Object, LSP B

According to the Site Manager, LSP B began working actively with improvements in 2013, when introducing a suggestion form to write down ideas for improvements. This has been complemented by an excel-action list accessible to management. According to the Operations

Manager, the current daily work and routines at the site are pressured and there is little room for improvement work, as production is prioritized in the first place. Improvement proposals are spread internally mainly by operators entering the site manager's or the operations manager's office, and presenting their suggestions. The Site Manager stated that he wishes to get the ideas on paper to not to forget about them. There were no explicit targets or strategies for how to motivate, prioritize or perform improvement related work at the site. Regarding deviations in production, such information is documented by operators in a deviation log by the operators, according to observations. However, interviews show that small or often occurring deviations are not logged.

#### Internal Benchmarking, LSP C

The introduction of the action list was planned after the site visit, according to the Site Manager at LSP C. At the time for the site visit, the site manager has made own initiatives with team leaders for minor adjustments within the facility to improve processes and efficiency in the meantime. This to see if significant improvements in daily work or increase in efficiency of the site would occur. The Site Manager explained that there were no explicit targets or strategies for how to motivate, prioritize or perform improvement related work at the site.

#### Internal Benchmarking, LSP D

LSP D began working actively with continuous improvement in 2015. It is the responsibility of the site manager and the team leaders to initiate work with improvements, and to communicate the progress to local employees and to the customer, according to the Site Manager. LSP D is mainly working with reactive improvements, according to observations. The action list is mounted on the daily control board where employees may write down suggestions. There were no explicit targets or strategies for how to motivate, prioritize or perform improvement related work at the site. It is, therefore, difficult to know how to prioritize between improvements suggestions, but also between improvements and the daily directly value adding routines, according to the Site Manager. Furthermore, the Site Manager considered that incentives among operators and local management to engage in improvement related work were considered as low.

#### External Benchmarking, Company A

Company A has been working actively with improvement work since the 1960s, however in another, more primitive way than today, according to the Quality Manager. Continuous improvement is anchored as part of the weekly production targets, and also derived from the long-term organizational vision of Company A. The long-term vision, targets, and their connection to the company, the business plan, and the customers, are discussed and evaluated during workforce meetings three times a year. There is allocated time to work with continuous improvement one hour each week per shift and department, according to the Production Manager. The work is based on pre-identified subjects. In addition, it is also possible to work with it during the overlapping between shifts. Furthermore, each department has a dedicated improvement board where employees may write down and work with the suggestions based on

a formalized process. Each employee is responsible for his or her own suggestions, meaning being responsible for making it happen but not to do everything on his or her own.

Communicated targets and KPIs for work related to continuous improvement are to accomplish one improvement suggestion per month for each employee. However, there is no timeframe for how long time should be spent on improvements, as complexity can vary according to the Production Manager. It is the realization of the suggested improvement in itself that should be seen as the motivation, according to the Quality Manager. Suggestions that are realized are visualized on the improvement boards to, among other things, improve motivation of leaving additional suggestions.

#### External Benchmarking, Company B

Company B has been working with continuous improvement for some time, but the current system was introduced in 2014. In order to obtain a vision and clear targets for improvements at Company B, the Logistics Manager explained that five workshops were held and the result was then analyzed. Strengths and weaknesses were discussed regarding various aspects of the targets and strategies for achieving the company vision and maximizing customer satisfaction.

Company B has dedicated two meetings for continuous improvement. The first is of one hour each week for specific subjects. The second is 30-60 minutes to mitigate identified problems in production. The continuous improvement process is driven by VU-groups (VU from the Swedish Verksamhetsutveckling, meaning business development), where each group is responsible for one department. The progress of the VU-groups is presented on meetings each month. Employees may also write down improvements on a suggestion form at the daily control boards. There exist no strict directives regarding the process of continuous improvement from top management more than each unit has to use a specific methodology when working with continuous improvement. According to the Logistics Manager, the ability of identifying proactive improvements is limited at Company B. The Logistics Manager believes that a forum for management and the department to meet and work towards an explicit goal is needed for this. It is further, critical to understand the current state but also where the department is heading to create a foundation for proactive improvement suggestions. This is something Company B is actively working with to establish.

Best practices are shared between departments and sites of the corporation, according to the Logistics Manager. Both by the use of a shared platform, a form for describing what the sites are doing well, as well as through a formal evaluation and comparison of systems used between sites based on a ranking system.

#### External Benchmarking, Company C

According to the Production Engineer, continuous improvement was introduced in 2012, and is a part of the philosophy and daily routines at Company C. The vision of Company C and how to maximize customer value is defined and communicated in the form of local tangible strategies and targets. There is however no structured system for continuous improvement

work. Instead employees work together with the tangible targets in mind, by improving routines and processes as part of the daily routine by minor changes aligned with the communicated strategy. Production management is then responsible for finding solutions to identified suggestions that operators cannot solve on their own, according to the Production Engineer. However, when an improvement plan has been developed, the responsibility for implementation is often dedicated back to the operators. In addition to everyday improvements, the Site Manager stated that Company C has recurring quality meetings, and also discusses major improvement potential together with their customers and suppliers.

Documentation of continuous improvement is performed on a monthly basis, and is presented on an improvement board located in the same space as the pulse-meeting board. There were no documentation and systematic development of best practices from sharing methodologies and routines between other sites operated by the corporation, something the Site Manager considered as a waste of resources.

#### Problem Identification

The following problem areas have been identified in the above subchapter, see table V, and will be discussed in the following analysis:

- Traditional and reactive approach to improvement work
- Lack of systems and formalized routines for achieving continuous improvement
- Few incentives among operators to engage in continuous improvement
- Quality deviations are stringently documented and seldom analyzed
- Work routines and processes are based on individual experiences that are not documented

Activity	Research Objects		Internal Benchmarking		External Benchmarking		
	LSP A	LSP B	LSP C	LSP D	Company A	Company B	Company C
Introduction of System	2016	2013	2017	2015	1960	2014	2012
Communicated Vision	None	None	None	None	Yes	Yes	Yes
Communicated Targets	None	None	None	None	Yes	Yes	Yes
Type	Formal suggestion schemes	Formal suggestion schemes	No explicit organization	Formal suggestion schemes	Formal suggestion schemes and meetings	Formal suggestion schemes and meetings	Formal suggestion schemes and meetings
Continuous Improvement Board,	None	None	None	Yes	Yes	Yes	None
Suggestions State and Progress Outcome				Yes	Yes	Yes	
				None	Yes	Yes	
				Yes	Yes	Yes	
Continuous Improvement Meetings	None	None	None	None	Yes	Yes	Yes
Allocated time for improvement work	None	None	None	None	Yes	Yes	Indirectly
Proactive work	None	None	None	None	None	None	Yes
Reactive work	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KPIs	None	None	None	None	Yes	Yes	Yes
Timeframe	None	None	None	None	None	Yes	None
Understanding of Company History and Future	None	None	None	None	Yes	Yes	Yes
Reward and Recognition System	None	None	None	None	Implementation and acknowledgment	Trophy	None
System for Employee Initiative and Resolving power	None	None	None	Yes	Yes	Yes	Yes
System for Feedback Approach	None	None	Yes	Yes	Yes	Yes	Yes
Approach	top-down	top-down	top-down	top-down	bottom-up	bottom-up	bottom-up
Process for reviewing work instructions	None	None	Yes	None	Yes	Yes	Yes
Ownership of suggested improvement	Site Manager	Site Manager	Site Manager	Site Manager	Proposer	VU-group	Department Management
Cause analysis of downtime and deviations	None	None	None	None	Yes	Yes	Yes
Best Practice	None	None	None	None	None	Yes	None
Training document	None	None	Yes	Yes	Yes	Yes	Yes

Table V. A compilation of the current state regarding improvement work based on the scoreboard assessment (appendix 1).



# 5 Analysis

The following chapter presents the analysis based on the current state at the seven sites studied and on literature presented in the theoretical framework. The topic areas analyzed are organizational structure, daily control and visual management, workplace organization, and improvement work. At the end of the chapter, an analysis of the implementation roadmap based on experiences at the benchmarking companies is presented.

## 5.1 Organizational Structure

This subchapter presents the analysis for the research objects regarding organizational structure (figure IV). This is based on systems presented in the theoretical framework (chapter 3) as well as in the current state description (chapter 4.2.1 and table II).

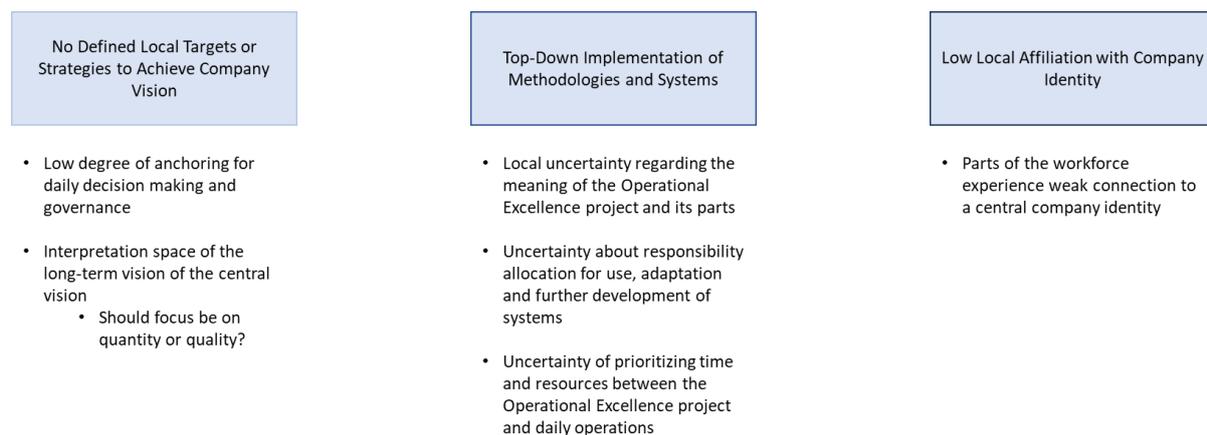


Figure IV. The identified problem areas regarding organizational structure at LSP A and LSP B.

### 5.1.1 No Defined Local Targets or Strategies to Achieve Company Vision

Long-term targets and strategies were considered as uncertain or non-existent at the local LSP sites compared to the external benchmarking companies. This implies that there are uncertainties regarding how to lead the local sites and how to manage operations in a way that generates maximized customer value, both in a short-term and a long-term perspective. The significance of this finding has support from Lind and Skärvad (2004) who argue that a vision is critical to strive for mutual goals, and to understand what actions and decisions that are rational to make.

#### Daily Decisions and Control not Anchored in Local Strategies or General Vision

It has been considered complex for local site managers at the research objects and at the internal benchmarking companies to make decisions or to lead the daily work in a way that is moving the organization closer to its general vision. A general reason to this complexity is considered to be conflicting goals regarding short and long term operational and strategic perspectives. Currently established local KPIs might be reached by either focusing on quality or on efficiency and speed. Both strategies may hence imply successful tangible results, however it is currently not defined which approach that would generate the most optimal customer value. The same

situation of uncertainties in leadership and prioritized factors occurs for other similar considerations at the sites, implying the lacking management support. Having specific goals is vital as mentioned by Kaufmann and Kaufmann (2010), for supporting employee performance in the right direction.

#### Uncertainties Regarding how to Reach a General Vision in the Long-Term Perspective

In the long run, difficulties in understanding what to focus on without knowing what competitive edge the local sites should provide is related to a risk of not consider relevant parameters and stakeholders involved in, and affected by, such decisions. This might further imply sub-optimizations which in turn might lead to organizational results not reaching their full potential, aligning with the findings by Harris and Harris (2012) and Tezel et al. (2010). Regarding local long-term decisions, interviews showed that investments were unsure, regarding if, how and why to invest for future needs, growth and efficiency improvements. Such situations hinder correct or relevant information or directives complicating decision-making (*cf.* Harris and Harris, 2012). However, given this situation, the lack of clear and communicated local strategies results in it being even harder to prepare and adjust for future customer requirements, as supported from the findings by Slack et al., (2016).

#### 5.1.2 Top-Down Implementation of Methodologies and Systems

Two outcomes have been observed at the LSP sites, firstly, local managers and operators tend to be critical or question initiatives that do not derive from local needs, but rather are centralized top-down initiatives. Secondly, it is not considered as obvious who is responsible for local implementation, adjustment and development of methodologies. Local sites currently rely on top management involvement for implementation and initiation of new methodologies and routines, and vice versa. Interviews and observations at the research objects showed that the implementations carried out within the scope of the Operational Excellence project have had low involvement and local adaptation from site employees, in contrast to the findings by Dennis (2015) who considered bottom-up involvement as a necessity for successful results. Lack of bottom-up involvement was further considered as a hinder for organizational change by Bhuiyan and Baghel (2005) and Fabrizio and Tapping (2006). If local employees are left without understanding or without experiencing the benefits that may come from implementations, it is likely that it will be difficult to reach high quality levels, cost efficient services and to provide maximum value to customers. This is a conclusion that aligns with the findings by Ajoje (2015). The full potential of the implementations and projects might hence not be achieved from a strict top-down approach, without the involvement from local employees at the LSP sites with support from top management. This statement further aligns with the findings by Manos (2007), who discourages usage of a strict top-down approach for local organizational implementations.

Methods have been introduced regarding the Operational Excellence project to reach operational improvements such as the information centers, but as stated by Ajoje (2015), several activities are needed to reach operational excellence within an organization. Similar problematization regarding the specific project vision and targets have been identified in

interviews with regard to the Operational Excellence project compared to the general one described above. There is hence a risk for LSP that the Operational Excellence project might not fulfill its full potentials possible as described by Miller (2014) if not achieving bottom-up involvement. The lack of bottom-up involvement is evident as the operators and managers interviewed argued that the information centers, as part of the Operational Excellence project, are used sporadically and not as part of daily routines. It is currently up to the employees themselves to study the information center if interested, which rarely occurs. However, if being used in practice, Ortiz and Park (2011) argue that visual boards create transparency and visibility of the organization and its units, teams and processes which generates understanding and awareness.

Furthermore, even if there are actual, local needs, or that local benefits can be achieved from implementation of new systems with methodologies and routines initiated by top management, the risk is considered high that standardized one-time-implementations do not get integrated as a natural part of daily operations and routines both when it comes to general implementations as well as specific ones for the Operation Excellence project. As argued by Liker and Meier (2006) as well as by Rother (2013) it is not possible to only implement existing systems, the systems also need to be modified and adapted to suit local needs and routines.

### 5.1.3 Low Local Affiliation with Company Identity

From interviews with employees at local LSP sites, it was evident that a majority of operators experienced stronger affiliation with the characteristics of local site, as well as with the closest customers, rather than with an unified central LSP identity. The information center, as part of the Operational Excellence project, is one implementation increasing this identity linkage, however only functional if the information on the information centers will be taken part of by local employees. An opinion stated by one of the interviewees at LSP A was that "everything that is LSP standard feels quite remote and not implementable at our facility", regarding centralized initiatives at LSP A in general. This is considered to potentially hinder the development of local strategies and targets that align with the general vision, considered critical by Slack et al. (2016). As well as of creating the bottom-up involvement considered important by Manos (2007).

### 5.1.4 Identified Potential for Improvements

The described problem areas result in the following negative effects on the operations of LSP A and B, see appendix V:

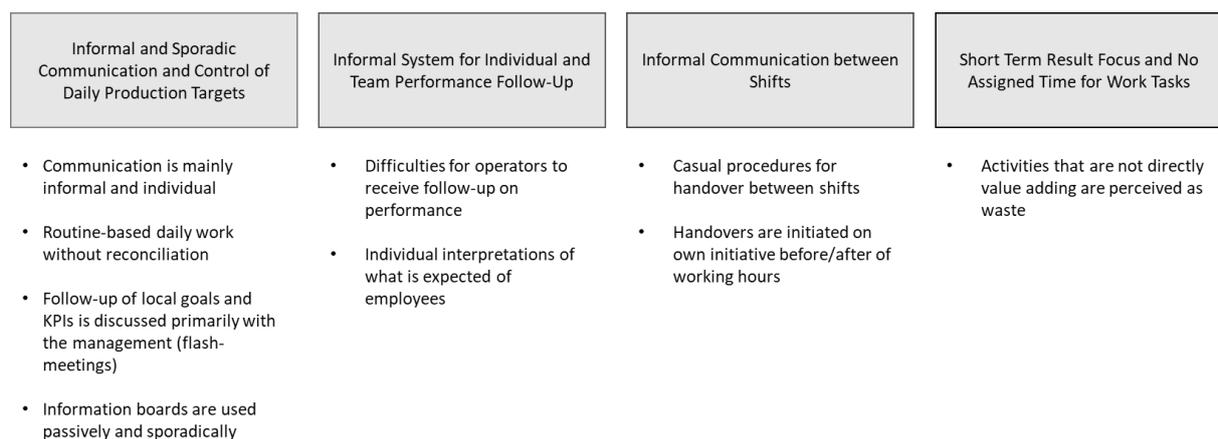
- Low motivation among employees
- Uncertainties regarding e.g. how to reach maximum customer value, achieve the company vision, and fulfill the intended goals of the Operational Excellence project
- Low effectiveness of operations and other tasks
- Low transparency of the corporation

Furthermore, the described problem areas have identified improvement possibilities, which will be further discussed in the proposed recommendations chapter. These are presented in same order as their correspondent problem area:

- Establish tangible targets and strategies aligned with the vision
- Bottom-up involvement and education
- Improved company identity

## 5.2 Daily Control and Visual Management

This subchapter presents the analysis for the research objects regarding daily control a visual management (figure VI). This is based on systems presented in the theoretical framework (mostly chapter 3.3) as well as in the current state description (chapter 4.2.2 and table III).



*Figure VI. The identified problem areas regarding daily control and visual management at LSP A and LSP B.*

LSP currently utilizes different local variants of production and resource planning in order to adjust for demand fluctuations, differences in customer orders, requirements, and prioritizations of work. However, production and resource planning are not considered as synonymous with daily control, according to the findings by, among others, Slack et al. (2010), Abernethy and Chua (1996), and Chai et al. (2014). According to Slack et al. (2010), production plans are based on expectations rather than reality while control on the other hand is the activity of dealing with sudden changes, managing ongoing operations. As defined by Slack et al., (2010): “Control makes the adjustments which allow the operation to achieve the objectives according to plan” (pp. 270). Daily control at LSP A and LSP B, is therefore considered absent as there are no daily recurring control meetings, and operators start working at their individual stations based on routine and without any prior formal communication with management or colleagues. However, parts have been implemented that may develop into daily control. The benchmarking companies, on the other hand, had daily meetings and daily control boards, see figure VII for comparison. The sites with more experience of daily control also had coordinators, escalating control meetings as well as iterative processes.

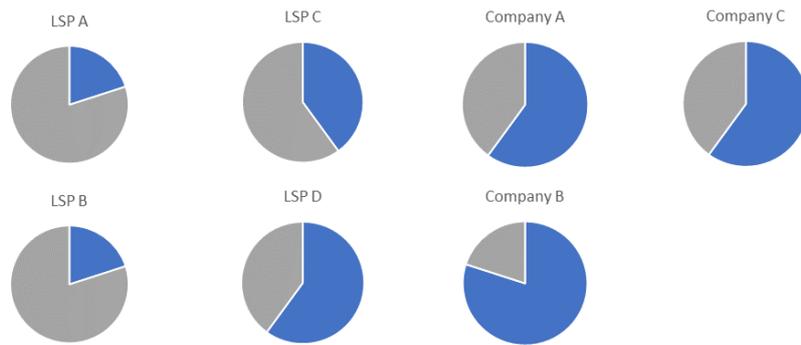


Figure VII. How far the research objects, internal and external benchmarking companies have come with their work with daily control and visual management based on the subjects mentioned in the chapter Current Situation as well as table III. The charts visualize progress on a scale from 1-10.

### 5.2.1 Informal and Sporadic Communication and Control of Daily Production Targets

As production related meetings are occurring once a week at LSP B and when considered needed at LSP A, this results in a discontinuous formal communication, which is the opposite to what is recommended by Mckeown (2013). Furthermore, Verbal and individual communication of changes is considered time consuming and not always accurately accessible for all employees. Communication of daily production needs and current focal areas are however something that according to Ortiz and Park (2011) is important for organizational performance. Constructive communication can furthermore be achieved by enhancing the transparency of relevant organizational KPIs and other metrics, as a follow-up on short and long-term business targets and the company vision, according to Eaidgah Torghabehi et al. (2016). The insufficient communication regarding daily operations and control may imply several negative consequences, that in turn are considered to lead to uncertainties and increased costs.

#### KPIs Discussed and Reviewed Weekly by Site Management and Top Management not Involving Local Operators

KPIs are not used on a daily basis in the control and planning of operations as e.g. follow-up and review on historical KPI measurements are mainly conducted during the weekly flash-meetings between site managers and top management of LSP. Ortiz and Park (2011) stated that communicating workcell and departmental performance information is vital and should be communicated to relevant departments. As mentioned, in order to control and manage daily production at LSP A and B, the site manager or team leaders walk around between operators at the shop floor to personally inform each operator about new information when considered needed. If deviations occur or if operators want to share information, operations at workstations involved are interrupted as operators also need to walk and talk with other employees involved in a certain matter, to state or explain the situation.

## Passive and Sporadic Utilization of Visual Boards

Visualization of current progress of production processes is considered passive and sporadic, as the visual boards with information were neither used as part of daily routines nor updated formally according to established routines. Eaidgah Torghabehi et al. (2016) stated that feedback on performances should be presented and visualized in a frequently updated and public manner. Ortiz and Park (2011) further argued that daily control boards should provide guidance and visualization of work day expectations, along with other potential future improvements and the progress of previous improvement suggestions. According to the same authors, visual control increases organizational performances in general. The benefits from current usage of visual boards at LSP A and B, to increase transparency and improve understanding of current and future needs and prioritizations in production as well as to spread critical information is therefore considered as restricted.

It is further considered important to distinguish the information center, that is updated weekly with information focusing on long-term site development (historical, long-term perspective) from daily control boards for production control used to inform about the current shop-floor situation (current and future, short-term perspective). As Ortiz and Park (2011) argued visual boards should be located on the shop floor, which is in contrast to common placement of the information centers. Due to the inability of daily updates by operators and team leaders and the location of the information centers, it is considered as unsuitable to use information centers for daily control purposes and as foundation for daily production meetings.

### 5.2.2 Informal System for Individual and Team Performance Follow-Up

Feedback and response on team and individual performance at LSP A and B is considered to be given seldom and sporadically as it is given when considered needed by local management or if the operator asks for it. Kaufmann and Kaufmann (2010) argue that feedback based on production result compared to pre-set goals in general increase performances. Which VandeWall (1997) agrees creates extrinsic motivation. Performances and results are currently measured at LSP sites, however the effort put behind each task is not recognized or given feedback on. Due to the findings by Kaufmann and Kaufmann (2010) arguing that feedback on performance is a necessary, the considered lack thereof at LSP A and B is hence defined as a relevant area for improvement. The operators interviewed further stated that they experienced lack of motivation for their daily routines, which according to Kaufmann and Kaufmann (2010) is one consequence from insufficient feedback on performance.

Interviews also showed that each operator has his or her own perception of performance prioritizations and targets, why there is hence uncertainties regarding performances expected from LSP. This further implies a risk for insufficient intrinsic motivation, that according to Hackman and Oldham (1974) requires satisfactory relationships between the employee and the work task. In summary, there are insufficiencies regarding concrete, communicated daily target levels and motivational factors for continuous efficiency.

### 5.2.3 Informal Communication between Shifts

Informal and unstructured handovers result in that important information from the previous shift, as well as daily targets and areas of prioritizations, must be verbally communicated between operators. Either during the informal handover, or during ongoing operations. Furthermore, several examples were given from operators, especially the night shift at LSP B, of how lack of information exchange between the shifts have caused uncertainties of what has been done and what is left resulting in wastes such as rework emphasizing the lacking system. Information provided to the day shift is furthermore rarely communicated to the night shift, which is considered to be leading to information discrepancy between the shifts. According to Ortiz and Park (2011), more accurate, precise and timely information results in better decisions by individuals at the right time. In addition, increased transparency and enhanced information flows may improve motivation and discipline, provide to a feeling of shared ownership over processes, and empower teams and individual team members to make better decisions and follow a better course of actions (Eaidgah Torghabehi et al., 2016).

### 5.2.4 Short-Term Result Focus and No Assigned Time for Work Tasks

The goal and one of the main principles of lean production is to eliminate wastes in the operation by, among other things, categorizing the activities of the operation in value-adding, supportive and non-value-adding activities (Slack et al., 2016). However, this is not implying that non-directly value adding work is not needed or beneficial to generate customer value in a long-term perspective as mentioned by Liker (2009). The strict focus on work that is considered as directly value adding implies that different forms of non-value adding work are considered as waste. Including work that might bring increased value in the future, such as investments, time assigned for improvement related efforts and initiatives, or analysis and mitigation of identified quality and process deviations.

Some basic forms of non-value adding work are however performed at LSP A and LSP B, as it is required in order to maintain production. Examples of this are cleaning and stocktaking. Thomas (2014) stated that by having clear work instructions, operators know exactly what will be needed through proper preparation before starting an activity, why the workflow can be performed faster. Furthermore, the general viewpoint was to decrease non-value adding work as much as possible to instead focus on what generates the maximal short-term revenue and profits. The reason for this is considered to be the high pressure and low perceived margin in achieving production targets and demand from customers by focusing on production in everyday work instructions. Leaving little or no margin for non-value adding work such as improvements, meetings, cleaning or similar. Liker and Meier (2006) stated that by utilizing proper standards for work instructions, productivity and quality can be improved simultaneously as costs and time spent on certain activities can be reduced. There is thus, a general resistance to implementing additional non-value adding work, as there are experienced as limitations in resources and time instead of looking at the long-term gains. This can further be connected to the lack of clear long-time targets and visions of the sites. Lind and Skärvad (2004) agrees that visions and goals should be used to inform employees about what actions

are required to decide and realize what is necessary in everyday work as each decision should be oriented towards achieving the targeted goal.

### 5.2.5 Identified Potential for Improvements

The described problem areas result in the following negative effects on the operations of LSP A and B, see appendix V:

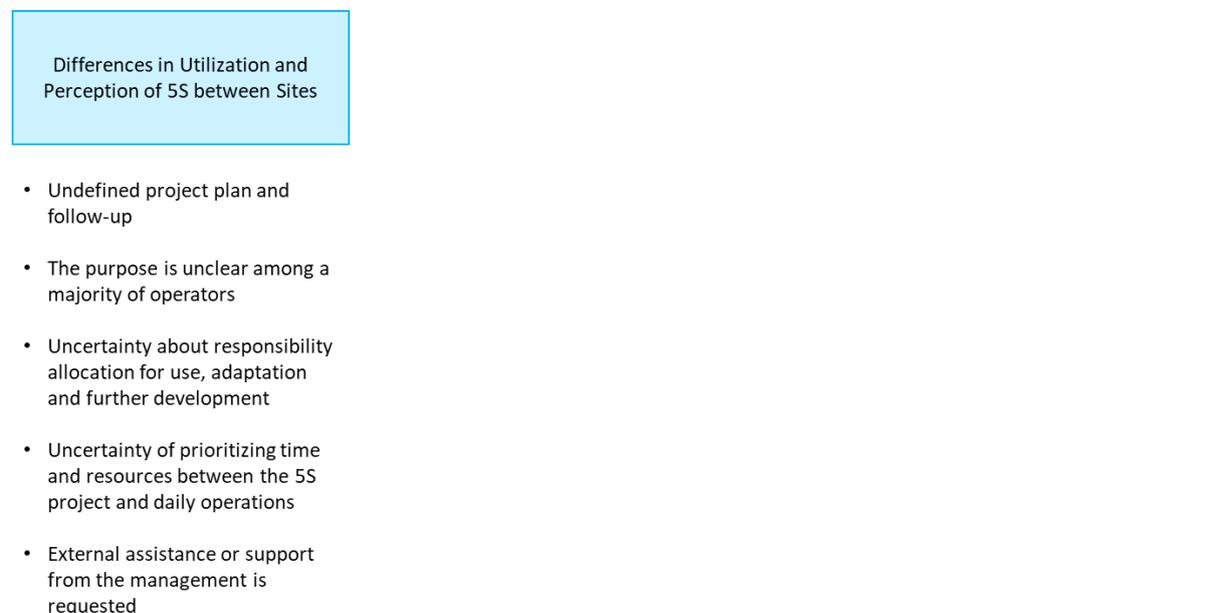
- Low motivation among employees
- Waste of time and resources
- Uncertainties regarding daily work
- Low effectiveness of operations and other tasks
- Low transparency between shifts

Furthermore, the described problem areas have identified improvement possibilities, which will be further discussed in the proposed recommendations chapter. These are presented in same order as their correspondent problem area:

- Establish tangible targets and strategies aligned with the vision
- Bottom-up involvement and education
- Improved company identity

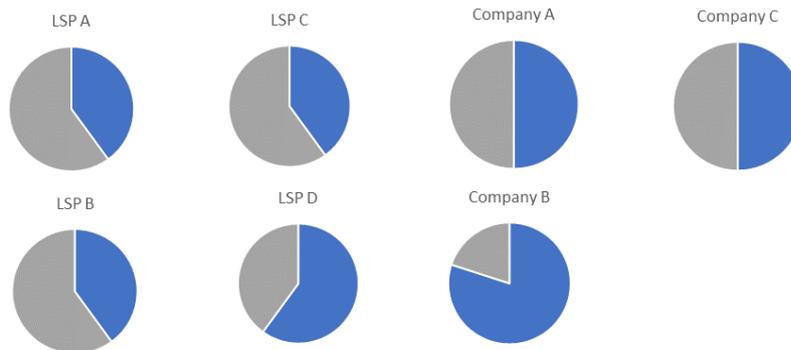
## 5.3 Workplace Organization

This subchapter presents the analysis for the research objects regarding workplace organization (figure VIII). This is based on systems presented in the theoretical framework (mostly chapter 3.4) as well as in the current state description (chapter 4.2.3 and table IV).



*Figure VIII. The identified problem areas regarding workplace organization at LSP A and LSP B.*

Local interpretation of what is involved in 5S, and what the main benefits from such a system is did vary between the LSP sites. When comparing the research objects LSP A and B with the benchmarking companies, the knowledge of 5S as well of the procedures required were low and somewhat misunderstood among employees at LSP A and B, as visualized in figure IX. Even though only one of the internal and one of the external benchmarking sites worked actively with 5S, interviewees at benchmarking sites showed understanding about the system and the potential benefits, which is considered relevant for a successful implementation and continuous use of such a system as part of daily routines.



*Figure IX. How far the research objects, internal and external benchmarking companies have come with their work with workplace organization based on the subjects mentioned in the chapter Current Situation as well as table IV. The charts visualize progress on a scale from 1-10.*

### 5.3.1 Differences in Utilization and Perception of 5S between Sites

The overall impression from observations and interviews at LSP A and B was that the majority of the operators and team leaders have little or no knowledge about what workplace organization is or involves, or what type of benefits that may derive from utilizing 5S methodologies as part of workplace routines. Some of the interviewees did rephrase parts of the procedures mentioned by Smith and Peterson (1998) such as cleanliness and comfort, but other procedures like safety and performance optimization were not as commonly known. Most of the benefits from 5S presented by Ortiz and Park (2011) were in general not known. Hirano (1996) stated that the five steps of 5S are the core elements to support the entire system of workplace system of a company, which is not considered as possible without sufficient knowledge for how and why to develop and implement the methodologies. Fabrizio and Tapping (2006) added that employees at each department together with management involvement should perform each task of the project, being the implementation of workplace organization.

Using a top-down approach when implementing and performing 5S is discouraged by Fabrizio and Tapping (2006) as commitment and involvement from all employees are necessary for a successful result that provide benefits to the workplace. According to Fabrizio and Tapping (2006), the parts missing, such as formal processes, are vital part of 5S routines, and necessary for success. Furthermore, employees who find workplace organization important and are giving

attention to its methodologies, are discouraged by the present system and lack of understanding by the other employees showing little interest or commitment. Hence, hindering the future development.

### 5.3.2 Identified Potential for Improvements

The described problem areas result in the following negative effects on the operations of LSP A and B, see appendix V:

- Waste of time and resources
- Uncertainties regarding the workplace organization

Furthermore, the described problem area has identified improvement possibilities, which will be further discussed in the proposed recommendations chapter:

- Sequential implementation with audits as stage gates

## 5.4 Improvement Work

This subchapter presents the analysis for the research objects regarding improvement work (figure X). This is based on systems presented in the theoretical framework (mostly chapter 3.5) as well as in the current state description (chapter 4.2.4 and table V).

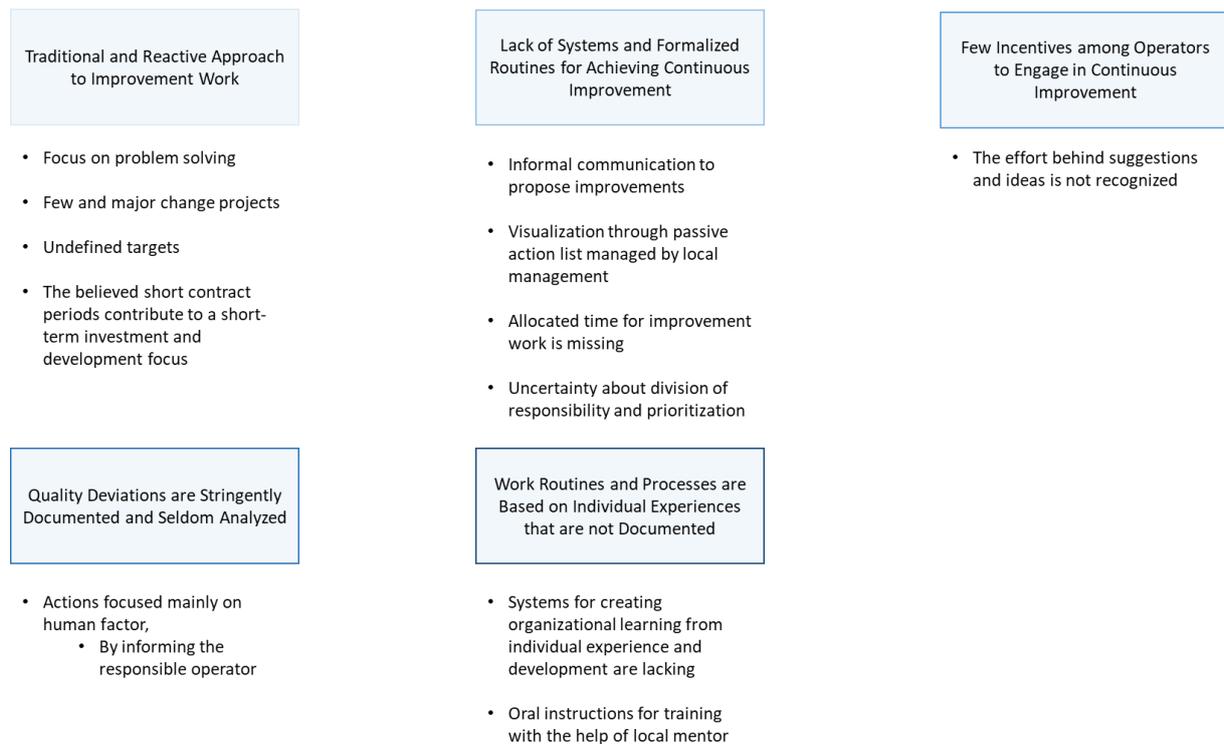
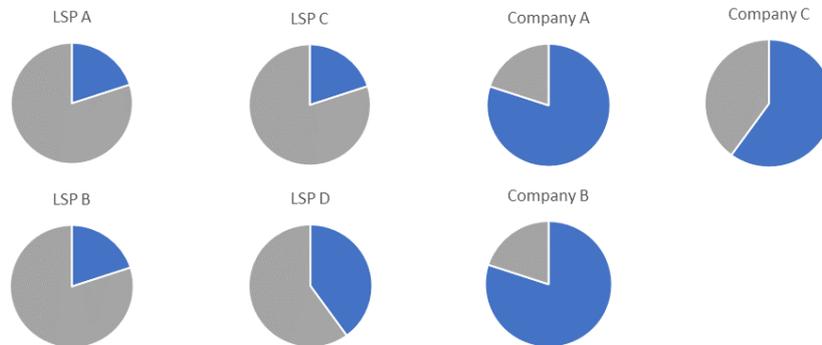


Figure X. The identified problem areas regarding improvement work at LSP A and LSP B.

According to Manos (2007), the essence of organizational continuous improvement is minor gradual changes over time. There is no standardized system or routines for working actively in

this way at LSP A and B which was generally encountered at the other sites, see figure XI. The internal benchmarking sites work with continuous improvement to some extent, and the external benchmarking companies have dedicated systems for continuous improvement that was anchored in a communicated general vision for development, to strive for optimal customer value. However, no holistic approach was identified as support and foundation for improvement work, something considered by Kurdve (2014) as one of the most critical factors for achieving successful results.



*Figure XI. How far the research objects, internal and external benchmarking companies have come with their work with continuous improvement based on the subjects mentioned in the chapter Current Situation as well as table V. The charts visualize progress on a scale from 1-10.*

#### 5.4.1 Traditional and Reactive Approach to Improvement Work

According to Jugulum and Samuel (2008), continuous improvement as a philosophy should permeate the entire organization, however at LSP's local sites, there are no active system or philosophy for continuous improvement apart from documentation in the action lists. There are further little structure and knowledge of how to suggest, document and proceed with improvements. Karlsson and Åhlström (1996) stated that implementing continuous improvement at the workplace in practice involves utilization of a functional system where operators and other employees are involved and motivated to contribute to improvement initiatives. Eaidgah Torghabehi et al. (2016) further stated that systems are intertwined meaning that visual management systems should be closely coupled with a performance management program, but also linked to initiatives for continuous improvement. According to Lind and Skärvad (2004), clear goals and communicated targets can make employees more aware of what type of actions that align with the company vision. This could be interpreted as that employees who have a better understanding of LSP as an organization and the general vision also will have increased understanding about what type of improvement that would align to the short-term targets and the business vision. Thus, be more motivated to propose suggestions for improvement.

#### Focus on Reactive Problem Solving Rather than Proactive Improvement

Based on observations, the improvement work occurring at the research objects have a rather traditional approach, as described by Manos (2007), involving few and larger reactive

improvement projects resulting in a rather radical change. There are however efforts made at the LSP sites to implement systems with a continuous improvement focus instead. It was commonly stated by interviewees that if a clear need has been identified, this is also looked into and necessary actions are performed after directions from local management. However, there are no philosophy of implementing small everyday changes and improvements from ideas possessed by individual operators. This is characteristic for a traditional improvement philosophy, according to the findings by Mika and Kovel (2006).

#### Undefined Targets or Strategies as Foundation for Proactive Improvement

It has been found complex for employees to work with and to motivate proactive improvements without a long-term perspective or strategy. According to Jugulum and Samuel (2008), a vision is critical in order to facilitate initiatives and work related to improvements. Without a strategy or long-term goal, improvements are hence likely to be focused on problem solving as reactive improvements. Anand et al. (2009) also argued for the importance of formalizing the direction of the organization, stating a vision and goals and implementing the culture of working with continuous changes by using an employee participation structure and standardized processes. The employees further need to be trained and have a development path to follow, they also need a support system for information during the process of continuous improvement (Anand et al., 2009). The current situation at LSP A and B imply that since it is not clear what efforts will constitute to increased future customer value through well-aimed improvement focuses and initiatives, it is also difficult to motivate and to prioritize between proactive improvement suggestions.

#### Short Contract Periods as the Reason for Short-Term Focus

Due to short contract periods with customers for the local sites, improvements and especially long-term investments are considered by the site managers to be restricted as payback periods may be outside of the current contract length. However, when comparing with the external benchmarking companies, the contract period was not considered critical for similar investment decisions, and what would generate future customer value and increase the chances of continued contracts were instead the driving force behind improvement initiatives. If using continuous improvement as an instrument to create growth (Mika & Kovel, 2006; Liker, 2009) and a philosophy to never be satisfied of the current state of the organization (Nicholas & Soni, 2006), continuous improvement as a companywide methodology should be independent from the lengths of local contract periods. In order to obtain desired results and to achieve future customer satisfaction, the correct processes are required and should therefore be continuously improved or updated for future demands and conditions. If LSP A and B do not invest for the future, or performs reactive improvement as a consequence of the contract periods and unsure future, this might instead be a limitation that might enable competitors to compete with a more long-term perspective. This conclusion is further supported by Anand et al. (2009) regarding that companies no longer compete with the processes they currently have but with their ability to continuously improve these processes.

### 5.4.2 Lack of Systems and Formalized Routines for Achieving Continuous Improvement

Karlsson and Åhlström (1996) specified three stages of maturity regarding continuous improvement in organizations. Based on the interviews and observations, LSP A and B were considered to have a lower degree of maturity according to that framework compared to the internal (apart from LSP C) and external benchmarking sites. The two research objects LSP A and B have an informal suggestion process, compared to the LSP D that have the same system only that it is available to all employees. Furthermore, compared to external benchmarking companies Company A and B that uses systems and routines for continuous improvement similar to the definition of quality circles presented by Karlsson and Åhlström (1996). External benchmarking companies Company A and B have also established routines, as well as time and resources designated for improvement work. While it at Company C is part of entire company philosophy. The structure for handling of improvement proposals at LSP A and B have resulted in low motivation among operators to engage in improvement work, along with uncertainties and low transparency of the processes. Karlsson and Åhlström (1996) suggested that to generate interest and commitment from the operators and management, as well as to visualize the quality of improvements, KPIs related to improvement progress should be used. KPIs or other metrics related to improvement activities are not used at LSP A or B, but are used by the external benchmarking companies.

#### Identified Methodologies and Routines for Continuous Improvement

The research objects were considered to have informal routines and systems for achieving continuous improvement. However, different methodologies were identified as used by the benchmarking sites. This aligns with the finding by Sokovic et al. (2010) that different methodologies or tools can be used in order to achieve continuous improvement. A comparison of the tools presented in the literature is compiled below in table VI. PDCA is used by two benchmarking sites and 4Q is used by one. Six sigma is not used by any of the benchmarking companies, however suggested by Brue (2015), Shankar (2009) and Sokovic et al. (2010) as a suitable methodology for facilitating continuous improvement.

	PDCA	Six Sigma (DMAIC)	4Q
<b>Purpose</b>	Iterative Process for Root Cause Identification and Removal	Identifying and Eliminating Defects	Root Cause Identification and Removal
<b>Steps</b>	4	5	4
<b>Outcome</b>	Action	Control	Sustain
<b>Problem Solving</b>	Temporary Solutions / Permanent Solutions	-	Long-Term Solutions
<b>Application Area</b>	Sole Assignments / Entire Programs	Results-Oriented Project Management	All types
<b>Problem Size</b>	Medium	Large	-
<b>Company Size</b>	-	Larger	-
<b>Other</b>	Strategic Learning Processes	Stage Gate within Projects	Produced by ABB

Table VI. Compilation of the characteristics of the possible continuous improvement tools.

### Informal Communication to Propose Improvement

The current system for leading and developing improvement related work and projects is considered as informal at LSP A and LSP B. However, according to Jugulum and Samuel (2008), continuous improvement requires a formalized process. The research objects LSP A and B both utilize the passive suggestion methodology. Coming with suggestions is, however not required by operators as part of their responsibilities as employees, nor is it required as part of daily routines. This system was not considered as functional by local management, as operators have only proposed a few relevant suggestions. There were however no formalized frameworks for how this type of suggestions should be handled by local management, or for how responsibilities for developing and implementing proposals should be divided.

### No Designated Time for Improvement Related Work and Uncertainties Regarding Prioritizations

Interviewed local managers at LSP argued that it would be beneficial with designated time for developing and implementing improvements, from proposals to finalized implementations similarly as described by Karlsson and Åhlström (1996) and as used at external benchmarking Company A and B. Simultaneously, the work and performance goals within the local sites are pressured as production is prioritized in the first place. In practice, this imply that it is difficult to find time for developing and performing improvement projects, and that development of a system for standardizing improvement work has not been prioritized beside production. The willingness to work with improvements exists on a local site level, however there are currently also a lack of resources in order for it to be focused on and systems for continuous improvement to be developed.

### 5.4.3 Few Incentives among Operators to Engage in Continuous Improvement

Alvesson (2013) stated that motivation creates incentives to perform and a desire to succeed. However, according to interviews with operators at LSP A and B, there is low motivation regarding engagement in continuous improvement and proposal of suggestions. Hackman and Oldham (1974) meant that there has to be a satisfactory relationship between the employee and the work task where the employee has to experience responsibility for the outcome of the work and gain insight about what is required to reach certain outcomes. In order for employees to experience responsibility for the outcome of their work, involving active engagement and productivity for improvement of their work environment, the employees must be allowed to influence factors at the workplace (Hackman & Oldham, 1980). Kaufmann and Kaufmann (2010) stated that challenging goals are preferred to simple goals when it comes to motivation. Furthermore, being more responsible for work tasks may result in an experienced responsibility for the production outcome, however, feedback is required to gain understanding for the result. The lack of incentives and motivation was further observed as the interest for presenting suggestions for improvements is low among the operators and team leaders, regarding sharing ideas both to improve the processes as well as the work routines and methodologies used by the employees themselves.

Eaidgah Torghabehi et al. (2016) argued that increased transparency and enhanced information flows may improve motivation and discipline together with moving responsibility further down in the hierarchy. Regarding insufficient follow-up, Karlsson and Åhlström (1996) stated that a part of the system for continuous improvement is to have a reward and feedback system. Feedback should, if possible, be given directly to the employee (Hackman & Oldham, 1980). Kaufmann and Kaufmann (2010) further argued that using feedback increases performance in comparison with excluding it as descriptive guidance that is necessary to change behavior as well as to achieve continuous learning and create understanding is provided, which further results in recognition among operators. To be recognized is appreciated by most employees and has a motivational aspect that has been shown to be successful (Mika & Kovel, 2006) which has further been emphasized by all external benchmarking companies.

#### 5.4.4 Quality Deviations are Stringently Documented and Seldom Analyzed

Analysis of the root causes to quality deviations in production and products are not performed at the research objects. Quality deviations are however documented and interventions are primarily focused on documentation and on informing the responsible operator about his or her performance.

##### Quality Assuring Methods

Quality and continuous improvement are correlated where quality programs can be used to reach the aimed standard, as stated by Manos (2007). Such programs contribute with a foundation to create a mindset focused on quality (Brue, 2015). Methods to counteract errors related to handling and packaging of products are considered as insufficient according to observations at the research objects and mainly at LSP A due to the lack of quality ensuring methodologies in production. The lack of these methodologies is utilized when handling deviations, and this may enable that the same error occurs again. By visualizing quality metrics, product and performance quality factors are likely to improve as stated by (Ortiz & Park, 2011).

##### Handling of Customer Claims

Dennis (2015) described *customer focus* as a main goal focusing on eliminating waste to increase quality and decrease costs and lead time. If efforts are made in an organization to improve current systems and processes and not only improve transaction issues, a deeper learning is needed (Argyris, 1977). Quality deviations in the form of customer claims are currently only documented and communicated to the stakeholders involved, however, no further investigation to prevent similar errors to occur in the future are done, as there is no formalized action plan to find and to handle the root causes of errors and quality deviations. This can be compared with what Argyris (2002) described as single loop learning occurring without modifying the underlying guiding values. When claims are received by LSP A and B, the responsible operator is notified by the site manager or one of the team leaders that he or she has caused an error resulting in an unsatisfied customer. This in contrast to a double loop learning system, where learning evolves from altering the root causes and processes performed by the operator, and consequently the actions (Argyris, 2002). This type of action and mindset

divides organizations between the ones that systematically solve their problems based on new knowledge and the ones that do not (Garvin, 1993).

#### Analysis of KPI Data to Identify Potential Improvement Areas

Data gathering for compiling and documenting KPIs is currently time consuming, however there is no time considered left for analysis or follow up on deviations in the KPIs according to Site Managers of the research objects LSP A and B. Hence, the model used for deciding is not changed and deeper learning cannot be achieved since the set targets and rules for decisions are constantly the same while to come to the realization of the actual cause modifications based on the results are needed (Bochman & Kroth, 2010). One reason for why this is not occurring may be that KPI documentation is sanctioned and required by top management, however, no system for analysis or follow up are in place in order to identify patterns in the KPIs. However, one relevant purpose of documenting KPIs should be to identify patterns in the data, to be used in analysis for why deviations and failure occur (Jaaron & Backhouse, 2017). Interviews showed that it is currently complex to use KPI-documentations for leading local improvements and solve local problems that might be understood from studying the KPIs. The usefulness of the KPIs as a tool to adjust for problem solving and improvement work may therefore be partially lost.

#### 5.4.5 Work Routines and Processes are Based on Individual Experiences that are not Documented

There are little efforts made to utilize experiences gained by operators or managers at previous employers, or from working at the specific site or between sites. This is considered as a waste of valuable knowledge as a resource, as new employees must learn how to best perform a certain task or operation.

#### No Formal System to Create Organizational Learning from Individual Learning

Not using the knowledge of the employees is considered a risk since it may constitute a potential weakness compared to competitive organizations with a more progressive program of accumulating individual knowledge. According to Thomas (2014), individual experience can be transferred into organizational learning, where best practices can evolve regardless of e.g. a high employee turnover, otherwise implying that experience and learning are lost when an operator leaves the organization. If hiring new operators without experience, this competitive edge must further be recreated for every employee that is hired. The most critical downside with not having a functional system for accumulating organizational learning from individual learning is the loss of competitive knowledge and experience when individual operators or other employees leave their employments.

Systems are needed to ensure that new knowledge is adopted into the current model and procedures for decision making (Dahanayake and Gamlath, 2013). Some operators at LSP have many years of experience from working at LSP's local sites, meaning that many have developed their own working methods. However, there are no effective system for documenting and learning from accumulated knowledge, as well as to transform this

accumulated knowledge to new employees or to the organization itself. It is likely that this affects the learning curve for new employees negatively, and restricting the possibilities of using additional extra operators when necessary, as it is currently inefficient to educate short-term employees. Training of work routines at LSP A and B is done verbally without a standardized framework in place, implying that education for new employees can vary, but also that there is no framework to continuously improve when suggestions for improved work related methodologies or similar are presented. The variation in work methodologies further may imply a variation in work efficiency between operators, as well as a risk for errors that are complex to analyze or follow-up due to the same reasons as presented above.

#### 5.4.6 Identified Potential for Improvements

The described problem areas result in the following negative effects on the operations of LSP A and B, see appendix V:

- Low motivation among employees
- Waste of time and resources
- Uncertainties regarding the aim and system for improvement work
- Low effectiveness of current and future operations and other tasks
- Low transparency of improvement processes

Furthermore, the described problem areas have identified improvement possibilities, which will be further discussed in the proposed recommendations chapter. These are presented in same order as their correspondent problem area:

- Incremental and continuous improvement complemented with proactive improvements
- Visualized system and place for improvement work
- Development feedback, responsibility distribution and recognition for employees
- Quality assuring methods and root cause analysis of customer claims
- Formal practices for best practice

### 5.5 Observed Roadmap for Implementation of Systems at Benchmarking Sites

As seen during the observations, most benchmarking companies began their operational excellence journeys by introducing systems for daily control or workplace organization, see figure XII. Regarding introduction of daily control, representatives from all external benchmarking companies stated that initial implementations focused on establishing simple routines that were repeated daily, rather than full systems all at ones that would be complex for local staff to understand. The routines were then gradually developed, as the agenda for daily meetings got more advanced and additional areas were visualized and documented on visual boards. The key to success when introducing new systems, according to representatives from benchmarking sites, is to start small and iteratively with involvement from local employees and support from management. Then gradually develop the systems in a way that best suits local needs that are experienced by local staff by the use of trial and error. Ownership, actual usage,

and responsibility for development of lean and operational excellence methodologies and routines should to a high extent belong to local staff as operators and team leaders, in order to achieve bottom-up involvement and obtain optimal results, according to representatives from the external benchmarking companies.

It was observed all benchmarking sites (apart from LSP C) early began with implementation of workplace organization and to redo it later due to insufficient routines and guidelines for how to achieve a successful initiation and adaptation to daily routines. The systems for continuous improvement was usually the last implementation taking place.

Early education and efforts to achieve involvement and understanding among all employees in workplaces where new methodologies or routines were about to be implemented, was considered as critical by representatives from all external benchmarking companies.

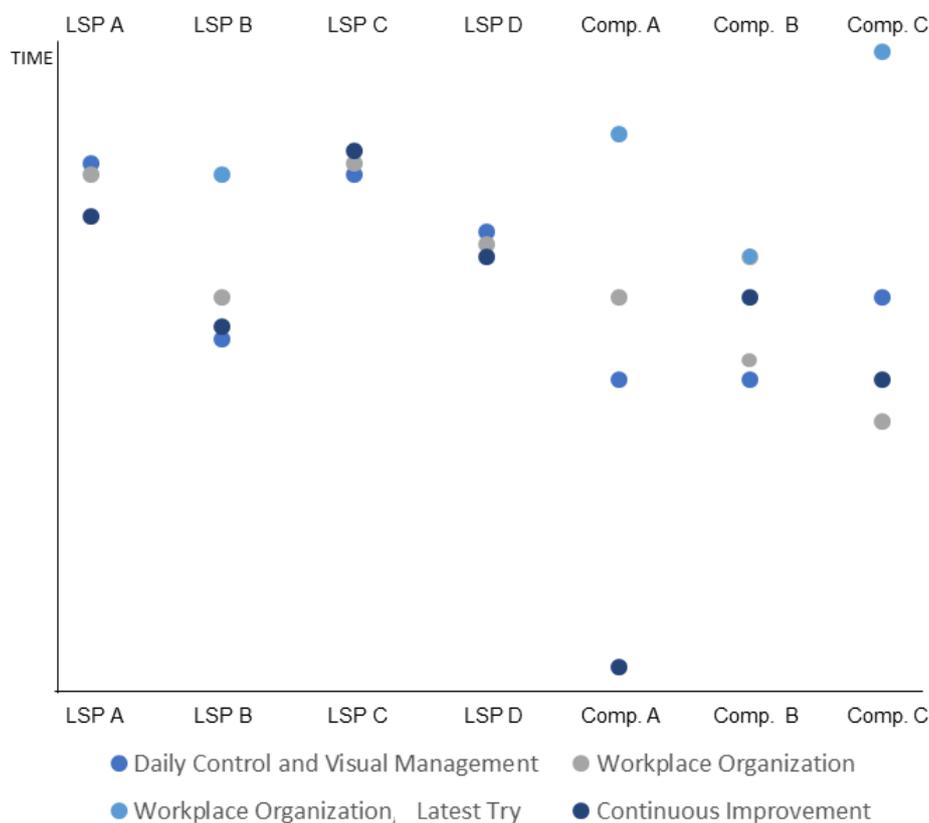


Figure XII. An implementation comparison of the implementation start of the systems at the seven sites.

The external benchmarking companies, except from Company A, began implementations by communicating to employees how the methodologies introduced would benefit the local site and align with the central vision to optimize customer value. At Company A, a site specific vision was formulated subsequently to participation in an educational program for lean management. External and internal benchmarking was used in order to learn from other sites that had previous experiences relevant to the implementations undertaken at Company A and

B. Company C did however not use benchmarking to learn from previous experiences at other internal and external sites.

It was evident that Company A, B and C have invested time and resources for long-term development, despite scarce time and financial resources, as well as uncertainties regarding contract periods with customers and the demand for future businesses. Designated focus on long-term development has been possible through defining clear strategies and targets for how to prioritize between short-term value adding activities, and future improvements and investments sanctioned by top management as part of the long perspective organizational vision.

Characteristics identified for successful implementations are therefore:

1. State a clear vision and targets to anchor the implementation and use of systems.
2. Educate all employees and learn from benchmarking.
3. Implement operational excellence systems gradually and iteratively, benefitting from trial and error.
4. Implement systems bottom-up, including employee ownership.
5. Top management should support the implementation.
6. Allocate time and resources appropriately, including division of responsibility.



## 6 Proposed Recommendations

The following chapter presents recommendations for targeting the potential for improvement described in the analysis. The recommendations are intended to ensure that segments of the Operational Excellence project are (1) implemented successfully, (2) adopted as a natural part of daily routines, and (3) sustained. Many of these recommendations can be made more advanced, such as digitization of systems. However, focus has been on finding implementations that are time effective and that can be implemented with low cost and resources for LSP and other organizations sharing similar characteristics.

### 6.1 Organizational Structure

This subchapter presents recommendations based on the structure and conditions of the organization as a whole and its specific sites (figure XIII).

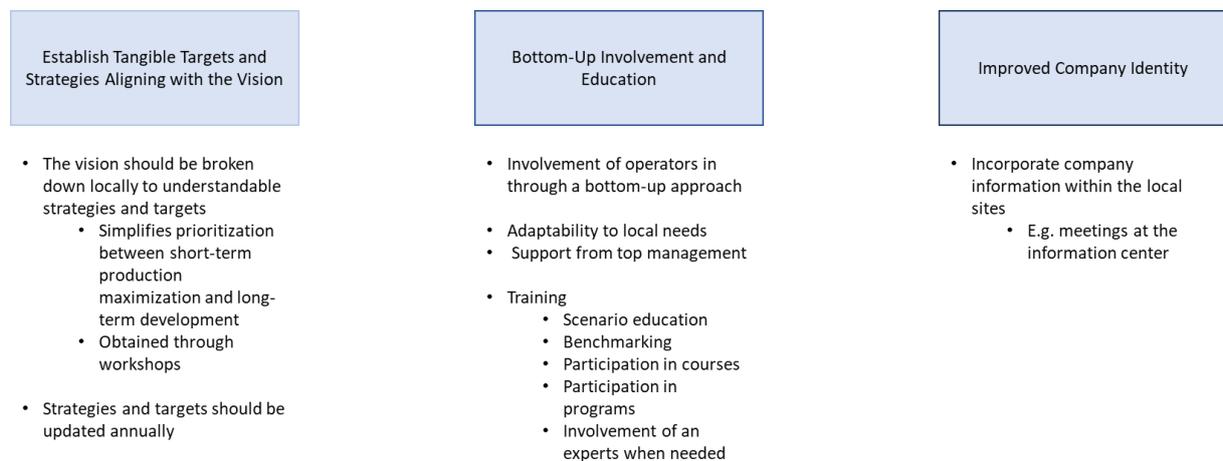


Figure XIII. Recommendations related to the organizational structure of LSP A and LSP B.

#### 6.1.1 Establish Tangible Targets and Strategies Aligned with the Vision

To be able to strive toward operational excellence and drive local site decisions in the right direction, both in the short and long-term perspectives, it is necessary to communicate a general vision for local sites to use as a beacon. It is critical that this strategy be interpreted by local and decentralized sites, in order for the whole organization to work in the same direction. This should be achieved by breaking down the general vision for the corporation into tangible, site specific targets and strategies to which local employees to relate. The vision is the situation aimed at, while the targets decide the day to day tasks of all employees in accordance with the strategy. Local site strategies and targets should provide a philosophy or guidelines regarding which types of actions and prioritizations that are likely to gain maximum customer value. When employees at local sites know where the site and the organization are heading, as well as which areas and factors are considered the most important by customers, the complexity of local prioritizations is likely to be reduced regarding, for example, short-term production maximization and long-term improvement for competitiveness. Moreover, by developing

defined targets and strategies, it is possible to communicate which tasks and activities that are most relevant for the site to spend time, resources, and investments on. This should influence work tasks and descriptions, the work environment, and the individual commitment of the operators. The visions, targets, and strategies should relate to the quality and quantity of the production as well as to the wellbeing of the employees. If a proposed system or an improvement does not align with the vision or any of the targets defined, it should not be implemented.

For employees to understand the current situation and for targets and strategies to be established, the management should involve the employees in workshops visualizing and mapping the organization and its processes. Such workshops should first involve top management and site managers, and later site managers and their respective site employees. Based on the current situation and trends for the future, known changes, budget etcetera, a new state should be mapped and a strategy established to reach it via short-term targets. The customer should always be kept in mind. The following areas, as presented by Ajoje (2015), are recommended as an inspirational framework:

- Waste elimination
- Improvement of productivity
- Increased quality levels
- Higher production efficiency
- Increased capacity
- Teamwork promotion and advancement
- A culture of continuous improvement

Strategies and targets should be developed and updated annually in a similar manner as the KPIs. It is then the responsibility of the operators to adjust their work and routines in a way that aligns with these targets, and that the targets are achieved. An illustrative example of a tangible target could be that ‘production should increase from 100 units per hour to 110’, instead of formulating the target as an increased production by 10% which is less tangible and hence less likely to be achieved. It is also important that the targets are independent of external factors, that is to say that they should be reachable even if the external environment changes.

### 6.1.2 Bottom-Up Involvement and Education

It is recommended to move responsibility further down in the hierarchy and to add more decision making and ownership to the team leaders and operators. This should be done by actively involving the local employees at the sites. This will improve motivation among the operators and is also rational as they possess the best knowledge of routines and tasks performed in the production. For the adoption of new methodologies and systems introduced by top management, it is critical that the need for the implementation derive from a bottom-up requirement. However, continuous support from top management is important during the implementation phase.

## Education

Education with affected employees as a starting point to understand new systems is considered fundamental for increasing the success rate. Workshops and seminar meetings could later also be held with the rest of the employees, as all personnel need to understand the benefits from systems introduced or routines updated. Five types of education are recommended, ranked from low to high in cost and involvement:

1. Internal scenario education. Possible scenarios and benefits that are expected to arise after months could be shown during one session, for example through educational games.
2. Internal and external benchmarking. To learn from the way of working at other sites through observations and by asking questions.
3. Individual participation in a professional course. Courses covering operational development are offered by most universities and some dedicated companies.
4. Company participation in a program. In comparison to courses, programs usually run for longer periods of time and involve lectures and workshops in an iterative process to guide through the implementation and utilization of methodologies and systems.
5. Hire an expert for specific purposes. An external consultant may be useful to help customizing the education required by the specific needs of the organization, and to provide professional and specialized recommendations for further development.

### 6.1.3 Improved Company Identity

Increased transparency between sites and improved communication channels to and from top management are recommended to increase the connection between sites and within the corporation. Specifically, it is recommended to incorporate (1) company information at weekly meetings at the local sites, and (2) company related information and progress at the information center. Weekly meetings, similar to those currently held at LSP B, are recommended and should be held with all employees by the information center to accumulate understanding of the progress of the organization and of how the local sites relate to the company. During the weekly meeting, both site specific and corporation specific information should be discussed. Information about vision, targets, budget, future, and past results should be included, as well as a wrap up from the flash meeting that is relevant for the employees at the specific site.

## 6.2 Daily Control and Visual Management

This subchapter presents recommendations related to the systems for daily control and visual management (figure XIV).

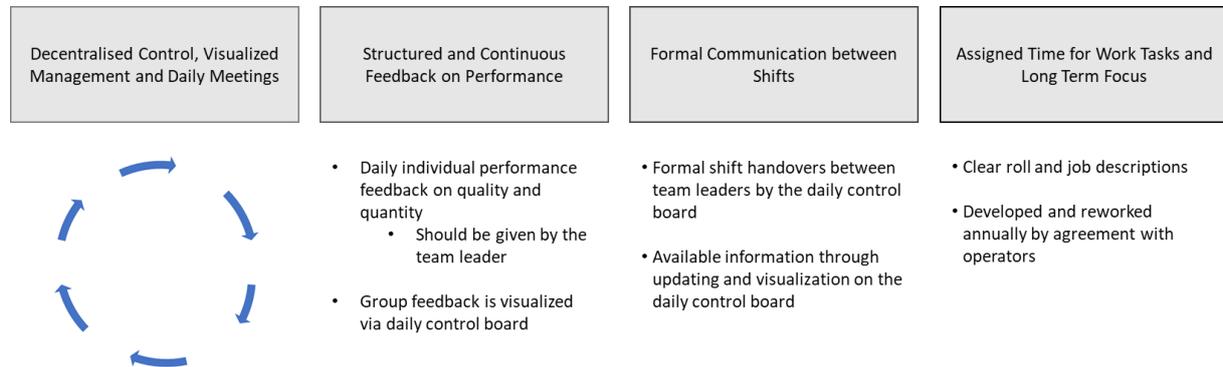


Figure XIV. Recommendations regarding daily control and visual management at LSP A and LSP B.

### 6.2.1 Decentralized Control, Visualized Management and Daily Meetings

To improve communication, management and control of daily work, as well as making sure that all employees are kept updated regarding current production statuses, requirements, and prioritizations, a system for daily control is recommended. As summarized in figure XV, the system should comprise methodologies and tools such as visual boards for daily control, daily control meetings, pulse-meetings, and follow-up on performance. Using coordinators, escalating control meetings as well as iterative processes is recommended to improve the daily control work and the regular daily work.

#### Information Flow

The daily meeting should be short, 5-10 minutes, and held at the beginning of each shift by a daily control board. All information on the daily control board should be updated before the meeting. It is recommended that a team leader is responsible for this. He or she needs to have time to check up on the information in relation to the current status of the production before the meeting is held. If targets have not been met, there is a chance to understand why, allocate responsibilities for who should fix what, and resolve errors as quickly as possible. The meeting should not be a forum for discussion, but only serve the purpose of status updating and task delegation. All employees should attend a meeting each day. If the site is large or complex enough, as is LSP B, the meetings are recommended to be department specific, such that administration has one meeting, production one meeting, and so on. Otherwise, as for LSP A, one common meeting is considered sufficient.

Furthermore, the recommended pulse-meeting, which is a forum for discussion and analysis, should include one representative from each department (if they have separate meetings) and shift (if possible). The pulse-meeting is recommended to be held once a week, or, if there are many departments, once a day after the department meetings. The pulse-meetings should be longer than the daily department meetings; 15-30 minutes may serve as a guideline. A visual

board is recommended for these meetings as well, and a similar structure could be used as for the daily control boards. Between the meetings, employees need to have the time to work with assigned tasks from the meeting, as well as to accomplish the daily regular work. New information needs to be gathered before next meeting, in order for the team leader to update the board.

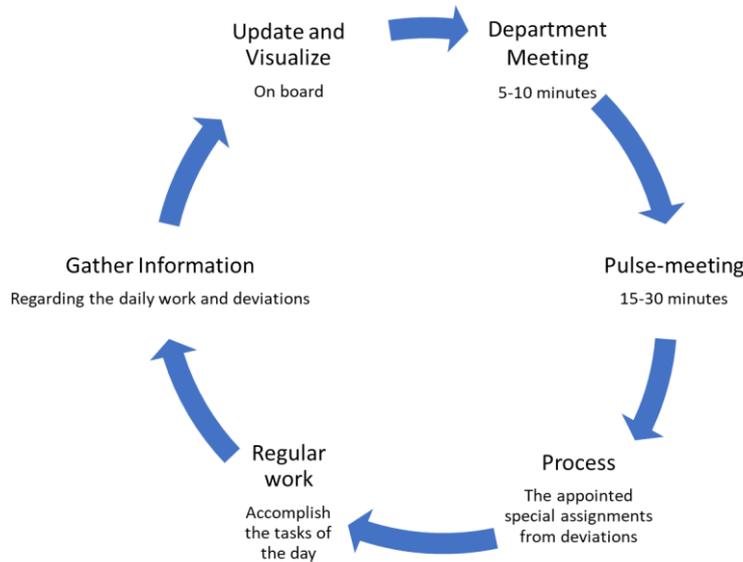


Figure XV. Recommended structure for daily control at an organization similar to LSP.

### Visualization

The information on the visual board for daily control should concern the site specific targets, tasks, and site structure. The layout should be standardized to a certain extent. All visual control boards should include the name of the department, the rules and the agenda for the daily meeting, the time for the meeting, safety and health information, information and status of staffing and attendance, as well as production target and production outcome. However, the structure may vary from site to site and even from department to department. Both the information and the layout should be decided upon by the employees who will be using the board (figures XVI and XVII for examples). The following is an example of an agenda:

1. Health and safety (the green cross)
2. Personnel status (attendance, info, absence, and similar)
3. Production targets
4. Production outcome or on-time-deliveries
5. Activities that are non-directly value adding (E.g. stock taking, cleaning, repair work, and so forth)
6. Continuous improvement
7. Workplace organization (5S)
8. Quality
9. The weekly plus (highlight something positive that has happened during the week)
10. Other / Misc. such as information about ergonomics.

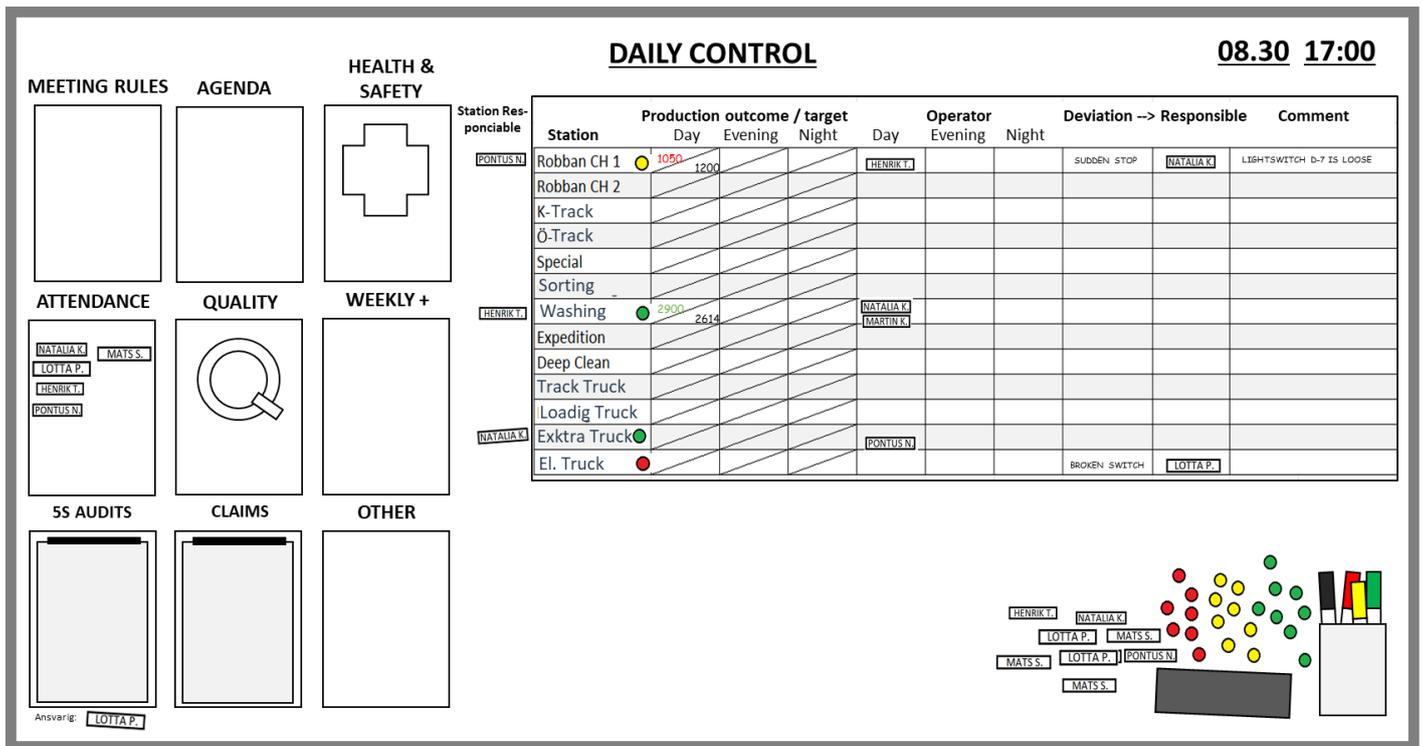


Figure XVI. One example of a board that could be used by LSP at LSP B.

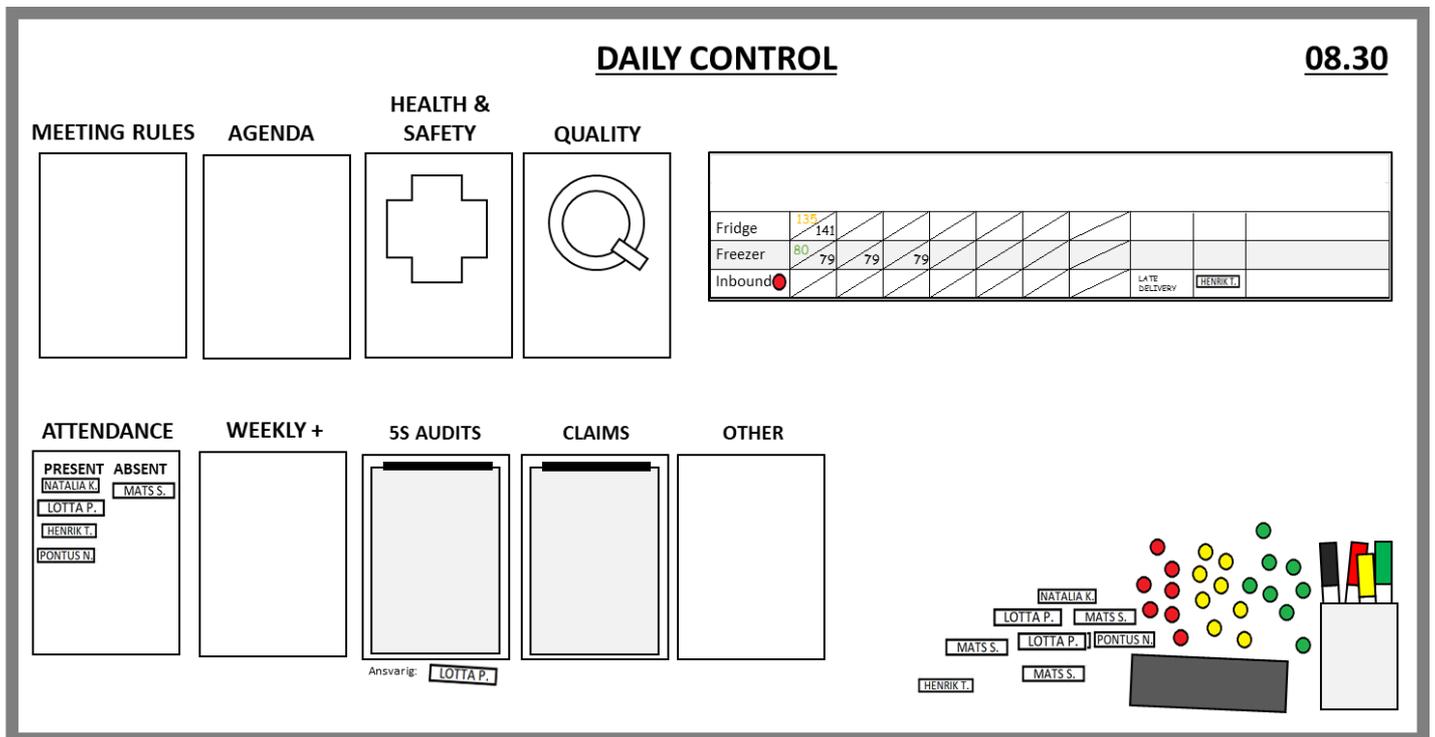


Figure XVII. One example of a board that could be used at LSP A.

The boards are supposed to be simple, interactive and possible for the employees to update continuously during the shift if something happens at one specific place and time. Forms regarding 5S audits, and claims are attached to enable a deeper understanding. The main purpose should be to communicate *what is the main focus of today and how to get there*. Moreover, graphs are not recommended on this type of board, as these are passive and static

and should be visualized at the information center. Shop floor employees and team leaders should be allowed to fill in the current production KPIs themselves in order for them to experience being in control of what is visualized on the board.

The first column should be used to write down daily targets and, later, the daily outcome. By using color coding of the outcome (green, yellow, and red) it is visualized if targets have been reached or not. Green indicates an outcome reached or better, yellow an acceptable outcome, and red an insufficient outcome. The next column is used to visualize who is working on which station during the shift (figure XVI only). The following columns are used for indicating deviations as well as appointing an employee responsible for handling the deviation. The last column is for further comments if necessary, and can be used to write messages or updates to the subsequent shifts. How far the action on any deviation has proceeded is visualized with magnets carrying the workstation's name: green for taken care of, yellow for in process, red for not dealt with yet. The responsibility division before the productivity board shows who is responsible for making sure that station in question is kept clean and tidy (more about this in subchapter four, Improvement Work).

The boards should be located at accessible and central places on the shop-floor or close to the actual work stations, preferably within the specific department, such that it is natural for affected personnel to pass them daily. Regarding the specific sites LSP A and LSP B, it is recommended to replace the current board at the beginning of the picking line in LSP A, and that the prioritization board at LSP B is removed (the line-up board will no longer be needed).

#### Visual Boards for Daily Control that Allows for Bottom-Up Involvement

In order for the visual boards of the information center to be utilized at their full potential, it is considered important not to top-manage their content and usage. Standardizing the boards completely might reduce the operators' and team leaders' sense of ownership and diminish the chances of the actual adoption of the boards on the shop floor.

The daily control boards will yield the greatest benefits if they motivate the work of operators and team leaders by encouraging them to understand the operational performance. The role of the site manager should be to motivate and teach the operators and team leaders how to measure and understand their own performances better, and how individual participation and commitment will affect the production targets for the whole team or functional group. It might be a warning sign if the boards get too standardized, as this could indicate that the local managers have merely implemented the boards according to the requirements of top management with little understanding. However, that is not to say that a standard basic structure is counterproductive, as long as there is potential for local adaptation to specific needs and ownership.

#### 6.2.2 Structured and Continuous Feedback on Performance

Soft values are recommended to be included regularly on a daily basis. To make sure that operators are performing according to what is expected daily or during a certain shift,

individual as well as team feedback on performance is needed in the daily control system. This should be delivered by the team leader and presented to each operator individually at one point during the day. This feedback should include both quantitative metrics, such as whether the individual production efficiency is within targets, and qualitative information, such as metrics related to the number and type of errors or quality deviations. Feedback on team level should also be presented by visualization on the daily control board under the heading ‘production outcome’, to be compared with production targets. The added performance of the team may vary from individual performances, which will show up in other indicators of improvement.

### 6.2.3 Formal Communication between Shifts

Shift handovers are recommended to be implemented in order to increase information exchange. Handovers are proposed to be verbal between team leaders of subsequent shifts, as well as visualized on the daily control board. By visualizing all shifts of the day on the board, the communication between shifts will become more transparent and each shift will know what to do and what the other shifts have done or will be doing.

As there is no time overlap between the shifts at LSP B, the first team leader(s) should update the second team leader(s) about the past shift by updating the visual board for daily control together with the second team leader during the informal time for handover. By doing so, no information is excluded and no misunderstanding can arise from interpreting the board incorrectly. However, as pointed out above, it is still recommended that the team leader has time to go through the production to make sure that the information is correct before the daily control meeting with the operators is held.

### 6.2.4 Assigned Time for Work Tasks and Long-Term Focus

As LSP has identified four restrictions (scarce time, budget, external ownership of site and products, and short contract periods) it is vital to motivate and to schedule for activities that are not directly value adding in a short-term perspective, yet necessary to ensure customer satisfaction in a long-term perspective. It is recommended that clear roles are formulated for all employees, including responsibilities and work divisions, such that on a daily basis the employees do not do more or less than expected in order to reach the set targets and vision. To accomplish this, clear work descriptions are needed for all roles at the sites. At the same time, each employee should have a better understanding of each specific role, as the flexibility for work rotations should be high. These work instructions also need to be reviewed and updated yearly when the vision and targets are set, and should be made in consent with the operators. Responsibilities should be clearly visualized at the workplace, such that it is clear for all employees who is responsible for doing what, at what time. It is recommended that general instructions are placed near the daily control board and that specific instructions are visualized at each workstation, including pictures and descriptions if appropriate.

The work instruction should include:

1. Routines for daily work, including instructions for handling, order picking, packaging, and so forth
2. Daily work and task responsibilities
3. Routines for work not directly value adding (such as allocated time for improvement work and workplace organization)
4. Routines for how to handle, document, and mitigate process and quality deviations

By having a clear division between administrative work and team leading activities (at LSP A), it should be possible to ensure clearer roles and responsibilities, with the administrator responsible for order handling, and the team leaders for team leading including daily control. By having clear written-down work instructions, it is possible to motivate different types of work and at the same time keep flexibility between different roles. Clear routines for handling deviations save time, as compared with a situation when operators try to find another employee who knows how to handle a specific deviation (especially at LSP B). Established deviation routines also prevent operators from trying temporary own solutions that will result in extra work for technicians who have later to attend to the problems properly.

### 6.3 Workplace Organization

This subchapter presents recommendations relating to workplace organization (figure XVIII).

Sequential Implementation with Audits as Stage Gates

- Educate and involve all employees
- Define metrics and photograph the precursor as a benchmark
- Follow the 5S steps and sequence:
  1. Sort
  2. Set in order
  3. Shine/Sweeping
  4. Standardize
  5. Sustain

*Figure XVIII. Recommendations regarding workplace organization at LSP A and LSP B.*

It is recommended that the implementation of workplace organization, 5S, focuses only on one of the steps at a time. Audits are recommended almost from the start and to be completed once a week and be visualized on the daily control board. They should focus on the current and past steps, not try to evaluate what has not yet been implemented. All factors inspected and evaluated during the audit should be rated on a scale from 1 to 5, indicating the level of satisfaction. The sum score should be calculated and expressed in percent of the total possible score. A lowest percentage should be decided upon as the acceptance level for moving forward

to the next S. When the audits have reached the acceptance level, or higher, for at least three weeks in a row, it is time to move on to the next step. However, if the percentage agreed upon is not reached during a number of weeks, a return to the past step is recommended, focusing the efforts there until again achieving a score high enough to move to the next step. For the 5S work to be well understood in the daily routine, one or more 5S coordinators should be appointed among the team leaders or permanently employed operators. They should take responsibility for follow-up and delegation of 5S related improvement work.

### 6.3.1 Sequential Implementation with Audits as Stage Gates

The steps of 5S should be taken in sequence, with emphasis on 5S-step one and two, sort and set in order, as the most important.

#### Project Preparation

This is the first of two recommended activities preceding the actual five steps of 5S. Focus during project preparation should be on education and involving management and operators.

The following must be done:

1. Allocate time and resources
2. Assign a project leader who is supported by management
3. Complete education
  - a. About the system
  - b. The process of implementation
  - c. When work is supposed to be performed
  - d. What is expected by each employee
  - e. What benefits should be expected, e.g. long-term profit increase
  - f. Decide if all workplaces should be included from the beginning, or if only one should be selected for an initial pilot project
4. Form a group to plan and handle the implementation. It is recommended that this group involves employees from different departments

Note: because departments and employees are different, it is important to include the right employees from each department for each task. No audits are considered necessary in pre-phase 1.

#### Complete Workplace Scan

This is the second of two recommended activities preceding the actual five steps of 5S. It should be decided what should be measured and with what type of metrics. 5S should reduce wastes in production, hence metrics should focus on this. The measures and metrics should be aligned with the site's overall strategy. It is recommended that the proposed measures are evaluated in the light of the four questions formulated by Fabrizio and Tapping (2006):

1. What *waste* is to be eliminated?
2. What *behavior* should be supported?
3. In what way should the measurements be *used*?
4. *Whose* viewpoint is critical?

Hence,

1. Find appropriate measures and metrics
2. Share the process of collecting 5S data and the value of the measures and metrics with employees, so all knows how to perform it
3. Start using the designated place on the daily control board or add another board for visualization of the process. The board should be user-friendly for all employees and display the following:
  - a. a visualization of what is going on related to 5S
  - b. a surface for visualizing audits
  - c. who is responsible for performing 5S activities, and who is responsible for auditing
4. Take pictures of the current state to use as reference during progress
5. Complete a checklist for scoring and rating the situation, resulting in the audit

Note: the measures should be easily collected and should indicate performance improvement. 5S audits should begin during this phase.

Sort, the first S

This step is the first 'S' in 5S. The focus during this step should be on sorting.

1. Determine criteria for sorting, e.g.
  - a. How often is each item used?
  - b. Mark all items with red tape or similar
  - c. If using an item or tool, remove the red marking
  - d. Dispose the items not used to holding area
  - e. Decide what to do with the items in the holding area
    - i. Give away
    - ii. Find another purpose
    - iii. Recycle
    - iv. Throw away
2. Dedicate an area for items that have been sorted away

Note: Keep it simple!

Set in order, the second S

During this step, the activity is to define a permanent address for each item kept

1. Map the current state of workflow to determine what is used where
  - a. Much info is already gathered from sorting, such as information about usage frequency
  - b. Bottlenecks might be discovered
2. Define and model a new state
3. Dedicate and visualize a specific location for everything, based on the frequency used and place of use
  - a. All work areas, aisles and machine shops should be taped or painted
  - b. Locations for tools should be marked on shadow boards
  - c. Safety risks should be marked with "Keep Clear" or similar

Note: The stage 'set in order' should be an iterative process, as optimum locations might not be found immediately

### Shine, the third S

Shine is basically the activity of cleaning and maintaining order, to ensure a clean workplace.

1. Determine criteria for the state of shine
2. Transform the criteria to a checklist
3. Include it in the daily maintenance routines

Note: Do not make the cleaning too intensive.

### Standardize, the fourth S

Standardize is the method of maintaining the three previous activities.

1. Determine the ideal state, based on the activities performed
2. Implement visual control to maintain the ideal state
  - a. Use a standardized system for labeling and marking
  - b. Use a uniform format for labels
  - c. Use color coding
    - i. Shadow boards in the same color
    - ii. Tapes or paint for aisles, workplace, and machine shops should have different colors
    - iii. Different colors should be used for fixed items, garbage containers, finished goods and part locations

Note: Make the system easy to understand, follow and practice

### Sustain, the fifth S

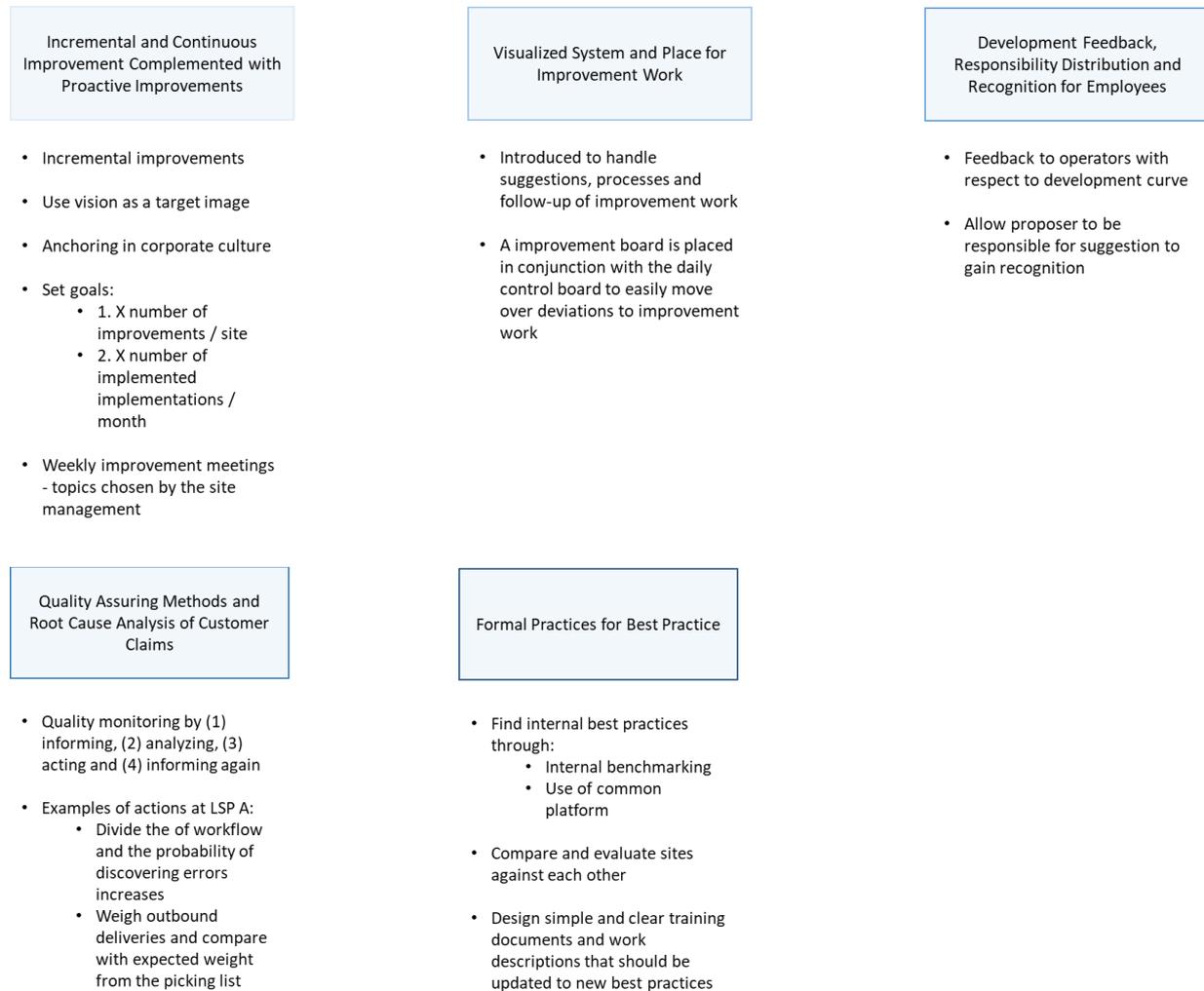
Sustain is when 5S turns into a habit. Discipline is required from each employee. All employees are supposed to work actively with 5S.

1. Educate again, this time as part of general workplace training
2. Allow changes and improvements to continue
3. Maintain cleanness
  - a. Each operator should be responsible for one station. This to allocate responsibility and recognition. This is visualized on the daily control board.
  - b. After each shift, this operator should make a daily walk to check up on the designated station and, with the help of a checklist, verify the cleanup performed by the operator who has been working at the station
4. Continue with performing and visualizing weekly audits and include:
  - a. An updated form for 5S audits
  - b. A schedule for when to perform the audits
  - c. Schedule for rotation among the auditors
  - d. A tracking sheet for 5S for communication of the current state

Note: Include 5S into the philosophy of the organization

## 6.4 Improvement Work

This subchapter presents recommendations related to systems for improvement work (figure XIX).



*Figure XIX. Recommendations for improvement work at LSP A and LSP B.*

It is recommended that a structured process is used for the implementation of continuous improvement. The initial recommendation is to map the current state to find a baseline, whereafter the direction of the organization is formalized as regarding improvement work to reach the vision. Then it is possible to identify problems and opportunities at the sites which may need improvement. The required changes should be implemented and identified waste eliminated. A new baseline having thus been defined, it is possible to begin working with continuous improvement. It is important to make the philosophy of continuous improvement an integral part of the company culture, as the improvement work requires a high degree of employee participation.

### 6.4.1 Incremental and Continuous Improvement Complemented with Proactive Improvements

It is recommended that the improvement work is continuously focused on small incremental changes. These continuous improvements should be guided by the general long-term vision and short-term targets. As regards the actual improvement work, two targets and KPIs are recommended to add and create incentives for improvement work.

1. Each department should suggest X improvements per month,
2. Each site should implement X improvements per month. These can be translated into the following KPIs:
  - a. How many suggestions for improvement has the site come up with during the month, as compared to target? (Suggestions/Target per site)
  - b. How many improvements have been implemented, as compared to target? (Implementations/Target per site)

Work with suggestions for continuous improvement can occur when operators have time over, depending on the fluctuations of production levels, but and should be added to the work instructions. By virtue of the explicit targets and KPIs, time for such work will be indirectly allocated. It is also recommended that there should continually be meetings for more proactive improvement work in smaller groups. Time should be allocated for such meetings once a week at a predetermined time. These meetings should be held by a dedicated leader, and the structure of the meeting should be systematized and formal, involving group activities to enhance ideas. A subject of improvement should be chosen on beforehand.

### 6.4.2 Visualized System and Place for Improvement Work

It is recommended that the improvement work makes use of a board, where each employee may write down improvements that come to mind at any time, and where all employees can take part of the suggestions. A dedicated employee should transfer the suggestions to the digital action list visualized at the information center. The structure, headings, and layout of the board should come from the employees using the board. It is recommended that the board has space for the following (figure XX):

1. Form for writing down suggestions
2. Evaluation of suggestions regarding utility and feasibility, and their subsequent sorting as looked into, set on hold, or dismissed
3. Suggestions being currently worked on, regarding
  - a. the progress of the implementation process. The same CI-tool should preferably be employed at all sites for easier communication between sites. The PDCA tool is recommended due to its simplicity and potential for powerful impact, and because PDCA was observed as the methodology used at LSP D. By color coding of the PDCA cycle for each idea looked into, it is possible to follow the process
  - b. whether someone else than the proposer is active in the evaluation/implementation

- The implemented suggestions and their consequences on the site. When all parts of the PDCA cycle have been filled in, the idea becomes an implemented improvement and changes are required on the site.

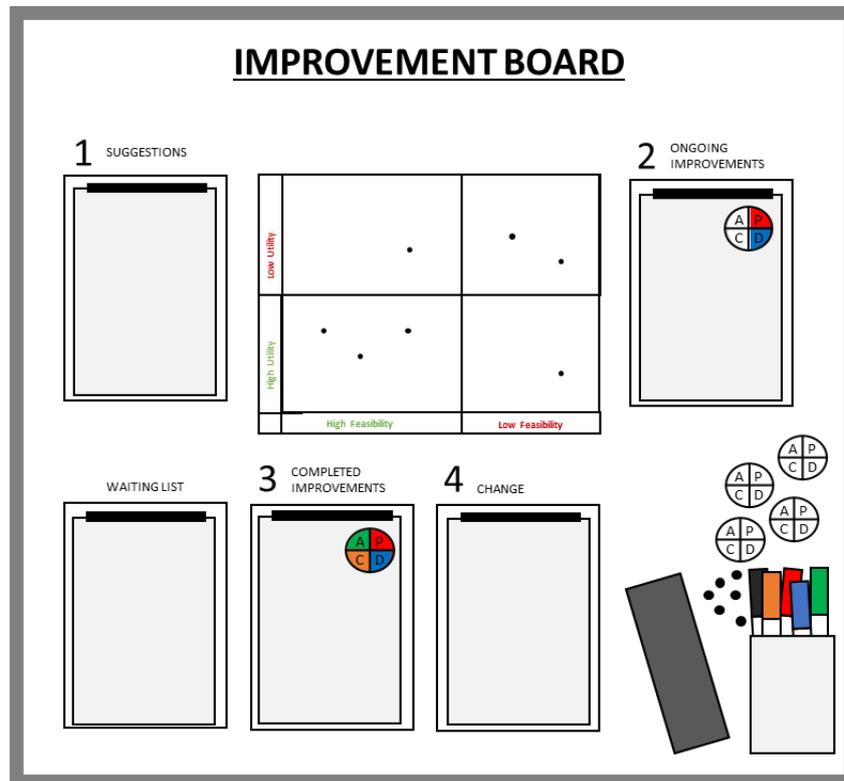


Figure XX. One example of a board that could be used in for continuous improvement work.

However, the implementation does not necessarily require the use of such a board. What is essential is that the implementation process is as structured. If using the board at LSP, it could be placed either between the information center and the daily control board at LSP B, or at the opposite side of that board. At LSP A, the board could preferably be placed on the outside of the office, opposite to the daily control board. In such manner, deviations from the daily control board to the improvement board would be easily facilitated. All employees should be engaged in this type of work. Participation in continuous improvement activities should therefore be added as an item to the work descriptions of all employees.

### 6.4.3 Development Feedback, Responsibility Distribution and Recognition for Employees

To develop the processes, the teams, and the employees as individuals, the use of a system for feedback and recognition is recommended. Firstly, as a rewarding system for accomplishment to the improvement targets and KPIs. Secondly, as the status update and feedback system should be complemented with a future goal and suggestions for making continuous improvement part of the daily work. This kind of feedback is likely to improve motivation, as it is interpreted as recognition by the employee getting the feedback. Recognition can also be

achieved by letting the proposer of an improvement be responsible for the further handling of that suggestion, which is recommended. However, this does not imply that the proposer has to handle it on his or her own. Others in the organization might be better suited and should be part of the evaluation of the suggestion, but the proposer should be involved during the entire evaluation and implementation.

#### 6.4.4 Quality Assuring Methods and Root Cause Analysis of Customer Claims

It is recommended that a quality assurance system is introduced to avoid customer claims. This system should be part of the daily control. Regarding LSP A, a division of the picking routine is recommended, such that one operator performs the picking and another the packing. In such manner two operators will check the same order. The checking by the second packing operator could be performed by checking the actual orders on the pallet against the order list. A system for order placement on the pallet would in this case be needed, as the packer would need to read the labels. Another suggestion would be to weigh the pallet on a scale and compare the result with the weight corresponding to the items on the order list.

In order to facilitate transparency and understanding of the situation, errors and customer claims should be displayed on the daily control board and so be made known to all employees at the site. As increased quality probably has a positive impact on everyone, the visualization of errors and picking rates may foster a culture of bottom-up driven improvements. Operators who are thorough in their work may react and tutor operators who have problems achieving the desired quality levels.

It is recommended that double loop learning is implemented to identify errors and notify the operators involved, counteracting that similar errors caused by similar reasons are allowed to occur again. However, what is included and what is not included in the current service system should first be evaluated and understood from a customer perspective. Initial changes based on such an evaluation could be made by an self-managing group. To prevent repeated failure, claims should be analyzed with regard to what makes a customer's demand valuable for the customer, what was not delivered, and why failure to meet the customer's demand occurred. When errors arise, customer claims come in, or KPI deviations occur, the following routine should take place, focusing on counteracting and preventing that something similar happens again:

1. Inform: all operators are notified about every identified error, whether or not it results in a claim, and whether or not it was caused by the notifying operator.
2. Analyze: the system and work environment where the error occurred should be analyzed to find the reason behind the error.
3. Take action: the system and work environment should be improved correctly by implementing the appropriate measure. Note: Do not focus on correcting the behavior of individual operators, as other operators might do the same mistake.
4. Inform again: about the changes made and update documents regarding the system or work environment if needed.

#### 6.4.5 Formal Practices for Best Practice

Internal benchmarking and information sharing for best practice are recommended, which also increases the connection between sites. Internal benchmarking has been recommended as a learning tool. However, it can also function as a tool for finding best practice, as sites may evaluate the processes of each other to find the best one. A complement to physical comparison of processes is to have a collaborative platform where best practices have to be shared. To motivate this type of work, recommendations are (1) to share information during flash-meetings about what each site is doing well and is proud of, and (2) to implement and evaluate each site, ranking the sites on a scale that reflects how well they are operating on parameters such as daily control and visual management, workplace organization, and continuous improvement. This should be performed by the Operational Excellence project group and presented to all sites in a form displaying how each site is performing compared to others. If a poor process is found during the evaluation, the Operational Excellence project group should recommend a best practice for the process to the site.

Best practice is also needed for work instructions. By letting the most experienced operator verify the documents, best practices will be a part of the daily work and become operational learning. The performance data used for feedback should also be used as material for the analysis of working processes. To reveal the best practice, the strongest performances should be analyzed for patterns of working. The operators with the best performance should be involved in the training of new employees. To ensure that the best practice is being taught, they should also participate in the coaching of those performing less well. Clear checklists for training are recommended to ensure a common standard from which to build on. These should include:

1. Health and safety routines
2. General information about the organization in general, as well as about the specific, local site
3. Work instructions
4. Introduction of the systems used at the site, such as the information center, daily control and visual management, continuous improvement, and workplace organization

The training document needs to be updated on a regular basis to ensure accuracy. It is recommended that this updating is performed annually, together with the other updates of documents when the vision and targets are revised.



## 7 Discussion

This subchapter presents a discussion of the study and the recommendations suggested, different implementation scenarios, and a proposed roadmap for the implementation of systems for daily control and visual management, workplace organization, and continuous improvement. Suggested future research is also presented.

### 7.1 Scenarios for Implementation

In order to achieve the purpose of this study and to answer the two research questions, recommendations for LSP A and B and for similar organizations were defined and presented in chapter 6, to improve service performance predictability, stability and uniformity of operations, and quality assurance using methodologies within the scope of operational excellence. However, there are different possible implementation approaches identified, having both advantages and disadvantages, for achieving operational excellence related benefits to increase company performance.

Four scenarios for potential implementation approaches are identified for LSP A and LSP B, as well as for other sites sharing similar characteristics. The different possible scenarios suggested are to (1) keep the current systems, (2) implement daily control, (3) implement primary recommendations, and (4) to implement all recommendation (figure XXI). Reviewing that operational excellence involves the strategic concentration on value maximization of operations from the perspective of the customers, by achieving higher production efficiency, waste elimination, improvement of productivity, and a culture of continuous improvement, among other aspects, it is evident that there is no generic solution applicable for all organizations. Instead, the most suitable implementation approach is considered dependent on specific characteristics of the organization in mind, as well as on internal and external stakeholder requirements and prioritizations. Specifying one implementation approach that is generically optimal for LSP as well as for other organizations with similar or slightly different characteristics, is outside the scope of this study. Instead, advantages and disadvantages with the four different implementation scenarios presented are discussed to provide understanding of how they might affect an organization similar as LSP.

To address the scenarios 3 and 4, the recommendations presented above can be divided into two categories: primary and secondary. The primary recommendations encompass the characteristics found for successful implementations. These are presented in the roadmap for the implementation of systems at benchmarking sites, for the basic implementation of daily control and visual management, and for the continuous improvement.

### 7.1.1 Primary Recommendations

1. Establish tangible targets and strategies aligning with the vision
2. Assigned time for work tasks and long-term focus
3. Bottom-up involvement and education
4. Decentralized control, visualized management, and daily meetings
5. Formal communication between shifts
6. Visualized system and place for improvement work
7. Training documents

### 7.1.2 Secondary Recommendations

1. Incremental and continuous improvement complemented with proactive improvements
2. Sequential implementation of 5S with audits as stage gates
3. Improved company identity
4. Quality assuring methods and root cause analysis of customer claims
5. Formal practices for best practice
6. Structured and continuous feedback on performance
7. Development feedback, responsibility distribution and recognition for employees

The four scenarios have advantages and disadvantages. Advantages of keeping the current systems are that the systems are sufficient to meet the existing production requirements and that the majority of employees are of the opinion that the systems work fine. However, continuous improvement and continuous daily control are not achieved as well as understanding for workplace organization. Implementing daily control (scenario 2) has the advantages that the implementation of only one system allows for concentrated focus of both management and operators, that daily management includes partial continuous improvement, and that a higher degree of daily control is achieved. However, continuous development as a separate system is not achieved as well as understanding for workplace organization. If the prioritized recommendations are implemented (scenario 3), that would create a stable base, generate working systems within daily control and visual management, and yield continuous improvement. However, this scenario requires dedicated resources and time, and feedback and motivation factors among employees are not fully achieved as well as understanding for workplace organization. If all recommendations are implemented (scenario 4), all the identified improvement opportunities obtain, and a strengthened community with learning from each other is reached. However, this scenario is resource and time consuming.

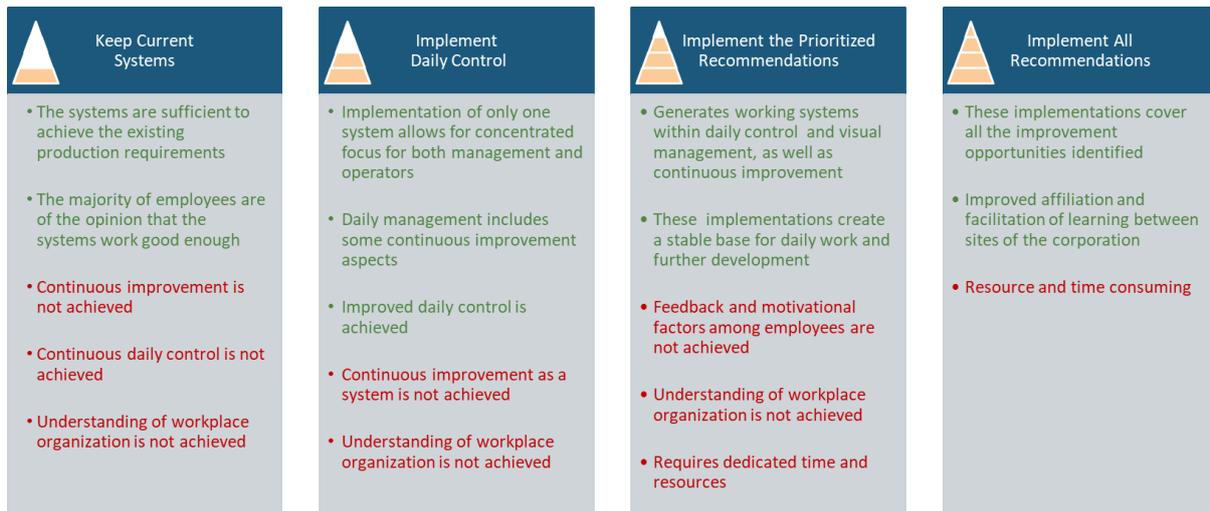


Figure XXI. The four possible scenarios and their advantages and disadvantages for organizations in the situation of the research objects.

## 7.2 Proposed Implementation Roadmap and Stage Gates

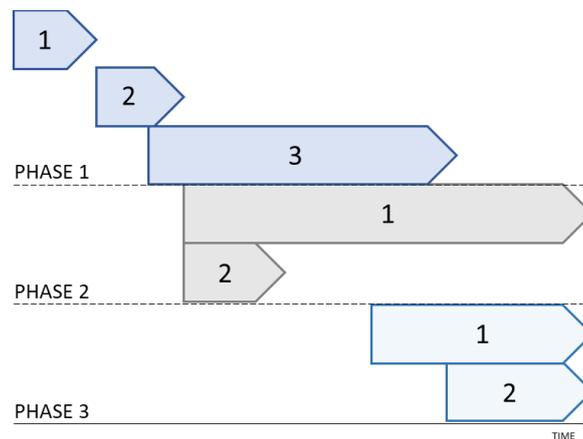
A roadmap recommended to be implemented according to the three-phase timeline visualized in figure XXII, focusing on scenario three and four. It is vital to begin phase one by formulating site specific visions as well as general and site specific targets and strategies, as these will be the foundation and guideline for all further implementations. When these have been formulated, decomposed to operators and changed into measurable KPIs through the workshops, it is time to formulate clear role and responsibility divisions described in work instructions including resource and time allocations. First when this is completed, and all employees know their general role and begin to understand what has been added to it regarding the implementation and maintenance of the systems, it is recommendable to start involving the employees with the aim of allocating more responsibility and power further down in the hierarchy. The general education about the systems under implementation should begin at this moment, before and during the implementation, as well as afterwards when needed.

Phase two concentrates on daily control to form a transparent organization and to involve employees. The daily control boards should be implemented as well as meetings, information gathering, and allocation of assignments. Initially the structure and layout of the boards could be marked with a permanent marker to facilitate erasing and changes until a functioning draft is found. As time passes, headings, information, and the layout of the boards may be added and adjusted if employees of departments have forgotten about important parts identified by the management. This due to the iterative nature of daily control. When the boards are in operation, the formalized shift handovers should be introduced.

When phase two has been implemented and running for some time, and both management and operators are comfortable with the new routines, it is recommended that phase three is started in parallel with the other phases. Due to the higher transparency, better understanding of the site, clearer work instructions and duties, there are fewer obstacles in the way for start

improving processes at the site. The suggested improvement board should be implemented and used for mostly reactive improvements. The action list has probably been discussed at several times by now, as have any deviations. However, it is important to note that in the beginning it is not relevant whether what has been suggested is actually an improvement or not. What is important is that the employees start to use the board on a regular basis. During this phase, a clearer description of what an improvement is and what it is not can be taught through education. Documents containing checklists for training should be formulated now to ensure that new employees receive the same impression as those already working.

When the sites are comfortable with the primary implementations, the move to the secondary ones is recommended. This does not mean that the sites have to begin the different phases at the same time, or work with them for the same amount of time. The top management should be present as a support during the entire implementation so that the employees of the sites are not overwhelmed.



*Figure XXII. Recommended timeline for the implementation of the primary recommendations. (1) establish tangible targets and strategies aligned with the vision, (2) assign time for work tasks and long-term focus, (3) bottom-up involvement and education, (4) decentralized control, visualized management, and daily meetings, (5) formal communication between shifts, (6) visualized system and place for improvement work and (7) training documents.*

### 7.3 Suggestions for Further Research

As digitalization of organizations has been considered as a general and ongoing trend, one suggestion for further research is to study the impact from digitalization of operational excellence sub methodologies, such as digitized visual boards for daily control, workplace organization and continuous improvement. Furthermore, it might be relevant to explore potential synergies between ERP-systems and integration with systems for daily control, and what consequences this might have on organizations converting from previously analogue systems. Another suggestion for further research is to evaluate the consequences from simultaneous versus sequential implementation of several different systems or methodologies within the scope of operational excellence, such as visual management and 5S. Additional studies may hence further evaluate how different implementation sequences can be evaluated in order to find the most optimal and sustainable approach and sequence for implementation.



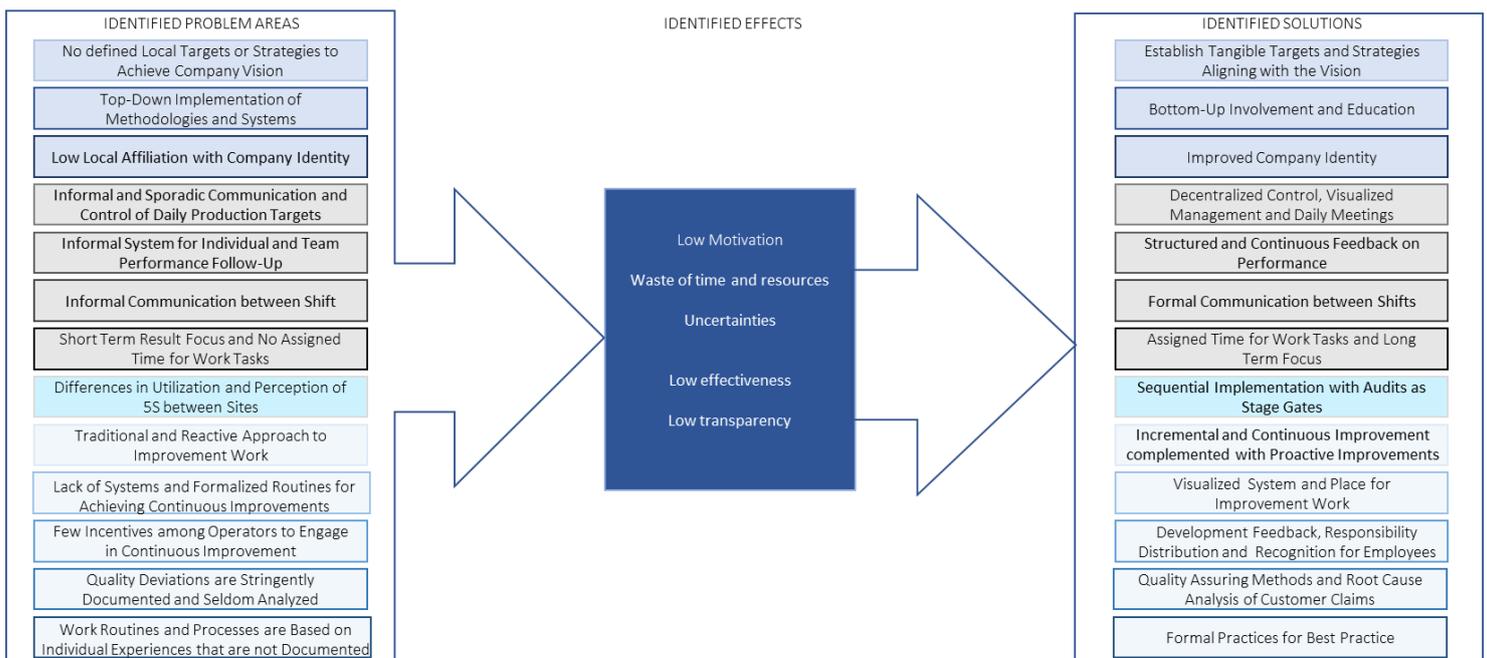
## 8 Conclusions

Three major conclusions were drawn from the study of the logistic service provider LSP.

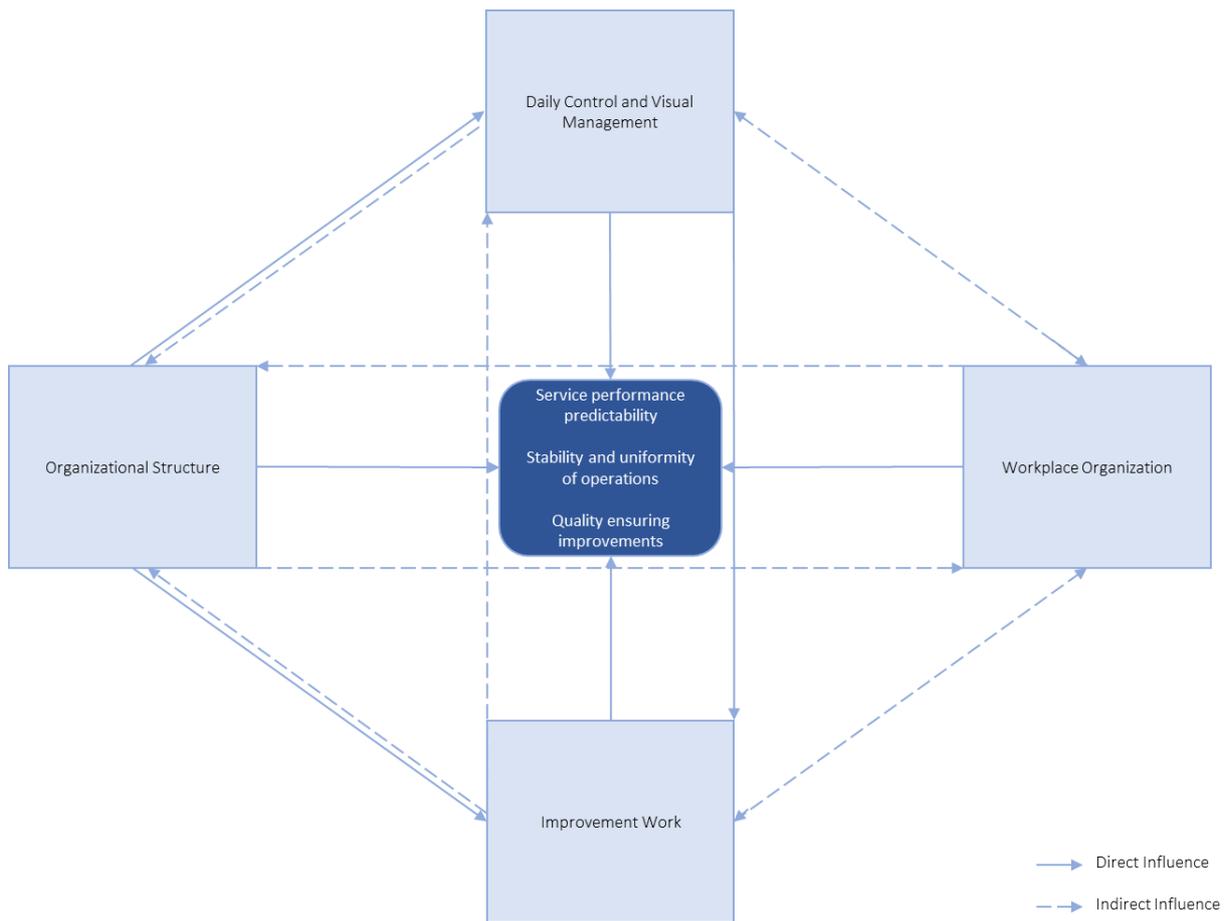
Firstly, the implementation of operational excellence at LSP is considered not to be hampered by restrictions identified by the company (scarce time, budget, external ownership of site and products, and short contract periods). Benchmarking sites were found to share similar restrictions and scarce resources due to internal pressure and customer requirements, despite internal ownership of site and products.

Secondly, there are problem areas at LSP with negative effects on operational excellence, such as low motivation, waste of time and resources, uncertainties, low effectiveness, and low transparency. For service performance predictability, stability and uniformity of operations, and quality ensuring improvements to be achieved, the identified weaknesses need to be addressed through approaches discussed in the thesis. Recommendations have been formulated for dealing with these problems (figure XXIII), encompassing the identified characteristics found for successful implementations.

Thirdly, there are direct and indirect influence on and between organizational structure, systems for daily control and visual management, workplace organization, and improvement work. These influences directly affect the implementation of operational excellence (figure XXIV).



*Figure XXIII. Identified problem areas, effects from current problem areas, and identified solutions, see appendix V for explication of the relationships.*



*Figure XXIV. The direct and indirect influence between organizational structure, daily control and visual management, workplace organization, continuous improvement, and the purpose of the thesis project.*

## Reference List

- Abernethy, M. A., & Chua, W. F. (1996). A field study of control system "redesign": The impact of institutional processes on strategic choice. *Contemporary Accounting Research*, 13(2), 569-606.
- Achinstein, P. (2004) *Science Rules: A Historical Introduction to Scientific Methods*. The Johns Hopkins University Press.
- Agrahari, R. S., Dangle, P. A., & K.V. Chandratre. (2015). Implementation of 5S methodology in the small scale industry A case study. *International Journal of Scientific & Technology Research*, 4(4), 180-187.
- Ajoje, O. (2015). Steps Required to Achieve Operational Excellence (OpEx) Within Clinical Programming. PharmaSUG 2015 - Paper MS14. <http://www.lexjansen.com/pharmasug/2015/MS/PharmaSUG-2015-MS14.pdf> [2017-08-25].
- Alvesson, M. (2013) *Organisation och ledning - ett något skeptiskt perspektiv*. Lund: Studentlitteratur.
- Anand, G., Ward, P.T., Tatikonda, M.V. and Schilling, D.A. (2009), "Dynamic capabilities through continuous improvement infrastructure", *Journal of Operations Management*, Vol. 27 No. 6, pp. 444-461.
- Argyris C (1977) *Double loop learning in organizations*. *Harv Bus Rev* 55(5):115–125
- Argyris, C., (1991). "Teaching smart people how to learn" . *Harvard Business Review*. 69 (3): 99–109.
- Argyris, C., (2002). *Double-loop learning, teaching, and research*. *Academy of Management Learning & Education*, 1(2), 206-218. doi:10.5465/AMLE.2002.8509400
- Bateman, N., Philp, L., & Warrender, H. (2016). Visual management and shop floor teams - development, implementation and use. *International Journal of Production Research*, 54(24), 7345-7358. doi:10.1080/00207543.2016.1184349
- Bell, E., J. Schroeder, and S. Warren, ed. (2013). *The Routledge Companion to Visual Organization*. London and New York: Routledge.
- Bhuiyan N., Baghel A., (2005) "An overview of continuous improvement: from the past to the present", *Management Decision*, Vol. 43 Issue: 5, pp.761-771
- Bochman, David J.; Kroth, Michael (2010). *Immunity to transformational learning and change*". *The Learning Organization: An International Journal*.
- Brue, G., & AccessEngineering (e-book collection). (2015). *Six sigma for managers* (Second ed.). New York: McGraw-Hill Education
- Bryman, A. (2012), *Social research methods*, 4.th edn, Oxford University Press, Oxford.
- Bryman, A., & Bell, E. (2011). *Business research methods*, 3d ed, Oxford: Oxford University Press.
- Bryman, A., & Bell, E. (2015). *Business research methods*, 4th ed, Oxford: Oxford University Press.

- Chai, T., Qin, S., & Wang, H. (2014). Optimal operational control for complex industrial processes. *Annual Reviews in Control*, 38(1), 81-92. doi:10.1016/j.arcontrol.2014.03.005
- Chao, R.O., Lichtendahl, K.C. & Grushka-Cockayne, Y. (2014). Incentives in a Stage-Gate process. *Production and Operations Management*, vol. 23, nr. 8, ss. 1286-1298.
- Dahanayake ND, Gamlath S (2013). *Learning organization dimensions of the Sri Lanka army*. *Learn Organ* 20(3):195–215
- Darvill, T. (2009). *The Concise Oxford Dictionary of Archaeology (2 ed.)*. Oxford University Press.
- Deming, W.E., Books24x7 (e-book collection) & Books24x7, I. (2000). *The New Economics for Industry, Government, Education*, 2nd edn, MIT Press, Cambridge.
- Dennis, P., & Books24x7 (e-book collection). (2015). *Lean production simplified: A plain-language guide to the world's most powerful production system* (Third ed.). Boca Raton: CRC Press, Taylor & Francis Group.
- Douven, I. "Abduction", *The Stanford Encyclopedia of Philosophy* (2017), Edward N. Zalta (ed.). Received 2017.12.04. <https://plato.stanford.edu>
- Dusharme, Dirk. (N.N.) "Six Sigma Survey: Breaking Through the Six Sigma Hype". *Quality Digest*.
- Eaidgah Torghabehi, Y., Maki, A. A., Kurczewski, K., & Abdekhodae, A. (2016). Visual management, performance management and continuous improvement: A lean manufacturing approach. *International Journal of Lean Six Sigma*, 7(2), 187-210. doi:10.1108/IJLSS-09-2014-0028
- Easterby-Smith, M., Thorpe, R., & Jackson, P. (2015). *Management and business research* (5th ed.). London: SAGE.
- Ebbinghaus, H. (2013). Memory: A contribution to experimental psychology. *Annals of Neurosciences*, 20(4)
- Eriksson, L.T. & Wiedersheim-Paul, F. (2008). *Rapportboken*. Stockholm: Liber.
- Fabrizio, T., Tapping, D., (2006). *5S for the office: Organizing the workplace to eliminate waste*. New York: Productivity Press.
- Garvin DA (1993). *Building a learning organization*. *Harv Bus Rev* 71(4):78–91
- Greif, M. (1991). *The Visual Factory*. Portland: Productivity Press.
- Hackman, JR. & Oldham, GR. (1974). *The Job Diagnostic Survey*. New Haven; JSAS Catalog of Selected Documents in Psychology (Ms. No. 810).
- Hackman, JR. & Oldham, GR. (1980). *Work Redesign*. Reading, MA: Addison-Wesley.
- Harris, C. and Harris, R. (2012). *Lean Connections: Making Information Flow Efficiently and Effectively*, CRC Press, Boca Raton.
- Hatzichronoglou, T. (1996). Globalisation and Competitiveness: Relevant Indicators. OECD Science, Technology and Industry Working Papers, nr. 1996/05, Paris: OECD Publishing. DOI: <http://dx.doi.org/10.1787/885511061376>

- Hirano, H. (1995). *5 Pillars of the Visual Workplace: The Sourcebook for 5S Implementation*. Portland: Productivity Press.
- Hirano, H., (1996). *5S for operators: 5 pillars of the visual workplace*. Portland, Or: Productivity Press.
- Jaaron, A.A.M. & Backhouse, C.J. (2017). "Operationalising "Double-Loop" Learning in Service Organisations: A Systems Approach for Creating Knowledge", *Systemic Practice and Action Research*, vol. 30, no. 4, pp. 317-337.
- Jaca, C., E. Viles, D. Jurburg, and M. Tanco. (2014). "Do Companies with Greater Deployment of Participation Systems Use Visual Management More Extensively? An Exploratory Study." *International Journal of Production Research* 52 (6): 1755–1770.
- Jackson MC, Johnston N, Seddon J. (2008). *Evaluating systems thinking in housing*. *J Oper Res Soc* 59(2):186–197
- Jacquette, D. (2002). *Ontology*. Chesham [England]: Acumen.
- Jevgeni, Sahnó & Shevtshenko, Eduard. (2014). Quality improvement methodologies for continuous improvement of production processes and product quality and their evolution. 2014. 181-186.
- Johnson, C. N. (2002). The benefits of PDCA. *Quality Progress*, 35(5), 120.
- Jugulum, R. & Samuel, P. (2008). *Design for lean six sigma : a holistic approach to design and innovation*. Hoboken, N.J. : John Wiley & Sons, cop.
- Karlsson, C., & Åhlström, P. (1996). Assessing changes towards lean production. *International Journal of Operations & Production Management*, 16(2), 24-41. doi:10.1108/01443579610109820
- Kaufmann, A. & Kaufmann, G. (2010). *Psykologi i organisation och ledning*. Lund: Studentlitteratur.
- Kurdve, M., Mälardalens högskola, Innovation och produktrealisering, & Akademin för innovation, design och teknik. (2014). *Development of collaborative green lean production systems*
- Lantz, A. (1993). *Intervjumetodik*. Lund: Studentlitteratur.
- Lind, J-I & Skäravad, P-H. (2004). *Nya team i organisationernas värld*. Malmö: Liber.
- Lixia, C., & Bo, M. (2008, December). How to make 5S as a culture in Chinese enterprises. In *Information Management, Innovation Management and Industrial Engineering, 2008. ICIII'08. International Conference on* (Vol. 3, pp. 221-224). IEEE.
- Manos, A. (2007). The benefits of Kaizen and Kaizen Events. *Quality Progress*; Feb 2007; 40, 2; ProQuest Central.
- Maskell, B. H., and F. A. Kennedy. (2007). "Why Do We Need Lean Accounting and How Does It Work?" *Journal of Corporate Accounting & Finance* 18 (3): 59–73.
- Mckeown, C. (2013). "Designing for situation awareness: an approach to user-centered design", *Ergonomics*, Vol. 56 No. 4, pp. 727-728.

- Mika, G.L. & Knovel (e-book collection) (2006). *Kaizen Event Implementation Manual*, 5th edn, Society of Manufacturing Engineers, Dearborn.
- Miller, A., & Ebook Central (e-book collection). (2014). *Redefining operational excellence: New strategies for maximizing performance and profits across the organization* (First ed.). New York: AMACOM - American Management Association.
- Moen, R., & Norman, C. (2006). Evolution of the PDCA cycle.
- Nicholas, J. & Soni, A. (2006). *The portal to lean production - principles and practices for doing more with less*. Boca Raton, FL: Auerbach.
- Ortiz, C. A., Park, M., (2011). *Visual controls: Applying visual management to the factory*. Boca Raton: CRC Press.
- Pietrzak, M., & Paliszkievicz, J. (2015). Framework of strategic learning: The PDCA cycle. *Management*, 10(2), 149-161.
- Pries, K. H., Quigley, J. M., Books24x7 (e-book collection), & Books24x7, I. (2013). *Total quality management for project management* (1st ed.). Boca Raton, FL: CRC Press
- Rother, M. (2013). *Toyota kata: Lärande ledarskap, varje dag* (1. uppl. ed.). Stockholm: Liber.
- Rother, M. (2010). *Toyota kata: managing people for improvement, adaptiveness, and superior results*. New York: McGraw-Hill.
- Ryan, R. M.; Deci, E. L. (2000). "Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being". *American Psychologist*. 55 (1): 68–78
- Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students* (7.th ed.). Harlow: Pearson Education.
- Sarkar, D. & Ebook Central (e-book collection) (2008). *Lean for service organizations and offices: a holistic approach for achieving operational excellence and improvements*, ASQ Quality Press, Milwaukee, Wis.
- Seddon J (2003). *Freedom from command and control: a better way to make the work work*. Vanguard Education, Buckingham
- Setijono, D. (2010). "Model and principles of stakeholders-oriented quality management based on radical (discontinuous) improvement - a modern re-interpretation of TQM and CWQC?", *International Journal of Quality and Innovation*, vol. 1, no. 2, pp. 167.
- Shankar, R., Ebook Central (e-book collection), & Knovel (e-book collection). (2009). *Process improvement using six sigma: A DMAIC guide*. Milwaukee, Wis: ASQ Quality Press
- Slack, N., Chambers, S., & Johnston, R. (2010). *Operations management* (6.th ed.). Harlow, England: Prentice Hall.
- Slack, N., Chambers, S. & Johnston, R. (2016). *Operations Management*. Essex: Pearson Education Limited
- Smith, R. B., Peterson, J. R., (1998). *The 5S pocket guide*. Florence: Productivity Press.
- Sokovic, M., Pavletic, D., & Pipan, K. K. (2010). *Quality improvement methodologies—PDCA cycle, RADAR matrix, DMAIC and DFSS*. *Journal of Achievements in Materials and Manufacturing Engineering*, 43(1), 476-483.

- Tezel, B., Koskela, L. and Tzortzopoulos, P. (2010). "Visual management in construction: a study report on Brazilian cases", SCRI Research Report.
- Thomas, A. (2014). FINDING SUCCESS IN SOPS. Automotive Body Repair Network, 53(4), 30-33.
- Thurén, H. (n.d). Källkritiska principer. Nationalencyklopedin. Received 2017.09.20  
[www.ne.se/uppslagsverk](http://www.ne.se/uppslagsverk)
- VandeWalle, D. (1997). Development and validation of a work domain goal orientation instrument, Educational and Psychological Measurement, 8, 995-1015
- Wallén, G. (1993). Vetenskapsteori och forskningsmetodik. Lund: Studentlitteratur.
- Walsham, G. (1995). "The Emergence of Interpretivism in IS Research", Information Systems Research, vol. 6, no. 4, pp. 376-394.
- Westlander, G, (1993). Socialpsykologi: Tankemodeller om människor i arbete. Göteborg: Akademiförlaget.
- Wilson, C. (2014). *Interview techniques for UX practitioners: A user-centered design method*. Amsterdam;Boston;: Morgan Kaufmann.



# Appendix I - Interview and Observation Guide

The guidelines for interviews and observations during site visits are presented in this part.

## 1 Interview Guidelines for Operators

Interviews performed with the operators at the research objects were semi structured. Hence, the questions below were used as a guideline. The interviews were further held in Swedish and this is thus a translation of the interview guideline used.

1. What is your role at LSP?
2. How long have you been working here?
3. What is your impression regarding the shifts? How do they differ?
4. How did you find out what you are supposed to be doing at this moment?
5. How is information between shifts handed over?
6. How are deviations documented and communicated?
7. Are customer claims communicated to you?
8. Does the information communicated to you differ from the information communicated to your co-workers independently of shift and team?
9. How and when is it possible to share ideas/suggestions?
10. Estimate how much time is used to search for information about what to do and how to do it during a regular workday?
11. Where are the bottlenecks in the process according to you?
12. What is the most important part in the everyday production?
13. What are the challenges in everyday production?
14. What are the challenges with the current system for communication and information sharing?
15. What wastes have you acknowledged in the production?
16. What does the term daily control and visual management mean to you?
17. What is done at this site interpreted by you as daily control and visual management?
18. What does the term workplace organization and 5S mean to you?
19. What is done at this site interpreted by you as workplace organization and 5S?
20. What does the term continuous improvement mean to you?
21. What is done at this site interpreted by you as continuous improvement?
22. What are the visions of this site and of LSP as corporation, and how is it used?
23. Based on your perspective, how would the activities and processes at the site be designed to achieve the optimal workplace?

## 2 Interview Guidelines for Management and Benchmarking

Interviews performed with the management at the research objects and representatives from benchmarking companies were semi structured. Hence, the questions below were used as a

guideline. The interviews were further held in Swedish and this is thus a translation of the interview guideline used.

### Introduction

1. What do this company do, and what is performed within this site?
2. What is your role?

### Daily Control and Visual Management

1. What does daily control and visual management mean to you?
2. How do this site work with daily control and visual management?
3. When did you implement the current systems and methodologies in place?
4. How have the methods and tools used been developed?
5. Is there a coordinator?
6. Who is responsible for the information and who can update it?
7. Is there a document, a standardized agenda, information or the like and for whom is it available?
8. Which KPIs are measured and documented on this site?
9. What is your opinion about the KPIs used?
10. Have you or someone else been through any training / education for daily control and visual management?
11. How can the sites day-to-day work be improved?
12. Is there anything you want to add?

### Workplace Organization

1. What does 5S mean to you?
2. Describe this site's system for 5S?
3. When did this site introduce the current system for 5S?
4. How is 5S work documented?
5. Is there a document, a standardized agenda, information or similar, and for whom is it available?
6. Is there a coordinator?
7. Who is responsible for the information and who can update it?
8. Are 5S audits used?
9. What do you see for improvement opportunities?
10. Is there anything you want to add?

### Continuous Improvement

1. What does continuous improvement mean to you?
2. How do this site work with continuous improvement work?
3. When did this site introduce the system you have today for continuous improvement?
4. How is improvement work documented?
5. How have concepts and tools been developed?
6. Is there a coordinator?

7. Who is responsible for the information and who can update it?
8. How are different stakeholders valued and prioritized in the work of continuous development, as well as in general?
9. How is cross-functional improvement work performed?
10. How is an improvement proposal and / or idea communicated? Is there a different approach depending on role?
11. How are incidents, deviations and customer claims treated?
12. Is there a document, a standardized agenda, information or similar, and for whom is it available?
13. Is there visual board dedicated to improvement work?
14. What KPIs are used for improvement work?
15. Are there any timeframes for improvement projects?
16. Have you or someone else been through any training / education for continuous development?
17. How can this site's improvement work become better?
18. Is there anything you want to add?

### 3 Observation Guidelines

Observations were performed at all site visits focusing on process flow, visualizations for daily control and visual management, workplace organization as well as continuous improvement. Some of the questions are daily control board specific.

1. How would you describe the process flow at this site?
2. What boards are used for visual management and where are they placed (daily control, workplace organization, continuous improvement)?
  - a. What is the layout and structure of the boards?
  - b. What headings are there and why?
  - c. How often is the information updated?
  - d. Who has access to it?
  - e. Is there updated information about, and status of, processes in the business? For all or just for some processes?
  - f. Does information on visual boards achieve that attention, leadership, and resources are focused on areas requiring extra attention?
  - g. Does the board notice current actions or countermeasures to address shortcomings in at the site?
  - h. Does the board visualize how the operation will normally work in comparison with how the operations currently work?
3. Are there work instructions by each station? What are their content and layout?
4. What 5S visualizations are there at the site (markings, labels, tapes, etc.)?

## 4 Scoreboards for Assessment of Current State

Scoreboards for assessment were based on the interviews and observations performed on daily control and visual management, workplace organization as well as continuous improvement. Each activity was scored on a scale from 0-10, apart from quantitative categories such as number of employees.

Organizational Structure		
Activity	Score (0-10)	Note
# of Employees		
# of Shifts		
Contract Period		
Production Ownership		
Management Involvement Daily Control		
Management Involvement Workplace Organization		
Management Involvement Continuous Improvement		
Education		
Experienced scarce time and budget		
Vision Used for Anchoring		
Total:		

Daily Control and Visual Management		
Activity	Score (1-10)	Note
Introduction of System		
Daily Control Board,		
	Safety	
	Quality	
	On-Time-Delivery	
	Attendance	
	Production Target	
Daily Meetings		
Daily Control Coordinator		
KPIs		
Dedicating Tasks and Problem Solving		
Gathering and Updating Information		
Approach		
Shift Handover		
Visualization of Work Instructions		

Quality Control		
Resource Planning,		
	Forecast Based	
	Capacity Based	
	Frozen Planning Period	
Total:		

Workplace Organization		
Activity	Score (1-10)	Note
Introduction of System		
New Try of Introduction		
Phase		
5S Interactive Board		
5S Coordinator		
5S Audit and Visualization		
Standardized Tools and Methods		
Approach		
Visual Color-Coding		
Ease of Navigation		
Cleaning routines		
Area Free of Unnecessary things		
Marked Aisles		
Marked Tools and Machines		
Total:		

Continuous Improvement		
Activity	Score (1-10)	Note
Introduction of System		
Communicated Vision		
Communicated Targets		
Type		
Continuous Improvement Board,		
	Suggestions	
	State and Progress	
	Outcome	
Continuous Improvement Meetings		
Allocated time for improvement work		
Proactive work		
Reactive work		
KPIs		
Timeframe		

Understanding of Company History and Future		
Reward and Recognition System		
System for Employee Initiative and Resolving power		
System for Feedback		
Approach		
Process for reviewing work instructions		
Ownership of suggested improvement		
Cause analysis of downtime and deviations		
Best Practice		
Training document		
Total:		



# Appendix II - Site Maps and Process Flowcharts

Site maps and flowcharts have been constructed for the research objects, LSP A and B. These are based on observations performed during the site visits.

## 1 Site Maps and Process Flowchart for LSP A



Figure I. The internal layout of LSP A.

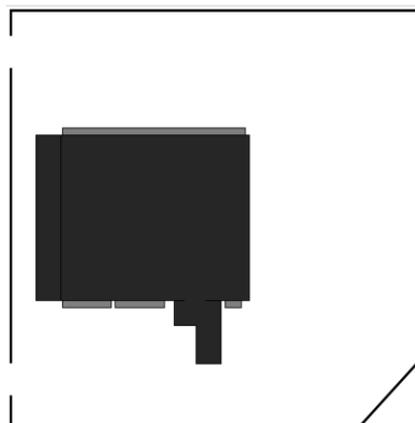


Figure II. The external layout of LSP A.

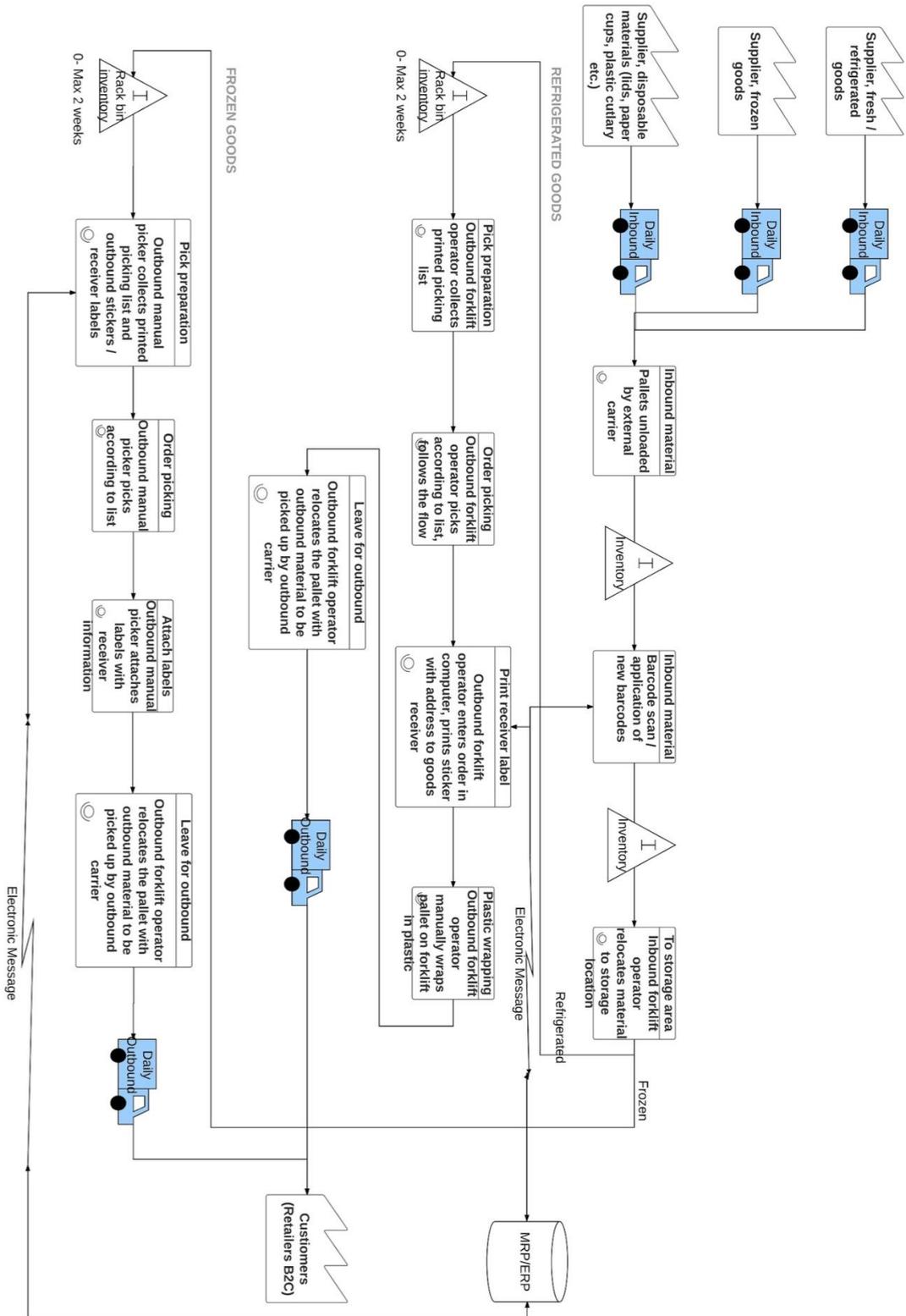


Figure III. The process flow of operations at LSP A.

## 2 Site Maps and Process Flowchart of LSP B

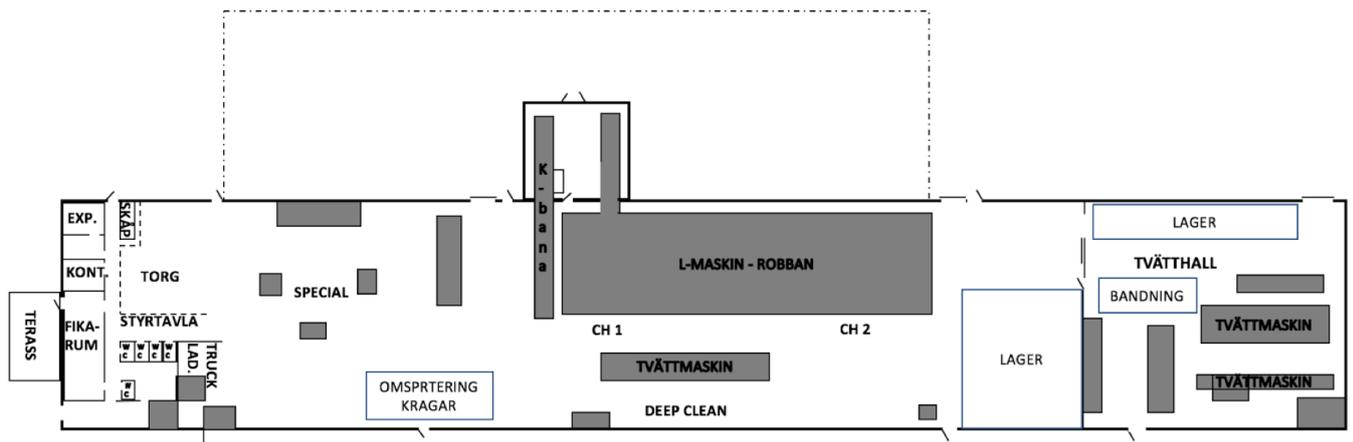


Figure IV. The internal layout of LSP B.

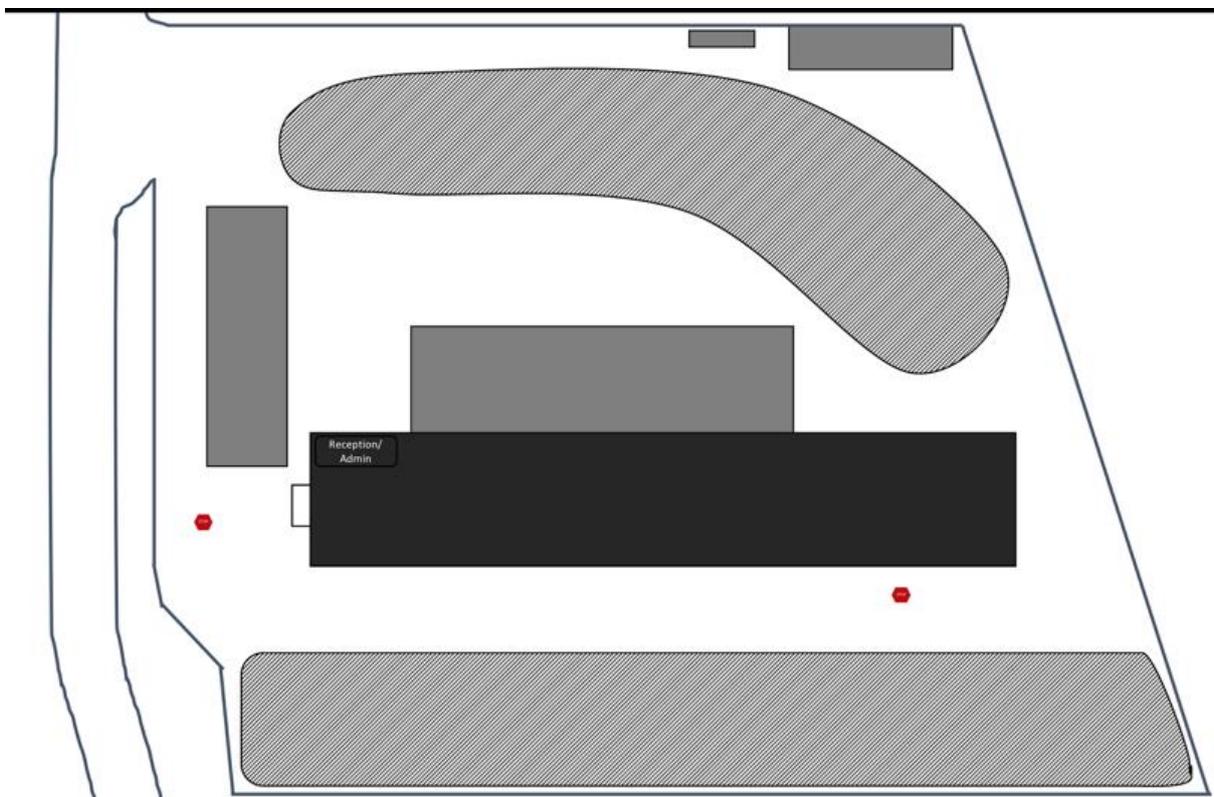


Figure V. The external layout of LSP B.

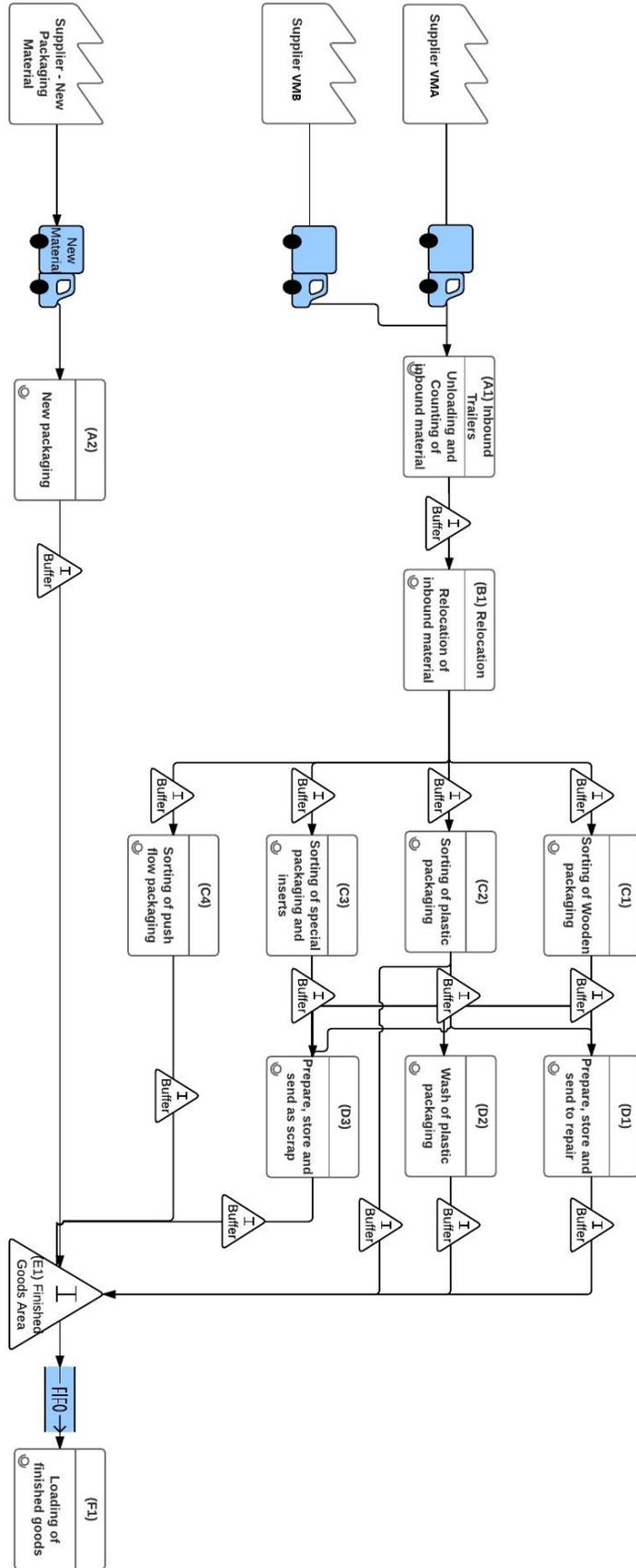


Figure VI. The process flow operations of LSP B.

## Appendix III - KPIs Used by the Sites Studied

The KPIs presented encompasses all sites apart from Company B and C as due to a general character of those KPI descriptions.

### KPIs documented at LSP A:

- Number of handled items, daily
- Current accumulated number of customer claims during the recent year
- Service level achieved as percentage of no errors in orders
- Number of incorrect picks per employee during each month
- Average efficiency per operator
- Accumulated amount of short-term leave per week
- Inventory errors per week
- Weekly penalty fees due to quality errors

### KPIs documented at LSP B:

- Actual production robot flow, per shift
- Efficiency of robot flow (Production speed per shift)
- Actual production 'K-flow' per shift
- Efficiency K-flow
- Actual production 'Special flow' per shift
- Efficiency 'Special' per shift
- Actual production 'sort pallet collars' per shift
- Efficiency 'sort pallet collars' per shift
- Actual production 'Disk wash' per shift
- Efficiency 'Disk wash' per shift as well as packing
- Actual production 'Blue boxes' per shift
- Efficiency 'Blue boxes' per shift
- Accumulated amount of short-term leave per week

### KPIs documented at LSP C:

- Order picking rate per operator and hour (production rate)
- Average production rate per operator
- Illness leave

### KPIs documented at LSP D:

- Production efficiency per working group
- Efficiency at individual level
- Attendance and absence are measured and documented
- Most of the data related to production are documented automatically by the automated warehouse management system.

KPIs documented at Company A:

- production outcome mainly by considering KPIs for on-time delivery.
- Absence of employees, such as short-term leave for illness
- Total number of machine hours utilized
- Total amount of hours in operation

## Appendix IV - Daily Control Board Agendas

The agendas used and visualized on the sites with thorough daily control boards are presented below. The content was explained through interviews and observed.

General agenda used at LSP D:

- Health and safety (the safety cross)
- Production targets and outcome
- Personnel status (attendance, info, absence, and similar)
- Activities out of normal operation
- Improvement work
- 5S, Workplace organization
- Other / Misc.

General agenda used at Company A:

- Time for meeting, rules for meeting and explanations of color codes
- An agenda
- Health and safety (the safety cross)
- Personnel status (attendance, info, absence, and similar), this is absent on the joint board
- Quality (the Q)
- Purchase (the I)
- Internal deliveries
- Each station along with status, production KPIs, a field for comments, responsibility for specific problem solving (matching names on magnets with production stations where problems have occurred)

General agenda used at Company B:

- Title, Department and Starting time of the daily meeting
- A meeting agenda
- Health and safety (the safety cross)
- Personnel status (attendance, info, absence), this is absent on the joint board
- The plus of the week (motivational news)
- Production related information / KPIs
  - On-Time Delivery (OTD)
- Production targets and outcome
- Continuous improvement
  - Suggestion board
  - Status of the iterative method used for control and continuous improvement of processes, CI-process.
- Workplace Organization, 5S

General agenda used at Company C:

- A meeting agenda
- Health and safety (the safety cross)
- Production targets and outcomes
- Personnel status (attendance, info, absence), this is absent on the joint board
- Competence matrix
- Workstation Line-up, this is absent on the joint board
- Prioritization
- Disturbances
- Quality metrics
- Material shortages
- Feedback on performance

# Appendix V - Summary of Problem Areas, their Consequences, and Recommended Solutions

A detailed schematic of the problem areas discussed in the analysis and their consequential effects and the recommended solutions. Followed by visualizations of each effect separately treated.

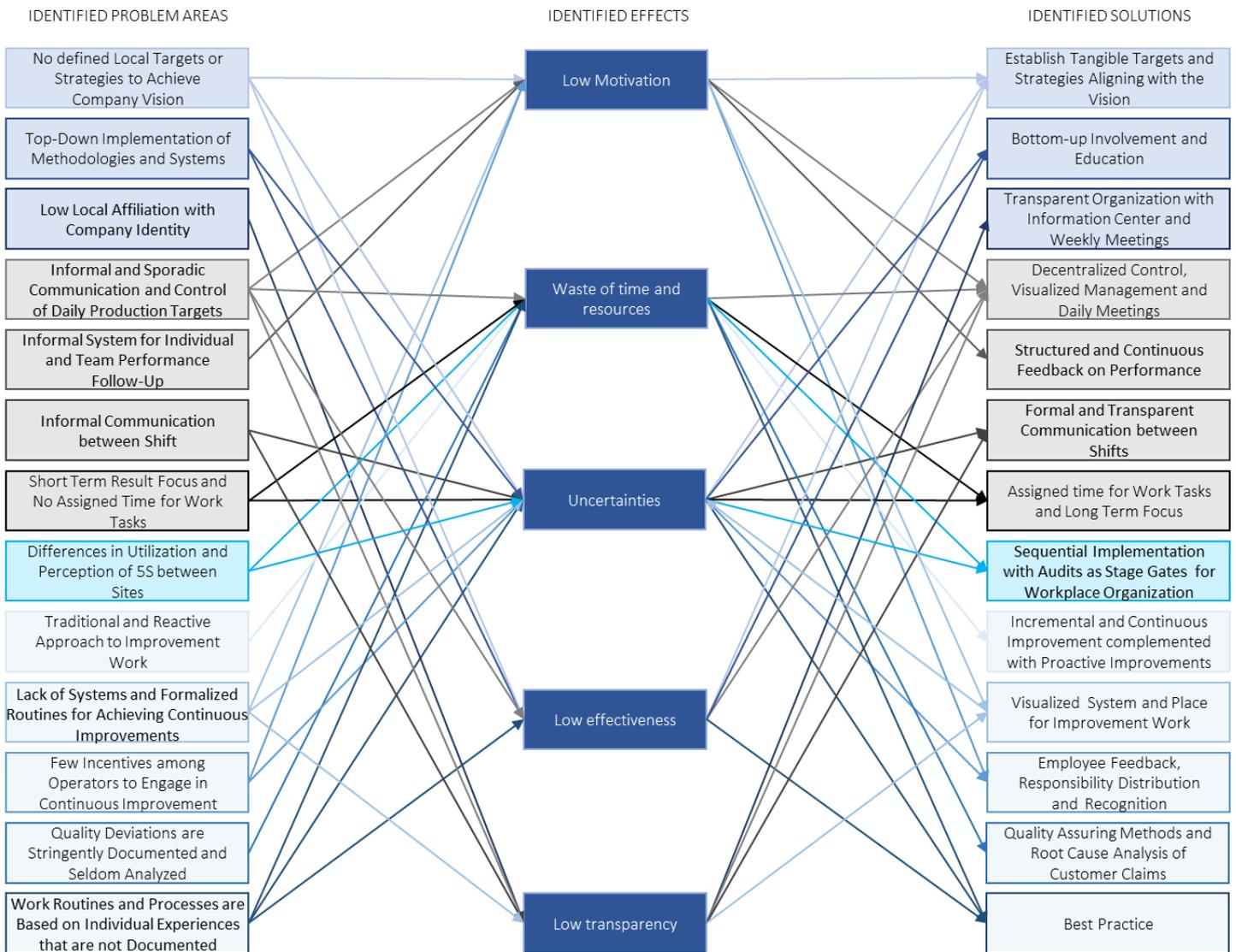


Figure I. A summarization of the five consequential effects.

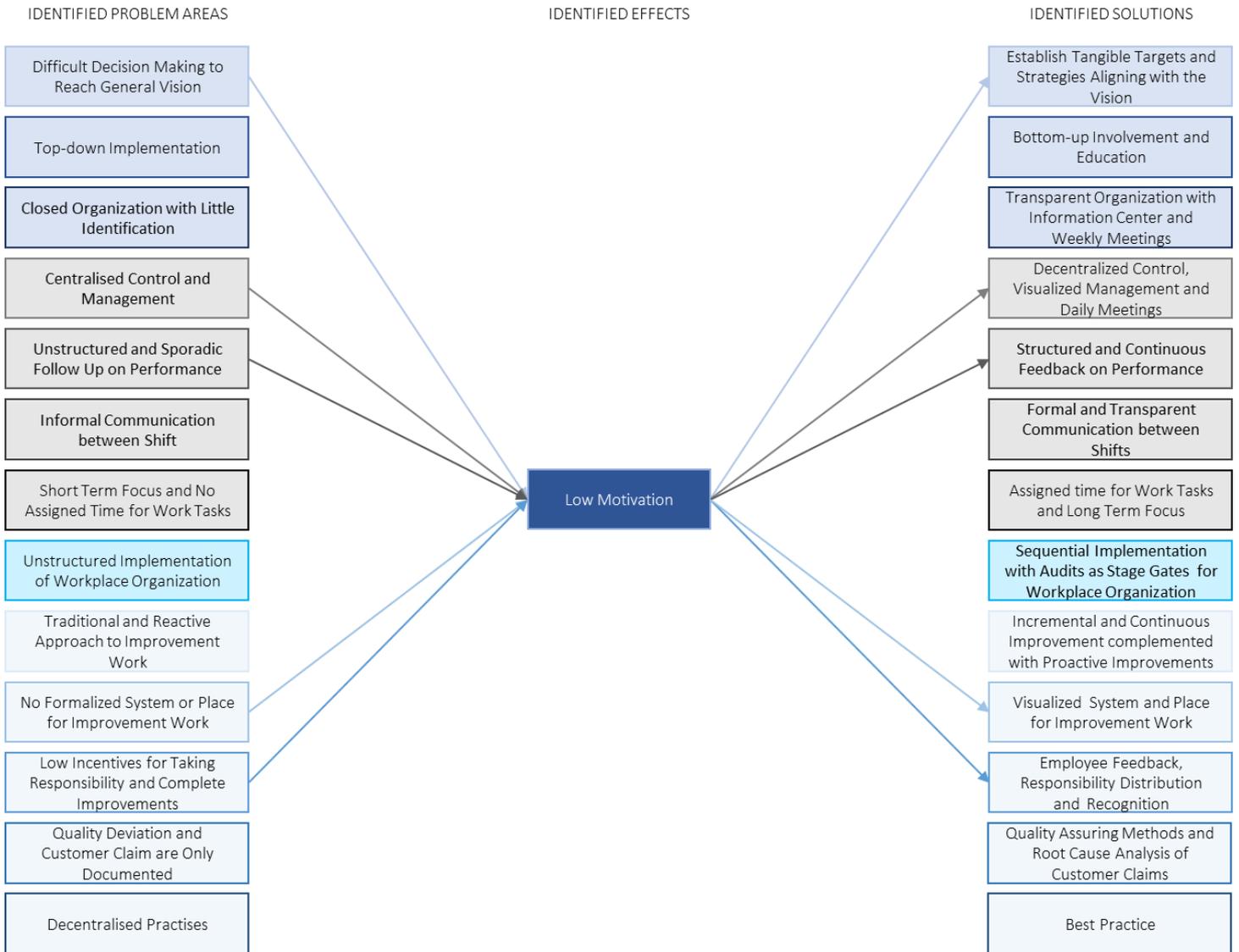


Figure II. A summarization of effect one - low motivation.

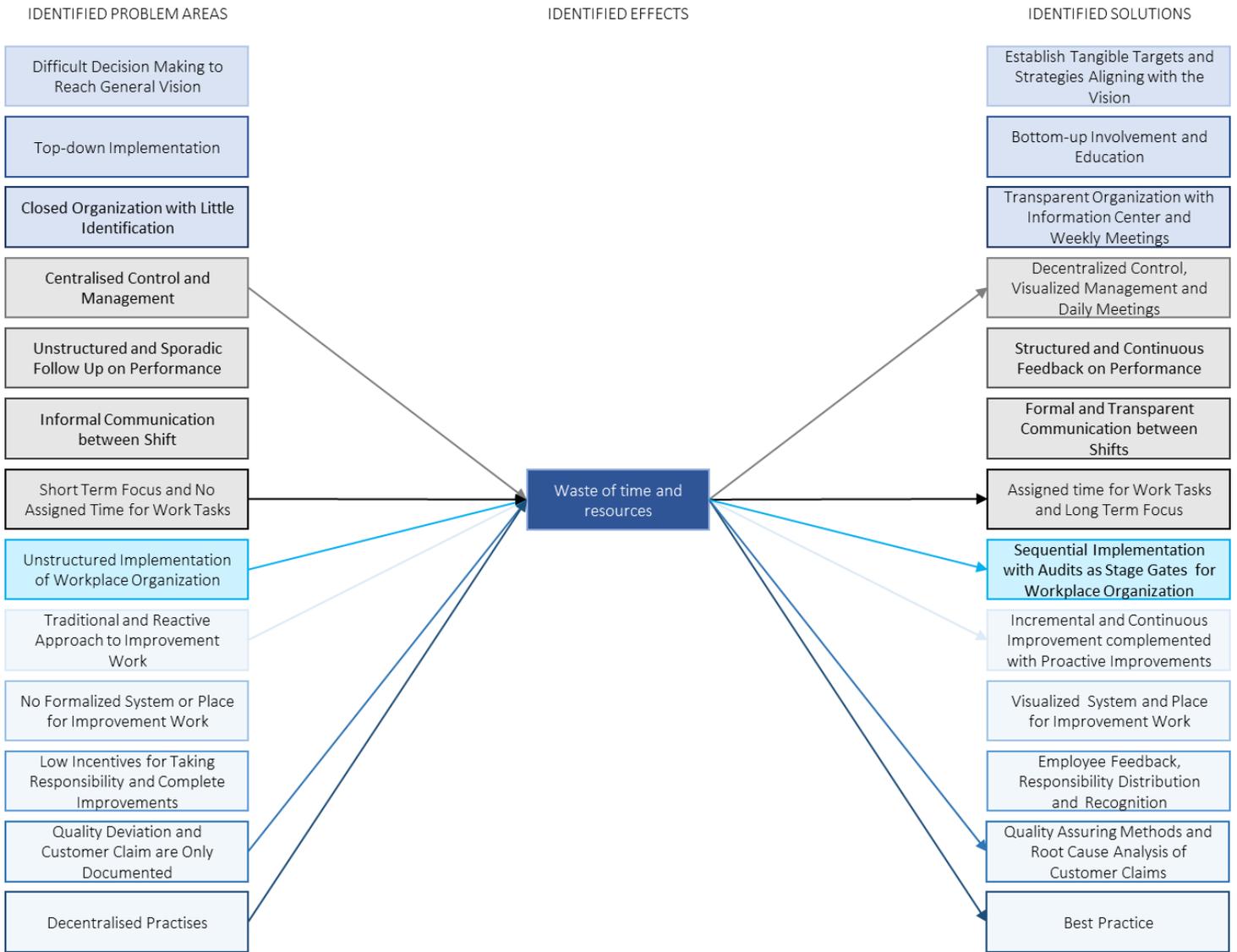


Figure III. A summarization of effect two - waste of time and resources.

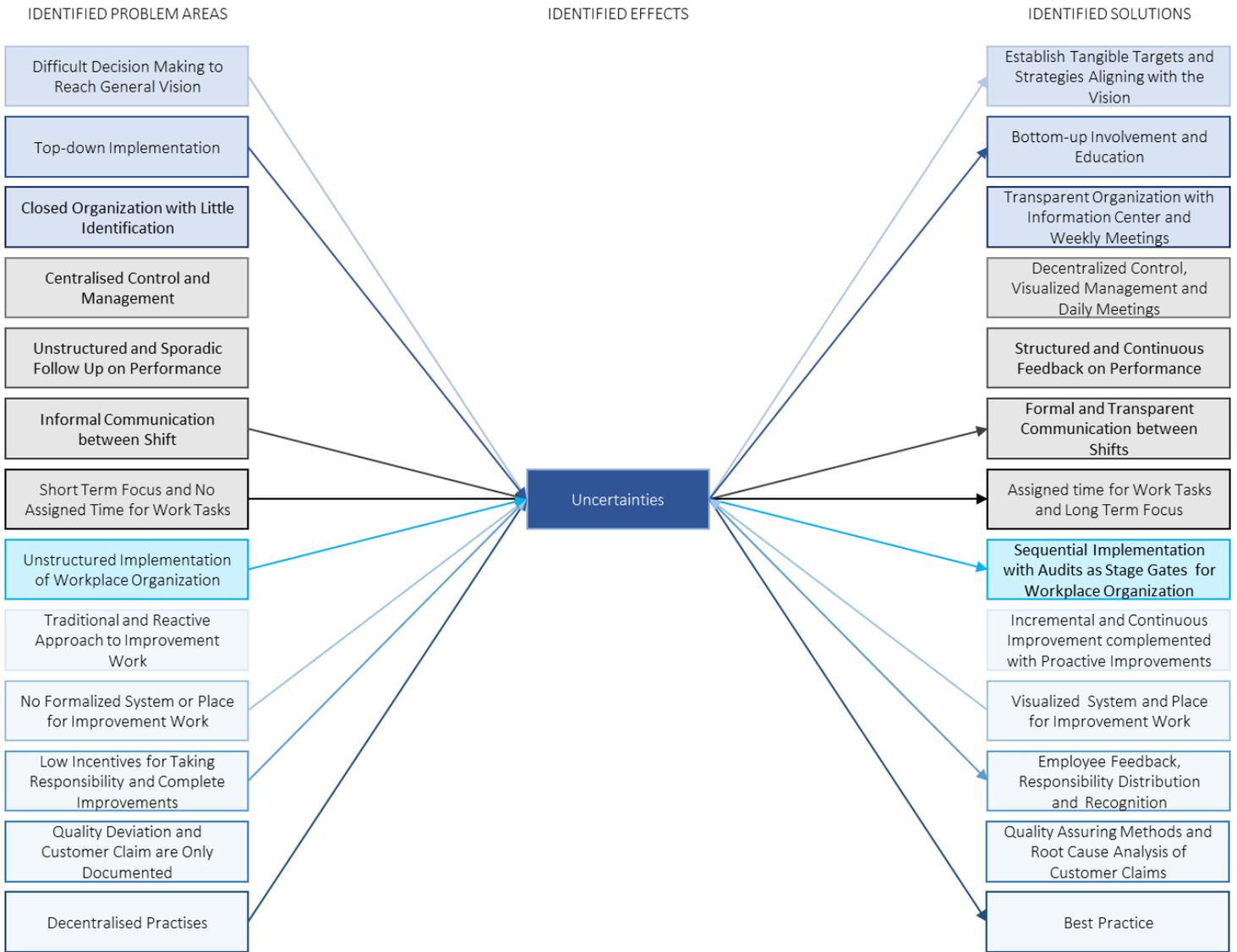


Figure IV. A summarization of effect three - uncertainties.

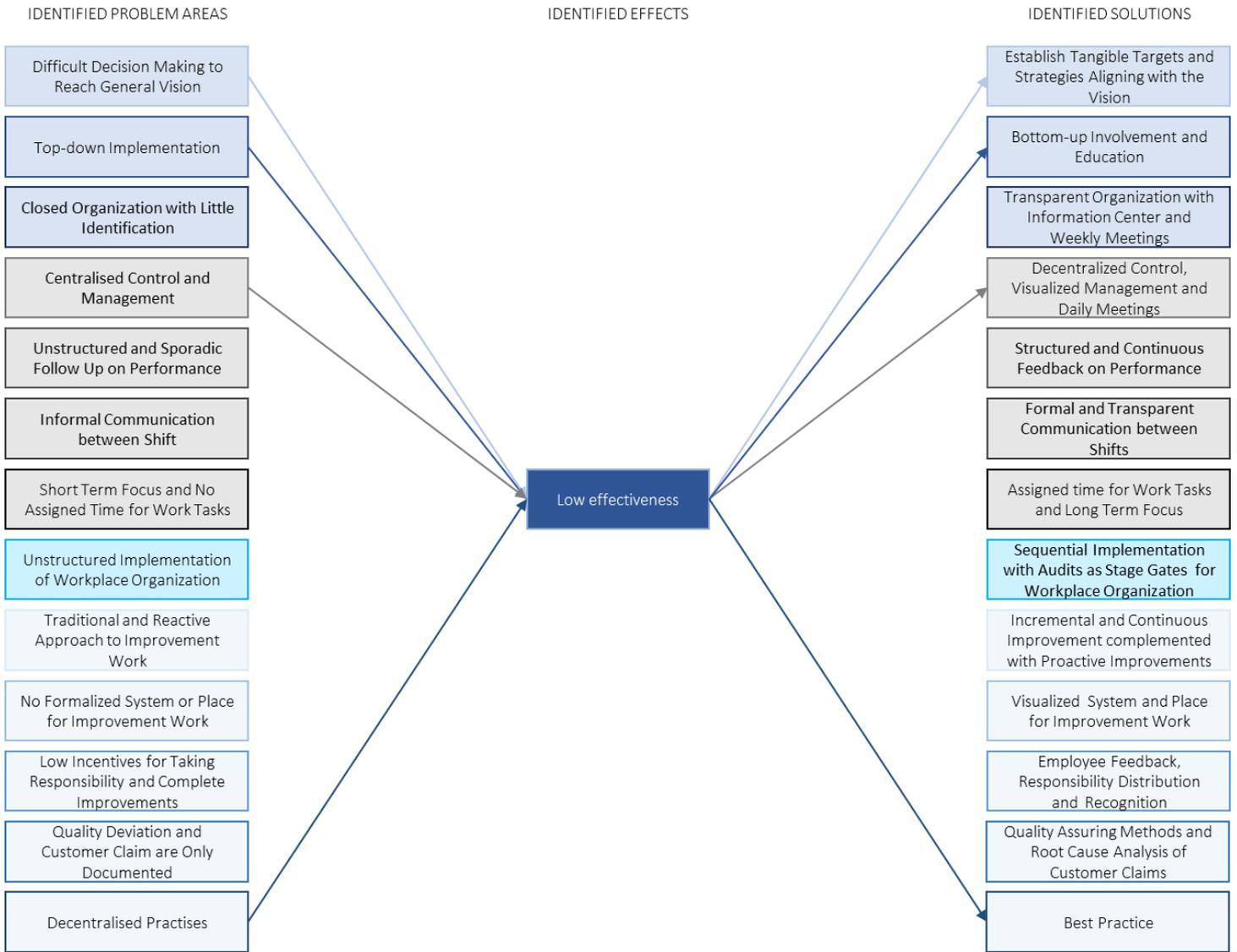


Figure V. A summarization of effect four - low effectiveness.

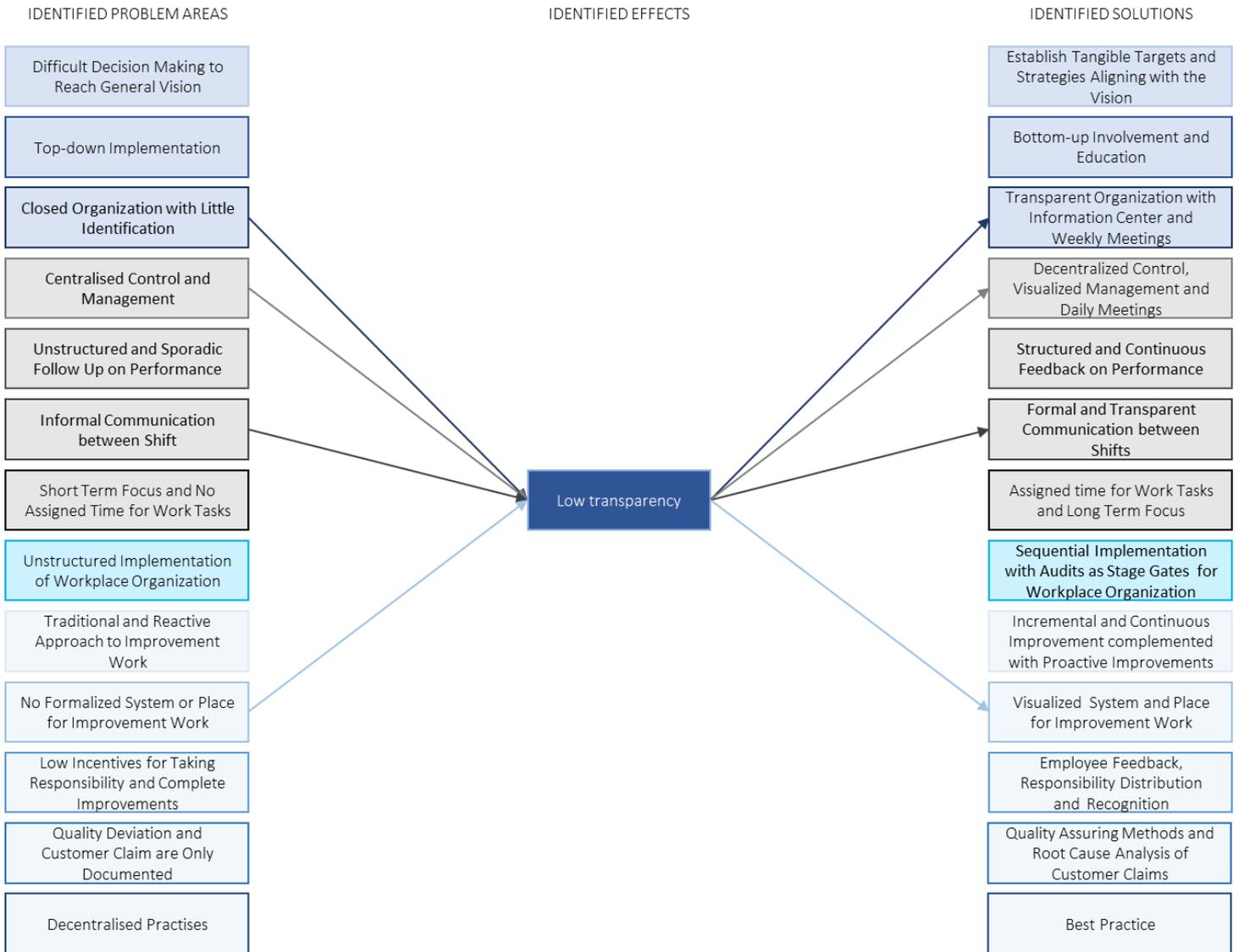


Figure VI. A summarization of effect five - low transparency.