Olli Nissinen

# Developing the 5S Implementation Guideline for a Food Production Company

Helsinki Metropolia University of Applied Sciences

Master's Degree

Industrial Management

Master's Thesis

14 May 2017

Helsinki Metropolia University of Applied Sciences

Wow, the word “preface” does look nice. This thesis has been a long road of personal and professional development, started in autumn of 2014. Back then the writer was a different man, the topic was different and life was different in so many ways. Thus writing these words really feels like the pinnacle of this all. Looking back to the journey, I would not change a thing.

Lean. The main framework of this study is a fascinating topic. As Lean in general, this study offers practical solutions and new thinking to the daily work of the people involved. However, in the end, motivation is the key to any change initiative to even have a chance. The motivation, support and commitment from my colleagues have been simply wonderful. To me it tells, we really can make a difference. This thesis wouldn’t have been possible without all of you who co-created with me. Thank you.

It has been a pleasure to dive again into the broad and fascinating world of management in the Industrial Management Master’s degree programme at Metropolia, I would like to thank all the lecturers who shared their practical and theoretical expertise in a fascinating way. My utmost gratitude and respect go to my instructor, Juha Haimala, for his razor-sharp comments and suggestions in the times when guidance was most needed. Many thanks to Sonja Holappa for all the comments and insightful suggestions provided. Special thanks to Zinaida Grabovskaia for being the first line of support in everything from textual corrections to finishing courses. You really made it possible for me to keep on moving. Thank you.

My mother and father, you have always supported and believed in me. You mean the world to me. My wife, best friend and companion, Satu. I would not be writing these words if it wasn’t for you. You are the reason I was able to continue when all of this felt to be too much. You supported me when it felt I didn’t have it in me. You gave me support and freedom when it was needed. And now, after all this, you are next to me taking care of our beautiful son while I am finalizing this study. It is truly a blessing to have you in my life. Now it’s our time. Thank you.

Olli Nissinen
Kirkkonummi
14th of May 2017

| | |
|---|---|
| Author<br>Title<br><br>Number of Pages<br>Date | Olli Nissinen<br>Developing the 5S Implementation Guideline for a Food Production Company<br>94 pages + 6 appendices<br>12th of May 2017 |
| Degree | Master of Engineering |
| Degree Programme | Industrial Management |
| Instructors | Dr. Juha Haimala, Principal Lecturer, Head of Department of Industrial Management<br>Zinaida Grabovskaia, PhL, Senior Lecturer<br>Sonja Holappa, MA, Senior Lecturer |



This study explores best practice for workplace organization according to Lean 5S principles. The case company of this study has launched a Lean management initiative in order to prepare for an increasingly volatile operational environment. To kick-off the implementation of Lean methods, 5S, a tool for systematic workplace organization has been selected as the first Lean tool to be introduced throughout the organization. The challenges in the first phase of implementation have indicated that there exists a need for standard work procedures and instructions to make the implementation proceed more efficiently.

The outcome of this study is a detailed 5S implementation guideline. The guideline supports the 5S implementation and ensures a harmonized and standard approach in all areas of the case company. The standardized documentation helps to reduce the time and effort needed to make 5S part of the daily routines for improving the organization, efficiency and safety of the work areas. The outcome can be utilized immediately in following phases of the 5S implementation as a supporting document, thus providing immediate support for the case company.

Finally, recommendations for next steps to be considered in the next phases of 5S implementation are provided based on the findings of this thesis.



| | |
|---|---|
| Keywords | LEAN, 5S, workplace organization, Change management |

**Contents**

**List of Figures**

## List of Tables

# 1 Introduction

Modern business environment is changing at an accelerating speed. It forces manufacturing companies to balance between maintaining strategic direction and reacting to customer requirements, as well as taking into account the megatrends, such as digitalization and urbanization on a global scale. Especially technological advancements are currently happening at an unseen pace, which is driving companies to adjust both internally and externally to trends such as virtualization, robotisation and IoT (Internet of Things) (Sitra, 2016). Additionally, in a survey conducted by the consulting company PwC, 89% of manufacturing CEOs of the participating companies also identified the customers and clients as the most influential stakeholders to their companies (PwC, 2016). These constantly increasing market demands and the uncertain economic environment are pressing companies to focus on what is truly important.

With the technical development speeding up and the customers being seen as more important and demanding than ever, the companies are required to be able to adjust flexibly, recognize value and constantly innovate. In this context, the Lean Manufacturing principles of focusing on customer value, eliminating waste and improving process flow seem more relevant than ever. During the past years, Lean has been resurfacing as one of the key management philosophies utilized in various industries.

## 1.1 Business Context

The case company of this thesis produces, sells and handles the marketing of food products and its by-products for a variety of industrial and retail customers. The case company has operations in two production sites in Finland and belongs to a European group with operations across Europe and a total of ca. 3300 employees. The case company in Finland employs approximately 280 persons and produced a turnover of ca. 143 million euros in fiscal year 2016-2017.

## 1.2 Business Challenge, Objective and Outcome

The case company's industry in Finland is undergoing a major change in its operating environment. The radical change in legislation of the industry, effective from 1 October 2017, means that also the Finnish industry is expected to face increasing competition

in all segments. Due to increasing profitability pressure, new and updated management processes are required in the production functions with a strong focus on customer value and efficiency. In order to prepare for this significant market change, a new strategy for the Finnish operations was established during end of 2016. As a part of the revised company strategy, a Lean implementation throughout the Finnish operations has been set as one of the initiatives to drive a cultural change towards a sustainably profitable business. To kick-off the lean implementation, 5S has been selected as a pilot project to ignite the cultural change via concrete involvement of the employees in all organizational levels of the case company. Time and effort has been invested in creating the structure to support and sustain the Lean implementation. For the 5S an implementation project for has been launched and a roadmap has been created. First areas have been selected as pilot areas to test the concept, gain experience and collect feedback from the selected approach before extending the implementation into other areas. Based on the initial experiences, the progress made in the first 5S areas has been unsatisfactory and too slow. The first comments from first phase of implementation suggest that a need exists for clear instructions and common guidelines in order to move forward in a more efficient and harmonized manner.

Accordingly, the objective of this study is *to create a detailed implementation guideline for 5S in the case company.* Thus, the outcome of this study is *an implementation guideline for the 5S* in the case company. The implementation guideline is co-created together with key responsible persons from the areas involved in the first implementation phase and finally validated together with the site management.

## 1.3 Outline of the Thesis

In this study, building of the implementation guideline starts by mapping the current state of the first phase of 5S implementation already carried out in select pilot areas in the case company. An analysis of the first implementation phase is done in order to identify the key strengths and areas for improvement in the current approach. The improvement areas and strengths are identified and formulated into the basis of the proposed implementation guideline, which is co-created together with key persons in the production and packaging areas. Based on the feedback from the responsible persons the first proposal for 5S Implementation Guideline is created. The Guideline is then presented to case company site management and based on their feedback adjusted into the final guideline for 5S implementation. The validated 5S implementation guide-

line is then used as support in implementing the 5S in a harmonized and efficient manner throughout the Finnish operations.

In order to maintain control and focus of the resources at hand onto a realistic project, the scope of this thesis is limited to the creation of the management approved implementation guideline. The actual implementation and management execution will not be a part of the scope of the Master's thesis.

This study is written in seven sections. Section 1 gives the Introduction to the study. Section 2 describes the method and material used in this study. Section 3 discusses the results of the current state analysis about the current state of the first phase of 5S implementation in the case company. Section 4 discusses the existing knowledge concerning Lean 5S, relevant topics in change management and best practice in 5S implementation projects combining these into the conceptual framework of this study. Section 5 presents the proposal for a 5S implementation guideline for the case company, and Section 6 describes the validation process from management for the 5S guideline. Finally section 7 the presents the conclusions, discusses the proposals for next steps in the case company and finalizes thesis evaluation.

# 2 Method and Material

This section introduces the method and material used in this thesis. The research approach and research design sections introduce the structure and logic upon which the study is built. After this the data collection and analysis methods are described.

## 2.1 Research Approach

The research approach utilized in this thesis is action research. Blichfeldt & Andersen (2006) have described the general nature of action research in the following way.

> Action research project begins mostly with the issues and concerns within some practical situation, with which the action researcher interacts. (Blichfeldt & Andersen, 2006)

A key component in distinguishing action research from other research approaches, such as case study, is the deliberately active and involving role of the researcher. (McKay & Marshall, 2001, 49. Cited in: Blichfeldt & Andersen, 2006). Thus, action research can be seen as a research approach where the researcher holds a duplicate role, both as an investigator and member of the studied organization. Action research can generally be defined by the following three broad characteristics): (a) "Research *in* action, rather than research *about* action, (b) a collaborative democratic partnership, and (c) a sequence of events and an approach to problem solving" (Coghlan & Brannick, 2014: 6).

These three main characteristics define the foundation of action research also in this study. The first key characteristic highlights that the goal of action research which is to improve the studied phenomena or process through participation and simultaneously build the scientific grounding for the study. This characteristic is one of the key reasons for selecting action research as the research approach also in this study, as the researcher holds a duplicate role both as researcher and practitioner in planning and implementing the developed actions. The second key characteristic of action research emphasizes the role of the members of the studied organization in developing the solutions, which also fits well with the current culture in the case organization and supports the selected approach. The third characteristic of sequential and cyclic approach to problem solving sets the action research clearly apart from other research approaches.

The cyclical sequence of action research is described in Figure 1 below. Figure 1 illustrates the cyclical approach of action research for solving the studied problem and improving the status quo through iterative action and research loops (Coghlan & Brannick 2014: 30).

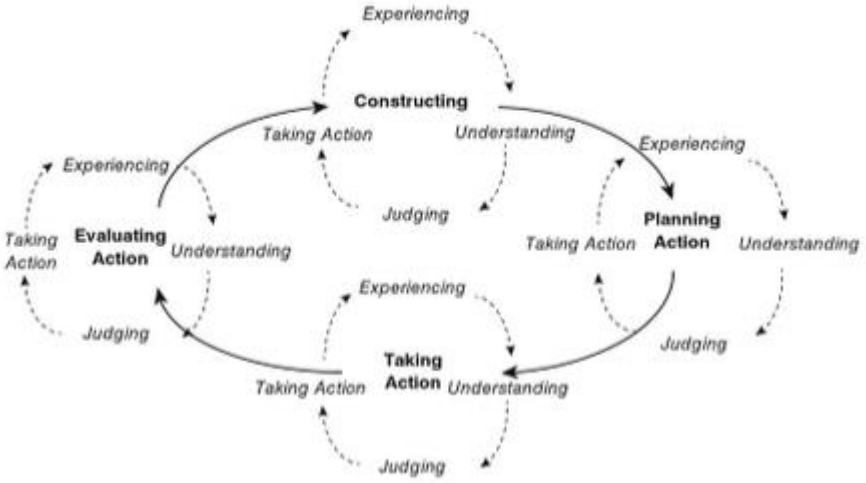



Figure 1. The general empirical method in Action research projects (Coghlan & Brannick 2014: 30).

Figure 1 illustrates the cyclical nature of this research approach into both of its aspects, action and research, which should be considered in a rigorous action research approach (Blichfeldt 2006).

In this thesis, the research design and consequently the thesis are built on similar principles of Action research. The research design built according to the action research approach is described in the subsection below.

## 2.2 Research Design

The objective of this thesis is to create a detailed implementation guideline for workplace organization according to Lean 5S principles. Based on the action research methodology, the research design of the study is built on the foundation of active collaboration with the members of the organization. The research design of the study is described in Figure 2 below.

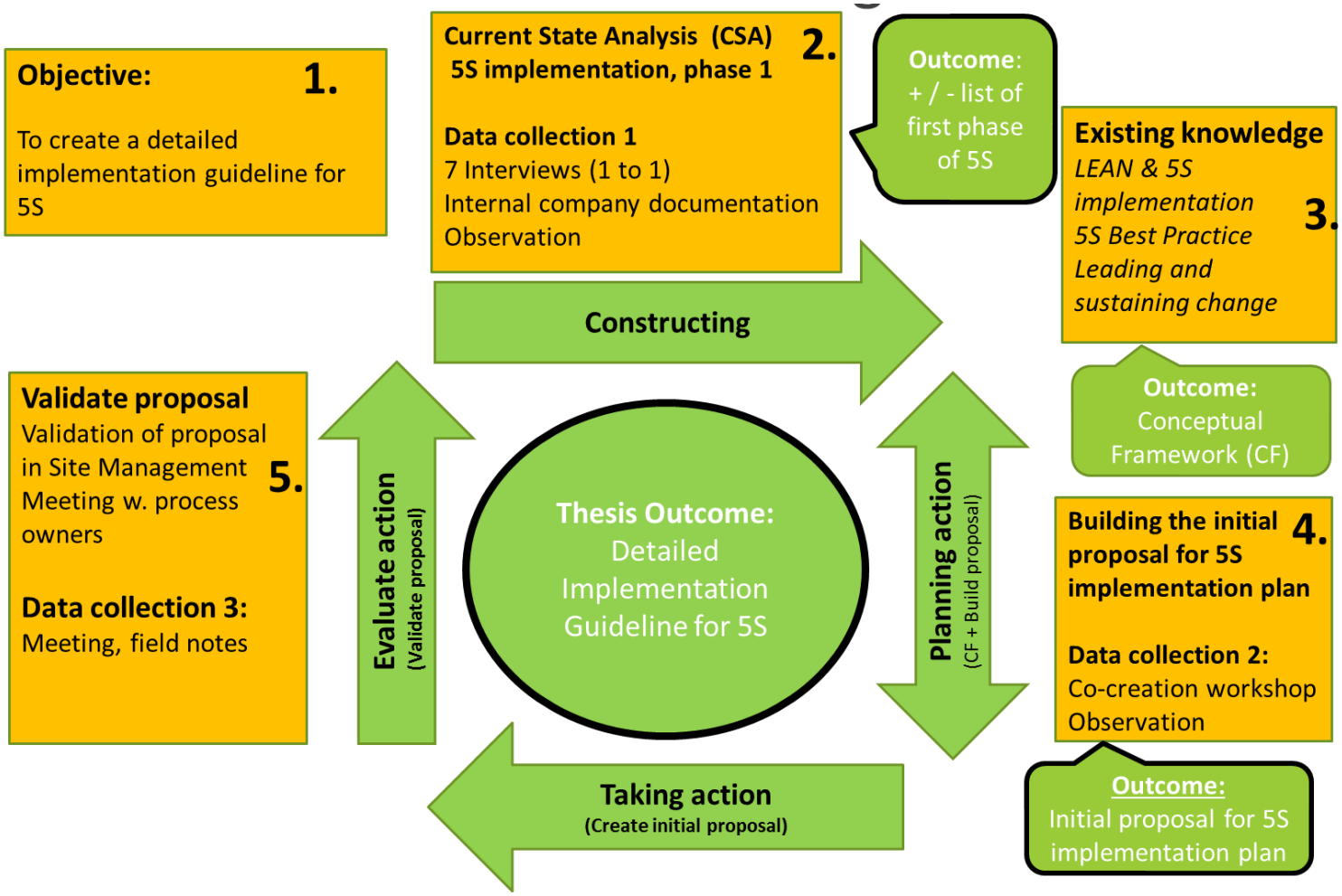



Figure 2. Research design of the study.

The research design of this study follows the Action research cycle organized into four logical phases, as shown in Figure 2. In this study the action research loop involves the following AR phases: (a) constructing, (b) planning action, (c) taking action and (d) evaluating action, divided into six research design steps.

The first step of the study defines the business challenge, objective, outcome and the scope of the study in order to provide the background and set the study into general context. The business challenge presents the business need and urgency for the study. The objective describes the key target that the study is aiming to accomplish, and the outcome presents the concrete result the study will provide for the case company as a solution for the business challenge.

In the second step of the study, the current state of the 5S implementation is analyzed. The current state is analyzed through data which is collected by interviewing key personnel from the 5S pilot phase, examining existing internal company documentation and through observation of the researcher as part of the implementation process. These data sources represent the first round of data collection (Data 1). As an outcome, the findings from the Current State Analysis (CSA) are collected and grouped into a list of key strengths and weaknesses discovered in the first phase of 5S implementation. Especially the key weaknesses will be further analyzed and categorized according to their source and criticality. The methods of data collection and analysis are further introduced in Section 2.3 below.

The third step of the study focuses on search for existing knowledge and best practice concerning Lean implementation, Lean 5S principles and Change management concepts. The existing knowledge is utilized in planning actions and creating the initial proposal for improving the key weaknesses identified during the CSA phase. As an outcome of this step, a Conceptual Framework (CF) for 5S implementation is created. The CF is used as a foundation which supports the action planning and secures that proven methods and best practice for solving the issues discovered during CSA are considered as part of building the improvement proposal.

Step four of the study focuses on the planning of the initial actions. The planning of action is based on the analysis of key findings from the CSA as well as on existing best practice discovered through the CF. As an outcome the initial proposal for improved 5S implementation guideline is co-created. The key personnel from production and packaging areas are engaged in providing the second set of data (Data 2) by participating in

a co-creation workshop. Data 2 collected in the workshop is combined with the observations of the researcher as part of the process. Data 2 is analyzed and the initial proposal for a 5S implementation guideline is created.

The fifth and final step of the study includes the feedback and validation step, where Data collection 3 is concluded. In this phase, the co-created initial proposal is presented to the site management of the case company. Based on the feedback, final adjustments are made and the validated 5S implementation guideline is created. Again, key personnel from the test area and researcher observation are used as the data sources to ensure valid and triangulated data collection. In this phase, site management is involved as respondent in order to validate the actions taken. As an outcome of step 5, a final 5S implementation guideline is created based on feedback to the initial proposal (Data 3) and the action research cycle is completed after evaluating the action taken.

A detailed description of data collection methods is seen as one of the key aspects of a rigorous research approach (Näslund, Kale & Paulraj, 2010:335). The following section describes the data collection and analysis methods chosen for this study.

## 2.3 Data Collection and Analysis

As described earlier in Figure 2, the research design of this study includes three phases of data collection. Data 1 is collected for understanding and analysing the current state of the pilot 5S implementation approach. Data 2 focuses on collecting ideas for the proposal building from the relevant participants in the production area and data 3 is collected to ensure validation of the final proposal. The study was conducted between January 2017 – April 2017.The interviews for data collection were held in February 2017 and workshops for Data 2 and 3 during March and April 2017.

Table **1** below shows details of Data 1 collection (for CSA).

Table 1. Data 1 collection (Analyzing the 5S implementation in pilot areas).

| # | Data type | Informant / role | Topic, description, relevance | Date and length | Documented as |
|---|---|---|---|---|---|
| ***Data 1 – Current state Analysis of 5S pilot phase*** | | | | | |
| 1.1 | One to one interview | Respondent 1: Production Manager | Experiences from the pilot area in Production. Accountable for the 5S implementation. | 13.2.2017, 26 min | Audio Recording, Field notes |
| 1.2 | One to one interview | Respondent 2: Lean Navigator | Experiences from the pilot area in Production and packaging areas. Practical coordination perspective. | 1.2.2017, 36 min | Audio Recording, Field notes |
| 1.3 | One to one interview | Respondent 3: Production foreman | Experiences from the pilot area in Production area. Foreman of the employees. | 7.2.2017, 35 min | Audio Recording, Field notes |
| 1.4 | One to one interview | Respondent 4: Shift leader 1, production | Experiences from the pilot area in Packaging area. Foreman of the employees. | 15.2.2017, 31 min | Audio Recording, Field notes |
| 1.5 | One to one interview | Respondent 5: Shift leader 2, production | Experiences from the pilot area in Production area. Member in the 5S pilot. | 15.2.2017, 30 min | Audio Recording, Field notes |
| 1.6 | One to one interview | Respondent 6: Shift leader, packaging | Experiences from the pilot area in Production area. Member in the 5S pilot. | 7.2.2017, 53 min | Audio Recording, Field notes |

Table **1** describes the data collection methods and sources used for Data 1 collection for the current state analysis. As seen from

Table **1**, the study collects primary data from several informants in different levels of the case company, and examines the problem with different data collection methods including interviews, workshops, observation and by scrutinizing the existing company internal documentation. A brief description of data collection methods is presented below.

In this study, the interviews are conducted as semi-structured, face-to-face interviews. The interviews are utilized in the first phase of data collection while collecting data for the current state analysis. The semi-structured character of the interviews is ensured by a list of interview questions. Each interview in Data collection 1 is conducted with the same set of theme questions which are designed to cover the main aspects of the pilot 5S implementation. The discussion during the interview is stored by audio recording and documented with field notes. The respondents represent key personnel from the 5S pilot phases already executed in production and packaging areas. They were chosen from different organizational levels to ensure that the current state of the 5S implementation is approached from several perspectives. The interviews are conducted in Finnish so that open and broad discussions are enabled and the risk of missing key elements due to language related issues is avoided. The summary of field notes is later translated into English.

Data collection 2 focuses on building the proposal for improved 5S Implementation plan based on the key findings from the CSA and the existing knowledge collected into the Conceptual framework of the study. In order to support the collaborative approach, workshops are used for developing the initial proposal. Thus, in this phase the main method for data collection is workshop-based collaboration with selected key individuals who have been working on the 5S pilot areas. As Näslund et al. (2010: 336) suggest, a team-based approach is seen as an especially relevant approach for an action research project. In this study, the team approach utilizes a combined team of researcher and the experts from the case organization. This approach brings benefits for both the research and the members of the case organization. It ensures access to information and data, as well as the possibility to include the tacit knowledge of the employees. For the case organization members, the combined team approach provides a chance for practical and theoretical learning as part of the research process. Table 2 presents the data collection PLAN for Data 2, building the proposal for 5S implementation.

Table 2. Data 2 Collection (Building proposal for 5S Implementation).

| | **Data 2 – Building the proposal for 5S implementation** | | | | | |
|---|---|---|---|---|---|---|
| **#** | **Data type** | **Participants / role** | **Topic** | **Date** | **Length** | **Documented as** |
| 2.1 | Workshop | Respondents 4,7,8 | Co-Creation of 5S implementation guideline proposal | April 5, 2017 | 1,5 hours | Field notes, audio recording |

In addition, in Data 1-2 collections, other data sources include researcher observation and existing internal company documentation, which is examined concerning workplace organization principles and Lean. For the implementing of actions, participant observations are also done in the field by the researcher as part of the team. This is done in order to obtain a holistic view of the current practices and background related to the 5S implementation. The internal documentation analyzed is presented in Table 3 below.

Table 3. Case Company internal documentation.

| ***Company internal documentation*** | | | | | | |
|---|---|---|---|---|---|---|
| **#** | **Data type** | **Participants / role** | **Topic, description, relevance** | **Date accessed** | **Length** | **Documented as** |
| 4.1 | Company documentation | Strategy presentation, production | Metrics / targets for Fiscal year 2017-18 | Feb 2017 | 1 page | Presentation, appendix |
| 4.2 | Company documentation | Lean toolbox “5S” | 5S introduction slide from group Lean-function | Jan 2017 | 1 page | Presentation, appendix |
| 4.3 | Company documentation | Quality handbook | Work instruction FS-00278 concerning workplace cleanliness and hygiene of packaging lines | Jan 2017 | 2 pages | Document |
| 4.4 | Company documentation | 5S Implementation training material “5S Koulutusmateriaali” | Training material for 5S | Feb 2017. | 27 slides | Presentation, |
| 4.5 | Company Documentation | 5S Implementation roadmap | Roadmap for 5S implementation | Feb 2017 | 6 slides | Presentation |

Finally, Data 3 focuses on the validation of the initial proposal as part of the site management team meeting. The validation is done by presenting the initial proposal to the site management team and collecting their feedback. The feedback from site management is then incorporated into the final proposal of the 5S implementation guideline. The data collection for data 3 is described in Table 4 below.

Table 4. Data 3 collection (Validating proposal for 5S implementation guideline).

| | Data 3 – Validating proposal for 5S Implementation | | | | | | |
|---|---|---|---|---|---|---|---|
| # | Data type | Participants / title | Role in 5S implementation | Topic | Date | Length | Documented as |
| 3.1 | Group discussion | Head of SHEQ | Accountable for SHEQ (Safety, Health, Environment, Quality) | Validation of initial 5S guideline document | April 21, 2017 | 30 min | Field notes |
| | | Site Manager (Site 1) | Accountable for Site level results and progress of 5S. | | | | |
| | | Production Manager | Owner of production area | | | | |
| | | Power Plant Manager | Owner of Power plant area | | | | |
| | | Investment Manager | Not relevant | | | | |
| | | Business Controller | Not relevant | | | | |
| | | Packaging Dep. Manager (Researcher) | Owner of Packaging area | | | | |

As seen from Table 4, the respondents of the validation phase represent the middle-management to top management levels of the company. They form the key decision makers with authority to ensure the 5S implementation moves forward and is allocated resources.

In this study, qualitative methods for data collection are used. Qualitative data in this context refers to data collected from interviews, existing company documentation and the observations of the researcher as part of the action research approach. In each of the data collection phases triangulation methods are used to ensure the reliability of the collected data. Both data and methodological triangulation are used to ensure reliability of the results from the data collection. The analysis of the data in the study is based on Thematic content analysis of the data collected into field notes, recordings, existing internal documentation and researcher observation.

The validity and reliability of the study are evaluated later in further detail in Section 7.4, examining the selected methods and their effects.

The quality of research results is typically measured through two main characteristics of research quality, such as validity and reliability.

## 2.4 Validity and Reliability Plan

*Validity* is generally seen as an examination of whether the evidence provided during the study is relevant. (Näslund, Kale & Paulraj, 2010: 338). Quinton & Smallbone (2006) state the following concerning general validity of research:

> *The really important point about validity for your work is that you must make clear to whoever is assessing your work that the rigour of your approach and your thinking about it is transparent.* (Quinton & Smallbone 2006: 126)

Validity is often further evaluated through more specific aspects such as internal and external validity. *Internal validity* focuses on examining whether the research actually measured what it intended to measure. The second aspect, *external validity* assesses whether the results of the research could be used in other contexts and if so, to what extent. The aspect of external validity is closely related with generalization and thus the concepts are treated as synonyms in this context. External validity is seen as very significant in quantitative studies, but according to Quinton & Smallbone (2006: 129), the significance is less relevant or non-existent in a qualitative study.

In this study, the collection of qualitative data is done based on practical experiences of a small group within the specific company context and culture. Thus, the results of the study are not suitable for broader generalizations as such. However, the aspect of external validity is considered in the research design when building the research design and the conceptual framework of the study. The research design follows the logic of Action research forming a full cycle as described in Figure 2 ensuring internal validity. The conceptual framework is based on an approach of connecting the issues identified during the CSA phase with existing knowledge and best practice concerning solving similar issues in other companies and industries.

*Reliability* of the research, according to Quinton & Smallbone (2006: 129), can be described as an assessment whether the same findings would be obtained if the research is repeated. In other words, Näslund et al. (2010: 338) define that reliability is to focus on considering the correctness of the stated evidence. Quinton & Smallbone (2006: 130) present, for example, the following methods for improving the reliability of a study:

"A) using different data sources, B) using different data collection tools, C) applying established theory from one area to another".

In this study, in order to ensure *Reliability* all the above mentioned techniques are used. Triangulation of data is executed by utilizing multiple informants on different levels of the organization and different functions as sources for data. Triangulation of data collection methods is also done by using a variety of methods including interviews, workshops and observation and by scrutinizing existing company internal documentation to collect data from different sources. The study collects primary data from several informants in different levels of the case company organization in order to ensure the reliability through participant selection. Finally, to ensure the quality of the proposed solution the research design of this study includes three phases of data collection, done at different points in time. Moreover, the research design and data collection methods are presented *transparently* including field notes and other relevant data, included as appendices of this study to ensure an audit trail that ensures that the same results could be replicated as befits the definition of reliability of research.

In addition to validity and reliability, other research quality criteria can also be ensured, especially such as logic and relevance. Logic can be defined as a "cause-and-effect explanation of an action, decision, event, phenomenon, or solution" (Businessdictionary, 2017). Different aspects of validity and reliability need to be considered against, for example, the *Logic* of chosen research approach which in this study is Action Research. Coughlan & Coghlan (2002) specify the quality requirements for Action research by highlighting the following aspects:

> Action researchers must consciously and deliberately enact the action research cycles, testing their own assumptions and subjecting their assumptions to public testing. The principal threat to validity for action research is the lack of impartiality on the part of the researcher. (Coughlan & Coghlan 2002: 237)

The conscious and deliberate consideration of *the logic* behind these phases of action research cycle is presented as the basis of the research design also in this study.

Additionally, one of the key criteria includes the examination of *the Relevance* when conducting a study. Relevancy can be defined as "the quality of being directly connected with and important to something else" (Macmillandictionary.com, 2017).

In this study, the relevance is ensured by building the research design to support the solving of the relevant Business challenge, which makes the foundation of the study. The definition for the business challenge is provided by the company Steering group, which ensures alignment with the business objectives. The outcome of the study is defined as “a detailed implementation guideline for 5S” which provides a direct solution to the business challenge and this outcome is pursued throughout the study supported by the research design.

Finally, the bias of the researcher and the selected reference materials is a key aspect to consider in this study as Action research is chosen as the approach. The researcher of this study holds a duplicate role as both the coordinator of the 5S implementation project and the researcher in the study. The researcher bias is considered by stating the role of the researcher as part of the project team. The possible effects of researcher bias are identified and controlled by using the same questions for each respondent during Data collections 1-3, recording full interviews and sharing the field notes for confirmation with each respondent.

# 3 Current State Analysis of 5S Implementation in Case Company

This section analyzes the current state of the 5S implementation in the case company. The current state analysis (CSA) is executed by examining the lessons learned from the first pilot phase of the 5S implementation in the case company.

## 3.1 Overview of the Current State Analysis Stage

The current state analysis starts by the overview of the preparatory phases of the 5S implementation project currently conducted in the case company. It is done to clarify the scope and context of the actions already under implementation by the case company.

The CSA is based on data collection by interviews with key persons in the first implementation phase. The data collection principles for the CSA phase are introduced in subsection 3.2. Additionally the existing internal documentation concerning the 5S implementation is scrutinized to obtain a thorough view on the current approach, with its strengths and weaknesses.

As a conclusion, the last section visualizes the key strengths and weaknesses of the current 5S implementation approach based on findings from the data collection. These findings are then used as a source for creating an improved implementation plan.

The data collection for CSA forms the first round of data collection in this study. As described in Figure 5, the implementation roadmap for the 5S concept is split into several phases. In this study, the current state analysis focuses on phase 1 of the implementation, including only a limited selection of areas used to collect experience and form the basis for later implementation areas. For the CSA the data collection was based on the first 5S implementation areas in packaging and production departments. Key persons involved in the mentioned areas were selected to be interviewed in order to collect their experiences on how the first wave of implementation progressed and what kind of issues should be learned from. The key persons were selected from different organizational levels including department management, area foremen and shift leaders in order to get a comprehensive view from several aspects and from persons in different roles during the implementation.

The interview questions used in Data collection 1 were designed to collect feedback from different areas that need to be considered in an implementation guideline. The categories used for questions were 1) Preparation and preplanning, 2) Positive and Negative experiences during the 5S actions 3) training materials used 4) Current state in the area 5) Development ideas and general feedback from the first phase. The interview questions used can be found in appendix 1. The interview results were recorded by phone and later documented into field notes. In addition to the interviews, also company internal documentation was scrutinized. Based on the collected data, a detailed description of the current state of the pilot 5S implementation is presented in the following sections.

## 3.2 Current Status of Lean Implementation, Its Execution and Scope

To systematically drive the implementation of Lean principles, the case company has founded a specific organization for the implementation of Lean principles company-wide. The case company has initiated a Group wide implementation of Lean Management during 2015. This organization ensures the implementation of Lean tools and philosophy into daily practices. The Lean organization of the case company with roles and responsibilities is introduced in Table 5 below.

Table 5. Lean Organization of the case company in Finland (Case Company: 2016a).

| Role | People | Comments |
|---|---|---|
| **LEAN Steering Group** | Management Group, Lean Navigator Experts, Lean Coordinator | • Responsible for overall FORCE/LEAN management and coordination in Finland |
| **Local LEAN Coordinator** | 1 Person | • As full time position as possible (now 0,6 FTE)<br>• Responsible for organizing LEAN training in Finland<br>• Supports LEAN thinking and coordinates LEAN implementation in Finland |
| **Navigator Expert ja Navigator** | 4 persons | • Delivers LEAN training in Finland<br>• Facilitates and supports project teams |
| **Project Leader** | Nominated per project<br>Has got min. LEAN Supporter training | • Part time position in project team<br>• Responsible for project progress in a greed frames<br>• Enables extending of project management and leadership knowledge in the organization |
| **Project Team Member** | Nominated per project<br>Some may have got LEAN Supporter training | • Part time position in project team<br>• Enables extending of project work and change management knowledge in the organization |

Through these organizational roles, the implementation to the daily operations is supported and in the beginning pushed forward through selected Lean projects. These projects are driven and supported by the case company's Lean-function and they aim to gain results by solving identified business challenges and promoting the Lean concept in a structured way. Table 6 below presents the Lean pilot projects started in the case company.

Table 6. First Lean projects in the case company (Case Company, 2016b).

| Lean - Project | Owner | Customer | Responsible | Start |
|---|---|---|---|---|
| Improving operation of Bosch 3 packaging line in POR | Site 1 Manager | Department manager | Lean Coordinator | 13.10.2016 |
| Developing resource management in Logistics | MD | Head of Logistics | Lean Coordinator | February |
| Improving operation of beet slicers in SAK | Site 2 Manager | Production manager | Lean Navigator | 1.10.2016 |
| 5S implementation in the factories and offices | Site managers, MD | Area responsibles | Lean Navigator | August 2016 |

As seen in Table 6 one of the first Lean projects is the "5S Implementation in the factories and offices". From this project topic arises the business need for this study. For this project a harmonized implementation plan is needed. For the management support of the project, certain roles have been defined to form the steering group of the project. These roles are also described above in Table 6 (Case Company, 2016b). The owners of the project are the site managers and the managing director of Finnish operations. Area responsible, generally the department managers of each functional area, act as the internal customers who order the improvement project and make sure it delivers the results expected. The project management of the topic is the responsibility of the Lean Navigator, who is also the researcher in this study.

The general targets for the Lean 5S project in Finnish operations were defined by the case company management and presented for the Project Manager. The 5S Lean project overview can be seen in Figure 3.

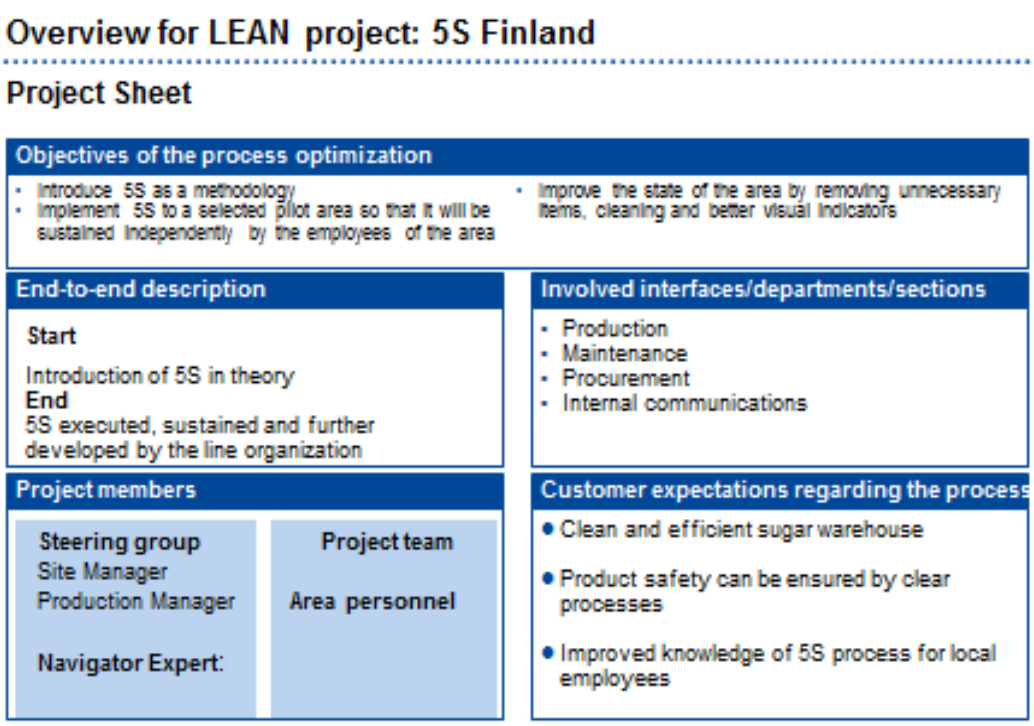



Figure 3. Lean project (5S in Finland) overview (Case Company, 2016c).

The project overview sets the objectives for the 5S project as a whole. As shown in Figure 3, the objectives are defined as introduction of 5S, implementation to selected pilot area and an improvement of the current state of the area by 5S actions.

Based on these objectives, an implementation roadmap for 5S implementation has been defined. During the 5S implementation roadmap definition, a total of 72 individual areas on the two sites of the case company were identified for the 5S implementation. It was done in order to have a more detailed overview on the scale of the implementation of Lean principles company-wide. For the roadmap, the current organization and physical areas were examined and a draft schedule and prioritization between functions and areas was made to gain an overview of the process. The complete roadmap for 5S implementation is presented in Figure 4 below.

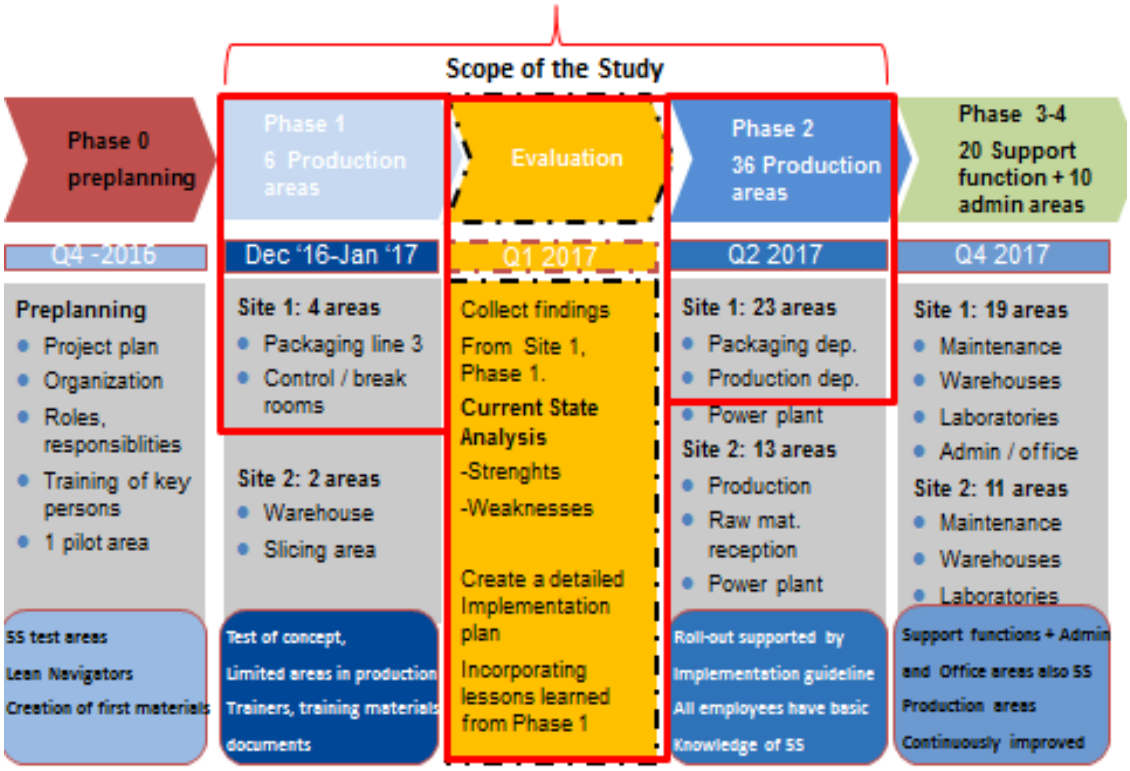



Figure 4: 5S Implementation Roadmap in the Case Company (Case Company 2016d)

As seen from Figure 4, due to the large amount of areas and the sheer size of work, it was seen necessary to split the implementation in to several phases with an accumulating speed of progress and area coverage. As the whole 5S approach was new to the organization, including the trainers, it was decided to begin the first phase of implementation with a few carefully selected, narrow areas.

In Phase 1, for example, the 5S concept was tested in practice. These areas were selected from the Packaging department and the Production department and form the main scope for the CSA section in this study. In the Packaging area, one of the key production lines (Bosch 3) and the common break room were selected as the target areas, whereas in the Production area a control room for production area was selected as the pilot area.

As an outcome of the CSA on these areas, a detailed list of strengths and weaknesses from Phase 1 of implementation was created. These key strengths and weaknesses will be discussed below and used to formulate a detailed implementation guideline to ensure a harmonized approach for the next phases of Lean 5S implementation in the case company.

## 3.3 Process Description of the Current 5S Implementation

The current implementation process can be split into six main stages.

The first stage is *Planning of the actions* needed in different levels of the organization to create the foundation for implementing the latter 5 stages which represent the practical five steps of the 5S approach, shown in Table 7 below:

Table 7. Five main steps of the 5S approach in the Case Company.

| *No* | *5S stage* | *Content of the stage* |
|---|---|---|
| 1 | Sort | Remove all unnecessary items from workspace. Utiilize red-tagging and establish a quarantine area, where tools, equipment, etc. can be placed in case of unclear responsibilities. |
| 2 | Set In Order | Organize the remaining goods efficiently and visually into their most suitable places. Consider aspects of safety, visual management and work ergonomics. |
| 3 | Shine | Make sure all the goods are in their places and the work areas are cleaned and inspected regularly according to assigned responsibilities. |
| 4 | Standardize | Make sure steps 1-3 have defined roles and responsibilities so that they can be repeated easily as part of daily work. |
| 5 | Sustain | Create measurements and target levels and ensure follow-up and continuous improvement of 5S principles. |

A process description of the current 5S Implementation is shown in Figure 5 below.

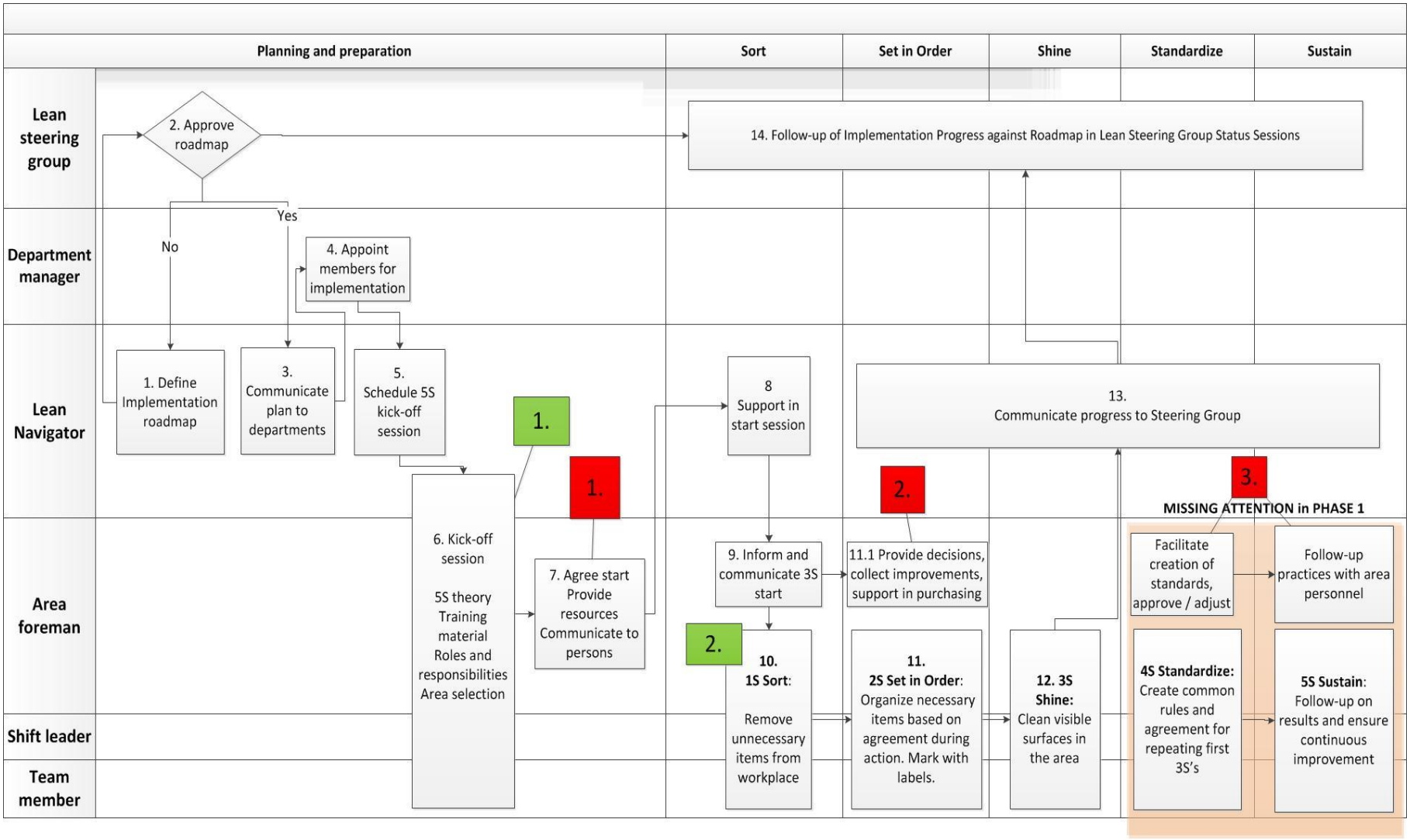



Figure 5. Current 5S Implementation Process in the Case Company.

As can be seen from Figure 5, there is a heavy emphasis on the planning stage, with several steps of planning and preparatory work needed before the actual 5S stages are started. The stages of planning and the actual 5S are presented individually in the following subsections in further detail.

### 3.3.1 5S Planning and Preparation – Process Description

The implementation process is started with a planning and preparation stage for the overall 5S implementation concept. This part of the implementation process is illustrated in Figure 6 below.

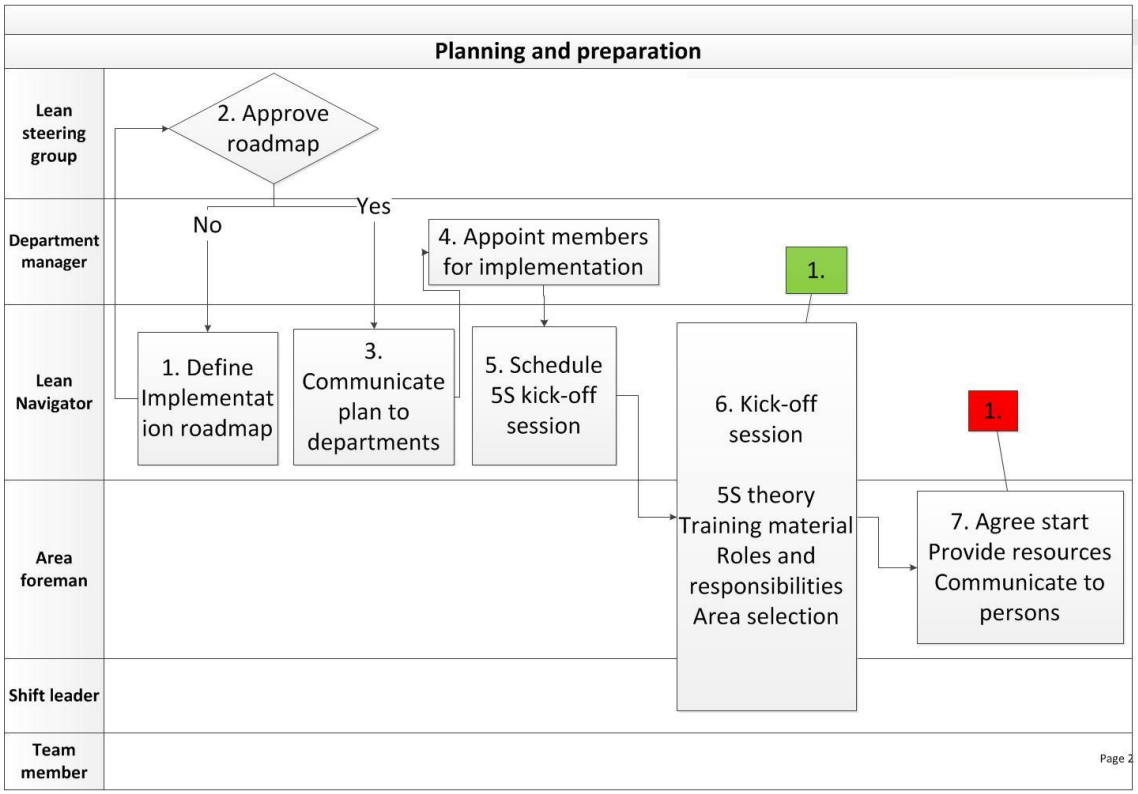



Figure 6. Planning and preparation stage of 5S Implementation, Phase 1.

As seen from Figure 7, the roadmap provides the basic overview of steps planned to move forward in a structured manner. *The Planning* stage continues with preparatory work concerning the area where the implementation is done, and is repeated per each area. The roadmap creation is done only once in the beginning of the project and is then used to follow-up on the progress of the implementation process.

Based on the interviews with key personnel and observation, the levels and different types of planning actions in the current approach are illustrated in Figure 7.

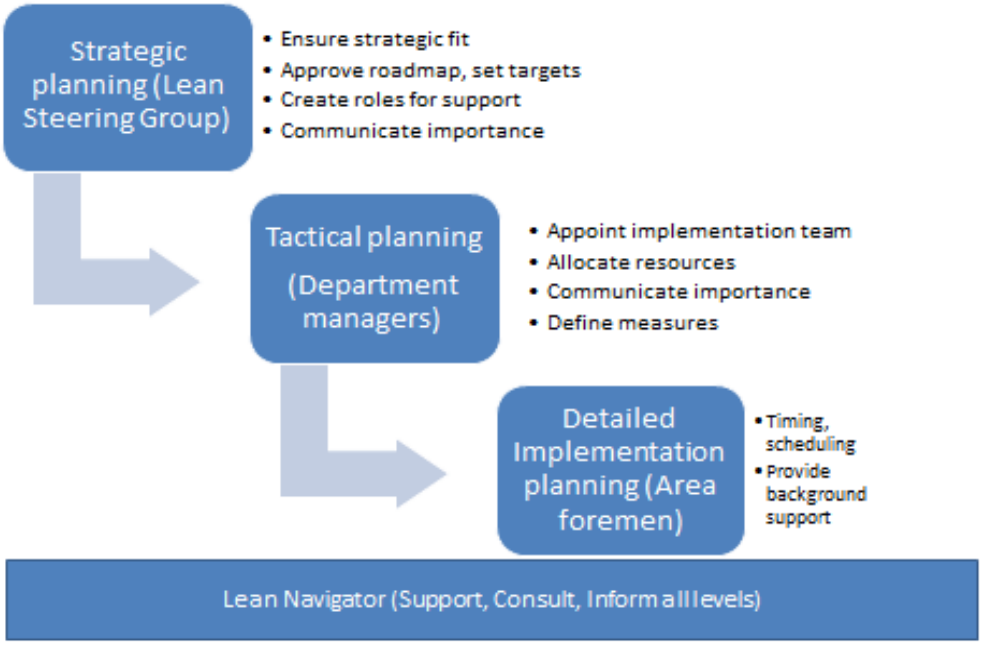



Figure 7. Levels of Pre-planning in 5S Implementation.

Figure 7 presents the different levels of planning practiced in preparation for the 5S implementation within the Case Company organization. First, the company management has identified the need for the 5S implementation and ensured the strategic fit for the 5S concept in alignment with company targets. Second, an overall implementation roadmap (Figure 4) was assigned to be created by the Lean Navigator who is responsible for the coordination, support and progress of the 5S implementation in general. The roadmap is presented to the Lean Steering group, which is formed by the company management as described in Table 5. The Lean Steering group provides feedback and either approves the roadmap or returns it back to definition for the Lean Navigator.

Once the roadmap has been approved, the implementation process moves forward and the plan is communicated to the departments based on the prioritization made in the roadmap. The communication is done by the Lean Navigator to the Department managers of the respective areas. The handover has been done verbally in a face-to-face communication without any formal procedures. In the context of this study, the handover has been done with the Department managers of the Production and Packaging departments.

After the communication, the department managers are accountable for the tactical level of planning. They ensure that the right resources are available for the 5S actions and suggest the responsible persons to be involved with a focus of developing the competences within their organizations. This level targets in ensuring the long term progress of the implementation. The success of this aspect in the tactical planning level was commented by a department manager during an interview as follows:

> *The line organization and especially the department managers should be more involved from the very start. So far it seems that it has not been fully understood, that this will mean a completely new way of working in the daily operations. Perhaps this first phase of implementation will demonstrate the benefits of 5S in practice and provide a clearer picture on the scope of changes needed. (Department Manager, 2017)*

This aspect highlights some of the issues identified in the first implementation phase and is something that will need to be considered as part of the proposal building for the implementation guideline in section 5.

The next level of Planning is done by the area foremen and shift leaders on a more detailed level, with an operational and practical focus. Based on the conducted interviews, the main goal for this level of planning is to ensure the availability of the dedicated personnel and agree on the exact timing for the 5S operations. During this Planning phase, it is also ensured that the selected persons for implementation are aware of the task and are motivated to execute.

The interviewed foreman described the key role of a foreman in the 5S implementation as “to act as coach and support from the background”. This level of planning was seen as critical from the point of view of all the shift leaders who mainly participated in the actual 5S steps. All of the three shift leaders interviewed mentioned that this phase of preplanning should be done more carefully. A shift leader in the Packaging department commented on the importance of the detailed planning in the following way:

> *Definitely more people should be included in the planning of the area. Many people took part (in 5S actions), but only because they happened to be in the area during their break. More time should be used for planning on who should be involved and how as many opinions as possible could be collected before the start of the 5S actions. If there are too few people involved, it was noticed that many aspects can be missed (Shift leader, packaging area, 2017).*

Planning and preparation phase has been finalized in the current approach with a Kick-Off session for the respective area. In the session the basic grounding for the 5S approach and the theoretical background has been provided. The Kick-Off session has been coordinated by the Lean Navigator and the participants have been the key persons chosen by the Department manager. Based on the data collection, the participants interviewed have generally been satisfied with the materials and approach in the Kick-Off sessions. The training materials used can be seen as one of the strengths in the current approach, based on the feedback from the interview. A shift foreman from the packaging area commented the preparations in the following way:

> *Enough information was received before concrete actions. 5S kick-off meeting was held by the Lean Navigator. It was a good session for getting in on the fundamentals of 5S; what it is and why it is beneficial (Shift foreman, packaging area, 2017).*

After the Kick-off session, the responsibility is with the area foremen to agree on the start timing on the agreed area for the 5S steps: 1.Sort, 2.Set in Order, 3.Shine, 4.Standardize and 5.Sustain.

The current process shown in Phase 1 of the implementation concerning the concrete 5S steps will be discussed in the next subsection.

### 3.3.2 5S Actions – Process Description

The concrete 5S actions have been initiated based on the decisions made during the planning and preparation phase. An illustration of the actions can be seen in Figure 8.

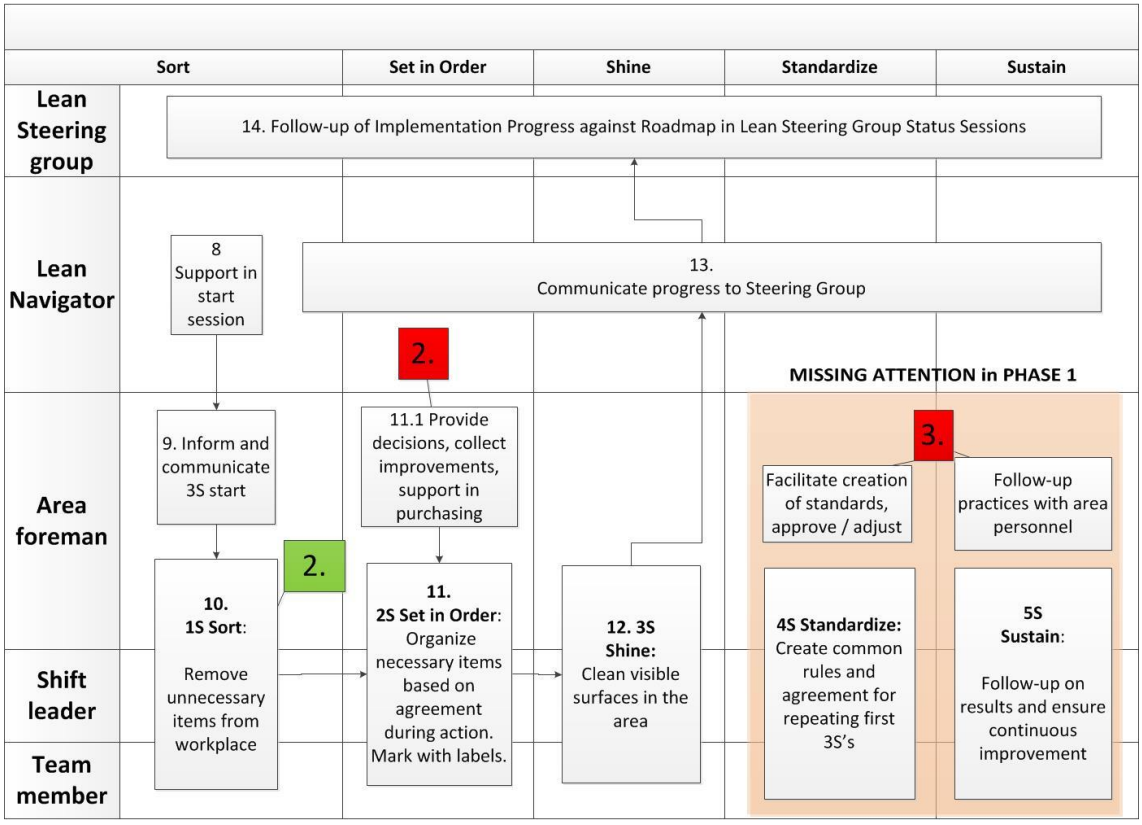



Figure 8: 5S actions in Implementation Phase 1

As shown in Figure 8, the first phase of the 5S actions is the called Sort, where any unnecessary items are critically evaluated and eventually sorted out and removed from the area. Before the actual sorting phase begins, the team selected by the area foreman is called into a 5S start session. In the start session, the team is presented with the basic knowledge of the 5S system, why it is done and why it is important. The training and support for the start session is provided by the Lean Navigator and the information is delivered via self-created training materials.

Based on the interviews, feedback regarding the training materials has been generally positive. Based on the experiences in the first phase of 5S implementation, a Lean Navigator evaluated the benefits of the training materials used in an interview:

> *The training materials were informative and beneficial, especially when there is an expert present to open them up. The printed materials however should be more condensed, and maybe felt too "heavy" for a person unfamiliar with 5S to start studying them independently. (Lean Navigator, 2017).*

Another important aspect was provided by one of the shift foremen in the Packaging area when asked what should be considered more thoroughly in the materials. He mentioned that *"As a lesson learned from the pilot the materials could include instruc-*

*tions on the practical steps of 5S on a more detailed level."* This was also mentioned by two other persons interviewed and will need to be considered as part of the proposal building phase of this study. After the start session, it is up to the area foreman to coordinate the practical start for the 5S actions. The Production area foreman described his own key tasks in the implementation as *"Selecting the area, the right personnel, coordinate and follow-up on the actions"*.(Production area foreman, 2017)

Based on the interviews, in both Production and Packaging areas the foremen had delegated the practical execution of 5S to their shift leaders. The shift leaders were reserved a time where they could focus on the 5S only during two consecutive days. The first phase, Sort, was started in both areas by going through all the equipment, tools, documents and eventually all the things within the selected areas. Sorting phase was seen as one of the most positive aspects of the 5S process so far. When asked about the positive experiences of the first phase, all the participants mentioned the progress made in the Sort phase. For example one of the shift leaders mentioned the following as a positive thing from the 5S implementation:

> It was great to see the actual change and feel that things that had been the same for decades were finally changing. It was nice to see that the clarity and organization were so visibly improved. (Shift leader 2, production area. 2017)

After the sorting is done, the remaining goods are 2.Set in Order. This phase is done in collaboration with people working in the area with the aim of finding and visually marking the appropriate places for the materials regularly needed in the area. In this phase, in both of the Production and Packaging areas it was identified that small purchases such as clothing racks, storage cabinets, new cleaning equipment and other minor improvements for sustaining the organization in the area were required. The execution of these purchases are in the responsibility of the area foremen, but in both areas these processes were not completed. The communication of purchasing responsibilities was not part of the training materials and was not discussed as part of the preplanning phase.

Based on the interviews, this part needs to be paid special attention to before moving into the next phases of implementation. This point was brought out for example by the Production area foreman, stating the following:

> Purchasing responsibilities should be clarified and paid more attention. How does the purchasing process for 5S proceed? How do we ensure a uniform approach concerning purchasing, so that everyone does not purchase their own materials, from various suppliers, various qualities and prices, etc. (Production foreman, 2017)

After the sorting and setting in order were finished, the third step of the process, Shine, is carried out. Shine means cleaning and visual inspection of the area which received a lot of positive comments from the respondents. In the 5S concept the last two phases of the process, i.e. Standardize and Sustain, focus on creating the necessary routines, standards and practices for the first three phases. In the first phase of implementation these two areas were not covered yet by the time of the interview. This concern was brought out unanimously by all the respondents, who pointed out their concern for the lack of these steps. Shift leader 1, Production Department (2017) in the production area commented in regards to this aspect in the following way:

> There are no clear rules on how to proceed after 3S, and individuals have different personal styles of working and maintaining organization naturally.
> There are no clear guidelines, but that can be seen as a clear target for improvement. No division of responsibilities has been made within the department, but it is clear that the 4S and 5S need to be continued soon, otherwise things will quickly fall back to the old ways. (Shift leader 1, Production Department)

As the quote above also points out, finalizing the 5S steps in the Phase 1 areas needs to be prioritized before moving into new areas. Otherwise the current progress and all the positive enthusiasm encountered can be lost and turned into negative experiences.

In the next subsection, the current roles and responsibilities are described in further detail and after this the key strengths and weaknesses are analyzed.

### 3.3.3 5S Implementation Roles and Responsibilities

In order to further clarify the roles and responsibilities in the current 5S implementation approach, a RASIC (Responsible, Accountable, Support, Inform, Consult) matrix is illustrated in Figure 9.

| Step # | Process step | Tool, documents, forum | Key tasks | Lean Steering group | Dep. Manager | Lean Navigator | Area foreman | Shift leader | Team member | Site manager |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Define 5S implementation roadmap | Powerpoint | | A | | R | | | | |
| 2 | Approve 5S roadmap | Lean steering group session, decision | | A | | I | | | | |
| 3 | Communicate 5S roadmap to departments | Foreman forums, Lean training | | A | | R | I | | | |
| 4 | Schedule 5S kick-off session per department | Meeting | | | A | R | I | I | I | |
| 5 | Appoint members and responsibilities for 5S areas | Decision | Participants per area, roles and responsibilities | | A | R | C | | | |
| 6 | Kick-off session per each area | Presentation, theory 5S | What, why and how 5S? | | A | R | I | I | I | |
| 7 | Select responsibles for implementation per area | Decision | Based on roles and roll-out in other areas. "Train the trainers" | | | S | A | | | |
| 8 | Schedule start on department / area | Timing, production restrictions | Reserve time for 5S only, avoid running in and out during sessions | | A | S | R | I | I | |
| 9 | Start on area | 5S Introduction to all members, align target | What, why and how 5S? | | | R | A | S | S | |
| 10 | Sort | "Before" photos, Quarantine, Remove unnecessary items | Area responsibles coordinate efforts, lean navigator consults | | S | C | A | R | S | |
| 11 | Systematize | Markings, visualisation, storage solutions, "place for everything | Area responsibles coordinate efforts, lean navigator consults | | S | C | A | R | S | |
| 12 | Shine | Clean and inspect area regularly | Employees in the area must decide this facilitated by area foreman | | | C | A | R | R | |

Figure 9. RASIC matrix roles and responsibilities in 5S Implementation, Phase 1.

Figure 9 illustrates the RASIC matrix in 5S Implementation project. As Figure 10 illustrates, the accountability (A) is moved from the top management towards the operational management and area foremen as the process steps move towards more practical actions. Noteworthy is also that the Lean Navigator is not actually seen as Accountable for any of the process steps, but acts as a project coordinator responsible for providing information, documents and supporting and consulting the departments.

As seen from Figure 9, upper management is responsible for the strategic aspects and follow-up (steps 1-3), whereas the department management is involved in defining the tactical aspects and ensuring the resources (steps 4-6). The critical accountability of the actions lies on the Area Foremen, who can be seen as the critical persons in driving the implementation forward (steps 7, 9-12). In the current approach the area foremen have delegated the responsibility for the practical actions to the shift leaders. According to the respondents this delegation of responsibility has caused lack of commitment and follow-up when the foremen have not felt the sense of urgency for the ownership of the area due to their roles in many other areas as well.

> *All actions discovered during the 3S were not followed through by the area foremen. More visible pressure, participation and commitment would be needed from the foremen. Even though the topic has been discussed, no actions have been followed through. Perhaps it is our task as Lean Navigators to get the message through better and ensure the foreman commitment in each area. (Lean navigator, 2017. Appendix 2:3)*

This feedback will be valuable to look further into as part of building the proposal for an implementation guideline.

## 3.4 Key Findings from First Phase of 5S Implementation (Data Collection 1)

The key findings from Phase 1 of 5S Implementation in the case company are categorized around key topics of Preplanning, Foreman's role, 5S approach and purchasing, which were stressed in several of the interviews during the first round of data collection. These categories contain the strengths and weaknesses discovered in the current implementation approach. The strengths and weaknesses are then further discussed in their own separate subsections below.

### 3.4.1 Strengths identified in the Phase 1 of 5S Implementation

The current state of the pilot implementation has already created many positive reactions according to the interviewed key persons from the different areas. The preplanning phase was one of the categories were both strengths and weaknesses were identified.

Table 7. Strengths identified in Phase 1 of 5S Implementation.

| Category | Strengths |
|---|---|
| Preplanning 1. | -Support in planning from Lean coordinators,<br>-Training preparations and materials done well |
| 5S approach 2. | -Sorting phase provides inspiring results<br>-The systematic approcach is seen as new and refreshing<br>-Results are made by moving systematically<br>-Employees are committed and excited by the visible results |

As shown in Table 8, the strengths are associated with the general preparation support from the Lean Navigators starting from the kick-off session, communication, training materials and general support in progressing with the 5S steps. The persons interviewed felt that the training preparations were done professionally and removed many of the question marks people mentioned having had before the Kick-off. As the whole concept of 5S is new to the organization, it was seen as critical to have a short theoretical introduction to the concept and the underlying principles, before jumping into action.

The second major strength identified is the commitment and excitement from the shop floor personnel after having participated in the cleaning up their own areas. The employees have seen the visible changes made possible by the systematic approach provided by the 5S concept. This is a very important factor which will surely give the approach a good solid foundation in the company to build upon. These positive reactions were mainly received immediately after the first of the 5S actions, 1.Sorting, when the involved team members can concretely see the change in the area for the first time. The comments from the respondents suggest that a common satisfaction towards the quick and grounded decisions considering outdated or unnecessary items that were removed from the areas were seen as refreshing and direly needed in many areas.

This is a key finding which will need to be carefully considered as a critical element to maintain and enforce in the next phases of the implementation.

### 3.4.2 Weaknesses identified in the Phase 1 of 5S Implementation

The main weaknesses of the current 5S implementation approach are grouped into four categories, two of which are the most critical ones and identified as the key areas to focus into. The unclear role of the foremen and the lack of effort in standardize and sustain phases will be the main focus areas to provide better support for through the implementation guideline.

Table 8. Weaknesses identified in Phase 1 of 5S Implementation.

| Category | Weaknesses |
|---|---|
| Preplanning | -Area selection unclear<br>-Too large or complex areas chosen for first areas<br>-Key persons have been missing from the 5S teams<br>-No time reserved, production duties are stopping 5S |
| Foreman role | -Foremen feel uncertain concerning their role<br>-No clear view on the responsibilites and methods on how and by whom the follow-up and control of agreed actions is executed |
| 5S approach | -Only 3S completed<br>-Areas show signs of falling back to old habits<br>-No follow-up routines agreed |
| Purchasing | -Missing harmonized purchasing approach between functions.<br>-Each area has specific preferences for materials, tools, etc.<br>-Responsibilities unclear, (Who, what, where from) |

As seen from Table 9, *Weakness 1* relates to the Preplanning stage and concerns the area and especially the team selection. It was criticised by many of the respondents, for example, in Packaging area:

> *Definitely more people should be included in the detailed preplanning. Many people took part, but only because they happened to be in the area during their break. More time should be put into planning who should be involved and also into how many opinions could be collected already before the start. If there are too few people involved, many aspects can be missed. (Shift leader in Packaging area) (Appendix 2: 16)*

It was already identified in the test areas that a lot of time was spent on discussing the right solutions, whereas it was identified that these types of pre-discussions could be done more thoroughly in the Preplanning phase already. Moreover, missing the critical people in executing the 5S actions can make them ineffective, or even create unnec-

essary resistance and confusion, and eventually lead into a lack of commitment in the areas which are utilized by many employees rotating in shifts.

*Weakness 2* was identified as related to the unclear role and responsibility of the area foremen as part of the 5S implementation. The interviewed area foreman, Lean navigator as well as the Production manager, felt uncertain concerning the role of the area foremen in the implementation process. It was identified that they are accountable for many of the process steps, but due to their large areas of responsibility, it turned out that they cannot focus on a specific area on a very detailed level and don't yet feel highly committed to the new 5S concept. Based on the interviews, the area foremen were also identified to be missing the in-depth knowledge and tools for the follow-up and control of the first 3 phases of 5S. This knowledge and commitment of the foremen is absolutely critical due to their central role as the direct manager to the shop floor employees. They will need to be able to both support and innovate as well as drive the implementation process forward.

On the other hand, foremen need to act as the authority and the referee, and ensure a rigorous follow-up in their areas, so that the new level of workplace organization will be maintained in the long term. The area foremen are responsible for creating the daily standards together with the employees, and they need to ensure that these standards are followed. The role of the area foremen will need to be emphasized by the whole implementation process and the supporting organization, in order to ensure the long term success of the new 5S concept. It was already identified that the uncertainty of the foreman's role has been seen as the lack of follow-up, and some areas have already showed signs of falling back to old habits.

*Weakness 3* is related to the missing focus of the last two steps of the 5S concept. The first 3S phases are very concrete and provide visible results, whereas the last two steps of 5S phases focus on creating the standards, for simple, and effective operation in the area and defining methods needed to sustain the reached level. The steps 4. "standardize" and 5. "sustain" of the 5S approach have not yet been reached at all in the first phase of the 5S implementation. This is mainly due to a lack of experience in using the 5S tool. More experience and a study of existing best practice is needed in order to provide better support for the line organization in creating solutions for standardize and sustain phases of the 5S implementation.

In relation to Weakness 3, the main emphasis so far has been on preparing for the concrete actions and the 3S phase, while the last 2S's have been lacking attention. This combined with an unclear foreman role makes a critical tipping point for the whole 5S implementation, and needs to be solved before moving to any further areas. The interviews with key persons in both the Production and Packaging areas highlight the fact that the principles for 4.Standardize and 5.Sustain phases are missing completely, while they are very much needed. These principles will need to be created by the project team together with the site management, department management and area foremen in order to ensure a harmonized approach that can be utilized in the following areas planned for implementation.

Finally, *Weakness 4* was repeatedly mentioned by the interviewed persons in connection to purchasing processes. During the 5S actions, usually many small improvements are identified which require purchases. The purchasing of identified improvements was not finalized due to unclear processes or missing experience from persons participating in the 5S operations. In this context, also the role of the area foreman is emphasized. The area foreman is responsible for the small improvements within his area, but in the context of the 5S operations, there seems to be confusion and uncertainty concerning the purchases.

The production area foreman brought out this important point that the purchasing department should be more directly involved as a key stakeholder in the Preplanning phase of 5S. The needs and historical preferences from different departments and different types of areas should be coordinated. This needs to be done in order to maintain economies of scale and effectiveness in purchasing, as well as to avoid each department ending up with a different tool for the same job. This weakness is not considered as critical as the two aforementioned, but it should also be critically addressed as part of the implementation guideline.

As a summary, the key findings from the CSA are listed in Table 9 below.

Table 9. Strengths and Weaknesses identified from Phase 1 of 5S Implementation.

| Category | Strengths | Weaknesses |
|---|---|---|
| Preplanning 1. | -Support in planning from Lean coordinators,<br>-Training preparations and materials done well | -Area selection unclear<br>-Too large or complex areas chosen for first areas<br>-Key persons have been missing from the 5S teams<br>-No time reserved, production duties are stopping 5S 1. |
| Foreman role | | -Foremen feel uncertain concerning their role; missing tools and competences 2.<br>-No clear view on the responsibilites and methods on how and by whom the follow-up and control of agreed actions is executed |
| 5S approach 2. | -Sorting phase provides inspiring results<br>-The systematic approcach is seen as new and refreshing<br>-Results are made by moving systematically<br>-Employees are committed and excited by the visible results | -Only 3S completed<br>-Areas show signs of falling back to old habits 3.<br>-No follow-up routines agreed |
| Purchasing | | -Missing harmonized purchasing approach between functions.<br>-Each area has specific preferences for materials, tools, etc.<br>-Responsibilities unclear, (Who, what, where from) |

As seen from Table 9, there are several positive aspects already identified in the current 5S implementation approach. At the same time, it is noteworthy that both categories with strengths contain also aspects that are seen as major weaknesses. The strengths will need to be maintained and enforced if possible when moving towards building a proposal for an implementation guideline. On the other hand, each of the identified key weaknesses will form the foundation for improvements to be incorporated into the implementation guideline in order to avoid these same weaknesses from reoccurring in the following phases of the implementation. The most critical weaknesses are highlighted in Table 7 and will be the focus area of this study.

Based on the criticality of the role of foreman in the implementation process as well as the missing focus on 4.Standardize and 5.Sustain phases of the 5S concept, these three weaknesses will be addressed in this study, to ensure a successful 5S implementation. These main weaknesses also reflect the key areas for which the existing best practice is studied next. Best practice will help to create a conceptual framework as a basis for building the proposal for an improved 5S implementation guideline.

# 4 Best Practice for LEAN 5S Implementation

This section discusses the critical elements for a successful Lean 5S Implementation. First, in order to create a solid foundation to support sustaining any Lean tools, the key concepts and philosophy of Lean Management approach are defined and described. Second, existing practices for 5S implementation efforts in other companies and industries are discussed with the focus on identifying key success factors and avoiding common pitfalls in 5S implementation projects. Third, the relevant key concepts of change management are discussed, with the emphasis on creating the right atmosphere for change and especially sustaining implemented changes. Finally, the key elements found from existing literature are combined into the Conceptual Framework for building the proposal in this study.

## 4.1 Lean Management Principles

The 5S method originates from the basic principles and theories included in the Lean management philosophy.

### 4.1.1 Five Basic Principles of Lean

The origins of Lean trace back to the Toyota Production System, developed and made famous by former Toyota CEO Eiji Toyoda and Lead Engineer Taiichi Ohno of Toyota Motor Company during the 1950s. The philosophy of Lean is centralized around the concept of identifying and eliminating *waste* in its different forms referred to as Muda, Mura and Muri. The most concrete form of waste is *Muda.* Womack (1996: 15) has described Muda in the following terms based on his study of the Toyota Production System:

> *Muda means "waste," specifically any human activity which absorbs resources but creates no value: mistakes which require rectification, production of items no one wants so that inventories and remaindered goods pile up, processing steps which aren't actually needed, movement of employees and transport of goods from one place to another without any purpose..*

The approach for systematic elimination of waste is the source of the five basic principles of Lean, which are illustrated in Figure 10 below (Womack & Jones, 1996:15-26).


Figure 10: Five principles of Lean (Womack & Jones, 1996:15-26, Hines et. Al, 2008:4).

The five principles of Lean illustrated above are presented in cyclical form, starting the continuous cycle of waste removal from *specifying value* from the perspective of the customer.

As mentioned above, an elementary aspect considering the concept of *waste* is to understand the concept of *value creation*. These elements are both fundamental focus areas in the Lean philosophy. Chiarini (2013: 16) provides a thorough explanation on the concept of *value added activities* by first defining the key elements of *processes and activities.* Processes can be described as a "sequence of activities used to manage one or more functions of the organization" whereas activities are seen as single operations and tasks that are carried out as part of the processes. From this foundation, a value-adding activity in a general context is reached when it can provide a higher value as an output than it requires as input. The generic approach is however defined in more detail in the Lean thinking. Lean thinking considers value added when it is made possible to operate processes so that the value that the customer recognizes is maximized while operating with the lowest cost possible. Thus we end up with the definition of *waste* as an activity that adds costs but is non-value-adding for the customer. The Lean thinking focuses on systematically eliminating this waste, which can be found in all processes. (Womack & Jones 1996: 15-16, Chiarini 2013: 16-17).

The second step is to identify the *value stream* of each product or service. Below is a general definition for a value stream to describe the collaborative aspects of Lean:

> *The value stream is the set of all the specific actions required to bring a specific product (whether a good, a service, or, increasingly, a combination of the two) through the three critical management tasks of any business: the problem-solving task running from concept through detailed design and engineering to production launch, the information management task running from order-taking through detailed scheduling to delivery, and the physical transformation task proceeding from raw materials to a finished product in the hands of the customer. (Womack & Jones 1996: 19)*

This identification of value streams exemplifies the holistic nature of Lean as a management philosophy which focuses on optimizing the entire value chain, instead of subprocesses or separate internal processes. Womack & Jones (1996:21) use the term *Lean Enterprise* to describe the organizational mechanisms needed for reducing waste across the total value stream.

The third principle of Lean is making the value creating steps *flow*. When the obvious waste has been identified and the value streams have been identified, the remaining value creating steps are made to flow. This principle, which seems counter-intuitive at first, requires significant effort in redefining the classical approaches to organizing work by departments and processing in batches. Instead, according to the Lean principles, continuous flow in small lots and right-sized machines should be pursued. The lean alternative is to redefine the work of functions, departments, and firms so they can make a positive contribution to value creation. It is also vital to speak address the real needs of employees at every point along the value stream so it is actually in people's interest to make value flow. (Womack & Jones, 1996: 21-22)

The fourth principle of Lean is to consider the *pull* from the customer. The pull from the customer can be safely utilized as driver for production processes when first the previous principles are put into good shape by Lean management. This way products can be made only based on what the customers actually tell they need, instead of pushing products which may end up being unwanted. (Womack & Jones, 1996: 24-25)

The fifth principle is the strive for *perfection.* According to Womack and Jones (1996:25-26) the previous "four initial principles interact with each other in a virtuous cycle" which completes the last step of the Lean cycle. The pursuit of perfection aims to continuously removing layers of waste as they are discovered during the previous phases of Lean approach. When value is identified and made to flow faster, it exposes new layers of waste which can be again systematically removed. And the more pull is

utilized the more obstacles for flow are exposed and thus made possible to be fixed. The strive for perfection emphasizes the importance of the people element in Lean. The role of transparency as a supporting mechanism in striving for perfection is described in the following way:

> *Perhaps the most important spur to perfection is transparency, the fact that in a lean system everyone —subcontractors, first-tier suppliers, system integrators (often called assemblers), distributors, customers, employees— can see everything, and so it's easy to discover better ways to create value. What's more, there is nearly instant and highly positive feedback for employees making improvements, a key feature of lean work and a powerful spur to continuing efforts to improve.* (Womack and Jones 1996: 26)

When the issues in daily working environments are made transparent and visually obvious, this creates an open system which enables instant feedback from the improvements, which is critical in empowering people for continuous improvement. (Womack and Jones 1996: 26).

### 4.1.2 "TPS House of Lean" – Combining Lean Tools and Principles

After briefly introducing the very foundation of Lean through the five basic principles, this subchapter presents a common way of combining the Lean framework into a so called House of Lean or House of Toyota Production System as it is originally known. The house of Toyota Production System is presented in Figure 15 below. (Liker & Convis, 2012:131).

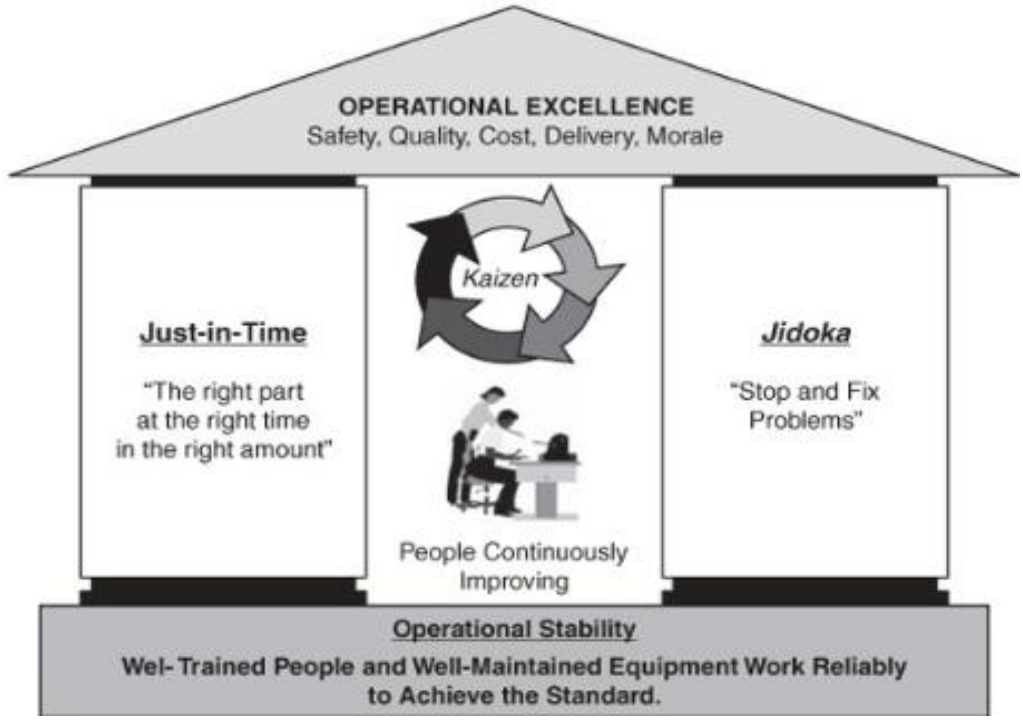



Figure 11: Toyota Production System House (Liker & Convis, 2012 : 131).

The house of the Toyota Production System illustrated in Figure 11: Toyota Production System House (Liker & Convis, 2012 : 131).) presents the basic principles that bring the Lean philosophy and tools together into a continuously improving system with people in the centre. The Toyota production System itself is largely designed to be a system that keeps on challenging the leaders and team members while striving for perfection. The two main pillars of the House of TPS are Just-In-Time (JIT) and Jidoka. JIT focuses in the long term to eliminate stocks and work-in-process completely throughout the value stream. This is targeted by aligning the whole value stream to work at a steady pace (flow) with the target of meeting customer demand (pull). With as little inventory as possible problems are made very visible, as there are no buffers to hide the problems caused by waste (Muda, Mura, Muri) in different forms. In a non-material process the lack of inventories could mean tight deadlines with little to no buffer times between batches of work or deliverable services.

The other main pillar of House of TPS is called *Jidoka.* Jidoka refers to machines or processes with the capability of stopping itself once a problem occurs. This is linked to principles called *Andon* and *visual management* which both target in bringing problems out instantly, easily and visually to all employees once they occur. The combination of JIT and Jidoka principles ensure that problems cannot and should not be hidden, but on the contrary, made visible and solved instantly. (Liker & Convis, 2012:131-132)

The two main pillars are not enough to form a house and alone create a rather fragile system. Thus the critical foundation is elementary in building any house. In the House of TPS the foundation is based on *operational stability.* Operational stability is built upon "well-trained people and well-maintained equipment working reliably to achieve the standard." This means that the aspects of competent and motivated people and *Kaizen* form the core of Lean and TPS. As the roof of the house, the results of operational excellence in the form of high performance in Safety, Quality, Cost, Delivery and Morale. (Liker & Convis, 2012:131-132)

## 4.2 Best Practice of Lean and 5S Implementation

This section introduces existing best practice for Lean and 5S implementation. The success factors from 5S implementations in other industries and companies are examined with the focus of identifying key success factors and most common pitfalls. The main emphasis is to identify best practice that supports the "Standardize" and "Sustain" phases of the 5S implementation.

### 4.2.1 5S Implementation Steps

*5S implementation* is defined as the process of changing the daily practices for workplace organization to follow the principles and systematically repeat the 5S steps of Sort, Set in Order, Shine, Standardize and Sustain. The steps are illustrated in a cyclical form in Figure 16 below:

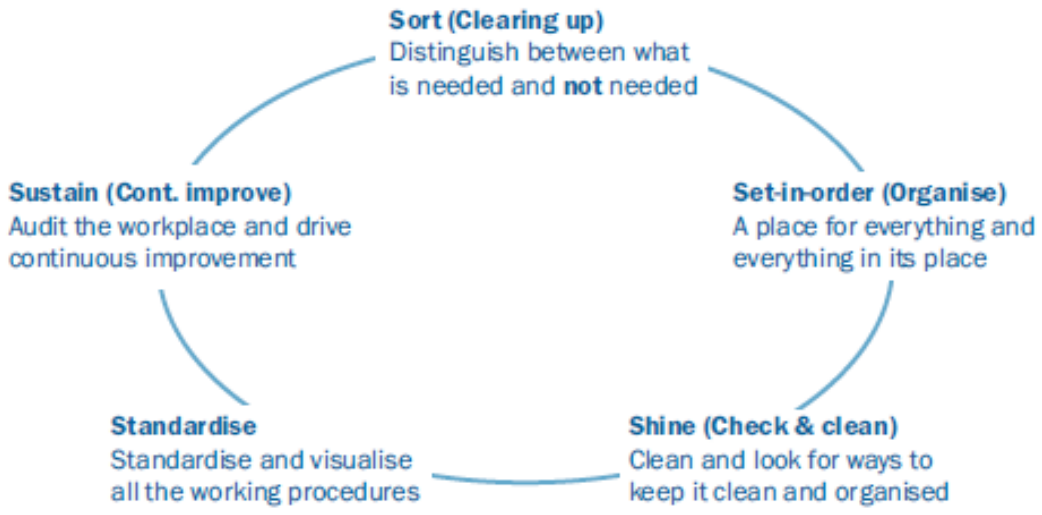



Figure 12: 5S implementation steps (Hines et al. 2008: 70)

As illustrated in Figure 12 above, the first three steps of 5S represent the concrete action steps, whereas the latter two steps Standardize and Sustain focus on creating the foundation for systematically repeating and continuously improving the process. As part of the Lean principles however the 5S needs to be seen as more than just a tool for tidying and organizing the workplace. In addition to being a tool for workplace organization, 5S can also be seen as a management tool for empowering and involving people in the continuous improvement of their own working environment. (Hines et al. 2008: 70).

Chiarini (2013: 67) emphasizes the importance of the 5S tool as a general test for the maturity of the organization to adopt the Lean principles.

> *5S represents the discipline and strictness that lie at the heart of Kaizen:*
> *If 5S fails to be introduced properly there's no point in going on, because the company isn't ready for the long way to improvement. (Chiarini, 2013: 67)*

This is why it is suggested by Chiarini that 5S should be one of the first methods to be introduced during a Lean implementation as it standardizes daily workplace management and thus is seen as much more than just workplace organization or housekeeping. (Chiarini, 2013: 84).

Chapman (2005: 27) offers a view on one of the common problems with 5S implementation by stating that "Many organizations implement only the first three steps and then wonder why the system doesn't work." This argument and its implications are examined later in the following subsections in further detail.

Hines et al. (2008: 57) offer two approaches to implementing process improvements, such as 5S. The "Pillars or Platform" approach is illustrated in Figure 13 below.

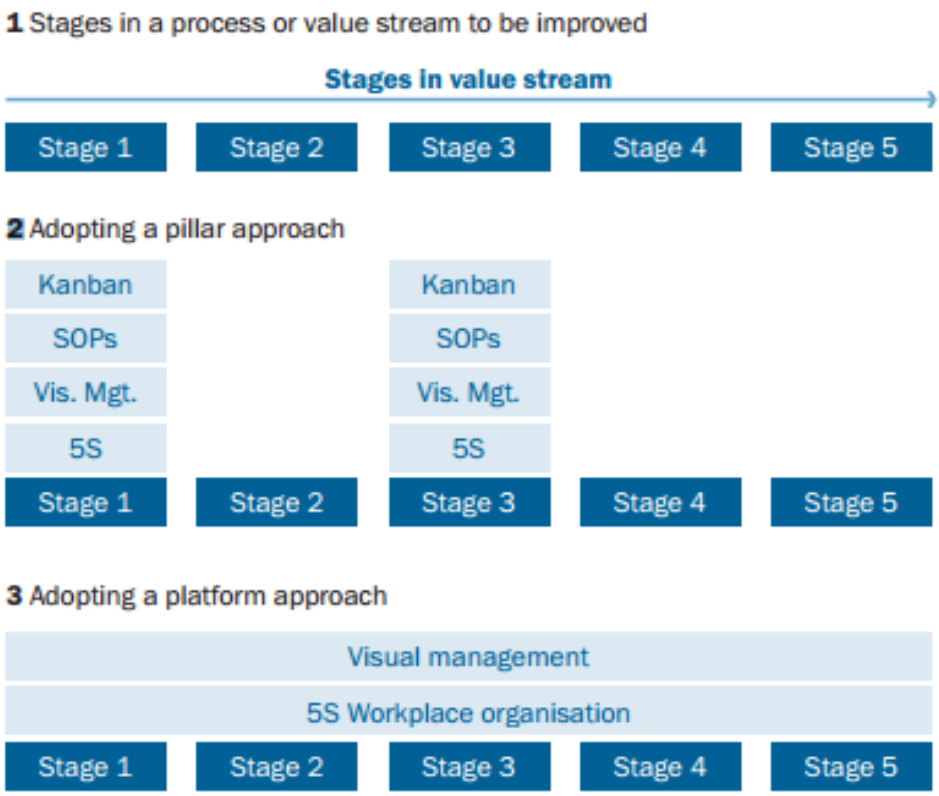



Figure 13: Pillars or Platform approaches to implementing process improvements (Hines et al. 2008: 57)

As seen in Figure 13, the two approaches both start with visualizing the value streams for improvement. After the stages in the value stream are identified there are two alternative approaches to improving *pillar approach* or *platform approach*. The key opportunities and possible threats in using either of these approaches in implementing process improvements are presented in Table 10 below.

Table 10. Pillars or Platform approach (Hines et al. 2008:57).

| | Pillar approach | Platform approach |
|---|---|---|
| Opportunities | • Quick demonstration of benefits<br>• Piloting approach for learning<br>• Generate involvement and belief early on | • Engages the entire workforce evenly<br>• Limited number of tools introduced at once offers better focus |
| Threats | • Developing "pillars of Excellence"<br>• Disengaging employees in other areas/stages<br>• Can stress the employees in the improved area through constant changes or working harder than other areas | • Takes a longer time to implement and produce results<br>• Can disengage managers if it takes too long to provide results |

As seen from Table 10, both approaches offer concrete opportunities and pose their own threats which in the end always depend on the status in the organization. A sustainable change often requires combining the aspects from both approaches. One approach is to start with the pillar approach to test the tools and then to continue according to the principles of the platform approach to effectively spread the use and methodology across the entire organization. (Hines et al. 2008:57).

### 4.2.2 Common Pitfalls in Lean and 5S Implementation

This subsection focuses on identifying common pitfalls in Lean and 5S implementations based on experiences available from existing literature and articles. As the 5S concept is one of the tools which are built upon the Lean principles, both Lean and 5S implementation experiences were studied. The Lean and 5S concepts should always be modified according to the organization and cannot be directly copied from company to company. However there are valuable findings to be made from the identified common pitfalls which could be avoided by recognizing them beforehand.

The sources used in this study to examine the common pitfalls of 5S Implementations in the topics of management role, "Standardize" and "Sustain" are briefly presented below.

Chapman (2005: 31) argues based on his experience that many companies start the implementation of 5S and end up only doing the first three S's with the rationale that

*"after cleaning up and organizing, employees will simply fall in line and sustain the visual factory on their own".*

Chiarini (2013: 82-89) presents a step-by-step approach to 5S implementation and offers a list of most common mistakes made by managers. Galsworth (2011: 14-16, 20) focuses on the aspects of Visual Management and provides many insights on Visual Management practices in relation to 5S implementation. Moulding (2010) has studied and presented a thorough explanation of different aspects in implementing 5S. Scherrer-Rathje et al. (2009: 79-88) have studied two Lean implementations in the same case company almost ten years apart. The first implementation was deemed a failure, whereas the second was viewed as a success.

The findings from the above listed sources are condensed into Figure 14 below.

| Management | Standardize | Sustain |
|---|---|---|
| Bottom up approach, lack of senior management support (Scherrer-Rathje et al., 2009) | 5S improvement time policy missing (Chapman, 2005) | Two last S's NOT formalized (Chapman 2005) |
| Lack of team autonomy in decsion making (Scherrer-Rathje et al., 2009) | Failing to stabilize 5S as daily management routine (Moulding, 2010) | Management involvement in follow-up (Chapman,2005) |
| 5S is a part of organizational culture, not just a method to improve efficiency (Moulding, 2010) | Only a one time 3S effort done. (Moulding, 2010) | Shitsuke = "Discipline" missing (Chiarini, 2013) |
| Management doing too much, without empowering people (Galsworth, 2011) | Instructions not visible for everyone (Chiarini, 2013) | Lack of indicators (Chiarini, 2013) |
| Conflicting orders from management ("5S is important BUT, finish order first.." (Chiarini, 2013) | Applying 5S only in times of no other urgent duties . (Chiarini, 2013) | Lack of periodic check-up on development (Chiarini,2013) |
| | Put 5S in place quickly, without considering visual aspects (Galsworth, 2011) | No actual time reserved for improvement (Galsworth, 2011) |

Figure 14. Common Pitfalls of 5S Implementation.

The key findings of most common pitfalls are categorized under topics of *Management*, *Standardize* and *Sustain.*

*Management*

The management aspect emphasizes strong commitment from all levels of management, but especially emphasizes the top management support and visibility. Scherrer-Rathje et al. (2009;82) point out one of the key aspects when lacking senior management commitment in their Lean implementation:

> *The lack of senior management commitment and interest in Lean also meant that employees who were affected by the lean changes did not understand how this new project was related to the many others which were occurring at the same time.* Scherrer-Rathje et al. (2009: 82)

Another point of view however is provided by Galsworth (2011: 16) as she emphasizes the strong role of the empowered workforce and warns against the managers not to conclude the visual aspects all by themselves thus leaving the value-adding workforce out of the development work.

The key role of communication is a common factor when considering the topic of Management in a 5S implementation. There can be no conflicting orders from management concerning the importance and prioritization of 5S activities. Ineffective communication of first successes made by the new way of working is critical in installing a positive drive for the change. Conflicting messages from management considering the importance of 5S actions versus finishing a production target can result in the reduced importance in the minds of the employees. (Chiarini, 2013: 88; Scherrer-Rathje et al. 2009: 82)

*Standardize*

The key pitfalls in the standardize phase were identified in lack of understanding the importance of this step and the time requirement that follows. In order to effectively standardize operations, it means that actions should be part of daily routines which are executed in the same way day to day. In this sense, it is critical to see that 5S is not just a set of daily actions, but needs to be considered as part of the daily management done by supervisors and managers. To reach standardization, a clear time policy is needed to ensure that there is a clearly dedicated time in a day where the standardized ways of working can be developed. In communicating and creating these standardized ways of working, the role of Visual Management is emphasized. In order to support management work, visual cues which help to identify issues immediately are needed

and this part is often overlooked when 5S needs to be implemented quickly with only the goals of tidy and organized workplace in mind. (Galsworth, 2011: 16; Chapman, 2005: 31)

*Sustain*

The last 5S phase Sustain, or “Discipline” as it can also be translated, is seen as the real test for the success of 5S implementation. Here it is highlighted, that it is not enough to just finalize the practical and concrete first 3S’s, but the two last S’s are the most important for the long term success of the 5S approach. Here, especially the top management involvement is seen critical to stress the urgency through audits and active and visible participation, e.g. in the form of walk arounds. The sustain phase requires strong indicators visually presented throughout the organization to tell the organization how the 5S actions are actually affecting performance. But just the visual indicators on their own are not enough, they require a periodic and systematic check-up on the level and also on how the method is developing. (Chapman, 2005:31, Chiarini, 2013: 88).

To find the positive examples, the key success factors from the same list of sources are presented in the following subsection.

### 4.2.3 Key Success Factors in 5S Implementation

The same sources which were presented in the previous subsection to look for the common pitfalls, were utilized to examine also the key success factors of 5S implementation. The same categorization of Management, Standardize and Sustain was used for also the success factors in order to find the strongest key elements which could be utilized as a foundation for building the solution in this study.

The key success factors in 5S implementation are illustrated in Figure 15 below.

| Management | Standardize | Sustain |
|---|---|---|
| Visible management commitment (Scherrer-Rathje et al., 2009) | Centralized 5S stations (Chapman, 2005) | Multi-level involvement, Top management -> ”shop floor leaders”(Chapman) |
| Ensure mechanisms for long term sustainability (Scherrer-Rathje et al., 2009) | 5S improvement time policy (Chapman, 2005) | Management involvement in follow-up (Chapman) |
| ”5S Business plan” with vision and mission (Moulding, 2010) | Visual factory! (Chapman, 2005) | Shitsuke = ”Discipline” (Chiarini, 2013) |
| ”Visual workplace Continuum” (Galsworth, 2011) | Procedures and instructions (Responsibilities, daily checklists, times) (Chiarini, 2013) | Indicators (Chiarini, 2013) |
| Clear, non contradictory communication from management (Chiarini, 2013) | VISUAL standards (Chiarini, 2013) | Periodic check-up on development (Chiarini, 2013) |
| | Stabilize daily management routine (Moulding, 2010) | Empowered workforce (Galsworth, 2011) |
| | CONTINUOUS sort, set in order, shine (Moulding, 2010) | Cracking the code on time (Galsworth, 2011) |

Figure 15. Key Success Factors in 5S Implementation.

The key success factors in each category are presented in Figure 15 above are further explained under their corresponding topics.

*Management*

As seen in Figure 15, the management category focuses on the visibility, communication and strategic choices made by the management. Moulding (2010: 88) suggests a specific 5S “business plan” in the form of a balanced scorecard in order to formalize the 5S approach. A framework for the 5S Business Plan is presented below in figure 20 (Moulding, 2010:88).

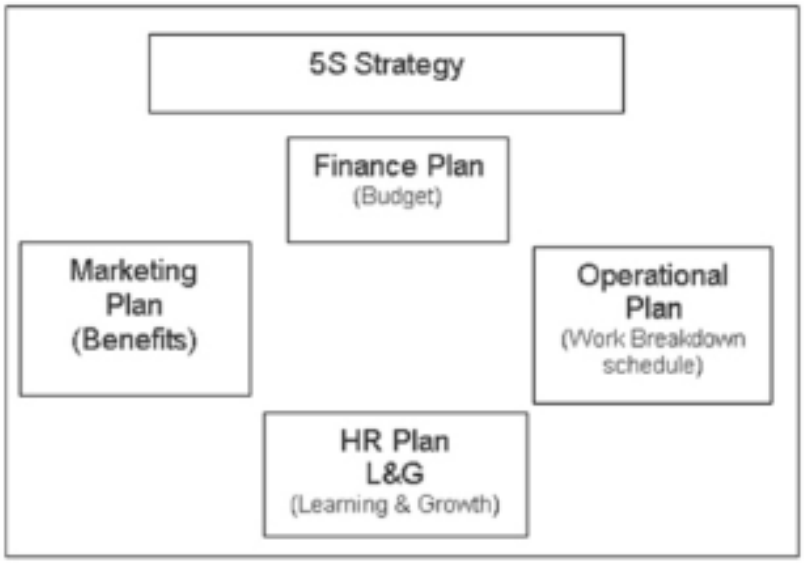



Figure 16. 5S "Business plan" (Moulding, 2010: 88).

As shown in Figure 16, the 5S Business plan could incorporate the aspects needed for communication in terms of Strategy (Benefits, goals, and direction), Resource plan (Budget, HR) and the operational plan for activities needed. The clear and uniform communication is emphasized and completed with a rigorous aim towards a *visual workplace,* which according to Galsworth (2011:14) is the "language of Lean made visual". The visual management concepts were seen as important parts of standardize and sustain phases as well.

*Standardize*

The key success factors for Standardize phase of 5S focus on the practical steps that help ensuring a standard 5S approach that can be repeated and developed easily with clear standards. Especially the *visual workplace* is a key concept which needs to be systematically managed as part of the standardize phase. One of the key findings that is suitable for both the Standardize and Sustain phases, is the need for an *improvement time policy.* This means that there should be an officially communicated time reserved on a regular basis for setting the workplace according to the standards and improving them. Galsworth (2011: 15) has named this task as "Cracking the code on time", and continues by arguing that the unavailability of improvement time is a false myth which must be challenged. By installing the visual management practices and reserving time for standardization and improvements, there will be a real chance for the new way of working to be implemented. Galsworth (2011:16) finishes by saying "Once

the code on time is cracked, improvement can become a daily practice that is also often deeply inventive".

The standardization phase is seen as directly linked to the daily management practices, supported by the creation of standards which support in bringing normally varying results under control. In this context, standards in form of e.g. responsibility lists, daily checklists and work instructions should be made immediately visible and brought to where the work is executed. When communicating the standards as many visual tools such as virtual whiteboards, photos, drawings and color coding should be utilized to make information obvious and support the daily management practices. (Moulding, 2010: 79; Chiarini, 2013: 88).

*Sustain*

The best practice identified for the sustain phase is focused on the visible involvement of all employees and the discipline to repeat and especially continuously improve the 5S status. The foundation is built through involvement through all levels, but especially the visible top management involvement is seen as the key success factor for Sustain in the long term. Top management can visibly demonstrate the commitment by participating in regular walk arounds or audits which provide a formalized way of providing support and feedback. Chapman (2005: 31) suggests using informal *shop floor leaders,* who are volunteers to provide daily support for harmonizing, monitoring and leading the implementation.

Galsworth (2011: 16) stresses the importance of empowering the workforce in the long term sustainment of 5S and Visual management practices. The operators and persons actually performing the operational work should be empowered by strongly involving them in all the 5S phases and by providing them challenging tasks to undertake. This includes the open communication of results and progress by making them visually available and updating them regularly and systematically, preferably by the teams themselves working in the areas complemented by regular audits from the management. (Chiarini 2013: 88; Chapman, 2005: 30).

In the end, it is important to see the 5S method as more than just a mechanical tool, but instead as a practical method for incorporating the Lean philosophy into daily work. In the center of the Lean philosophy are the principles of *Kaizen (Continuous Improve-*

*ment)* and *People continuously Improving.* This aspect is described by Ballé in the following way:

> *The key transformation lesson I've had to learn the hard way from my senseis is that lean transformation is about using the lean tools to develop the kaizen mindset in every employee, as opposed to applying the lean tools to every process to get a quick boost. (…).You must see the (Lean) transformation in terms of how well the individual supervisors are creating standard conditions in their areas. The issue then becomes a "train the trainer" program: how to train supervisors at 5S so that they train their teams at practicing it every day. (Ballé, 2009)*

As suggested by Ballé, a strong focus should be paid on using the Lean tools, such as 5S, for developing the people and their understanding of the Kaizen mindset, instead of quick fixing issues or supporting one-time projects. After all, it is the people who are executing the processes and it is their motivation and competence that needs to be carefully planned and reacted to, which makes sustaining 5S a management issue more than anything else. In the core of sustaining 5S is making sure that people are trained and do what they are trained every day. And if there are issues concerning productivity, quality or other indicators, the 5S conditions should not be used to solve the problem, but to make the problems (waste) in production visible, so that it is easy and simple to visually identify the causes during standardized daily management practices. (Ballé, 2009).

The principles of Visual Management as a tool for supporting Lean thinking and 5S are presented in the following subsection.

### 4.2.4 Visual Management and the Visual Workplace

As explained in the previous subchapter, the elements of Visual Management are seen as a key factor in both Standardize and Sustain phases of a 5S implementation. In this subsection, the concepts of Visual Management and the Visual Workplace are defined, described and analysed and connected into the context of 5S Implementation.

Toyota, which was earlier introduced as the origin of the Lean thinking and concepts, places a strong emphasis on Visual Management as part of its leadership culture. Liker

& Convis (2012: 153) explain the role of Visual Management at Toyota in the following way:

> *It's impossible to overstate the importance that Toyota gives to visual management. Every metric that matters throughout the company, especially on the shop floor, is presented visually for everyone who is involved in meeting the goal to see.(…) Many of the tools of the Toyota Production System are mistakenly viewed only as methods for improving the process. In most cases, they are intended to display the standards visually so that any deviations are visible to all.(Liker & Convis, 2012:153)*

The focus to Visual management at Toyota is based on three key reasons: "(A) it clarifies expectations, (b) determines accountability for all parties involved and (c) gives the possibility to track their own progress and self-development." Thus the key task for a leader or manager is to ensure that the visual management systems focus on the right issues and can be easily understood at a glance. (Liker & Convis, 2012: 153-154)

Galsworth (2004: 44) combines the general context of Visual Management into the concept of Visual Workplace. She offers the following view on the use of visual management in the workplace: "Visual workplace is not about posters and signs. The visual workplace is the language of Lean production made visual". The purpose of the visual approach is to identify and eliminate deficits in information through visual solutions. A definition of an ideal state of a visual workplace is a self-ordering, self-explaining, self-regulating and self-improving work environment, where what is supposed to happen, happens on-time supported by visual devices. (Galsworth, 2004: 44).

Kattman et al. (2012: 412) even argue, that the Visual workplace and 5S concepts can be used interchangeably. Based on the definitions above by Liker & Convis and Galsworth, it could be said however that the Visual Workplace and 5S although integrated, are not precisely interchangeable. 5S refers to the specific process steps of workplace organization, whereas Visual Workplace focuses solely on the visual aspects with lesser focus on the systematic focus to daily management and leadership.

The 5 levels of a Visual Workplace are presented in Figure 17 below (Galsworth, 2004:46).

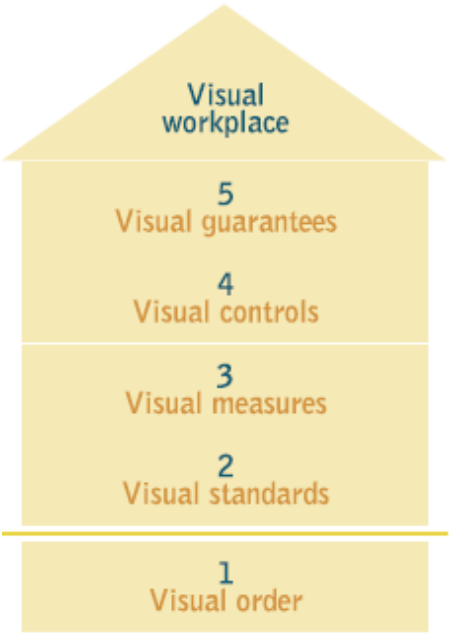



Figure 17. Five levels of Visual Workplace.

The five levels of Visual Workplace presented in Figure 17 are built on the foundation built on the first level, visual order. The visual order is the key in building a visual workplace as it answers to the most common question in workplace, the “Visual where” as formulated by Galsworth (2004: 45). This step is the starting point in answering the questions including “where” by defining a clear visual order in the physical workplace, whether in production areas or offices. The five levels of the visual workplace and their connection to the five phases of 5S is collected into Table 11 below (Galsworth, 2004:45-46; Kattman et al., 2012: 425).

Table 11. Five levels of Visual Workplace and the connection to 5S phases.

| Level | Description | Meaning | Tools, examples | 5S phase |
|---|---|---|---|---|
| 1 | Visual Order | Answers to ”visual where” | Tool silhouettes, Shadowing, Bordering | Set in order |
| 2 | Visual standards | Answers to ”what, who, how and how many” | Work instructions, Pictures, SOPs (Standard operating procedure) | Standardize |
| 3 | Visual measures | Visual metrics showing whether production is behind or ahead of planned demand (takt). Visual problem solving tools. | Online displays, A3 problem solving templates | Standardize |
| 4 | Visual controls | Detailing the standards based on number, size, volume. Visual triggers (Kanban) | Pull-systems, e.g. Kanban, max-min marks | Standardize, Sustain |
| 5 | Visual guarantees | Error-proofing, | Poka-Yoke design | Sustain |

As described in Table 11 (Galsworth, 2004:45-46; Kattman et al., 2012: 425) the levels of Visual workplace, their meaning and the specific tools can be connected to the steps in the 5S system. First level, the visual order is mainly considered during the second 5S step of Set in order, where many of the “visual where” questions are considered when planning the right locations for the necessary tools, finding the right place for everything and marking them in a way that they can be returned just as easily as they were picked. This involves solutions such as shadow boards, tool silhouettes and bordering to mark the locations in a clear and visual way.

The second level, visual standards answers to the questions “what, who, how and how many?” and can be seen to connect directly with the 5S phase Standardize. In this step visual standards are created and presented visibly directly in the areas where the work is done. The visual standards can be published in the form of photos, drawings or flow charts as an example. (Galsworth, 2004:45-46; Kattman et al., 2012: 425)

The third level of a Visual workplace establishes visual measures. Visual measures are traditionally metrics that visually inform how well the area is performing against the target and enables an immediate and transparent way of communicating to all employees at once. Visual measures can also include problem solving tools if the measures show

a need for improvement. Examples of these can be online Andon boards or A3 problem solving templates. Visual measures need to be defined and followed as part of the Standardize phase in the 5S approach. (Galsworth, 2004:45-46; Kattman et al., 2012: 425)

The fourth level consists of visual controls. This level gives visual standards a more detailed level in daily operation by defining visual levels of control based on number, size, volume and so on. This helps to control and operate according to the defined standards and makes deviations immediately visible. Examples of visual controls can be Kanban or pull systems or simple maximum –minimum gauges or high-low marks and colour coding. (Galsworth, 2004:45-46; Kattman et al., 2012: 425)

The fifth and final level of the visual workplace is reached when visual guarantees are built-in as a natural part of the process of work itself. These types of mistake-proofing mechanisms are often referred to as Poka-Yoke, which refers to an approach that relies on modifying or designing the process to reduce the possibility of errors by making it either impossible to happen, or at least immediately visible at a glance. These types of solutions and innovations are elemental to the 5S phase of sustain where also the continuous improvement of the 5S concept is in focus. Poka-Yoke solutions make the workplace easier and simpler to sustain, when the possibility of making errors can be avoided entirely. (Galsworth, 2004:45-46; Kattman et al., 2012: 425)

Below are a few examples of visual workplaces.

Figure 18: Visual Workplace - Visual Order (Hines et al. 2009: 71)

Figure 19: Example of a Visual Workplace – Visual standards (Galsworth, 2004:47)

As seen from the above figures, the visual management practices instantly support and integrate as part of the 5S method and vice versa. As discussed earlier, elemental to both approaches is the demand for a strong management involvement and participation and strong employee dedication in order to sustain 5S and visual workplace in the long term. The next section introduces existing best practices concerning leading and sustaining change.

## 4.3 Leading and Sustaining Change

In this section, the relevant body of knowledge concerning change management is presented. The 8 step model for change framework of Kotter (1996) is used as the cornerstone in providing best practice for managing a large cultural change as is the case with a 5S implementation. In the following subsections the Accelerated Change Process model (Atkinson, 2014) is introduced and aligned with the 8-step model for

Change created by Kotter. In the last subsection, the key factors of a Sustainable Lean initiative are discussed against the Sustainable Lean Iceberg model formulated by Hines et al. (2008:9).

### 4.3.1 8-Step Model for Change

Change management is one of the topics which have been studied in great depth during the decades since 1950s. The world today affected by globalization and digitalization is changing faster than perhaps ever before. As identified in the previous section, the key success factor in managing a radical change of working procedures such as a 5S implementation, the aspects of management involvement and example and sustaining the reached changes are repeatedly emphasized. Kotter (2012: 8-9) describes the natural qualities of major changes in the following way:

> *To date, major change efforts have helped some organizations adapt significantly to shifting conditions, have improved the competitive standing of others, and have positioned a few for a far better future. But in too many situations the improvements have been disappointing and the carnage has been appalling, with wasted resources and burned-out, scared, or frustrated employees. To some degree, the downside of change is inevitable. Whenever human communities are forced to adjust to shifting conditions, pain is ever present. (Kotter 2012: 8-9).*

This emphasizes the general human tendency to change resistance. Kotter's study of dozens of different sizes of change initiatives resulted in a condensed list of eight most common errors when starting a major organizational change, whether it is called re-engineering, re-strategizing, mergers, downsizing, quality efforts, cultural renewal or something else changing the state of the organization dramatically. Any of these common errors can be devastating to a change initiative, but can be avoided. The answers to avoiding these common errors require understanding why organizations resist change as they do and how can this be systematically and effectively overcome through a multistep process. As a solution to tackle the eight common errors of change Kotter has created the Eight Stage Change Process. The eight common errors and the change process stages to tackle these errors, together with the key actions required in each stage are described in Table 12 (Kotter 2012: 19, 24).

Table 12: Eight common errors and the stages of change (Kotter 2012: 19, 24)

| # | Common error | 8 steps | Possible actions |
|---|---|---|---|
| 1 | Allowing too much complacency | **Establish sense of urgency** | Identify or create crises / opportunities<br>Drive people out of comfort zone<br>Set higher standards<br>Increase external feedback |
| 2 | Failing to create a sufficiently powerful guiding coalition | **Create guiding coalition** | Find the right people (Leadership / management)<br>Create trust and team spirit through dialogue<br>Develop a common goal |
| 3 | Underestimating power of vision | **Develop vision and strategy** | Direct, align and inspire actions<br>Strategy to achieve vision |
| 4 | Undercommunicating the vision | **Communicate change vision** | Constant communication through multiple channels<br>Top management setting the example |
| 5 | Permitting obstacles to block the new vision | **Empower broad based action** | Align structures with vision<br>Remove barriers, confront opposers<br>Provide training and constant communication |
| 6 | Failing to create short -term wins | **Generate short term wins** | Avoid urgency to drop, celebrate wins!<br>Provide reasons for sacrifices<br>Reward desired behaviour |
| 7 | Declaring victory too soon | **Consolidate gains and produce more change** | Use increased credibility to build on short-term wins<br>Promoting and rewarding change agents<br>Involve more people, increase speed |
| 8 | Neglecting to anchor changes firmly in the corporate culture | **Anchor new approaches in the culture** | Make change ”the way we do things around here”<br>Communicate connections between new way and success<br>Ensure leadership development and succession |

The different transformation process phases are described above in Table 12 with color coding. The first four steps marked with blue are used to “defrost a hardened status quo”. The orange steps from five to seven represent new practices that are brought in during the transformation. The eight and last step grounds the changes into the company culture and aims to sustain the reached changes. A distinctive requirement for the eight step model is also the importance of sequence. The sequence of the steps supports creation of inner momentum for the change process, which is required to overcome the inertia of the organization resisting the change. (Kotter 2012: 25)

*Defrosting Status Quo*

The first phase of the change process is to defeat the sense of complacency by establishing a sense of urgency. This phase requires a critical evaluation of the operating environment to identify crises hidden under the surface. People need to be driven out from the comfort zone by setting higher standards in form of challenging targets, utilizing external customer feedback more and insisting on taking interactions with unsatisfied customers, suppliers and other stakeholders. According to Kotter (2012: 45), no matter how the change process is started or by whom, most companies find progress

difficult in steps 2-4 unless a majority of the managers see the current state unacceptable. (Kotter 2012: 35-47)

The second step of change focuses on creating a guiding coalition which can effectively and credibly lead the change. The guiding coalition needs to consist of key individuals with enough power and influence to lead change. In addition the guiding coalition needs to develop a common set of goals and create a common trust amongst each other to work as an effective team. (Kotter 2012:47-59)

After the guiding coalition is formed, the third step is about creating a vision and strategy for the change. The vision is the long-term target for the change, which directs and preferably inspires actions. Strategy is then created as a set of actions to achieve the common vision. (Kotter 2012:60-71).

Once the vision and strategy have been created, they need to be effectively and continuously communicated. The fourth step is to communicate change vision. Multiple channels and forms of communication should be relentlessly utilized in delivering the vision to the entire organization. In this context, perhaps the most powerful communication is done through example of the guiding coalition. Actions that conflict with the verbally communicated vision can quickly destroy all the transformation efforts made thus far. (Kotter 2012:72-84).

After the first four steps which focus on defrosting the status quo, it is time to move to the next steps, which focus on bringing in the new concepts.

*Bringing in new practices*

The fifth step is empowering broad-based action. This step focuses in aligning the organizational and process structures with the newly communicated vision. It requires that any visible barriers in form of persons or structures are confronted and dealt with. In this phase it is also critical to provide necessary training, especially for the key change agents in order to empower a broader group of people as part of the transformation. (Kotter 2012: 85-95).

After the change has been visibly started and first results can be seen, it is crucial to quickly generate short term wins, which is the sixth step. By generating short term wins, the sacrifices made by many employees in forms of added effort are justified. The

short term are also used to avoid the drop of urgency during a long-term change. The key drivers for change who made the wins possible should be rewarded and encouraged. (Kotter 2012: 96-106).

Once the first wins have been generated, it is not the time for complacency, quite the opposite. The seventh step of change is to consolidate the gains and produce more change. In this step the speed of the change process can be increased and more people should be involved in the process. In this phase the key change agents should be identified and visibly rewarded for their contribution. (Kotter 2012: 107-117).

*Grounding the changes into company culture*

In the eighth and final step of change the new approach need to be anchored as part of the culture. The new ways of operating need to be communicated actively and the connections between new approaches and organizations success should be highlighted actively. In this phase it is vital to also consider the long term sustainment of changes and ensure leadership development and succession plans. (Kotter 2012: 118-127).

The eight step model by Kotter offers a concrete checklist which can be utilized when considering the changes required in a 5S implementation.

### 4.3.2 Sustaining change and installing Lean Continuous improvement

Atkinson (2014: 13) argues that in order to understand what makes change work, is to understand also what conditions allow modern change processes to fail. The most common conditions allowing Lean continuous improvement programs to fail are listed in table

Table 13: Common Conditions causing Lean Continuous Improvement initiatives to fail (Atkinson 2014: 13)

| | |
|---|---|
| **Failing to understand what Lean could do for your organization** | Lean is seen too much as a solution for manufacturing businesses only and has been poorly applied to the service and the public sector. Only by integrating OD with Lean will the culture of continuous improvement ever become a reality |
| **Lack of Leadership from the Senior management Team (SMT)** | It is easy to commit and lead the process but many SMT's lack the will, the momentum or the understanding to do so. Leadership is about giving direction and promoting strong values by which the organization can deliver to the customer. |
| **Failure to Focus on Strategic Direction** | Without strategic focus any road will get you to where you want to go. If Lean isn't part of your competitive strategy, then it's purely an 'add on' which equates to no more than 'flavour of the month' |
| **Integration on Change with Business Plan** | Your change strategy should be integrated with your quarterly business plan and strategic intent |
| **Focusing on Techniques rather than Behaviours** | Until behaviour changes, nothing changes. Focus on behaviours that take you nearer your customer focused goals |
| **Doing change to people rather than engaging with them** | Trust your people. They are the most important resource you have, treat them with respect. They can leverage change to bring about significant improvement |
| **Failing to develop a coherent and robust communication intent and strategy and maintain the momentum to sustain, interest and motivate** | We have yet to find an organization that over communicates its intent and purpose for continuous improvement. Tailor your communication goals and media to address key stakeholders. Develop media and feedback mechanisms that illustrate whether you are closer or further away from your goals. |

As seen in Table 13, there are several conditions that affect Lean Continuous Improvement initiatives to fail. There are two critical conditions to highlight in the context of this study. Focusing on techniques rather than behaviours points out a key condition that is typical to many Lean initiatives. As described in the previous sections, Lean is more a management philosophy than a set of techniques or tools. Thus the focus in Lean initiatives, such as 5S, need to be primarily on changing the behaviour of the people, instead of implementing tools. The second critical condition to avoid is "Doing change to people rather than engaging with them". In order to avoid this condition, it is critical to emphasize the two core Lean principles of Kaizen and people continuously improving when changing the processes. The change needs to be done with the people, not to the people.

*Accelerated Change Process*

In order to avoid the common conditions mentioned in Table 13 above, a five stage Accelerated Change Process (ACP) can be utilized. This approach combines aspects of GE's Change Acceleration Process (Von Der Linn, 2009) and the Eight steps of Change by Kotter presented in previous subsection. (Atkinson, 2014: 15). The stages of the ACP are presented in Figure 20 below.

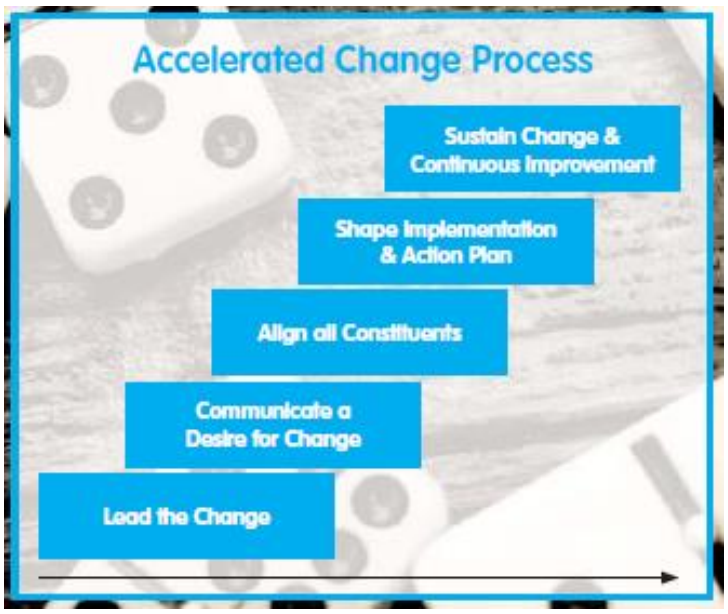



Figure 20: Accelerated Change Process (Atkinson 2014:15)

The ACP stages presented in Figure 20 are presented to overlap one another in order to highlight the impact of each step on the following step. As the change is considered in an organization, the so called unintended consequences need to be considered after taking each step. These consequences require continual feedback and adaptation as seen necessary (Atkinson 2014: 13).

The first stage of ACP emphasizes the passion and conviction of the leaders of the change. This requires positive enthusiasm from those in leadership positions. The enthusiasm of the Lean sponsor or client must be matched by the internal lean consultant or facilitator, who must express alike level of energy, commitment and motivation in all connections concerning the lean implementation. (Atkinson 2014: 15).

The second stage focuses on extensive communication and creating a desire for change. People should not be summoned to any workshops or a corporate “roll out” without understanding why the change in operations is necessary, what are the tangible benefits and what the role and responsibility of each participant will be in supporting the initiative. Role of change leaders is to commit everyone to participate and make them aware that the change will be in the best interest of the organization. (Atkinson 2014: 15-16).

After the leadership and communication stages have been started, it is time to align constituencies. This stage focuses on creating a detailed action plan with responsibili-

ties and specific measures including milestones and timeframes. In this stage the communication of the vision needs to consider also the different stakeholders, such as for example staff, representative groups, customers and suppliers and make sure that the message is communicated in alignment to all (Atkinson 2014: 16).

Stage four focuses on shaping an implementation plan. It is critical for the people involved to know where they and their team fit in the overall scheme of change and how different factors cause another to work. Especially this stage focuses in transmitting a clear understanding of when the future desired state can be achieved. (Atkinson 2014: 16).

The fifth and last stage of the ACP model is sustaining change and continuous improvement. For Lean to be sustained in the long term, it needs to be supported by key people in the organisation. It is not enough to launch an event and believe Lean will be implemented without further stimulus. Effective change requires fuelling from enthusiastic and committed people, feeding back success stories of how the change has benefitted the organisation. It is also important to remember, that Lean might very well not be the only initiative currently ongoing. Other projects may be competing for the same resources, sustaining the momentum of the Lean initiative thus requires effectiveness to keep it moving and providing visible results. The final aspect of sustaining the changes, is to measure, monitor and quantify the progress. It is critical for the long term sustainment of Lean to link the cultural change to the business improvements. Thus it is important to be able to quantify and monitor the relationship between cultural change, business process improvements and bottom line results through causal relationships. The cause-effect relationships are a strong way to demonstrate the wins created by Lean implementation (Atkinson, 2014: 16-17).

### 4.3.3 Sustainable Lean Iceberg

Companies initiating Lean change often focus on the tools and techniques such as Value Stream Mapping and 5S. Although this approach may lead to quick wins, and helps build trust amongst employees, sustaining these short term improvements can turn out to be problematic. Hines et al. (2008: 9) present the Sustainable Lean Iceberg Model to highlight the difference between the two main aspects needed for a sustainable Lean implementation. There are the highly critical, so called enabling factors which are hidden beneath the surface and the concrete visible factors which are seen above

the waterline. The sustainable Lean iceberg is presented in Figure 21 below. (Hines et al. 2008: 9).

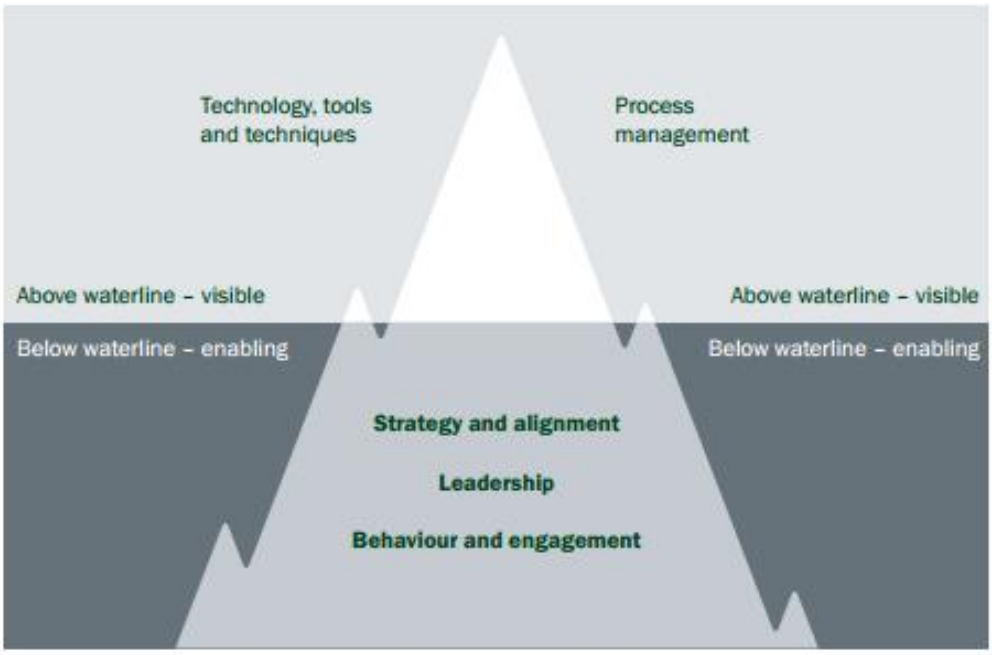



Figure 21: The Sustainable Lean Iceberg Model (Hines et. al, 2008: 9)

As illustrated in Figure 21, the sustainable Lean approach is built upon three main enabling factors: Behavior and engagement, Leadership and Strategy and Alignment. The visible part of Lean consists of the technology, tools and techniques and the process management aspects.

The first element below the water is *Strategy and alignment*. For Lean to provide sustainable results and to be anchored into the culture of the company, a coherent vision, strategy and need to be established. Just creating these however is far from enough, as the strategy needs to be communicated and fully deployed throughout the levels of the organization.

The second element below the water is *Leadership.* In this aspect, the distinction between leaders and managers is critical. Leaders are characterized by having a guiding vision, can motivate and inspire people and have passion and integrity. Leaders are capable of producing change, often to a dramatic degree. The key tasks of the leader are to be innovative, inspire trust, have a long-range perspective and challenge the current state. A leader inspires with words, deeds and actions by involving everyone to

participate in delivering change and reduce fire-fighting in non-value-adding work, or waste in other words. (Hines et al., 2008: 11-12)

The third and final element below the water is *Behaviour and engagement.* The engagement of people is the essential goal of a Lean journey. It will essentially define the ultimate success of Lean. The steps of an engagement journey are described in Figure 22 below.

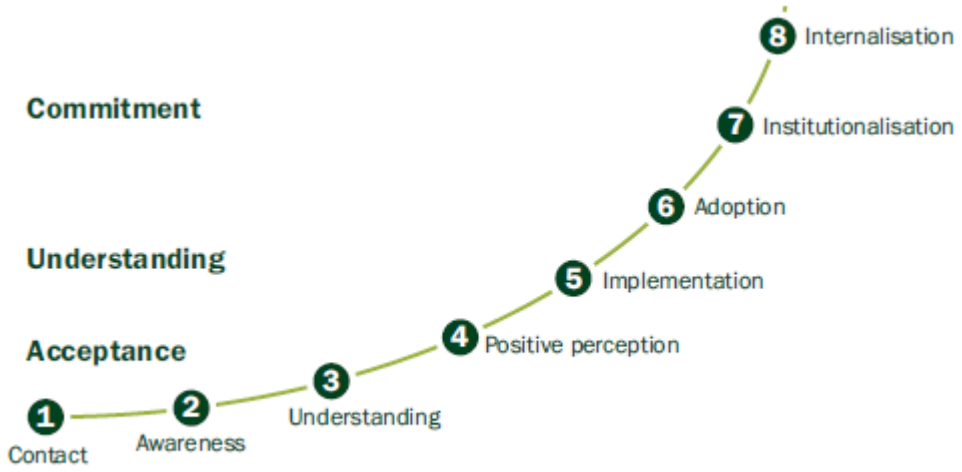



Figure 22: Lean Engagement Journey (Hines et al. 2008: 12)

The Lean engagement Journey steps described in Figure 22 highlight the role of communication where a well created and aligned strategy, combined with effective leadership can assist a great deal. These steps also reflect the eight steps of change model (Kotter, 2012: 19) presented in section 4.3.1.

The two visible aspects of Lean: Technology, tools and techniques and process management are seen most commonly in “Lean” organizations. They focus on visible changes to the process flow and waste elimination. However their role in sustaining Lean is secondary to the enabling factors of strategy and alignment, Leadership and especially affecting the behavior and engagement of the employees. (Hines et al., 2008:11-12).

## 4.4 Conceptual Framework for 5S Implementation Guideline Creation

The key findings from existing literature concerning Lean Principles, Leading and sustaining organizational change and 5S best practices are combined into a Conceptual Framework for an Implementation Guideline for 5S, illustrated in Figure 23 below.

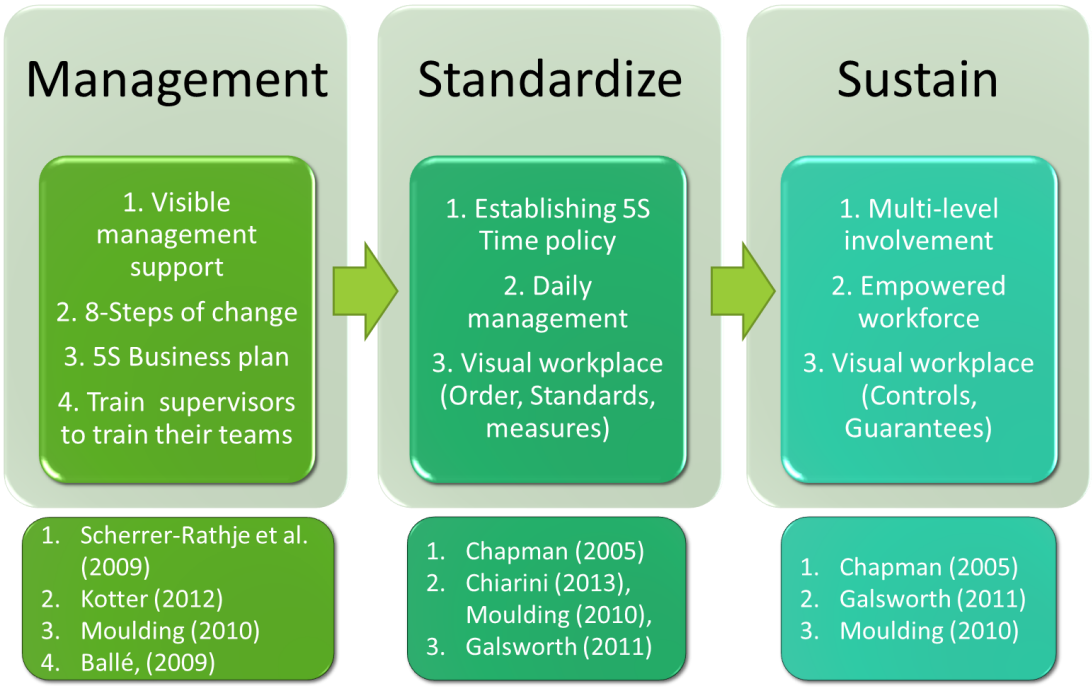



Figure 23: A Conceptual Framework for a 5S Implementation Guideline

As presented in Figure 23 above, the conceptual framework is built to address the key weakness areas identified as a result of the CSA section. The key focus areas are represented by the three main pillars, including selected best practice to support the proposal building for each of the main weakness area.

The first pillar addresses the key issues concerning unclear role of the area foremen in implementing 5S. In order to address these issues the importance of visible management support (Scherrer-Rathje et al. 2009), key aspects of change management and the 8-steps of change concept (Kotter, 2012), a 5S business plan (Moulding, 2010) as a practical tool to visualize and formalize 5S implementation and the understanding of a manager's role as a trainer (Ballé, 2009) are presented.

Subsequently also the two main pillars are built to address the key weaknesses identified in the CSA phase. The second pillar is used to address the key weaknesses discovered in the CSA considering inadequate focus on the Standardize phase. To pro-

vide the foundation for the Standardize phase of 5S, the concept of establishing the time policy (Chapman, 2005) is presented. A second key concept is to create rigorous and solid daily management routines to support standardizing 5S. Third supporting concept for the Standardize phase is to introduce the first three levels of the Visual Workplace model by Galsworth (2011) which will assist employees in all levels to adhere to the agreed standards as part of daily operations.

The third pillar focuses on introducing the best practice to address issues identified in the CSA phase concerning the Sustain phase of 5S. For this pillar, the lessons learned from existing 5S implementations in other industries are studied. The key concepts relevant for this study are the Multi-level involvement (Chapman, 2005) to create an empowered workforce (Galsworth, 2011) and to utilize the concepts of the Visual Workplace (Moulding, 2010) in support for the sustain phase of 5S implementation.

The conceptual framework will act as the foundation for building the proposal for a 5S implementation guideline. The building process of the 5S implementation guideline is described in detail in the following section.

# 5 Building Proposal for a 5S Implementation Guideline

This section incorporates the key findings of the current state analysis and the conceptual framework into an initial proposal of a 5S Implementation Guideline.

## 5.1 Overview of Proposal Building Stage

The business challenge behind this study was the unsatisfactory progress made during the first phase of the 5S implementation. Thus, the objective for this study is to create an Implementation Guideline for 5S to ensure a harmonized and efficient implementation across all areas in the next phases of implementation. The implementation guideline proposal combines the key elements identified during the CSA, Conceptual framework and the proposal building workshops.

In order to secure alignment with daily operations, the elements for the initial proposal of a 5S implementation guideline are discussed together with four key colleagues in production and packaging departments of the case company. In the first part of proposal building, data concerning key ideas to be included in the 5S implementation guideline is collected from the key stakeholders in a workshop session and used as the source material highlighting key focus areas to be included in the proposal. This qualitative data from the workshop forms the second round of data collection for this study.

In the second part of proposal building the initial version of the 5S implementation guideline is created based on the CSA findings, conceptual framework and ideas co-created during the proposal workshop. Foundation for the proposal is the conceptual framework, which was introduced in section 4.4. The conceptual framework combines best practice concerning 5S implementation such as the Visual Workplace (Galsworth, 2011) and relevant key theories in change management concerning initiating and sustaining change such as the 8-step model of Change (Kotter 2012). The existing knowledge is adjusted for the operational environment of the case company and utilized in building the initial proposal for a 5S implementation guideline most suitable for the operating environment.

In the third part, the initial proposal is presented to the key stakeholders for first round of feedback. The feedback from the key persons using the 5S implementation guideline will be incorporated into the final version, as they are the internal customers using the

document. The finalized initial proposal will then be taken to validation by the site management, which is discussed in section 6.

## 5.2 Co-Creating Proposal for 5S Implementation Guideline – Data 2

The proposal addresses key findings from the current state analysis and is supported by the best practice presented in the conceptual framework. After the proposal is built, it is presented to the site management for final feedback and validation.

As described during the current state analysis (section 3) of this study, the case company has already started the 5S implementation phase 1, but the results and progress so far have been unsatisfactory. Thus the focus in the proposal building is to tackle the key issues identified during the CSA which are causing the implementation to lack progress. The most critical weaknesses described in section 3.4.2 based on the CSA findings were the unclear role of middle-management and missing tools and support for the critical Standardize and Sustain phases of 5S. These identified weaknesses pose a serious threat to overall continuation of the 5S implementation and need to be critically addressed. Thus, these three key issues are selected as the focus areas to be specifically addressed in the proposal. In addition to addressing the identified key issues, the 5S Implementation Guideline must cover all the areas of 5S implementation in order to serve as a supporting document also in the following phases of the 5S implementation in other areas and functions.

The proposal workshop was held in April 2017 with two main goals. The first goal was to introduce the CSA overview from 5S implementation phase 1 to the involved colleagues in order to share the lessons learned from the 5S areas worked on in Phase 1 of implementation. The second and main goal was to collect and co-create the key ideas that should be included in a 5S implementation guideline. The participants of the workshop and their roles in the organization in the 5S implementation are presented in Table 14 below. The agenda and field notes from the workshop are recorded in full detail in Appendix 4.

Table 14: Participants of Proposal Building Workshop (Data Collection 2)

| **Respondent, Data 2** | **Organizational Role** | **5S Role** |
|---|---|---|
| **R**(espondent) **1** | Production Manager | Dep. manager, area owner |
| R2 | Development engineer | Lean Navigator, coordinator |
| R3 | Production foreman | Area foreman |
| R7 | Packaging foreman substitute / Shift leader | Area foreman / 5S area responsible |
| Researcher | Packaging area manager | Lean Navigator & dep. manager |

As shown in Table 14, the participants represent the key positions in the areas of the first phase of 5S implementation. They will also have a significant role in the following phases of implementation as they are responsible for the majority of total number of areas to be covered by 5S.

*Management*

First, the key ideas on how to improve and clarify the management aspects were categorized. Most importantly the role of management was commonly seen to be an actively visible owner of the 5S method and to set the example and new level of demand. The critical role for management was seen to assign responsibilities for physical areas and then focus on delegating the actions, so that the additional time needed for the first actions is spread evenly in the organization. During the proposal workshop Respondent 1 (Production manager) emphasized the importance of delegating actions in the predefined areas in order to broaden the basis for implementation in the following way:

> We will begin driving this onwards in the shifts where the area responsible persons with the most experience happen to be. They will first gain experience more rapidly and later start training the next level of new 5S trainers onwards. (Respondent 1, production manager)

This supports the principles of “Train the trainer” concept by Ballé (2009), as presented in section 4.2.3 earlier. The ideas collected under the topic “Management” highlight the necessity of the managers to be focusing on the *right things*, instead of just *doing things right*. During the discussion, it was also seen critical that the time reservation is clearly communicated by management and distinguished between the first “3S Blitz” and the time needed afterwards to repeat the daily Standardize and Sustain actions. As a summary, the key focus of both department managers and area foremen was seen to be on creating the urgency, finding the right people to drive change forward

and visibly setting example and ensuring the new standards level are reached and developed.

*Standardize*

For the standardize issue, the ideas to be incorporated were more concrete and very directly applicable into a guideline. The demand for supporting checklists and support for issues such as which actions should be considered to be standardized were clearly needed. Also clear standards for the time reservation, especially concerning how the time and effort is split between making production and 5S efforts, was seen important. One of the weaknesses identified already in the CSA phases was the purchasing of new equipment and smaller storage solutions. For this topic, specific lists for standard suppliers and sources were requested. It was also brought forward during the workshop that it could be beneficial to make 5S familiar by utilizing already existing systems and tools:

> To standardize and sustain phases, it could be beneficial to use the already existing tools and systems. Could e.g. the checklist for 5S actions be included in the shift log book (konepäiväkirja) to make the 5S steps part of the daily routine. (Respondent 7, Packaging area foreman substitute / Shift leader)

This kind of ideas and findings which are directly in relation to the daily operations are very valuable and emphasize the importance of co-creating ideas with the future internal customers of the guideline.

*Sustain*

The third main focus area was about the Sustain phase, which is the critical measure for long term sustainability of 5S as part of daily operations. As mentioned above, also for the sustain phase it was seen important to try to find support for the 5S implementation from the already existing tools and practices. In this context, it was mentioned that the already executed SHEQ (Safety, Health, Environment, and Quality) walks called “TUTTAVA” rounds could be combined with the actions from the 5S Sustain phase. This would help to avoid creating an additional burden to the organization in the form of entirely new processes, but instead 5S could be introduced into already existing routines by slightly altering the existing instructions. For the communication and feedback system on the other hand, new ideas in the form of tools and best practice was seen

necessary to be mentioned in the guideline. Concerning communication and knowledge sharing there was a valid proposal raised during the workshop, as follows:

> 5S area responsible persons should have a common forum for sharing best practice, ideas and talk about faced challenges from their respective areas. (Respondent 2, Lean Navigator)

Both cross-functional communication and knowledge sharing are critical aspects considering building an *empowered workforce* which can sustain and continuously improve 5S in the long term. To support the concept of *empowered workforce,* another idea was raised, which underlines the role of the operators who are the actual specialists in their own areas. The following quote rounds up the essence of the Sustain phase:

> The development and continuous improvement ideas should eventually be coming from the operators, who should independently execute the easy, smaller improvements. (Respondent 7, Packaging area foreman substitute / Shift leader)

The above quoted ideas from the proposal building workshop were highlighted as they support the key purpose of Sustain phase, making 5S a permanent part of daily work. The key ideas provided during the proposal building workshop are condensed into Table 15 below.

Table 15: Summary from Data collection 2 (Proposal Building Workshop, April 2017)

| Management | Standardize | Sustain |
|---|---|---|
| Set example, be visible in areas. Focus on ensuring engagement and commitment (R3) | Clear checklist template on what needs to be considered in the standardize phase (R1, R3) | Incorporate 5S with existing SHEQ walks (TUTTAVA). (R1) |
| 3S blitz + Regular time reservation for Standardize and Sustain (R7) | Time reservation to be communicated by Dep. Managers (R1) | Provide ideas for a feedback and communication system (R1) |
| Management to delegate area responsibilities (R1) | Standardize regular purchases. Sources and technical execution. (R2,R3,R7) | Create a platform or forum for sharing ideas between areas. (R2) |
| | Utilize already existing tools to develop routines. (R7) | Empower operators to provide continuous improvements (R7) |

These key ideas presented above will be incorporated into the first proposal for 5S Implementation Guideline, presented in the following section. The fit between the weak-

nesses identified as the result of CSA, the existing best practice identified in the conceptual framework and the key ideas collected during the proposal building phase are combined into a summary presented in Figure 25 below.

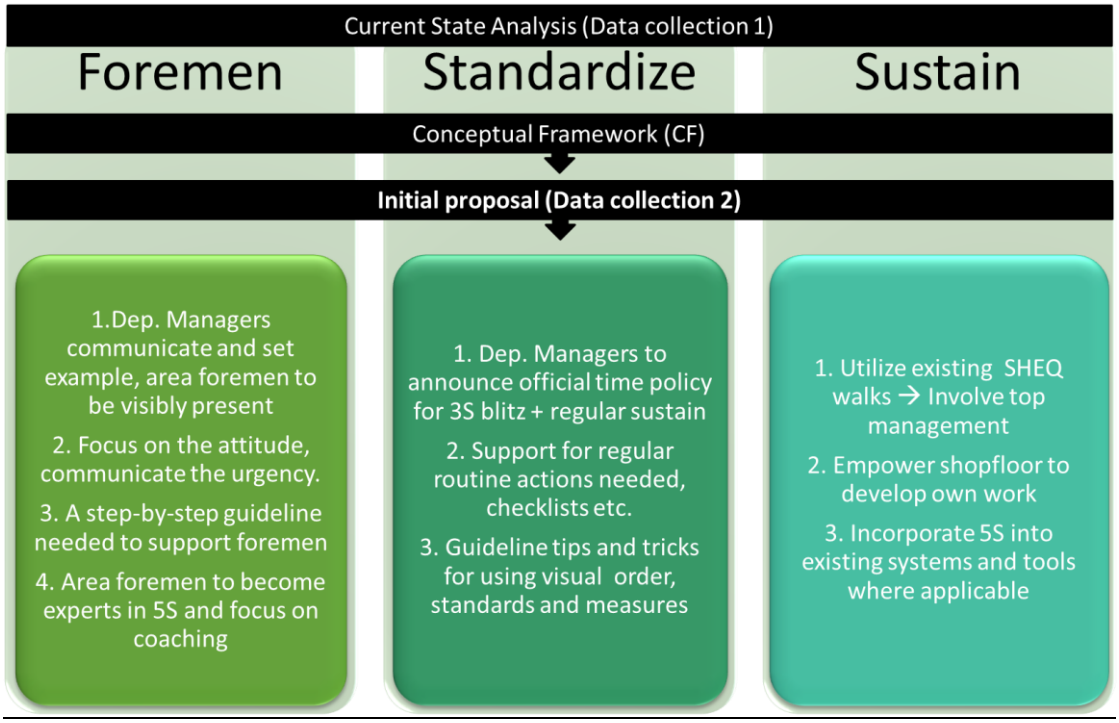



Figure 24: Connection of CSA, CF and Initial Proposal

As shown in Figure 25 above, the key issues concerning Management, Standardize and Sustain form the three main categories most urgently requiring solutions. The conceptual framework in the second layer addresses the key topic areas by providing specific existing knowledge and models to be adjusted into solutions whereas the bottom layer consists of the ideas co-created during the proposal workshop. These layers are incorporated into the first proposal for a 5S Implementation Guideline. The structure and logic of the Implementation Guideline proposal are presented in the next subsection.

## 5.3 Proposal for 5S Implementation Guideline

The proposal for 5S implementation guideline is built on the basis of solving key weaknesses and incorporating strengths identified in the current state analysis. Existing best practice is studied and combined into the conceptual framework which supports the proposal creation. The third element of proposal building is the co-creation of ideas together with key stakeholders of the 5S implementation in production and packaging

areas of case company during a proposal building workshop. The purpose of the guideline is to work as a supporting step-by-step guideline for managers and area responsible persons who will be implementing 5S in their respective areas in the following phases of implementation and ensure an efficient and harmonized approach across all areas.

The general structure and the contents of the 5S Guideline are condensed into Table 16 below.

Table 16: Structure and main content of the 5S Implementation Guideline

| Chapter in 5S Guideline | Purpose of section | Findings CSA | Key aspects from CF |
|---|---|---|---|
| 1. Introduction | Provide 5S background, purpose, goal, benefits, roles, change theory | | Change management, 5S principles |
| 2. Implementation checklist | Standard checklist to support foreman work | Foremen feel uncertain of role, missing tools | Standardized daily management routines |
| 3. 5S Preparations | Preparatory tasks to ensure smooth start | Key persons missing, time reservation unclear | Sustainable Lean Iceberg model, Time policy |
| 4. 5S Training | Ensure basic principles for 5S are understood | Training materials worked well | Sustainable Lean Iceberg model |
| 5. 5S Photo logistics | Record the visual baseline and agree on photo logistics | Missing methods for follow-up | Visual workplace |
| 6. 5S Area selection | Create visual boundaries for area selection | Area selection unclear | Visual workplace |
| 7. 5S Area Checklist | Prepare and modify checklists per each area | | Standardized daily management |
| 8. 5S Steps | Step-By-Step guide for the 5S actions | | Standardized daily management |
| 8.1 Sort | Red-tagging, Quarantine area | | 5S Best Practice |
| 8.2 Set In Order | Visual systems (Outlining, Labeling, Shadow Boards) | Purchasing: sources and technical execution | 5S Best Practice, Visual Workplace |
| 8.3 Shine | Visual and Physical checks for cleaning and inspection | | 5S Best Practice, Visual Workplace |
| 8.4 Standardize | Agreeing on the procedures for repeating 3S steps. | No efforts done for standardize | 5S Best Practice, Daily management |
| 8.5 Sustain | Defining the principles on how to sustain, based on discipline of both the team and individuals. | No efforts done for sustain | 5S Best Practice, Management visibility, daily management |
| 9. Visualize and measure results | Create routines to record and demonstrate progress in work areas | No measures agreed | 5S Best Practice, Visual management |

The 5S Implementation Guideline is built into a MS Word –document to allow flexible modification, update and sharing across all functions. The document is stored into the M-files document management system, to allow version tracking and accessibility for all employees in both sites of the case company. In order to ensure widest possible usability for the document, the guideline is written in Finnish, which is the local language of the case company.

The structure of the guideline document proceeds logically starting from general topics such as introduction and 5S principles and continues onto further details. The first chapter acts as the introduction for the 5S principles and clarifies the purpose and method of using the guideline. In the introduction, the proposed implementation roles and responsibilities are introduced and the concept of PDCA (Plan, Do, Check, Act) is presented to be utilized throughout the guideline. As part of the introduction the key prerequisites for change are presented (The will to change, necessity of time reservation and tools). As the tools, the 8-steps of change by Kotter (2012) is provided as a reference to be followed and adjusted during the 5S implementation.

The second part of the guideline includes Chapter s 2-7. These chapters focus on the preplanning phase where the necessary arrangements and preparations are made in order for the actual 5S actions to be executed as efficiently as possible. The chapters 2-7 consist of a general checklist for the implementation actions, step-by-step guide for the preparatory tasks, help for organizing the 5S overview training, guiding principles for the 5S photo logistics as part of the Visual Workplace principles, as well as the Area Checklist to provide foremen with a way of creating a standardized baseline to measure the following 5S actions against. Especially this part of the guideline aims to provide the foremen and area responsible persons with a clear set of instructions per each area to consider while progressing towards start of the 5S actions. With the document the foremen are given a support to which they can draw ideas from in case of having doubts or uncertainty on how to proceed. As a summary, Chapter s 2-7 focus on building the foundation for standardized daily management principles, supported by visual management tools.

Chapter 8 includes the actual 5S phases. In this chapter, the details for of each 5S step; Sort, Set in Order, Shine, Standardize and Sustain are introduced and provided with instructions on what to pay attention to and how to make sure the steps are executed rigorously and according to similar standards in all areas. It is highlighted in the guideline, that the purpose is not to offer a ready-made solution for 5S that can be di-

rectly implemented “as is” in all areas and environments. However there are many elements and common standards that can be utilized independent of the area or function that 5S is implemented in. These company level standards are paid attention to and introduced in the guideline with the goal of reaching a harmonized way of executing 5S throughout the company.

The actions instructed in Chapters 8.1 to 8.3 present the actions needed to execute the concrete 3S steps. 3S steps are presented in a systematic way and focus on immediate documentation of the agreements, which will later simplify and smoothen the execution in the phases of standardize and sustain. During the 3S sections, pictures from existing best practice and concepts identified during the proposal building workshop are incorporated into the guideline in the form of specifying comments and checklists supporting a harmonized approach.

The phases of standardize and sustain are presented respectively in chapters 8.4 and 8.5 of the 5S implementation guideline.

*Standardize*

Chapter 8.4 focuses on providing managers and foremen the tools to support creation of daily management practices for 5S. In the standardize phase the goal is to evaluate the actions taken so far and formulate the best practice identified into agreed written standards for the work area in question. Many of the actions taken are already provided in the preparatory chapters or are written down as they have been executed during the 3S steps during chapters 8.1 to 8.3 of the guideline. In this section the guideline supports the team to review the already executed practices and identify practices working best for the area and team in question. Checklists with additional questions to consider are offered to ensure a standard approach in case something has not been executed thoroughly enough first time around. The main part of the guideline focuses on making sure the agreements for repeating the 3S steps have been made explicitly and communicated visually in the area so that each team member is aware of the standard procedures for repeating and developing 5S.

*Sustain*

Chapter 8.5 concludes the last step, Sustain. This chapter in the guideline focuses first on evaluating the internal motivation and discipline of the organization to work accord-

ing to standards created in previous phases. The evaluation is done both on team level as well as individuals. The purpose of this segment is to evaluate how well the standards that have been created and written down during the previous 5S phases are actually rooted in the daily operations. For this purpose the guideline offers a standardized step by step method in the form of a checklist for evaluating the discipline and identifying the areas for improvement. The individual evaluation of 5S sustain focuses on the evaluation of the own working area of each employee individually. This portion targets to provide methods for self-reflection and creating a sense that each individual with their own thinking and example is a part of affecting the wider atmosphere and eventually affecting the success of the Sustain phase.

Last Chapter 9 of the guideline, “Visualize and measure results”, supports and links directly to the Sustain phase. This chapter provides guidance for creating measurements and agreeing on the principles for following up on how the status in the areas is developing. The follow-up practices are based on repeating the practices and evaluations already done on the earlier phases, thus supporting the sustenance of standardized daily management routines. In this section, the emphasis is on the agreeing on the type of measurements used to follow the progress of 5S, but also setting the standards for continuous improvement by agreeing collectively on the target levels for improvement after each evaluation is done. This is a critical aspect in sustaining the 5S in the long term as the concept requires a continuous process to plan and test solutions, analyze results and correct where needed.

As mentioned earlier, the multi-level involvement is one of the key aspects in a successful 5S implementation. Thus the validation of the 5S implementation guideline is done together with the site management. Thus, the following section presents the validation process for the 5S implementation guide proposal.

# 6 Validation of the 5S Implementation Guideline

This section focuses on presenting the measures taken to ensure that the co-created proposal actually fits the needs and requirements of the case company by validating it together with site management. The validation process including management feedback and the resulting validated 5S implementation guideline are presented.

## 6.1 Overview of Validation Phase

In order to validate the co-created contents, the initial proposal for a 5S implementation guideline was presented to the key stakeholders of the Site in the Site Management Team meeting in April 2017. The site management team meeting was chosen as the forum for validation as the owners and key drivers are participating the meeting as the regular participants. The co-created proposal was presented to the site management team for feedback and validation. After this, the received feedback and ideas for development were incorporated into the validated 5S implementation guideline document.

## 6.2 Validating the proposal for 5S Implementation Guideline

For the co-creation of the ideas for the proposal, key personnel in the operational functions of the organization were involved. For the validation however, the acceptance and support from the management level was necessary. Thus, for the validation the site management meeting was seen as the appropriate forum, as it already consists of the key stakeholders accountable for results of the departments and supporting functions. The members of the site management team meeting are presented in Appendix 5.

As seen from Appendix 5, the members of the meeting represent the owner levels accountable for the areas of the phase 1 and 2 of the 5S implementation as defined in the roadmap for 5S implementation described earlier in Figure 4. These members have the decision making authority in their respective areas and thus form the key stakeholders to drive the 5S implementation forward. It was also seen as an important aspect to gain the site management approval and input, as they need to demonstrate and communicate urgency for commitment in making the 5S as part of the daily operations.

There was a 30 minute slot prepared from the agenda of the site management meeting, which was used to introduce the contents of the initial proposal for the 5S imple-

mentation guideline. The purpose was to get feedback and identify areas where development is needed and eventually reach validation to publish and officially communicate the guideline onward to the organization.

Key findings of the feedback received during the site management meeting are condensed into Table 18 below.

**Table 17: Validation feedback from Site Management Meeting**

| Feedback type | Feedback by | Comments | Chapter of the guideline document |
|---|---|---|---|
| Development | Head of SHEQ | Align with company color standards in hygiene areas | 8.2 Set in Order |
| Development | Head of SHEQ | Incorporate 5S sustain / measurement principles with SHEQ (TUTTAVA) rounds | 9. Visualize and measure results |
| Development | Site Manager | Condense guideline by using even more pictures and visual examples. | All |
| Positive | Production Manager | Tested guideline proposal in Production Control Room, seems to work well! | 8.4 Standardize |
| Positive | Site Manager | This is a good start to proceed with Later we should continuously improve based on feedback during the next phases | All |

As seen from Table 18 above, there were comments for both developments and things that were seen as positive in the proposal. The developments are considered and incorporated into the final proposal for 5S implementation guideline. The main feedback was that the guideline was approved and can be communicated further as a central tool to help support the overall 5S implementation in the next phases, eventually in all areas of the company. The validated proposal for 5S implementation guideline including the development ideas from the Site management meeting is presented in the following subsection.

## 6.3 Summary of Final Proposal for 5S Implementation Guideline

The final proposal for the 5S implementation guideline is the result of findings from data collection from several stakeholders on many different levels of the case company or-

ganization. In addition, the key findings from best practice on 5S implementation is used to provide existing knowledge to support the managerial work, and the critical phases of standardize and sustain. The comments from the validation session with site management are incorporated and the final version of the proposal, which has been agreed to be used as official support document for the 5S implementation. The structure of the validated 5S implementation guideline document with chapters and overview of the content is presented in figure 19 below.

Table 18: Structure of the validated 5S Implementation Guideline

| Chapter in 5S Guideline (pages) | Purpose of section | Developments from validation session with Site Management |
|---|---|---|
| 1. Introduction (2-5) | 5S Guideline Introduction, create urgency for change | |
| 2. Checklist (6) | Standard checklist to support foreman work | |
| 3. 5S Preparations (7-14) | Ensure preplanning tasks, affect behavior and ensure engagement from personnel | |
| 4. 5S Training (14) | Communicate 5S principles, align with company strategy and targets | |
| 5. 5S Photo logistics (14) | Create visual management baseline | |
| 6. 5S Area selection (15) | Delegate responsibilities | |
| 7. 5S Area Checklist (17) | Create foundation for standard work | |
| 8. 5S Steps (18-34) | Step-By-Step guide for the 5S actions | |
| 8.1 Sort (18-21) | Red-tagging, Quarantine area | |
| 8.2 Set In Order (22-29) | Visual systems (Outlining, Labeling, Shadow Boards). | Color coding standards for hygiene areas. |
| 8.3 Shine (30) | Visual and Physical checks for cleaning and inspection | |
| 8.4 Standardize (31-32) | Create standards for repeating 3S steps. Reach joint agreements on above topics. | Emphasize existing company standards and tools (e.g SHEQ walks). |
| 8.5 Sustain (33-35) | Principles and actions for Sustain, based on discipline | Connect to principles of existing SHEQ walks (TUTTAVA) |
| 9. Visualize and measure results (38-39) | Create routines to record and demonstrate progress in work areas . | Incorporate measurements with existing SHEQ walks (TUTTAVA) |

As seen from Table 18 above, based on the feedback received during the validation session, there were no major changes seen necessary to the overall structure and logic of the guideline. However, there were a few developments identified, mostly concerning the integration with already existing company internal SHEQ standards and procedures, such as the color coding and TUTTAVA walks. These developments were directly incorporated in to the guideline as part of the existing chapters they relate to.

One of the identified developments needed during the validation process was to connect the 5S visual management principles to the already existing color standard document. The mention of the was added as part of Chapter 8.2.3 focusing on the 5S step Set in order. It complements the visual management principles and ideas of standardization by connecting the 5S into the already created color standard.

Another main discussion point during the validation was to emphasize connection to already existing tools and principles. One of these mentioned was to align the sustain phase of 5S as part of the already existing TUTTAVA –rounds. TUTTAVA rounds are already used to evaluate the work safety, product safety and visual appearance of the organization. It was identified that these areas could be well incorporated with the 5S principles, which provide a systematic definition and standard for evaluating the status of areas. Thus, a new section 9.2 was included to demonstrate the natural fit of the TUTTAVA rounds as part of measuring the results of 5S. In this section the standards for evaluating the results were also defined explicitly to fit both the TUTTAVA and 5S principles.

The final, validated version of the 5S implementation guideline consists of a total of 40 pages and was stored in the document management system M-files to be available for all of the case company employees without restrictions. The cover page and table of contents are included in Appendix 6.

# 7 Discussion and Conclusions

In this final section, first the structure and findings of the thesis are summarized. In the second subsection suggestions for next steps are presented. Third subsection evaluates the validity and reliability of this study and last the closing words are provided to close off the study.

## 7.1 Executive Summary

The objective of this study was to create a detailed implementation guideline for workplace organization according to Lean 5S principles. The case company of this study had no previous experience in Lean and support for the already started implementation of 5S was critically needed. Based on findings of the first phase of 5S implementation it was seen that the chosen approach was not delivering expected results due to unclear roles and missing competences in key areas. In order to ensure efficient progress and avoid further waste of time and resources in following phases of implementation, the key elements needed to better support the 5S implementation were analysed, defined and incorporated into the guideline document.

In order to analyse the starting point, a current state analysis (CSA) of the first phase of 5S implementation was conducted. During the CSA qualitative data was collected by conducting interviews with key stakeholders of the first phase of 5S implementation. In order to receive a holistic view, also existing case company 5S project documentation was examined. As a result of the CSA phase, the key strengths and weaknesses of the first implementation phase were identified to be addressed in the implementation guideline. Based on the CSA findings, the existing best practice concerning 5S implementation phases of Standardize and Sustain were studied. Another area where existing knowledge was utilized was to provide clarification to role of middle management in change initiatives. Key concepts in aforementioned areas are combined into a conceptual framework that was used to ensure the theoretical grounding for the proposal building phase. In order to ensure practical fit to the case company, the initial proposal for a 5S implementation guideline was co-created together with key stakeholders in production and packaging areas. In the final phase, the proposal was validated by presenting and discussing the guideline document in the site management meeting.

The business benefits of this study are reached by creating the basis for a standardized implementation approach, which supports the creation, sustainability and continuous improvement of safe and efficient work environments. Previously no specific doc-

umentation existed to support the work of implementation teams. As one of the findings from the current state analysis it was identified that the managers and area foremen felt uncertain on how to continue implementation after the concrete 3S steps. As a result, the initial positive progress made was already seen to start to deteriorate after only weeks of the 3S actions. Based on the co-creation with the key stakeholders the 5S implementation guideline now addresses the key elements that were unclear in the first phase of implementation. In addition all the phases of a 5S implementation are covered by the implementation guideline, thus supporting progress in new areas.

The co-created guideline provides the managers and area foremen with a concrete document which can be used in different ways depending on the level of expertise in 5S methods. For an individual already familiar with 5S, the guideline can serve as a checklist to support implementation or as a collection of best practice. In the case of a novice in 5S methods, the guideline can provide support as a complete step-by-step 5S manual. The co-creation approach utilized during the thesis has already provided many of the stakeholders with more information on the 5S steps which were seen unclear in the first phase of implementation. Also the site management has been involved in the validation process which improves their awareness of the importance of their role as the drivers of the 5S implementation.

The guideline document is created as a general document without a specific department or function related restrictions in order to enable broadest possible utilization in all of the areas of the case company, including administrative functions and office spaces. The guideline document enables and supports the creation of a truly standardized 5S approach in the case company which will avoid waste of time and resources. Besides these directly measurable benefits, the guideline especially supports the daily management work of foremen so that they are better equipped for supporting and training employees in their own areas in aspects of 5S. This way all the levels of the organization can be empowered and engaged and thus sustain and continuously improve the workplace organization, efficiency and safety of their respective areas.

## 7.2 Recommendations for Next Steps

In this section recommendations (R) for next steps are presented based on the findings of this study.

### R1 – Continuous Improvement of Guideline

The topic of this study addresses an issue which will eventually affect all the functions and areas of the case company as the 5S implementation moves along. The outcome of the study is an implementation guideline document, which was co-created together with colleagues from the production and packaging departments. As the 5S implementation moves forward, it is vital to continuously develop the guideline document and revise it based on the feedback from each area. For every area where 5S is implemented, it would be beneficial to establish a *formal feedback session* including the department manager, area foremen, and the entire team that participated in the 5S actions. This session should be organized after each round of 5S actions to ensure sustainability and continuous development of the 5S method and to involve all participants to provide their ideas for development.

### R2 – Internal Marketing of the Guideline

Internal marketing of the 5S implementation guideline should be done throughout the company in all levels and as broadly as possible, e.g through the company intranet and the internal magazines. In addition to general information, the primary target group of internal marketing efforts should be the foremen responsible for the physical areas in all functions. For this purpose the existing meetings targeting foremen topics, such as the “Foreman forum” should be utilized to effectively and in a centralized manner promote the guideline and introduce its purpose, benefits and contents. In the foremen forums the top management could also stress the urgency of a standardized approach and support in maintaining urgency as the implementation moves along.

### R3 - 5S Communication plan with Top Management Perspective

As with all major change initiatives, a continuous, systematic and centralized communication plan for 5S by utilizing multiple channels will assist in keeping the initiative fresh in people’s minds. Management should actively emphasize the benefits through positive examples from the areas. It is vital to remind employees of the urgency of the ac-

tions and also publicly communicate and celebrate success stories to build positive momentum. This should be delivered preferably in the name of top management to keep the priority visibly high.

R4 – Nominating 5S Champions

Visible top-management commitment would benefit the long-term urgency of the 5S actions. It is advisable to nominate a “5S champion” from the local management team for each area where 5S is implemented. The 5S champion could occasionally participate in the area audits and communicate the importance of the actions just by visibly participating. It is critical to set the example and communicate urgency through all management levels.

R5 – Software Support for Documenting and Reporting 5S results

In order to assist the area foremen in documenting and communicating the 5S area results, analysis of investing into software to support these steps is suggested. By utilizing a database with in-built visualization tools the area responsible persons could focus on discussing and analyzing the results together with their teams, instead of using time for manually documenting and publishing information to areas. However, the manual documentation is easy and flexible to establish in the first phase and the software support is only relevant after the 5S methods have been established as part of daily routine.

## 7.3 Thesis Evaluation

This section first evaluates the results of the thesis against the original objective and how well the the thesis solves the business challenge it inteded to solve. After this a reflection against the reliability and validity plan presented in section 2.4 is made.

### 7.3.1 Objective and Outcome

The objective of this thesis was to create a detailed implementation guideline for 5S. As an outcome of this thesis, the detailed implementation guideline for 5S was co-created with the key stakeholders and validated with site management. The resulting guideline document is ready to be taken in to use immediately. However, effective utilization of the document requires a centralized communication to foremen and an introduction on

the elements and purpose of the guideline document as each area proceeds with the implementation. These elements were not in scope of the study, and thus it can be concluded that the originally defined objective and outcome of this study have been achieved. The study provides the case company with a detailed implementation guideline for 5S ensuring a harmonized and standardized approach for the implementation.

### 7.3.2 Reliability and Validity

Section 2.4 discussed the reliability and validity plan of this study and first the two aspects of validity were presented. The internal validity of this study was ensured through the three rounds of data collection according to the research design. First employees from different levels of the organization were asked to provide their experiences from the first phase of 5S implementation. Second, the initial proposal was co-created again with a selection of employees ranging from the department management to the operator level. In the third round of data collection the site management team participated in the validation of the proposal in an open discussion. The validity of the study could have been further enhanced by using a wider base of employees for the CSA phase. The selected amount of respondents was seen to be adequate as saturation in the feedback was identified. The strength of the validation of the proposal could have been enhanced by executing a test implementation in a selected area where the functionality of the guideline could be more thoroughly tested. Now the validation was done on a weaker level, by validating the concept in a site management team session.

The objective of this study was to solve a company specific issue, which required a customized approach and solution for this specific context. In this study, the collection of qualitative data was done based on practical experiences of a small group within the specific company context and culture. Thus, the results of the study are not suitable for broader generalizations as such. However, the aspect of external validity is considered in the research design when building the research design and the conceptual framework of the study and many individual elements can be generalized. However, creating a general theory or solution was not the intention of this study.

*Reliability* evaluates whether the same findings would be obtained if the research is repeated. In this study multiple methods were used in order to ensure Reliability. Triangulation of data was ensured by utilizing multiple informants on different levels of the organization and different functions as sources for data. Triangulation of data collection

methods was done by using a variety of methods including interviews, workshops and observation and by scrutinizing existing company internal documentation to collect data from different sources. Finally, to ensure the quality of the proposed solution, the data collection was done at different points in time. The results of data collection methods are presented transparently including field notes and other relevant data, included as appendices of this study to ensure an audit trail that ensures that the same results could be replicated as befits the definition of reliability of research.

In addition to validity and reliability, other research quality criteria can also be ensured, especially such as logic and relevance. Logic can be defined as a "cause-and-effect explanation of an action, decision, event, phenomenon, or solution" (Businessdictionary, 2017). Different aspects of validity and reliability need to be considered against, for example, the *Logic* of chosen research approach which in this study is Action Research.

The conscious and deliberate consideration of *the logic* behind these phases of action research cycle is presented as the basis of the research design also in this study. Following the research design, the sections of the study are logically built upon the findings made in the previous section. CSA findings highlight the key issues to be solved, for which the CF phase provides support in the form of existing knowledge discovered by studying relevant literature. Based on the support acquired from existing knowledge an initial proposal is built to address the key issues. Logically, the proposal is evaluated, and management feedback is incorporated into the final proposal forming a coherent and logical study.

*Relevance* of the study needs to be assessed against how well the study is connected with and important to the case company in this context. The outcome of the study is a concrete solution to support solving the business challenge presented by the company steering group. Thus the outcome in the form of a detailed implementation guideline for 5S offers a relevant, practical and immediately applicable solution for the case company which can be multiplied and used in all of the implementation phases and in both of the two sites of the case company.

Finally, the bias of the researcher and the selected reference materials was a key aspect to consider, as the researcher of this study was holding a duplicate role as both the coordinator of the 5S implementation project and the researcher in the study. The effect of researcher bias was mitigated by stating the role of the researcher as part of

the project team and controlled by using the same questions for each respondent during Data collections 1-3. The effect of the bias was minimized also by audio recording the interviews and transparently presenting the field notes for confirmation with each respondent.

## 7.4 Closing Words

This study aimed in solving a practical and urgent issue identified by the case company during the first phase of its Lean transformation. The outcome helps the company immediately by providing a concrete document that ensures a standardized approach across all areas of the company, thus saving time and effort in the implementation phase. Even more importantly the outcome of the study helps the case company by providing a clear set of tools and actions needed to ensure that the 5S method can be sustained and continuously developed. In the near future, the case company plans on continuing on implementing the Lean ideology for which the 5S provides a solid foundation. The results of this study can also be utilized as a reference for implementation documentation in other types of projects affecting the daily management processes.

The greater benefit of this study can be found from affecting the mind-set of the people who participated in the process and the users who will utilize the 5S guideline in the future. The approach of the study has involved many people and helped them participate in a co-creative and collaborative way by respecting people and working towards a mentality of continuous improvement. This is a foundation to build a truly Lean operation upon, and the first bricks have been laid on a never-ending path of striving to perfection.

## References


Ahlstrom, J. (2010). Smart Talk: Leverage Lean's 5S, HME News, vol. 16, no. 7, pp. 14.

Atkinson, P. (2012). OD strategies: Installing a Lean and Continuous Improvement Culture. *Management Services*. Winter, pp. 12-17.

Ballé, M. (2009). 5S Again and Again and Again. Available from: https://www.lean.org/balle/DisplayObject.cfm?o=1109. (Accessed Mar 16, 2017).

Blichfeldt, B.S., Andersen, J. R. (2006). Creating a wider audience for action research: Learning from case-study research. *Journal of Research Practice*. Vol. 2 (1), Article D2. [Online] http://jrp.icaap.org/index.php/jrp/article/view/23/43. Accessed Feb 2, 2017.

BusinessDictionary.com. *Logic*. WebFinance, Inc. http://www.businessdictionary.com/definition/logic.html (Accessed: April 07, 2017).

Case Company (2016a). “Lean organization in Finland”: Case company presentation 20161123_Lean update Finland. Accessed 19.2.2017.

Case Company (2016b). “Lean Projects in Finland”: Case company presentation 20161123_Lean update Finland. Accessed 19.2.2017.

Case Company (2016c). “Overview of Lean 5S project”: Case company presentation 5S - Suomi_DRAFT (ID 50234).pptx, slide 3. Accessed 19.2.2017.

Case Company (2016d). “5S Implementation Roadmap”: Case company presentation 20161123_Lean update Finland. Accessed 19.2.2017.

Chiarini, A. (2013). Lean Organization: from the Tools of the Toyota Production System to Lean Office. *Perspectives in Business Culture*, Vol. 3. Available from:

http://link.springer.com.ezproxy.metropolia.fi/content/pdf/10.1007%2F978-88-470-2510-3.pdf. Accessed 20 November 2016.

Chapman, C.D. (2005). Clean House With Lean 5S. *Quality Progress. V*ol. 38 (6), pp. 27-32.

Fast, L. (2016). How to Create a Culture to Sustain 5S. Available from: http://www.industryweek.com/how-create-culture-sustain-5s. (Accessed 20 November 2016.)

Galsworth, G. (2011). The Visual Workplace. *Printing Industries of America.* Vol.3 (2), pp.14-16,20.

Galsworth, G. (2004). The Value of Vision. *Industrial Engineer*: Vol. 36 (8), pp. 44-49.

Kattman, B., Corbin, T.P, Moore, L.E., Walsh L. (2012). Visual Workplace Practices positively impact business processes. *Benchmarking: An International Journal*. Vol 19 (3), pp. 412-430.

Kotter, J.P (2012). *Leading Change – With a New Preface by the Author*. First edition. Boston Massachusetts: Harvard Business Review Press.

Lean Enterprise Institute (2017). "Muda-Mura-Muri". Available from: https://www.lean.org/lexicon/muda-mura-muri. Accessed 25.3.2017.

McKay, J., & Marshall, P. (2001). The Dual imperatives of Action Research. *Information Technology and People. 14*(1), pp. 46-53.

Macmillandictionary.com. *Relevancy*. Macmillan Publishers Limited 2009–2017. http://www.macmillandictionary.com/dictionary/british/relevance (Accessed Apr 13, 2017)

Moulding, E. (2010). 5S, *A Visual Control System for the Workplace*.Authorhouse UK Ltd, Central Milton Keynes.

Näslund, D., Kale, R. and Paulraj, A. (2010). Action Research in Supply Chain Management — A Framework for Relevant and Rigorous Research. *Journal of Business Logistics*. Vol. 31 (2), 331-355.

Ohno, T. (1988). *The Toyota Production System: Beyond Large-scale Production*. Portland, OR: Productivity Press.

PwC (2016). “19th Annual Global CEO Survey: Industrial manufacturing key findings” PriceWaterhouseCoopers. Available from: http://www.pwc.com/gx/en/ceo-survey/2016/industry-focus/industrial-manufacturing-key-findings-global-ceo-survey-2016.pdf. Accessed 20 November 2016.

Quinton, S. and Smallbone, T. (2006). *Postgraduate Research in Business: A Critical Guide*. London: Sage Publications Ltd.

Scherrer-Rahtje, M., Boyle, T.A., Deflorin, P. (2009). ”Lean, take two! Relfections from the second attempt at lean implementation”. *Business Horizons.* Vol. 52, pp. 79-88.

Sitra (2016). *Megatrends 2016*. Available from: https://www.sitra.fi/julkaisut/Muut/Megatrends_2016.pdf. Accessed 20 November 2016.

Torkkola, S. (2015). *Lean Asiantuntijatyön johtamisessa*. Helsinki: Talentum Pro.

Von Der Linn, B. (2009). “Overview of GE’s Change Acceleration Process (CAP)”. Available from: https://bvonderlinn.wordpress.com/2009/01/25/overview-of-ges-change-acceleration-process-cap/. Accessed 2.4.2017.

Womack, J. P.& Jones D.T (2003). *Lean Thinking*. New York: Free Press.

Womack, J.P, Jones D.T, Roos, D. (1990). *The Machine that Changed the World*. New York: Free Press.

# Appendix 1 - Data Collection 1, Interview questions

| Questions | Kysymys FI | Kysymys EN |
|---|---|---|
| 1 | Kuinka valmistautuminen 5S pilottiin eteni? | How were you prepared for the 5S pilot area operations? |
| 2 | Oliko sinulla riittävä tietämys 5S perusteista ennen aloitusta? | Did you have sufficient information before starting 5S actions? |
| 3 | Mikä meni hyvin ensimmäisessä 5S kohteessa? | What was successful in the 5S pilot area? |
| 4 | Mikä ei sujunut hyvin ensimmäisessä 5S kohteessa? | What was not successful in the 5S pilot area? |
| 5 | Mitä tekisit toisin seuraavalla kerralla? | What would you do differently in the next area? |
| 6 | Mitä mieltä olit koulutusmateriaaleista? | What were your thoughts on the training materials used? |
| 7 | Mihin materiaalissa tulisi kiinnittää enemmän huomiota? | Where should in the training materials should be more focused on? |
| 8 | Kuinka ensimmäisen 5S kohteen siisteys ja järjestys on säilynyt? Hyvin vai huonosti? Miksi ja miten? | How has the organization in the pilot area been maintained? Well or poorly? Why and how? |
| 9 | Kuinka 5S käyttöönottoa voisi kehittää ja helpottaa? | How could the 5S implementation be improved? |
| 10 | Muuta palautetta pilottikohteesta? | Other feedback from the pilot area? |

## Appendix 2 – Data Collection 1 Field Notes

| **Date** | **13.2.2017** | |
|---|---|---|
| **Respondent** | **Production Manager** | |
| **Questions** | **Question, EN** | **Comment** |
| 1 | How were you prepared for the 5S pilot area operations? | I was planning the scope of the areas, providing resources and considering the timing during our regular shutdown meeting. I presented the topic after the area selection was made. |
| 2 | Did you have sufficient information before starting 5S actions? | Yes, the 5S concept was mentioned as part of the LEAN training from the Group. The 5S quick introduction was presented before the start session which gave a good condensed information. |
| 3 | What was successful in the 5S pilot area? | The first 3S actions have been executed really well. There has been a fair amount of time reserved, without too many additional duties. Perhaps as a manager I should take a more visible role in the Standardize and Sustain actions (4S & 5S).<br><br>Perhaps the follow-up should be combined with already existing forums for work safety. |
| 4 | What was not successful in the 5S pilot area? | The 2 last steps Standardize and Sustain have not yet been finished!<br><br>There were too many interruptions, as the production responsibilities were prioritized. Resourcing could have been a bit more thorough.<br><br>Perhaps the purchasing processes should be clarified further a bit, purchasing department will surely provide ample support. |
| 5 | What would you do differently in the next area? | The line organization should be involved more in all of the organizational levels. It has not been internalized completely what this 5S concept means, and that it really requires a new way of working. Perhaps through the pilot areas we see the benefits in practice and it will speed up the progress.<br><br>Perhaps at least in one area the foreman level should be included “hands on”.<br>Executing the 5S in the own office gives a good perspective and give practical experience. |
| 6 | What were your thoughts on the training materials used? | Big plus on utilizing the pictures, before / after examples especially. |
| 7 | Where should in the training materials should be more focused on? | The execution of purchases could be mentioned in the materials. More detailed implementation material could be needed. What each of the phases really means? What steps are included in each of the S’s?<br><br>The quick introduction should be given to all participants who are involved. |
| 8 | How has the organization in the pilot area been main- | Somewhere between good and bad. There is not enough follow-up and measures. The supervision |

| | | |
|---|---|---|
| | tained? Well or poorly? Why and how? | should be done by the foreman responsible of the area. |
| 9 | How could the 5S implementation be improved? | It has been an ok model so far, bit more details would be needed for the materials and the last 2 S's need to be completed. |
| 10 | Other feedback from the pilot area? | |

| **Date** | **1.2.2017** | |
|---|---|---|
| **Respondent** | **Lean Navigator** | |
| **Questions** | **Question, EN** | **Comment** |
| 1 | How were you prepared for the 5S pilot area operations? | There was good preparation from the LNs, materials, quarantine stickers, etc trainings were given in advance.<br><br>A downside was that not all the persons had the same level of knowledge to start with.<br><br>There was a clear scheduling for the 5S start, it was a big benefit that the communication was made early enough. |
| 2 | Did you have sufficient information before starting 5S actions? | Before the first Area in Plant 2, i felt i didn't have enough practical experience. The training from the group function did not cover this Lean tool at all. Looking at it afterwards, I did not feel I was prepared enough for the first area, especially for working with new, unfamiliar people. Experience has been gained quickly after the first areas. |
| 3 | What was successful in the 5S pilot area? | It was great to see the motivated participation of the employees in all the areas once they saw what this was about. It was good that people were given the allowance to get rid of the unnecessary goods without additional acceptance rounds etc. People really seemed to understand that this is more than just a clean-up round. Seeing the results immediately brought a lot of positive energy to the teams and also myself as a Lean coordinator! |
| 4 | What was not successful in the 5S pilot area? | All actions discovered during the 3S steps were not followed through by the area foremen. More visible pressure, participation and commitment would be needed from the foremen. Even though the topic has been discussed, no actions have been followed through. Perhaps it is our task as Lean Navigators to get the message through better and ensure the Foreman commitment.<br><br>The last two "S's" need to be finalized, it should be the next step to really focus on these. |
| 5 | What would you do differently in the next area? | The area selection needs to be paid more attention. The area size needs to be considered very realistically and concrete targets need to be set for each session. At least the 3S's need to be finalized by a certain date.<br><br>For the rollout to continue, there should be a target pace set. For example "1 area per month". A meeting with the foremen that this team goes through this time period area XYZ"<br><br>Also more attention should be paid to the preparational tasks, reserving trash cans, selecting quarantine areas, etc. They take up too much time during the actual actions.<br><br>Lot has developed already through gained experience. |
| 6 | What were your thoughts on the training materials used? | The training materials were informative and beneficial, especially when there is an expert present to open them up. The printed materials however should be more condensed, and maybe they felt too "heavy" for a person unfamiliar with 5S to start studying them independently and working with them. |
| 7 | Where should in the training materi- | Promotional materials and emphasis on the simple principles "get rid of unnecessary stuff" and "sustain organization". |

| | | |
|---|---|---|
| | als should be more focused on? | Focus on elaborating the Sort –phase in more detail and what is the difference between 5S and regular cleaning. Emphasize that there is no need to find a place for unnecessary things, but they can be removed entirely instead.<br><br>It has been well brought out that 5S is NOT a project.<br><br>For the future, it could be a good idea to create a more detailed package for the foremen, with step-by-step instructions. |
| 8 | How has the organization in the pilot area been maintained? Well or poorly? Why and how? | Generally well. The employees want to look after the space themselves. It comes out time after time however that not all the improvement ideas were executed and followed through by the foreman. It is an important aspect so that it is convenient to sustain the gained level of organization in the long term!<br>It can be seen that there really has been a need for this kind of actions. And this has now been maintained without the actual 4S and 5S actions. |
| 9 | How could the 5S implementation be improved?<br><br>How could the involvement of the foremen be improved? | More tools, such as labeling devices are needed.<br><br>Clearer instructions are needed on who can decide what to throw out. People need more support on decisions concerning what to throw out. The foremen should support the process from the beginning.<br><br>They should also reserve a full day from their calendars to participate, support and follow up actively. They should really feel ownership of the areas. |
| 10 | Other feedback from the pilot area? | There has been a good preparation from the training staff. Good progress has been made, even though some of the plans have been too extensive in the beginning. |

| **Date** | **7.2.2017** | |
|---|---|---|
| **Respondent** | **Production Foreman** | |
| **Questions** | **Question, EN** | **Comments** |
| 1 | How were you prepared for the 5S pilot area operations? | I Participated in selecting the 5S pilot area in the refinery and selecting the right persons from the department for the implementation<br><br>Theoretical background was given during the training sessions with LEAN navigators.There it was made clear what 5S specifically means. The target area chosen was good due to the clear need for improvement (filledwith materials, in need of cleaning and organizing).<br><br>My role was not to actually participate in moving or doing, just to coordinate and follow up as the foreman. The selection of personnel together with LN was critical as this was just the starting point.<br><br>No negative comments so far. |
| 2 | Did you have sufficient information before starting 5S actions? | Yes, I felt I had sufficient information of 5S principles. Also close follow-up of the test areas in practice. Had seen practically what 5S consists of. |
| 3 | What was successful in the 5S pilot area? | Definitely success was achieved in clearing out the unneeded ”stuff”. Great that organization was improved by the reorganization and marking.<br><br>“This might come as a question later, but how do we ensure the follow-up and how will we make sure that the status will be sustained?”<br><br>Are there control tools and or principles in the 5S system for evaluating the status. It is easy to do all of these steps once, but how will the sustainment be ensured? Of course it is part of the foremen duties, but in my opinion it shouldn’t be so that the foreman goes and does a check and only then things are corrected, but it should be formed into a routine. “<br><br>Checking and assessing the status could and should ideally be a part of the daily routine. |
| 4 | What was not successful in the 5S pilot area? | No much negative seen in the first phase. No specific need as a foreman to be involved in concretely participating in the 3S operations.<br><br>“Some could think that this has gone too far. “ |
| 5 | What would you do differently in the next area? | Own role could be similar in the next area also, no problem to be even more involved. My view is that the shift leaders have a critical role also in the future areas and they will all have a fair share of participation in the future areas.<br><br>My role is to act as a “manager” and provide support from the background.<br><br>Careful planning with clear scheduling is needed. Collect shift leaders, LNs, and foremen together and create a plan for target areas, role assignments and what kind of support |

| | | |
|---|---|---|
| | How should the planning for the next areas be performed? | would be needed. Time spent for preplanning would surely not be wasted.<br><br>I would not consider it a bad thing at all if a few persons from the department would also have some kind of special 5S competence within the team.<br><br>Also the key persons could have a responsibility in the follow-up phases, who does what and when. |
| 6 | What were your thoughts on the training materials used? | Just fine, they have explained the topics on an adequate level.<br><br>Should the preplanning be a focus in the materials already? → Hard to say. |
| 7 | Where should in the training materials should be more focused on? | Perhaps the materials and posters could be utilized to spread the message on site and in every space to deliver the 5S message more clearly. |
| 8 | How has the organization in the pilot area been maintained? Well or poorly? Why and how? | The status has been maintained well. It needs to be said that the status of the pilot area has been changed significantly due to the renovation operation in the control room. More persons work in the area than normally. |
| 9 | How could the 5S implementation be improved? | Information for the operators and the utilization of focus group sessions could be increased. Especially the role of the implementation personnel should be emphasized and their feedback used in promoting the 5S message. |
| 10 | Other feedback from the pilot area?<br><br>Specific question from earlier interviews concerning the purchasing aspects. How do you see the purchasing of materials? | In the pilot area the purchasing of materials, lockers, etc. should be paid more attention!<br><br>Purchasing responsibilities should be clarified and paid more attention. How does the purchasing process for 5S proceed? How do we ensure an uniform approach concerning purchasing? So that everyone does not purchase their own materials, from various suppliers, various qualities and prices, etc.<br><br>Purchasing department should be involved in coordinating the purchasing of parts, tools etc. One aspect also the maintenance related improvements during 5S. How should these be coordinated and prioritized?<br><br>“These aspects may have a negative impact and affect the atmosphere on the whole implementation if not considered with care.”<br><br>This is a point that could be improved and should be considered before starting the operations in the area. |

| **Date** | **15.2.2017** | |
|---|---|---|
| **Respon-dent** | **Shift Leader 1, Production** | |
| **Questions** | **Question EN** | **Comments** |
| 1 | How were you prepared for the 5S pilot area operations? | LN told a week before about the topic and the target area before actions.<br><br>It was agreed where to start and what to start doing. The split of the area into smaller subareas was agreed upon and where the quarantine area is placed.<br><br>Training was very beneficial, other people who have not been trained yet don't yet see the benefits. |
| 2 | Did you have sufficient information before starting 5S actions? | The materials were run through well, and support from LNs was valuable. Own competence not yet on a sufficient level to start training other persons.<br><br>Materials should be refreshed individually to better prepare for next areas. |
| 3 | What was successful in the 5S pilot area? | The organization of the area is clearly significantly improved. Much nicer to work in the area when unnecessary items were removed. Everything is easily accessible.<br><br>"Lot of unnecessary items were thrown away and more space was released for the necessary items. The clarity makes working more efficient. "<br>Improvement ideas were discovered e.g concerning the lighting. |
| 4 | What was not successful in the 5S pilot area? | Improvement ideas were not executed! It took quite a lot of time to agree the right places.<br><br>There were also other duties that were seen as more pressing. Interruptions take the mind of things.<br><br>Roles and responsibilities concerning purchases should be agreed in advance. |
| 5 | What would you do differently in the next area? | More focus on the preplanning in the area. What kind of goods in the area, how much, where, etc. Could have made the actual processing more efficient. |
| 6 | What were your thoughts on the training materials used? | Training materials were very suitable. Clear and concrete package which I could utilize myself in further training. Easy to understand and covered the topic well. |
| 7 | Where should in the training materials should be more focused on? | It could be mentioned in the materials that it is preferable to visit and familiarize the area before the start. |
| 8 | How has the organization in the pilot area been maintained? Well or poorly? Why and how? | The area is used as a temporary control room while the main control room is under construction. The new persons working in the area temporarily do not follow the 5S principles and this will not work until everyone follows the principles in a similar way. There are no clear rules defined for the area. People work according to their old habits. |

| | | |
|---|---|---|
| | | The standardize and sustain phases need more emphasis. |
| 9 | How could the 5S implementation be improved?<br><br>Were there right persons involved in the area? | More training needed for the trainers before the roll-out is continued. Important that nothing vital is missed.<br><br>The work was rather efficient, with a more detailed preplanning it could have been even better.<br><br>Involvement from a person who is working in the area was seen as a positive thing. |
| 10 | Other feedback from the pilot area? | It's good to now be able to utilize these lessons in other areas. It was nice to notice that working in the area became more pleasant. Good ideas were discovered which can be used in other areas. |

| **Date** | **15.2.2017** | |
|---|---|---|
| **Respondent** | **Shift Leader 2, Production** | |
| **Questions** | **Question,EN** | **Kesto** |
| 1 | How were you prepared for the 5S pilot area operations? | There was a systematic communication approach from the LN, which reduced the uncertainty towards 5S start.<br><br>There was a verbal communication of the timing and start. Information was provided early enough. |
| 2 | Did you have sufficient information before starting 5S actions? | I felt, that I had sufficient information. Received the materials in advance, so it was possible to get familiar with the materials beforehand.<br><br>The training right before the start focused the actions well and made clearer what the objective is. The 5s method was internalized and it was clearer to proceed into actions. |
| 3 | What was successful in the 5S pilot area?<br><br>What provided motivation and helped in getting the results? | It was good that the decisions were made right on the spot concerning the sorting of unneeded items.<br><br>The area selection was good, it was limited enough.<br><br>It was positive to see the actual change and feel that things that had been the same for decades were finally changing. It was nice to see that the clarity and organization was visibly improved.<br><br>There was a clear internal motivation to avoid searching for items and materials.<br><br>After the second day there was a wrap up for the follow-up items. |
| 4 | What was not successful in the 5S pilot area?<br><br>Did you have sufficient time to focus on 5S only? | There could be clearer rules on what is needed and what is not. Many items were left as it was not absolutely clear whether to throw out or not.<br><br>More experience is needed to be more certain in throwing things out.<br><br>First day of action went really well, but the second day was a lot more challenging. There were other duties on the second day and it was harder to maintain focus.<br><br>There is a small risk when the budgets are small that the once disposed goods are returned from the junkyard as there is not sufficient budget to buy the necessary things. |
| 5 | What would you do differently in the next area? | There should be someone who actually is working in the area as part of the team?<br><br>The participants should be better considered in the pre-planning already. Now it was a bit of a lucky chance that a person working in the area just happened to be available. |
| 6 | What were your thoughts on the training materials used? | The material was clear and extensive enough. It was good that it was shown just before the start of the concrete actions. |

| | | |
|---|---|---|
| 7 | Where should in the training materials should be more focused on? | Nothing to fix, materials worked well. |
| 8 | How has the organization in the pilot area been maintained? Well or poorly? Why and how? | The status was maintained really well for a long time, until the conditions in the area were changed. The control room renovation forced the process control team to be moved to this area temporarily which affected the status of the area negatively.<br><br>The current status is better than the status quo, but it can be seen that the understanding and rules of the concept are not on a level that could maintain the status for a longer period.<br><br>There are no clear rules on how to proceed after 3S, and individuals have different personal styles of working and maintaining organization naturally.<br>There are no clear guidelines, but that can be seen as a clear target for im-provement. No division of responsibilities has been made within the depart-ment, but it is clear that the 4S and 5S need to be continued soon, otherwise things will quickly fall back to the old ways. |
| 9 | How could the 5S implementation be improved? | Better preplanning might be needed so that the size of the area would be more thought out beforehand. The future use of the space should also be considered more carefully. |
| 10 | Other feedback from the pilot area? | No negative experiences, it was nice to execute and see the changes.<br><br>The effort and results were well aligned.<br><br>The cleaning personnel gave very positive feedback from the improved cleanliness and organization of the area after the 3S actions.<br><br>A small revision would be needed personally to be able to independently continue roll-out onto the next area. |

| **Date** | **7.2.2017** | |
|---|---|---|
| **Respondent** | **Shift Leader, Packaging Department** | |
| **Questions** | **Kysymys EN** | **Comments EN** |
| 1 | How were you prepared for the 5S pilot area operations?<br><br>What actions were taken to prepare before the actual start? | Enough information was received before concrete actions. 5S kick-off meeting was held.<br><br>Enough time was allocated from the foreman. No other duties to be done simultaneously with 5S operations. |
| 2 | Did you have sufficient information before starting 5S actions?<br><br>Did something turn up during the implementation where more information would have been needed? | Yes, had enough information and support as LNs were present in the first area. Support for the first area seen critical also for next areas. Important to do according to the 5S steps, and so that no steps are skipped.<br><br>No, theory was well processed before. |
| 3 | What was successful in the 5S pilot area?<br><br>Was the size of the pilot area reasonable? | Good that the LEAN navigators supported the process. It was natural for us to try to skip some steps, but LNs steered back on track. When the area is small enough, it is beneficial to take everything out on the floor etc. to see how much really needs to be sorted out.<br><br>Things progressed nicely, the schedule was used well.<br><br>The area was just the right size.<br><br>There was a clear ownership for all the goods in the first pilot area. That was different for the next areas. Thus not so many persons were needed in discussing and processing the area.<br><br>Whereas in the packaging area many more opinions were needed as the area is in common use. Especially for the systematization part required more discussions and looking for compromises.<br><br>People were engaged and saw that things are progressing. They had a clear motivation to be involved and they provided good ideas for improvement.<br><br>As a coordinator the respondent felt that the Sorting phase progressed and decisions were made rapidly without hesitation.<br>The results were seen as satisfying, the status has improved from the starting point. |
| 4 | What was not successful in the 5S pilot area? | Area 1:<br>The purchasing of identified needs was not completed. The purchased goods were left on the level of discussion. Discussions with the foreman have been taken, but no actions.<br><br>Why? Maybe they should have been organized bet- |

| | | |
|---|---|---|
| | | ter, they were not part of the practical doing so were left out. For me personally the creation of purchase requisition is not clear. It is not so easy and simple, tools missing.<br><br>Very few things that did not go well in the first area.<br><br>Area 2:<br><br>Definitely more people should be included in the planning. Many people took part, but only because they happened to be in the area during their break.<br><br>More time should be put into preplanning who should be involved and also into how many opinions could be collected already before the start. If there are too few people involved, many aspects can be missed.<br>How was the preplanning done? Mainly it was just me and a colleague and there were no other persons planned for the actions. For the production line area people were utilized as they were available. No production was running at the time. This is a lot more challenging when production is on-going.<br><br>It would require a clear commitment of time for the persons only for the 5S. After the ideas have been collected, not all the persons need to be involved in executing them. (Proposal)<br><br>Things were done as they came, but a bit more emphasis should have been put on the planning and scheduling before actions. |
| 5 | What would you do differently in the next area? | Informing the people well in advance, and providing training what 5S is.<br><br>The implementation coordinators should create their own plan for approach including the personnel needed and reserve the time to focus only on 5S.<br><br>Purchasing of tools and equipment was challenging. Lot of time was spent in looking for cleaning trolleys for example.<br><br>Purchasing department was consulted and used as support for finding the suitable goods. Purchasing department commented that their focus is keeping the number of articles in control. There were conflicting views on what type of brushes are suitable, as people have several opinions depending on their individual needs and types of usage.<br>A collective approach for purchasing would be needed.<br><br>Solution: Purchasing should be included in the discussions earlier! |

| | | |
|---|---|---|
| | | Maintenance supported well in providing different solutions for storing, electricians made requested changes rapidly.<br><br>Already existing spare furniture was utilized in sourcing for equipment. The implementation team knew that spare furniture exists, but actually ended up finding a solution for something else than the original intention was.<br><br>An old glue container was taken into new use as a container and thus junk was turned into a useful equipment.<br><br>First there was a concern will the spare part room have enough space, but in the end the finding was that there is loads of spare room after the steps were finalized. |
| 6 | What were your thoughts on the training materials used?<br>Were the materials detailed enough?<br>Did the materials focus on the right things? | Materials brought out the idea and concept of 5S well. And it was essential to bring out what 5S is NOT.<br><br>The 5S steps were thoroughly presented. As a lesson learned from the pilot the materials could include instructions on the practical steps on a detailed level. |
| 7 | Where should in the training materials should be more focused on?<br><br>Did you use the materials with the involved personnel?<br><br>Were there questions challenging the approach? Was it unclear why this is being done? | The respondent found that it could be useful to highlight the practical steps of implementation better.<br><br>The roles and responsibilities should be clarified already in the materials.<br><br>The material was not used and described to the persons involved, but the respondent felt it should have been used. Only a verbal description of the plan was ran through before starting.<br><br>The team that is involved in the 5S area, a practical exercise on paper could be useful to run through with the persons before starting actual operations. |
| 8 | How has the organization in the pilot area been maintained? Well or poorly? Why and how? | The status in the areas has been maintained “rather well”. The areas are tidy and it is easy to notice wrong goods in the wrong places.<br><br>When something starts to gather that doesn’t belong, it has been about not noticing something during the sorting phase. If these things come, a common agreement is done with the personnel to find the right place and evaluate the unnecessary things.<br><br>It is critical that all the employees in the area are **committed** and **respect** the status.<br><br>Commitment can be seen, as an example there was a comment about a pile of paper that was not where |

| | | |
|---|---|---|
| | | it should be “no marked place for these” was jokingly mentioned by a person. This highlights that the thinking is there.<br><br>There are no clear rules or processes for following up the status. Discussions with the LN and foreman have been taken considering what could be the method and forum for the follow up. |
| 9 | How could the 5S implementation be improved? | All said above. |
| 10 | Other feedback from the pilot area? | Many has said that the 5S principles are things of ”common sense”. Respondent mentioned that perhaps some things are left out if only the “common sense” part is used. He feels that 5S is a tool that ensures that all the steps are utilized. |

Content of the appendix is placed here.

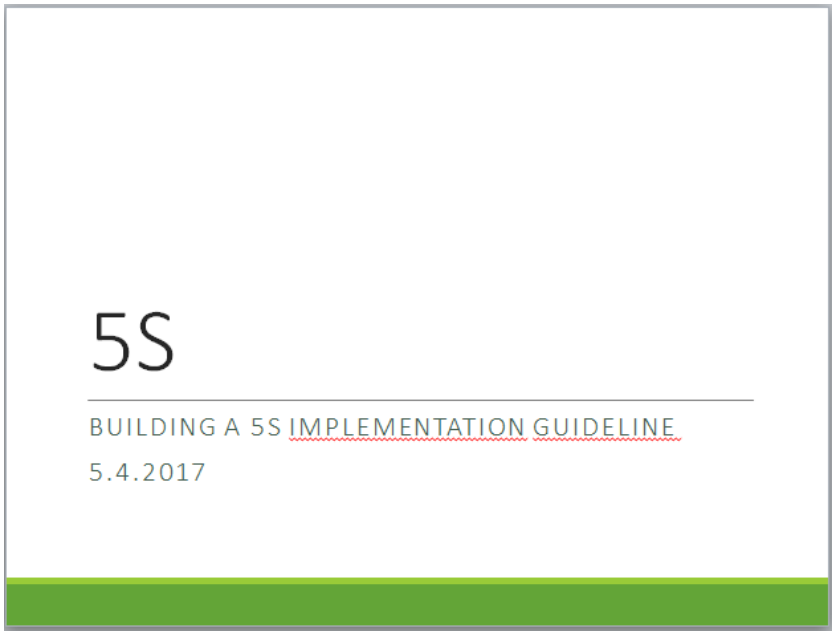
# Appendix 3 – Sources and key ideas for Sections Conceptual framework

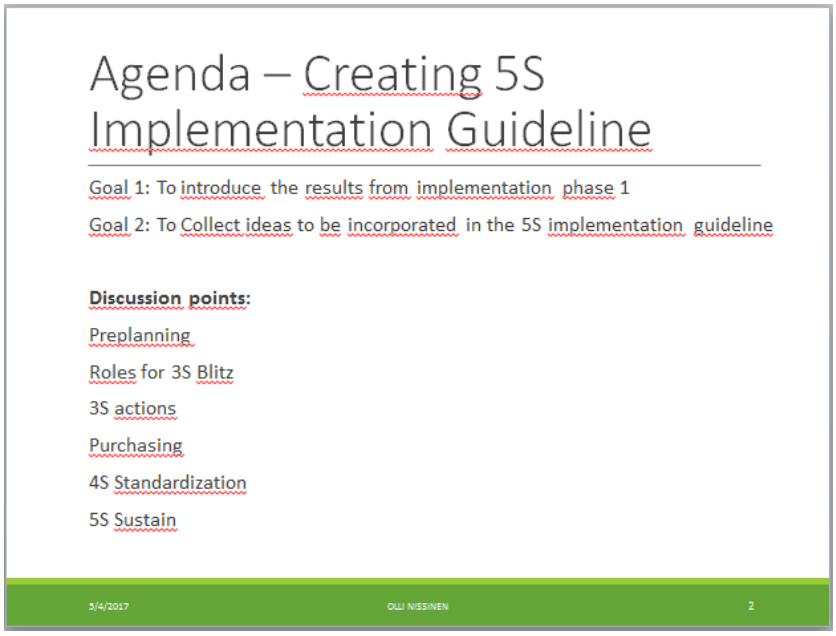
| Color | Author |
|---|---|
| | Chapman, 2005 |
| | Chiarini, 2013 |
| | Galsworth, 2011 |
| | Moulding, 2010 |
| | Scherrer-Rathje et al., 2009 |

| Management | Standardize | Sustain |
|---|---|---|
| Bottom up approach, lack of senior management support (Scherrer-Rathje et al., 2009) | 5S improvement time policy missing (Chapman, 2005) | Two last S's NOT formalized (Chapman 2005) |
| Lack of team autonomy in decsion making (Scherrer-Rathje et al., 2009) | Failing to stabilize 5S as daily management routine (Moulding, 2010) | Management involvement in follow-up (Chapman,2005) |
| 5S is a part of organizational culture, not just a method to improve efficiency (Moulding, 2010) | Only a one time 3S effort done. (Moulding, 2010) | Shitsuke = "Discipline" missing (Chiarini, 2013) |
| Put 5S in place quickly, without considering visual aspects (Galsworth, 2011) | Instructions not visible for everyone (Chiarini, 2013) | Lack of indicators (Chiarini, 2013) |
| Management doing too much, without empowering people (Galsworth, 2011) | Applying 5S only in times of no other urgent duties . (Chiarini, 2013) | Lack of periodic check-up on development (Chiarini,2013) |
| Conflicting orders from management ("5S is important BUT, finish order first.." (Chiarini, 2013) | | No actual time reserved for improvement (Galsworth, 2011) |

# Appendix 4 Workshop - Proposal for 5S Implementation Guideline and Field Notes

## Workshop agenda




## Workshop details

- Date: 5.4.2017
- Start: 12:00
- End: 14:22
- Duration:1h 22min
- Participants, roles
- Audio recording, field notes

Participants and their roles:

| Respondent, Data 2 | Organizational Role | 5S Role |
|---|---|---|
| Respondent 1 | Production Manager | Dep. manager, area owner |
| Respondent 2 | Development engineer | Lean Navigator, coordinator |
| Respondent 3 | Production foreman | Area foreman |
| Respondent 7 | Packaging area foreman substitute / Shift leader | Area foreman / 5S area responsible |
| Researcher | Packaging area manager | Lean Navigator & dep. manager |

Field notes:

**Ideas for Preplanning - Phase**

Respondent 3: We have good pilots already, but they are both on the control area. We need one more pilot area on the production areas, supported by navigators.

Respondent 2: It is the same principles that should be applied after all. No difference should be made.

Respondent 3: There is more cross functional aspects in the process area, where I'm hoping that the trained implementation teams and Lean navigators both are included.

Respondent 1: The idea for 5S would be for the operators to do a tour for themselves where they are able to do their own corrections right away at the spot. Tuttava rounds are then used for the larger rounds with more demanding maintenance aspects. One aspect could be that during the 5S rounds it is checked that a notification has been made.

Respondent 3: What I meant with the need for a pilot area in production is that we don't look for the perfect world at once, but start the continuous improvements. What I'm looking for is a solution to the resources. We will of course make it alongside of the work, or do we detach completely from the regular work? If so, how do we make this happen?

Respondent 1: My thought was that there must be ample time, for example two weeks. The field man is there and it is in his duties to execute 5S improvements.

Respondent 7: We tried this in the packaging area, but it didn't work alongside the regular work. The time reservation was not there and production was overrunning the 5S actions and things were left unfinished.

Respondent 2: There are times in the day where it is possible to execute 5S actions, the field man already has the responsibility to roam around the work areas.

Respondent 7: I would say that e.g 15 min / day is ok after the 3S has been done first, but first a session with more time needs to be organized.

Respondent 3: There has not been clearly stated what all is included in the 5S actions. It cannot be just restricted to tools and equipment. It needs to be listed what should be considered, what is not critical. → **GUIDELINE PROPOSAL**

Respondent 2: There are small stacks of equipment here and there, could they be more centralized?

Respondent 3: We already make the TUTTAVA (SHEQ) walks, but the same equipment are collected back between the rounds. This is exactly the problem for not creating the rules and guidelines for the daily work routines. We have taken pictures and sent them forward, but nothing has happened.

Respondent 1: Area responsibilities will be made in advance.

Respondent 7: Making the 3S steps requires a clearly reserved time for the "blitz".

Respondent 2: The resource planning needs to be made carefully so that the key resources can be utilized in spreading the knowledge and experience forward.

Respondent 3: Surely there's time, but THE WILL to prioritize?

Respondent 2: It cannot be just told to the field operator that: "go do 3S". There needs to be the right persons selected with a sufficient level of knowledge. There needs to be a clear communication that the 5S actions help the daily work. We need to find the great examples that show the benefits in practice.

Respondent 3: How about operating in shifts? Do we only do these in the morning shift?

Respondent 1: We will begin driving this onwards in the shifts where the area responsible persons with the most experience happen to be. They will first gain experience more rapidly and later start training the next level of new 5S trainers onwards.

**Ideas for 3S execution**

Respondent 1: Prepare waste removal solutions (metal, energy waste, etc). Create quarantine areas specified per need.

Respondent 3: Could it be useful to create a common quarantine area?

Respondent 7: Enough expertise is needed for the evaluation of the quarantine area. We had a couple of close calls when important tools were almost disposed. → **GUIDELINE**

Respondent 2: Communication of the quarantine area very critical → **GUIDELINE**

Respondent 1: Infoscreen could be used to communicate the location of the quarantine areas "Go check the quarantine area by XX.XX.XXX"

Respondent 7: I want to emphasize that the time reservation for clearing the quarantine areas need to be scheduled and made official, e.g by utilizing the shift schedules. → GUIDELINE

Respondent 3: how about the contractors who are not working directly for us, we have a lot of goods laying around which are owned by the contractors.

Respondent 1 & Respondent 2: They should follow the same rules, but the rules have to be communicated first to the hosts of the contractors.

TASK: make a template for quarantine area. → Olli → **GUIDELINE**

Respondent 1. Could there be a template for the 4S, standardization? There is already a template: Area checklist → **GUIDELINE**

Respondent 2: The area responsible could be the key person to make sure that developments are taken forward.

**Ideas for Purchasing**

Respondent 7: There are not that many purchases done in the packaging area currently. We are lacking routines and competences.

Respondent 2: Instructions needed for basic routine purchases, where to buy, which suppliers are preferred per category. → **Two aspects**: Technical execution of purchasing (instructions) and the contract sources (**process**) need to be addressed.

Respondent 3: Do we need to harmonize the purchases? In what materials?

Respondent 7: This was one of the issues during the pilot phase,

Respondent 2: It should not be the first principle to buy everything anew. There's a lot of materials already in stock in the MRO warehouse which should be utilized.

Respondent 3: Categorization between stock items and special, onetime purchases.

Respondent 2: Critical to first start with the simple solutions and look for internal warehouses first, before purchasing:

If needed into stock, alignment with purchasing

Also utilize the internal maintenance as a supplier for small developments

SOLUTION: Create a shortlist for common suppliers to use in purchasing (contract suppliers) together with purchasing. TIP: Utilize also chat functions in webstores.

**Ideas for STANDARDIZATION**

Respondent 1: Cleaning procedures need to be collected from the facility department.

Agreements and guidelines need to be made visible and brought to the workplaces.

Is there a template available for a checklist on what to standardize?

To standardize and sustain phases, it could be beneficial to use the already existing tools and systems. Could e.g. the checklist for 5S actions be included in the shift log book (konepäiväkirja) to make the 5S steps part of the daily routine.

**Ideas for SUSTAIN**

Respondent 1: Feedback system, how will the communication be delivered to the responsible departments. → As a solution the audit form with 5S levels can be used.

Tuttava rounds can still be utilized as well, they can fulfill the function of visible management participation. A new level of discipline needs to be set and these rounds can be utilized to set that level.

There is a ready index in the TUTTAVA template, which calculates the score. The TUTTAVA checklist just needs to be more thoroughly detailed and the criteria explained in further detail according to 5S principles.

See TUTTAVA materials: POR tuttavakierrokset.pptx, Tuttava POR pakkaamo 2017.xlsx

Respondent 2: If there are not enough resources to work on the actions, the message needs to be delivered to top management. First a well-planned first phase needs to be completed and experience gained before saying that there is no time or resources.

Respondent 7: The development and continuous improvement ideas should eventually be coming from the operators, who should independently execute the easy, smaller improvements.

Respondent 2: For the future it would be beneficial to get the shift leader levels to talk and share experiences together. → Consider a platform / forum to share experiences, etc. “5S coffee break”

**Appendix 5: Validation of Proposal with Site management**

- Site Management meeting 4/2017
- Date: 21.4.2017
- Start: 08:00 visit to Production Control Room to see 5S in practice
- Start of Discussion for 5S 9:30
- End: 10:00
- Duration:30 min
- Participants, roles:

| Data 3 – Validating proposal for 5S Implementation | | | | | | |
|---|---|---|---|---|---|---|
| **Data type** | **Participants / title** | **Role in 5S implementation** | **Topic** | **Date** | **Length** | **Documented as** |
| Group discussion | Head of SHEQ | Accountable for SHEQ (Safety, Health, Environment, Quality) | Validation of initial 5S guideline document | April 21, 2017 | 30 min | Field notes |
| | Site Manager (Site 1) | Accountable for Site level results and progress of 5S. Visible support and example. | | | | |
| | Production Manager | Owner of production area | | | | |
| | Power Plant Manager | Owner of Power plant area | | | | |
| | Investment Manager | Responsible for external operators in projects | | | | |
| | Business Controller | Cost controlling and reporting | | | | |
| | Packaging Dep. Manager (Researcher) | Owner of Packaging area | | | | |

**What kind of development is needed?**

Head of SHEQ:

“Has there been alignment or standardization with the color coding of hygiene equipment; brushes, gloves etc? Alignment is needed with color coding according to group hygiene areas.”

”Instructions for current SHEQ (TUTTAVA) rounds should be incorporated into the guideline” –Head of SHEQ

Site manager:

”Guideline could be a bit more condensed, maybe replace some text with pictures? Focus more on visuality.

**Positive aspects / experiences that should be emphasized?**

Production manager:

”Standardize actions done in new production control room e.g. whiteboard utilized for communication according to guideline. It provides concrete assistance in the actions needed as all of this is still rather new to us. We need to learn a completely new way of working and this does not come easy, but the guideline should make this change easier.”

“After a week of working with the document positive feedback has been received from the users!”

Site manager:
“This is a good start to proceed with! Later we should continuously improve based on feedback from the next phases”

**Appendix 6. Title page and Table of Contents of the validated 5S implementation guideline.**

# 5S jalkautus-manuaali 2017

Yksityiskohtainen kuvaus 5S jalkautuksen vaiheista toimenpiteineen

5S = Sorttee-raus, Systema-tisointi, Siiste-ys, Standardi-sointi, Seuranta

## Sisällys