



CHALMERS
UNIVERSITY OF TECHNOLOGY

A Lean approach to management efficiency

Andreas Forsberg

MASTER'S THESIS 2018:NN

A exploratory research of Preem Petroleum's production management operations

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Industrial and Materials Science
Production Engineering
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2018

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Typeset in L^AT_EX
Gothenburg, Sweden 2018

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Abstract

With the all more increasing efficiency challenges the energy business faces due to the global export there is a lot of benefits to gain by evaluating the possibility to reduce wastes both in production and development processes. This thesis aims to identify and acknowledge possible improvements in line the Lean philosophy within a production organization of a large fuel company, in order to do so the members of the production management were studied with an active exploratory research approach in order to get a clear overview of the organization branches and operations. Several concepts of the Lean philosophy were regarded have a large potential within the organization, although visualization and pulse methodologies were observed to be of great need and easily applicable.

Keywords: Production, Lean, Management, Visualization, Pulse, Continuous Improvements, Key Performance Indicators.

Acknowledgements

First of all i want to give a special thank you to my supervisor at Preem AB, Sofia Lagerkvist, for giving me the opportunity to study a production management at first hand with near unlimited access, it has truly been a privilege. Secondly, i want to address a thank you to Thomas Beillon, Joacim Calner, Leif Eriksson, Helena Kristensson, Nicklas Mattsson and Fredrik Thell for allowing me to follow you and sitting in on your meetings, you all possess tremendous amount of knowledge and experience that has been incredible to take part of. Further i want to thank my supervisor and examiner at Chalmers University of Technology, Dag Bergsjö, your flexibility, input and guidance in this thesis has been very much appreciated.

Andreas Forsberg, Gothenburg, October 2018

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1

Introduction

The all more increasing global export of supplies has toughened the competition in several industries, the Oil & Gas industry are also affected by the increased needs of export and higher production rates. In an effort to cope with the need of improving production and organizational efficiency many companies turns to the Lean philosophy due to its extensive use to streamline operations, reduce costs and increase revenues. At a oil refinery in Sweden the mindset is no different and therefore they recently decided to move towards the Lean philosophy by starting implementing the toolbox 5S in their production and now wants to further extend their commitment by introducing the concepts of Lean to the management group in an attempt to streamline their operations and increase the management efficiency.

Extensive research has been performed towards Lean in production but other industries and organizational contexts has not been developed at the same rate. The field of Lean in an organization setting is although steadily increasing and a vast amount of studies are performed on an annual basis. Previously has Lean been entirely associated with production but with the all more increasing focus on management and organization the philosophy has begun to spread to non-production industries as well which opens up more opportunities for research within the field.

The concepts of Lean are now practiced and researched within development offices, programming, emergency services and management all over the world. This has caused a paradigm shift in how Lean is practiced and viewed by the public, the focus on cycle-times, machine layouts and leveled production has been replaced with information flows, process mapping and visual management. The ability to reach out to all employees and inform objectives, strategical goals and progresses is a all more increasing priority for companies in all branches. However, the research in the subject is still limited outside of production settings.

Research suggests that in order for an organization to be efficient the management needs to have clear objectives and a structured planning. Objectives, which should cohere with the business plan and ensure its success, therefore it's of great value to visualize and track the status of the objectives. The Lean concept of visual management has thereby proven to be of great use within many organizations due to its capabilities to effectively visualize and inform strategic goals and progresses. But it's not only the concept of visual management that influences the efficiency of a organization, several of the Lean philosophy's mindsets and methods aims to do

just that as increasing organizational efficiency and reduce all forms of wastes is a main element within the philosophy.

With the exception of a production setting it's arguable that the most valuable tools is standardized processes in collaboration with visual management, as this allows elimination of wastes in the organization and creates a gateway between the work performed on a daily basis and the objectives of the business plan.

1.1 Purpose & Aim

The purpose of this thesis is to improve management efficiency by introducing parts of the Lean Management philosophy and evaluate the current way of working with a Lean perspective in mind. As the management requests a primary focus on one or several of the following parts within process control, change management and visual management the aim is to choose parts that best fits the company's need and is easily managed.

Process Control	Change Management	Visual Management
- Information Flow	- Standardized Work Instructions	- Visual Boards
- Process Mapping	- Policy Deployment	- Key Performance Indicators
- Daily Management	- Continuous Improvements	- Visual Planning

1.2 Delimitations

As the Lean philosophy contains a vast amount of toolboxes and methods to streamline operations and increase efficiency only a handful can be considered to be evaluated within the time frame of the project, considered parts will therefore be limited to the ones requested by the management group. The management group covers all departments related to the operation and maintenance of the production as well as the lab and education departments, in order to produce useful and valuable results to the company the project will focus more towards departments that has obvious use of the tools and mindset of the Lean philosophy. The results of the thesis should not be seen as an implementation of Lean but rather qualified suggestions of improvement potentials during their transition towards the philosophy and a evaluation of their current methods.

1.3 Research Questions

With a large interest in both managerial and production questions, together with the fact that the case company recently started with implementing parts of Lean the topic came quite automatic. However, due to the large subject that Lean is the research had to be broken down into more specific questions. As stated by Booth, Colomb, Williams, Bizup and FitzGerald (2016) one have to find a reason beyond

devoting months of work towards a specific topic, in this case the strong interest in both the topic itself and the case company became sources for motivation.

Booth et al. (2016) argues that while writing about a broad topic which include several different aspects one might get intimidated by the idea of finding and reading available sources. Although, if the topic is broad by nature it's of great help to narrow the scope of the project by first defining a research question and then subject it into sub-questions (Booth et al., 2016). The project aims to answer the main research question RQ_0 , but to answer this complex and broad question it has been broken down into the two sub-questions RQ_1 and RQ_2 according to Booth et al. (2016) principles.

RQ_0 : How can Lean be used to increase efficiency in a management setting?

RQ_1 : How can barriers in information flow be countered with Lean?

RQ_2 : How can visualization systems affect efficiency?

2

Methodology

The Methodology chapter describes the research's aim, process, design and execution. It contains detailed information on how the research aimed to produce practical and useful findings supported by a theoretical framework that's applicable in a real working environment, as well as its execution of retrieving information from the practical as well as the theoretical field.

2.1 Research Design

Research design refers to the choice of how data will be collected, analyzed and evaluated during the research. There are several defined research designs but each research tend to use different designs due to different topics and settings. However, the designs can be divided into the two groups exploratory and conclusive (Creswell, 2007).

The research will be exploratory conducted with a flexible research design in form of a case study. Bell (2010) states “a case study approach is particularly appropriate for individual researchers because it gives an opportunity for one aspect of a problem to be studied in some depth within a limited time scale”. A flexible research design allows for information to be collected from different sources which aligns with the practical and theoretical aim of the study, the research design will also be complemented with influences of action research which allows participation and evaluation (Robson and McCartan, 2016).

Information from the practical field was received by interviewing experts and evaluating methods from companies that continuously work with Lean as a part of their operations. Theoretical information was gathered by performing literature reviews which acquired the latest research within the field and provided a valuable insight to different mindsets. To further support the legitimacy of the thesis quantitative data was collected by acquiring data from published surveys in the subject.

The use of both qualitative and quantitative methods is a all more common practice in the research field as it allows for an expanded understanding about a research problem. A research which includes both methods is termed a mixed method research, the mixed method practice rise from the need to address complex questions where the use of one method did not suffice to support its claims

(Creswell, 2007).

A mixed method is characterized by the focus on research problems that requires an examination of a real-life context, multi-level perspectives and cultural influences (Tashakkori and Creswell, 2007; Burch and Heinrich, 2016). Tashakkori and Creswell (2007) argues that the mixed method design 'encompasses more than simply combining qualitative and quantitative methods, but rather reflects a new epistemology paradigm that occupies the conceptual space between positivism and interpretivism'.

2.1.1 Flexible Research

With a flexible research design the research is not limited to be conducted in a specified way, the focus lies instead on the findings which allows the research design to emerge during the progression of the research (Wentzel and Bertilsson, 2015). According to Wentzel and Bertilsson (2015) there is often a close relationship between researcher and participants which risks to bias the research, it's therefore of great importance to be open minded, ask questions and verify the authenticity of the collected data (Wentzel and Bertilsson, 2015).

The reason for using a flexible design in this research is because of it's allowance of case studies which enables the researcher to triangulate data from multiple sources (Yin, 2018). A case study is described by Yin (2018) as an 'empirical inquiry that investigates a contemporary phenomenon in depth and within its real-world context'. With Yin (2018) views the contemporary phenomenon would in this case be efficiency and the real-world context a management setting.

The design is most common in a qualitative setting where the variable of interest is not quantitatively measurable, as the variable of interest in this research will not indicate any changes over the short time period of this study the research can thus be seen as qualitative. A key aspect in why this design has been used is its allowance for research questions to be continuously improved during the progression of the research (Robson and McCartan, 2016). Flexible research requires a conceptual framework, purpose and methods where the conceptual framework is the hypothesis which will be evaluated and researched with defined methods to reach the goals stated in the purpose.

2.1.2 Action Research

The design of a action research allows for the researcher participate and evaluate the situation in collaboration with the practitioners. The design is particularly appropriate when a new approach is grafted into an existing system (Bell, 2010). The aim with a action research is described by Denscombe (2002) as 'to arrive at recommendations for good practice that will tackle a problem or enhance the performance of the organization and individuals through changes to the rules and procedures within which they operate' which aligns with the aim of this thesis.

Action research tends to be most effective while applied in a small circle, as with larger interactions the design loses parts of it's purpose as a researcher will be unable to provide a change in either mindset or methods. A common practice within action research is the cyclical process PDCA (Plan-Do-Check-Act) which purpose is to evaluate and implement changes in iterations. However, in this thesis the action research will be mostly tilted towards its sub-design evaluation which focuses on assessing the effects and effectiveness of a studied object (Robson and McCartan, 2016).

2.2 Research Process

The research was planned to consist of three main phases, case company, frame of reference and reference companies which is visualized in Figure 2.1. The process will start with the case company phase where observations will be made during a limited time frame. When all departments have been a part of the observations the research will progress to the frame of reference phase where research and information of the field of study will be gathered and analyzed. After a frame of reference had been created the research progress into the phase of reference companies where other companies was be observed and interviewed in an effort to gain inspiration to ideas that could be applicable to the case company.

The case company and frame of reference will be the most extensive phases in the research as the reference companies will be just touched upon, this is due to the time-frame of the research and the limited amount of companies that accept outsiders to get an insight into their operations. The research has set a high goal with its aim to increase management efficiency which might be unrealistic, but the hope with the case study is to identify problems in the organization that might be solved with thoughts from the Lean philosophy. The different phases will be described in further detail in their separate sections 2.4 Case Company, 2.5 Frame of Reference and 2.6 Lean Experts.

Dividing the research into different phases provides a more structured way of performing the research. With a structured division the focus can be directed to the phase of interest which allows for a better performance. However, a negative aspect with phase division is that the information gathered by different phases was be unable to interact before the final phase was concluded. As this research was performed in an effort to provide a basis for efficiency increment according to the Lean philosophy the negative sides of the phase division was limited and the performance gains were seen as to large to neglect.

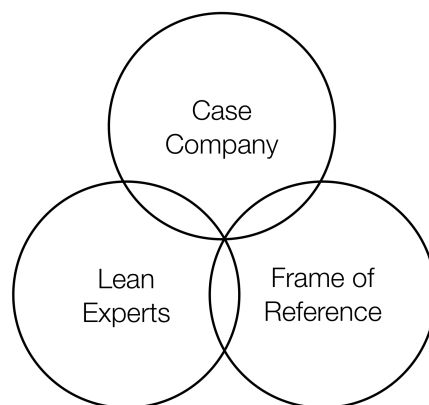


Figure 2.1: Research Process Phases

2.3 Reliability & Validity

Reliability and validity are acting as fundamental terms in a quantitative research, although it has no confirmed translation towards a qualitative research. Bryman (2016) argues that the term trustworthiness, consisting of four the criterias confirmability, credability, dependability, and transferability can act as a substitute for qualitative settings. The content and intentions of the criteras are elaborated under their respective paragraphs according to Bryman (2016) thoughts on trustworthiness in qualitative research.

Confirmability

Confirmability is concerned in ensuring that the researcher has shown to be acting in good faith, it should be apparent that no personal values nor theoretical liking has affected the conduct or findings derived from the research (Bryman, 2016). All statements made in the work has therefore been handed to the stakeholders for confirmation in an effort to ensure the research's objectivity.

Credibility

Credability relates to that the researchers interpretation of the studied social world is confirmed and accepted by that social world (Bryman, 2016). Research were therefore sent for confirmation by involved stakeholders, this method is a common approach and often referred to as respondent validation.

Dependability

Dependability entails that a complete record are kept during all phases of the research process, the record should be able to be provided to peers to perform an audit at the end of the research as a method to establish that proper procedures has been followed (Bryman, 2016). This method was followed during the research even though Bryman (2016) mentions that auditing has not yet become a popular approach to enhance dependability.

Transferability

Transferability relates to the research ability to be transferred to another context or setting as qualitative research often is performed with a contextual uniqueness. Researchers are therefore encouraged to provide rich details about the context so others may be able to determine if the conclusions might be applicable during their context as well (Bryman, 2016).

2.4 Case Company

The research will be concluded within the production management group at Preem's oil refinery which is located in Lysekil, in order to get a insight and perception of their daily operations the study will start with a period of observations where the researcher will observe each member of the group. The observation period will be concluded over a time frame of seven weeks where each member of the production management group will be observed one week each. However, after the observation period is completed the research will still be observing the management group during their weekly meetings. The observation phase made during the research aims to provide required information on how the different departments are connected and how they interact.

Observations made during the phase also focuses on how the management group distributes information and decisions made on a management level, and how they handle the feedback loop from the ground floor. During each observation period the aim is to acquire knowledge and identify possible improvements in the departments operations. In the later stages of the research the project will return to the case company phase where education of methods and concepts that was learned and studied at the frame of reference and reference companies phases will be made during a lecture hold at the case company.

This research has relied heavily on the case company phase to find situations at the case company where parts of the Lean concept can be used to ease or improve their operations as the research aims to conclude findings that could be used in a real world setting. Although the research has been conducted almost entirely at the case company a thoroughly frame of reference has been created to support the argument of using the Lean concept in different problematic situations noted during the case company phase.

All research at the case company has been of exploratory nature with the purpose to explore how the Lean concept can be used in managerial and organization settings in form of a case study. According to Yin (2018) case studies has been commonly used by researchers to identify, explore and describe phenomena, outcomes or questions.

To successfully identify problematic situations and their cause one needs to have a deep understanding about an organization and their operations. According to Woodside (2010) a main benefit while performing a case study is the possibility to acquire a deep understanding about an organization, and that acquiring this deep understanding should be the goal of every case study. The deep understanding is achieved by triangulating data from multiple sources such as direct observation by the researcher, asking for operational explanations from case participants and analysis of written documents and environments (Woodside, 2010).

2.5 Frame of Reference

With a research question and hypothesis defined one can start collecting data to test it, although one needs to be careful to plunge into research without a plan (Booth et al., 2016)(Bell, 2010). Booth et al. (2016) explains that it's easy to aimlessly wander from one article to the next, with a chance of not discovering any literature with real value to the project. However, they do not condemn the aimless readings if the project is not limited by a deadline as they tend to lead towards new ideas and important discoveries (Booth et al., 2016).

According to Booth et al. (2016) and Bell (2010) a researcher who's working with a limited time frame should focus on finding relevant materials accessible through local institutions with a well developed search strategy. A well developed search strategy allows for identification of materials that relates directly towards the topic and effectively eliminates the thousands that are not. External databases such as Google Scholar might contain materials unavailable at the local institutions and can therefore be seen as a considerable bonus for academic users. However, the amount of search results from those databases can be enormous and unrelated to the topic causing the time to sift through the findings to be considerable (Bell, 2010).

As there has been a huge amount of research made in Lean with a production setting it's easy to find credible and acknowledged sources with that setting, but in other settings there has been a lot less research and it's harder to recognize reliable sources. In the search for literature one should always be questioning the reliability of the source and check if the literature is published by a reputable press, made by a reputable scholar or peer reviewed. These three indicators does not guarantee reliability but is a good guideline follow in the search for reliable sources (Booth et al., 2016).

The frame of reference is based on a literature review that focus on finding information and studies relevant for the chosen field of study. The literature review was concluded according to Bell (2010) and Booth et al. (2016) thoughts and expertise in the subject, literature was therefore searched by using Chalmers University of Technology's official channels for information in form of its own library and provided accesses to databases, public channels for information such as Google Scholar was also of use.

The literature review were started by searching for recently published material and then progressed into reading material recommended by the supervisor as well as literature chosen by courses at Chalmers regarding the field. Previous theses within the field conducted at Chalmers were also be read in a attempt to find new and applicable research and local expertise. The findings from the literature review was used as a basis for a frame of reference which the findings of the research were be compared against during its progression.

2.6 Lean Experts

The Lean Experts phase started by identifying experts that use the Lean philosophy in their operations on a daily basis with the aim to conduct a interview. In the search for experts both professors and Doctor of Philosophy (PhD) researchers at Chalmers were regarded, searches for experts outside of the university has not been conducted due to the limited time frame. Professors and PhD researchers were interviewed in order to take a part of their valuable expertise in the subject of interest, the interviews aimed to get inspiration and connect similarities between their thoughts on the subject and the findings in the frame of reference to recognize tools and methods that might be applicable to the case company.

All of the interviewed experts were connected to Chalmers University of Technology as either employed professors or PhD researchers. However, if there were more time available for the research the possibility to interview experts at other universities or institution would have been a great addition to increase and verify the research authenticity. The interviews were conducted in a semi-structured way which allows the interviewee to express his or her own opinions about the subject (Patel and Davidsson, 2011).

With a semi-structured interview the researcher has a set of defined questions but can at the same time adapt them and ask follow up questions during the interview (Robson and McCartan, 2016). This way the interview can be adapted to the context but at the same time follow the main structure to ease the answer analysis (Wentzel and Bertilsson, 2015). Even though the interview can be adapted to the context and deviate from the original question structure it's of great importance to make sure that the interviewee reflects and answers the research questions (Bryman and Bell, 2011).

While performing a structured interview the answers tend to be closed and often affected by the question formulation. A semi-structured interview can according to Bryman and Bell (2011) help to catch unexpected perceptions which enhances the information gathered by the interview. These perceptions can provide the researcher with new topics and insights, allowing for further research in aspects that was never thought of in the first place (Edmondson and McManus, 2007).

3

Case Company

3.1 Production Organization

The production organization consists of education, emergency services, lab and a production department which operates the refining process and acts as the central department of the whole oil refinery. The production department is illustrated in Figure 3.1 in a attempt to describe its organizational layout, the other departments acts independent departments and is thus not included in the illustration.

The production department is consisting of two different types of positions, shift working positions and day working positions, where shift positions is working according to a shift schedule and five shift teams rotate to cover all hours of the week. The organizational structure of the production department can be considered to be flat as there is only two levels between the production management and the operators, although the organizational structure is based this way it might not perfectly reflect reality. The Shift Operator is in charge of all production related operations and has a key role in the collaboration between operation engineers and operators and can thus be seen as an additional level of managers. However, the Shift Operators does not have a personnel responsibility, this is instead taken on by the Shift Manager which is considered by people at all levels to be working exceptionally even though the structure can be quite complicated to comprehend when not seen first hand.

Positions as coordination engineers and operations engineers are positions in the organization that works during office hours, these positions report directly to each area associated production manager in the production management. Coordination engineers coordinates work tasks and collaborates with the other departments to ensure that maintenance and repair operations is performed in their assigned area while operation engineers ensures that their part of the refinery process is running smooth and performing as determined.

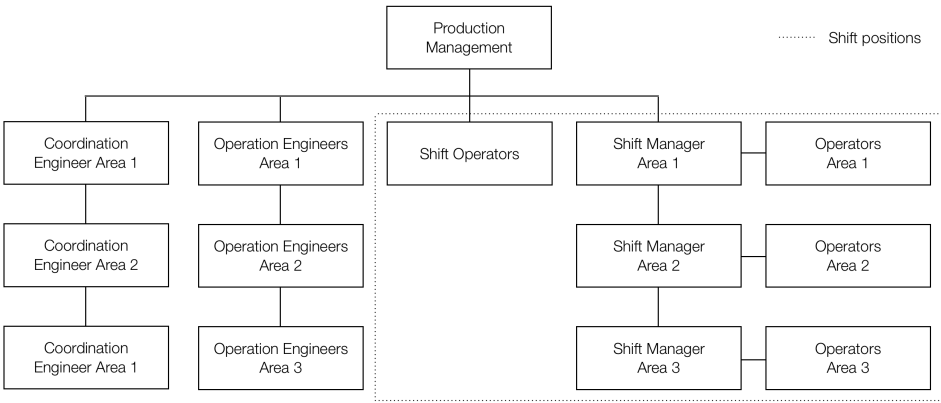


Figure 3.1: Production Department Organizational Layout

3.2 Production Management

The production management is organized as six different department heads with the production manager as its supervising officer. The management consists of managers from the three different production areas as well as the lab, emergency service and education departments which is visualized in Figure 3.2. The production areas act as directorial departments who request services from the other departments. The lab can thus be seen solely as a service department for the production while the emergency service and education department acts independent as well as in collaboration with the production areas. The HR Business Partner (HRBP) however does not report to the production manager but acts rather as a support resource for the managers in their operations.

The management group consists of people with different backgrounds, several of the managers are raised in the company and has there their whole careers from blue collar workers to managers, while others have been acquiring experience and from different companies as well as educational institutions, although with the exception from the Lab Manager the production managements knowledge within the Lean philosophy is limited.

All members of the production management has their assigned location at the refinery and thus they are often interacting on a daily basis, beyond these interactions the management also has a standing meeting once per week where each head of department participate. At those meetings is events that took place during the previous week discussed along with a standardized agenda that includes security deviations, updated work instructions and information from the operations manager.

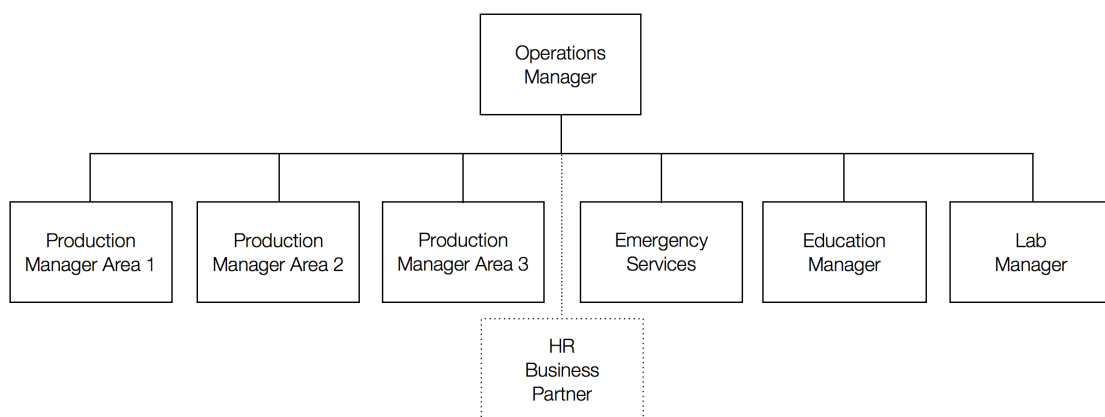


Figure 3.2: Production Management Organizational Layout

3.3 Observations

In order to acquire experience of how the different departments works several periods of observations was made. The observations were performed by studying each head of department during one week each, the observations gave an insight to their operations and provided information about struggles and obstacles in their daily work tasks. The observations were extended outside of the production management to include studies of Shift Operators and Operation Engineers as well, a full list of participants can be seen in Table 3.1. This was done with the aim to provide a more holistic view of the production organization and to trace the information flow from the top to the bottom of the organizational structure.

With the Lean philosophy's prolonged background in production research tends to focus more on departments influenced or oriented towards production operations. Although all of the studied departments are connected to the production operations by being a part of the production management they don't necessarily interact with the physical production facilities nor operations. In this research however all the departments is observed and evaluated regardless of their interaction with the production. The observations aims to identify how they can apply methods and tools from the Lean philosophy in their operations.

Title	Department	Study Period
Operations Manager	Production	1 Week
Production Manager	Production Area 1	1 Week
Production Manager	Production Area 2	1 Week
Production Manager	Production Area 3	1 Week
Fire Manager	Emergency Services	1 Week
Lab Manager	Laboratory	1 Week
Education Manager	Education	1 Week
Shift Operator	Production	2 Days
Operations Engineer	Production	1 Day

Table 3.1: Persons studied during the case company observations

4

Frame of Reference

The Frame of Reference chapter will introduce the theoretical framework of the Lean philosophy, providing the reader a deeper understanding of the concepts cornerstones and its usefulness. All of the parts integrated into the Lean philosophy will not be presented but merely the concepts that were used and evaluated throughout the research.

4.1 Visual Management

The concept of visual management is a central part within the Lean philosophy, it aims to provide information about production, organization or other settings in a transparent holistic view. However, the concept of visual management is not new, it's an ancient invention which spread rapidly through industries in the early 90's as the traditional information methods of reports, telephones and computers did not suffice when the industries needed to produce more efficiently, with better quality and at a lower cost (Greif, 1991). Nowadays the concept is not only integrated in the soul of producing companies but is also starting to get acknowledgement in pure developing and managing organizations as well.

Visualization provides an systematic approach to transfer knowledge between different stakeholders in a organization as it acts like a bridge which links individual knowledge and the wider organization together at a common ground (Whyte, Ewenstein, Hales and Tidd, 2008). In knowledge intensive industries the visualization practice has been widely adopted as it has proven to be a powerful method for sharing knowledge between stakeholders (Lindlöf, Söderberg and Persson, 2013).

Using visual management as a communication method creates a transparency that can not be found in conventional workplaces, with the visualization practice delays, deviations, and reports can be accessible to all stakeholders and not just an individual recipient (Greif, 1991). According to Greif (1991) a distinctive aspect with visualization as a communication method is the open group of recipients which causes the information to not be limited by a set of individuals, specialists or hierarchies but rather a given area, allowing everyone that's working or passing by in the area to observe the visualized information (Greif, 1991).

The method is distinctively different from traditional ways of communication in the respect of how information is distributed and received. As described earlier the information is not limited to a set of individuals but rather a given area, in line with the purpose of a self-serving principle the method relies on the intention of people to become information recipients (Greif, 1991). However, when information is accessible to everyone and not directly directed towards an individual there may be a problem with people making themselves uninformed, it's therefore of great importance to create a positive work culture in which information is not ignored for personal gains.

There is several uses with the visualization concept, but one of its prime benefits is the managements capability to acquaint colleagues about the corporate values, vision and goals (Mestre, Stainer, Stainer and Strom, 2000). It's extensively used by management in successful companies to maintain the corporate vision, visualizing how the company is progressing in reaching its goals as well as informing, reminding, and motivating the corporate members (Mestre et al., 2000).

Visual management is often seen as an important principle in development settings due to the complexity of organizations which makes it difficult to see the actual process without the support of visualization systems (Morgan and Liker, 2006; Ludvig Lindlöf and Trygg, 2012). According to Ludvig Lindlöf (2012) the visualization concept allows organizations to achieve a flow-orientation in their information stream which enables transfers of information and knowledge between people. Although visualization aims to create a transparent organization information should not be displayed just because it's at hand. Visual management systems must be kept simple and only display information that's of importance for the process (Parry and Turner, 2006).

That visualization supports human cognitive functions is a well researched area and widespread in both society and industry, several studies in how humans comprehend and perceive information has shown that sight is the largest contributor to our remembering process of the five senses. According to J. S. Oakland (2007) researchers estimates that the sight makes up seventy five percent of our ability to process information. Although the scientific proven benefits visualization still seems to be underutilized in management settings (Ludvig Lindlöf, 2014).

The era of digital transformation has taken its toll on visual management systems as well, the question if information should or should not be displayed digitally is a often discussed subject among modern researchers. Bhansin (2015) argues that enormous screens might impress visitors but might not be practical for its users, while Catic, Stenholm and Bergsjö (2016) argues that digital systems can increase the versatility. Whether or not a visual system should be analog or digital seems to be unconcluded by previous research as both have specific benefits and weaknesses.

4.1.1 Visual Planning

Visual practices has been developed to enhance the information flow, prioritization, cooperation and decision-making of a process. Visual planning is one of these practices which can be found in the visual management concept, it aims to communicate, coordinate, manage and execute deliverables of an ongoing process by physical visualization of the process tasks as described in an article by Ludvig Lindlöf and Trygg (2012):

"Visual planning is when development teams use frequent meetings and physical representations of tasks in order to manage deliverables and tasks throughout the execution of a project" - (Ludvig Lindlöf and Trygg, 2012, p.4)

Ludvig Lindlöf and Söderberg (2011) argues that visual planning makes the communication more efficient by visualizing a teams activities in a unified view and that one of the main benefits with visual planning is the short meeting, as this prompts real time information that concerns all team members to the surface. Planning meetings can thus be seen as a forum where both planned and ad-hoc information can be shared and evaluated among the participants, this enables peoples engagement which empowers the communication and support for continuous improvements (Dabäck, 2016; Parry and Turner, 2006).

Visual planning creates a transparency and overview of the current status in process that can't be acquired elsewhere, this allows users to easier identify wastes in the process and enables faster decision making (Jaca, Viles, Jurburg and Tanco, 2014). With the transparency and updates of activities that visual planning provides can managers level the work tasks among a team to maximize the productivity, the method also allows problems to surface at an early stage in the process which limits its impact (Holmdahl, 2010; Lindlöf and Söderberg, 2011; Dabäck, 2016).

According to Mascitelli (2011) is planning vital for the success of a process and that plans are simply a product of planning. Visual planning should therefore not be seen as a set plan, but rather as a dynamic support tool which continuously tracks and updates the plan (Wentzel and Bertilsson, 2015). This belief is shared by Ludvig Lindlöf and Söderberg (2011) who stresses the importance of viewing visual planning as a support tool and complement to previous working methods rather than a replacement.

Holmdahl (2010) argues that visual planning express its best effects when used as a support tool through the entire organization, all the way from the management to the blue collar workers. Visual planning boards are therefore often divided into three time horizons depending on interest and application, these time horizons are short-term, mid-term, and long-term (Ludvig Lindlöf and Söderberg, 2011).

Visual Boards

Visual planning uses boards for physical representations of tasks, deliverables and milestones. A basic form of a visual board is visualized in Figure 4.1 which illustrates a short-term visual board. The x-axis of visual boards represents the time-frame and can be altered to fit the application, however, the y-axis is constant and represents users which can be either an individual, group of persons or department (Ludvig Lindlöf and Söderberg, 2011). In Figure 4.1 the time resolution of the board is constructed to represent a whole week where task, deliverables and milestones is color-coded to become more understandable (Holmdahl, 2010; Ludvig Lindlöf and Söderberg, 2011).

When introducing visual boards the users must be empowered to develop their own layout and standard as this creates a deeper feeling for ownership and responsibility (Parry and Turner, 2006; Ludvig Lindlöf and Trygg, 2012). Ludvig Lindlöf and Söderberg (2011) as well as Parry and Turner (2006) argues that the users should write their own activities notes and be responsible for their own row without the interference from others.

The color-coding can be different depending on the interest, even special notes can be utilized to mark critical components or deadlines which marks visual boards as a versatile support tool that can be adapted to special needs. Holmdahl (2010) practices the color-coding of activities, deliveries and milestones seen in Figure 4.1, while other researchers such as Ludvig Lindlöf and Trygg (2012) color-codes notes of activities, deliverables, problems and absences. However, which type of color-coding or number of notes that's used is trivial, as long as all users is working according to a set standard (Ludvig Lindlöf and Trygg, 2012).

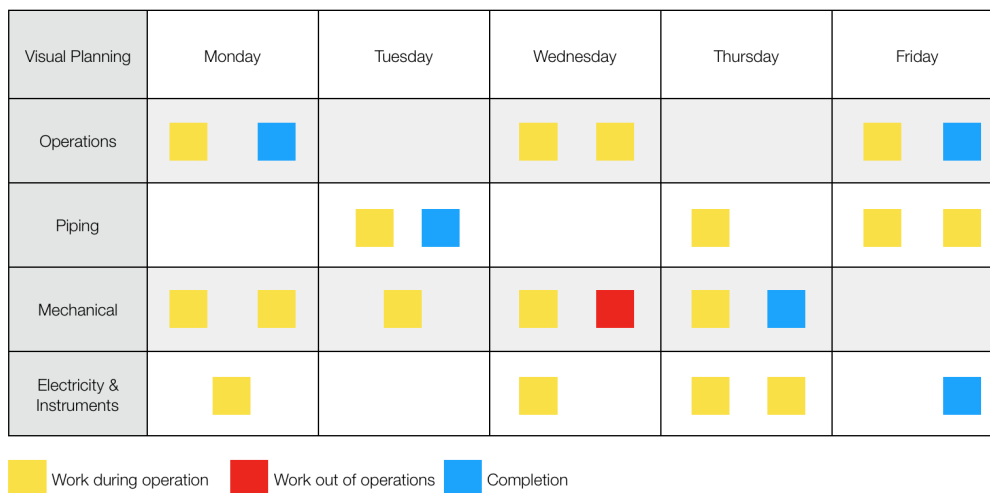


Figure 4.1: Visual Board Of A Short Term Plan

Visual Planning Meetings

At the visual planning meetings the participants are standing up, the point of this is to create a sense of urgency which increases the focus and results in a effective and active meeting (Ludvig Lindlöf and Söderberg, 2011; Mascitelli, 2011). Mascitelli (2011) also argues that planning meetings should be held with a limited non-flexible time frame as this causes people to reveal the most important information first without going into details.

How often meetings should occur depends on the setting, the duration and frequency of the meetings can vary from daily meetings to once a month depending on the communication needs (Andersson and Torinson, 2017). However, the team members must be given enough time to collect new information between the meetings, otherwise the meetings will bring no value (Mascitelli, 2011; Ludvig Lindlöf and Söderberg, 2011).

Mascitelli and Winett (2007) recommends having meetings taken place during the mornings as information tends to be forgotten and stresses the importance of attendance from all members as the meeting should act as a forum for information exchange and coordination which otherwise isn't possible.

Digital Visual Boards

Along with the era of digital transformation has several visual management systems been developed to digital versions, although the opinions of the usefulness of this are split between researchers. Ludvig Lindlöf and Söderberg (2011) highlights that the use of software risks constraining the team communication, this is explained to originate from the enclosure and concealment of information that comes with the nature of digital systems (Ludvig Lindlöf and Trygg, 2012).

According to Parry and Turner (2006) are physical boards superior to digital boards and mentions limitations in ownership, knowledge expectations, and data presentation as arguments for his claims. Although these arguments are valid it's not impossible to overcome the limitations, the limitations can be countered by developing user friendly interfaces that removes the knowledge barriers and using specialized screens for the task (Andersson and Torinson, 2017).

However, Wentzel and Bertilsson (2015) points out that there are settings where a digital board is better suited for the task, in their article they urge for the use of digital planning boards when the users are not based at the same location. According to Mascitelli (2011) this is might be true when it's not possible to reap the largest benefit and main purpose with visual planning, the face-to-face discussion and team interaction as stated in the following quote:

"A virtual project board may be easy, but having team members see each other face-to-face is the most powerful "visual" management tool there is."
- (Mascitelli, 2011, p. 112)

Yolean

One of the most recent developed digital visual management tools, Yolean, manages to act as a bridge between pulse and visual planning. It's architecture is built around the aggregation of individual plans into the context of all the teams in which those individuals participate, allowing teams to see the synchronization on a higher level (Yolean, 2018).

Yolean acts as a digital visual management tool with the goal of stimulating communication around tasks, deliveries, obstacles and questions. It makes hidden value flows visible by acting as a catalyst for people to meet on a regular basis and communicate in their daily work, no different from a physical board (Yolean, 2018).

It's ability to act as pulse board, visual board and as a virtual planning forum for distanced teams provides a versatility that cannot be found in analog physical boards, the previously mentioned limitations that Parry and Turner (2006) saw with using digital boards has been avoided by it's simplicity and user-friendly interface. A statement made by one of the Lean founders Daniel T. Jones on his thoughts about Yolean settles the debate on the usefulness of digital systems in visual management:

"Yolean has managed to keep the simplicity of the Lean tools while adding the benefits of digitalization. I am impressed" - Daniel T. Jones, Lean Enterprise Academy

4.1.2 Pulse Methodology

In industries the use of Pulse or *Obeya* rooms is a recognized management method in which a specific room is designated for visualization of processes and methods. The pulse methodology aims to create an environment where dependency parties can frequently synchronize by informing, defining, and solve process deviations (Kaya, Stenholm, Catic and Bergsjö, 2014). Pulse rooms thus removes the communication barriers between departments in a organization by providing a common platform for information sharing and collaboration.

According to Ludvig Lindlöf (2014) the method helps functional managers and project managers gain a better overview of organization activities on an aggregate level. Although the pulse creates a holistic overview of the current processes its main purpose in a large organization is to promote the communication, interaction and problem solving between departments (Dabäck, 2016; Kaya et al., 2014). Pulse rooms can therefore be seen as a central dispatch where the departments meets to collaborate and coordinate processes. Pulse boards are mounted at the walls which helps with the interactions and creates a transparency in which everyone can see the current status of the organization.

Pulse boards visualizes activities and status of processes in large matrices, due to the color-coding of the matrix it's simple to get a holistic view which provides an instant insight into the status of the activities in the entire organization (Oosterwal, 2010). As with the visual planning notes the number or colors of the matrix can be adapted to suit the setting as long as a standard is used, in Figure 4.2 the illustration of a pulse board contains three colors which each represent either no, short lasting, or long lasting deviation.

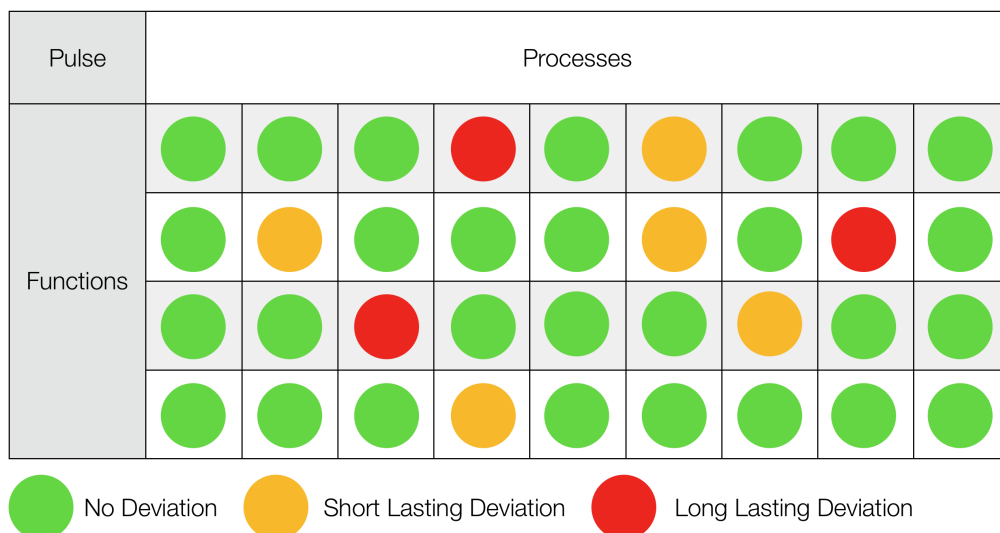


Figure 4.2: Pulse Board Illustration

4.2 Daily Management

The concepts of daily management and visual management can often be seen used together due to its great complement, although, here are the two considered as separate and not in any way depending and so one can be used independently without the others existence. Daily management focuses on how the information flows through the organization while visual management focuses on removing information barriers, create transparency and stimulate communication (Levinson, 2012).

Daily management aims to create a organic information flow between the organizational levels as seen in Figure 4.3, this information flow ensures that everyone has knowledge about the current situation in the organization (Levinson, 2012). The information flow is created by establishing short meetings at the different organizational levels where appointed representatives from each level are informing the level above what they discussed.

However, daily management meetings does not only create a more informed organization, it also allows for managers at the level to distribute work tasks, follow up on previous performed tasks and ensure that the plans are followed by the development of activities lists and routines (Levinson, 2012). By the development of routines and structured activities lists that team members can follow throughout the day the expectation of their performance are easier understood, this allows team members to be more independent and conscious about their expectations. In short terms the goal with daily management is to ensure that everyone in the organization knows the current situation and be informed about the activities they are expected to perform, and thus removing waste by the creation of a knowledgeable organization (Levinson, 2012).

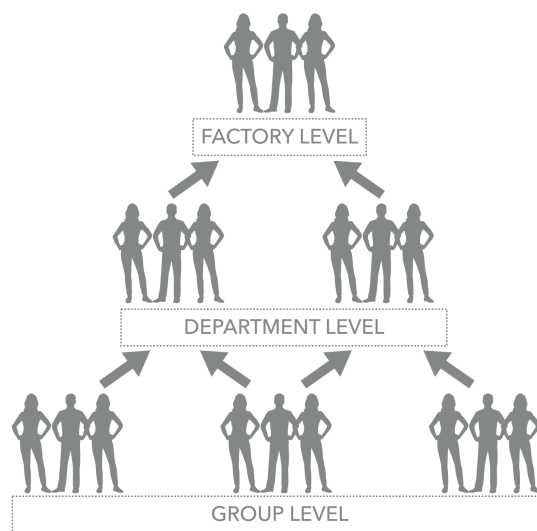


Figure 4.3: Daily Management Meetings

4.3 Process Mapping

Process Mapping is the concept of creating detailed actions that are taken throughout an entire process, ranging from processes at the ground level to the absolute top of an organization. The concept is acting as a part of the Lean Management philosophy due to its ability to identify process actions that either adds value or creates wastes within a process, several process mapping tools such as flowcharts, value stream mapping, and string diagrams are therefore frequently used within industries. However, the methods address to different types of situations, value stream mapping includes a holistic view where the entire chain from supplier to customer is included while flowcharts addresses specific actions in a process. Flowcharts has recently been adopted by a large amount of companies due to implementations of the ISO standards 9001 and 14001 which maps the processes of a business, an example of a process map can be seen in Figure 4.4 which illustrates the different steps of a recruitment process.

All types of process mapping highlight the actions of a process with the underlying intent of finding improvement potentials. According to Damelio (2011) adding the knowledge of a process into a process map creates an opportunity for analysis of improvement potentials to achieve a specific purpose, as well as a basis for knowledge distribution. The method also improves the understanding of what's of importance in the process by describing the currently best-known way to perform a work task (Damelio, 2011).

Martin and Osterling (2012) describes process mapping as an effective method for grasping the current situation at a granular level and as a effective tool for analysis and design of processes. Although the process map should be able to serve as an base for analysis it should always be kept simple and understandable but as true to the real environment as possible (Martin and Osterling, 2012).

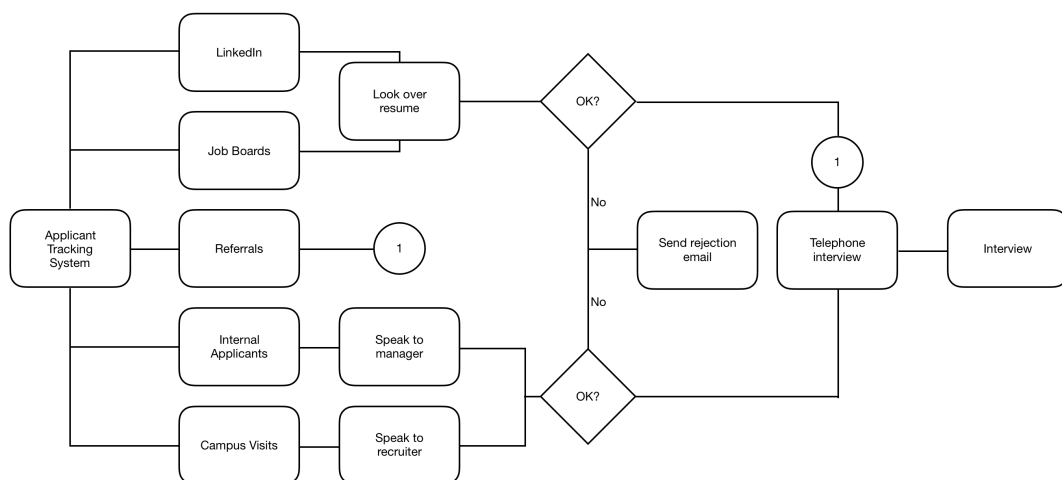


Figure 4.4: Recruitment Process Map

4.4 Key Performance Indicators

Key Performance Indicators (KPI's) represents a set of organizational defined measurements that's regarded most critical for the current and future success of the organization. KPI's are used by businesses to quantify their business objectives and enables for regular check-ups on their performance and progress (Parmenter, 2007). The KPI's allows for accurate current performance measurements which in turn allows the organization to:

- Learn from past outcomes
- Improve future results
- Report externally
- Focus effort
- Monitor output
- Demonstrate compliance

Information from the KPI's can be used as a basis to make faster and more accurate decisions, the method can thus be seen as a vital support tool across the organization which minimizes errors and uncertainty (Marr, 2015). Monitored KPI's thus provides information about an organization in a way that allows for challenge of strategical assumptions which ensures that the company is steadily moving in the right direction without the need for guesses (Marr, 2015).

KPI's are due to the information basis it provides often seen as a vital method for managements to efficiently steer the organization, as without it are management decisions often affected by circumstantial events which causes decisions that has no clear relation towards the strategical goals of the organization to be made (Parmenter, 2007).

Which type of KPI that should be used are dependent on what the organization has defined for objectives, although a common denominator for all KPI's are to measure something of relevance to the target objective. KPI's therefore needs to be put in a context where decisions and actions can be traced to an impact on the measurement, as it's otherwise numbers and data with no clear relevance (Marr, 2015).

However, KPI's are not limited to be used by management as a basis for their decision making progress, it's regularly used to influence the employee behaviour to reach certain objectives by creating KPI's that they can affect. According to Marr (2015) this procedure is common and can be achieve extremely positive results in the progress to reach strategical objectives due to the dialog up and down the organization it creates (Marr, 2015).

4.5 Policy Deployment

Policy deployment or *Hoshin Kanri* is a method for ensuring that the vision set by management drives progress and actions at all levels in the company. The method strives to create an organization where all members of a company work towards a common goal by aligning the top managements strategy with the plans of the middle management and the actions performed by blue-collar workers and can thus be seen as a long-term variant of daily management. With all members of an organization in alignment and a clear understanding of their role in the achievement the productive power of an organization is at its optimal point (Hutchins, 2016).

The method is often described as a catch-ball process where a vision is set by the top management which then aligns and creates strategic goals with the underlying organizational level how the goal can be achieved, this process of alignment is iterated all the way down in the organizational level to the blue-collars and eliminates wastes that comes from inconsistent direction and misguiding communication (J. Oakland, 2011). Along with the goals are Key Performance Indicators (KPIs) created to track the process of reaching the goal, according to Hutchins (2016) it's of great importance that the KPIs directly links to the vision with the goal as the KPIs often creates an impact in behavior that affects the drives towards the goal's achievement.

However, it's not limited to pushing strategic goals down the organizational levels, it also focuses on acquiring information about progresses and results in the other direction (Liker and Convis, 2012). The results of the actions is reported back up in the chain of organizational levels which closes the loop of information exchange. Policy deployment can thus be seen as creating an information flow that runs through the entire company, where goals and KPIs travels from the top and the results are returned from the bottom as seen in Figure 4.5.

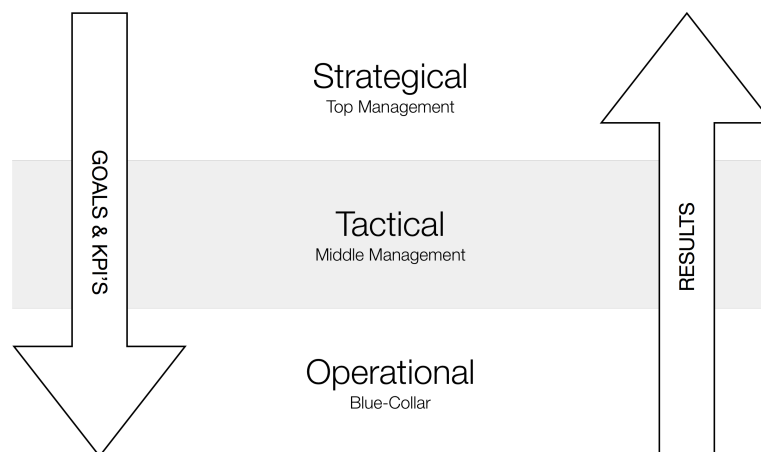


Figure 4.5: Policy Deployment

4.6 Continuous Improvements

Continuous improvement is a method for identifying opportunities, streamlining work and reducing waste. The method is based on implementing incremental improvements which over time builds a process of operations excellence. The process reduces the fear and resistance of change, allowing organizations to develop without the need of waiting for a strategical shift (Smalley and Katō, 2011).

When approaching the concept of continuous improvements the practitioner needs to have an open mind, and a willingness for experiments in order to obtain results (Smalley and Katō, 2011). However, the experiments can not be conducted without a rigorous amount of time to reflect upon the process and how it can be improved, improvement ideas should therefore come from the employees as they are closest to the problems. Allowing people to improve their own work also causes a positive impact on employee engagement, simply doing things differently does not constitute continuous improvements, one must be engaged enough to dig deeper into the process and ask fundamental questions about its execution and existence (Smalley and Katō, 2011).

Continuous improvements is a dynamic, ever-changing process which requires commitment, the process can therefore cause frustration as it's like climbing an never ending ladder. As argued by Stewart (2012) senior managers needs to balance the level of recognition for improvements with the desire of achieving the ideal state, a healthy balance motivates an organization to continue develop in a desirable rate. Managements that empowers employees to implement improvements thus creates a more efficient organization as incremental improvements are usually inexpensive but value adding to the operations, without a system of continuous improvements the real potential value of a process can never be realized (Stewart, 2012).

The concept of continuous improvements and standardization builds upon each other, where one would not be able to exist in it's current form without the other. The process could be compared to a staircase, were each step is a new standard based on the previous but with incremental changes of improvements. The process of continuous improvements and standardization is visualized in Figure 4.6 which illustrates the concept.

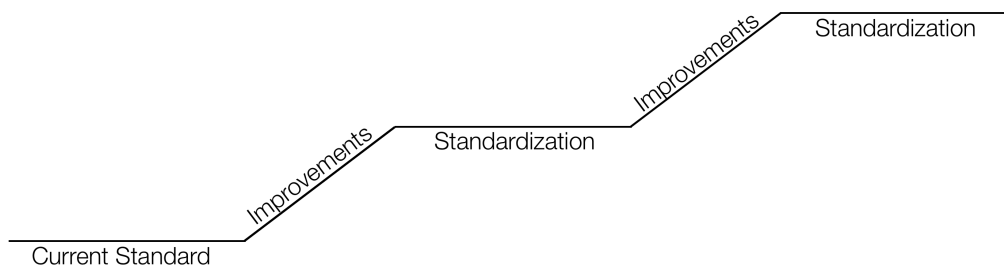


Figure 4.6: Continuous Improvements Concept

4.6.1 Continuous Improvement Cycle

While working with continuous improvements an iterative four step cycle method is often used, one of the most commonly known is the Plan-Do-Check-Act (PDCA) cycle illustrated in Figure 4.7. The PDCA cycle was originally developed by the quality control movement as a learning tool and consists of both single and double loop learning which is argued by Pietrzak and Paliszkiewicz (2015) to be crucial for effective organizational learning during strategic management processes. The method is used in all types of organizations to develop processes by the iterative cycle of implementing improvements.

Plan

During the Plan stage the analyst formulates the mission and conducts a strategic analysis. The vision and strategy should be developed and translated into operational actions. Defining what needs to be accomplished and indicators on when it's accomplished, as well as the objectives is of great importance during this stage (Pietrzak and Paliszkiewicz, 2015).

Do

At the Do stage the actions defined in the Plan is carried out, the strategy is communicated and the organization is aligned to support its implementation.

Check

During the Check stage the effects of the actions is observed, the results is examined to verify that the objectives and goals is achieved. Deviations from the plan is also checked to ensure that the underlying reasoning is still valid (Pietrzak and Paliszkiewicz, 2015).

Act

Actions at the Act stage is dependent on the results, if the objectives were not achieved adjustments need to be made during the Plan stage and the cycle resets.

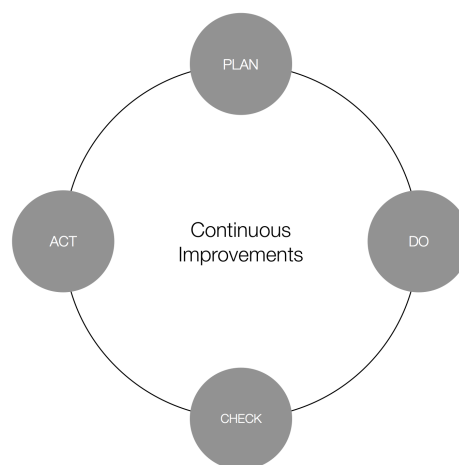


Figure 4.7: Continuous Improvements Cycle

4.7 Standardized Work

Standardized work is acting as the fundamental pillar on which continuous improvements relies on, without it there is no opportunity for improvements due to the non-existent base line on how the operation is conducted. One can argue that the whole concept of continuous improvements therefore is unobtainable without first obtaining the operations base line that standardized work instructions provide. Thus, the two concepts can be seen interconnected as visualized in Figure 4.8, continuous improvements needs standardization and standardization needs continuous improvements (Patchong, 2014).

The method aims to create a base line of how an operation is conducted by providing clear instructions and culture on how to perform a process. However, according to Patchong (2014) this does not just enable continuous improvements but also delivers long-term benefits in terms of improved safety, better quality, higher productivity and increased team morale. Arguments of improved safety, and increased quality is supported by Niederstadt (2016) as well, whom points out that standardized work should not be limited to cyclical production processes as it can be applied on all types of processes.

Standardized work should not be seen as set in stone in any way, practitioners of the tasks has to be able to form it and affect its content. Therefore, the creation of standardized work can be seen as an iterative process which resets each time an improvement has been identified. These incremental improvements causes the work practice to be steadily climbing up to the goal of operational excellence, the standard should therefore not be seen as the way of performing a task but merely as the current best known way of performing the task (Liker and Hoseus, 2008).

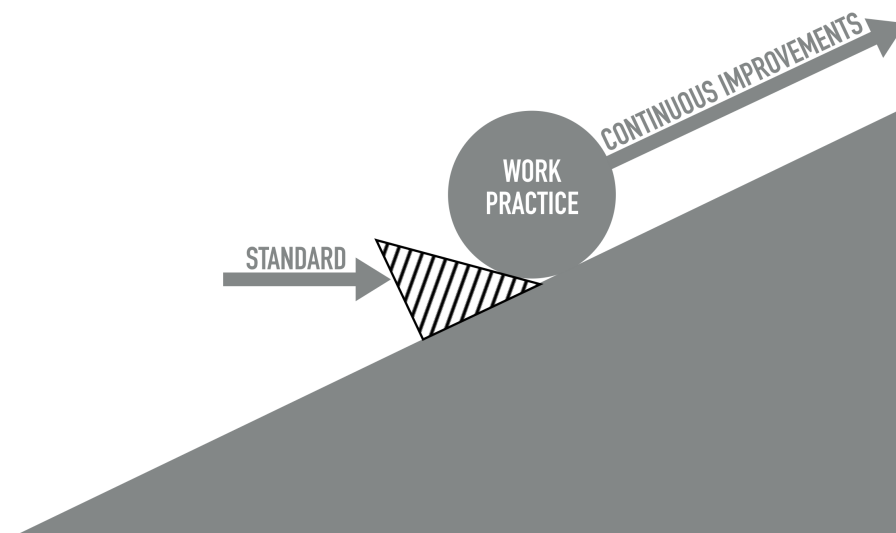


Figure 4.8: Illustration Of Standardized Work and Continuous Improvements Relation

4.8 Value Added Time

All the of the mentioned methods in the Frame of Reference chapter are used for the same reason, remove wastes and increase the share of value adding time in a process. In order to grasp the different aspects of a process all of the actions made in that process are divided into the three different sections value adding, necessary, and waste seen in Figure 4.9.

- Value adding are the actions that brings 'value' to the process, value can thus be explained as the actions that is bring a change or effect that an internal or external customer is willing to expense, e.g a creation or decision.
- Necessary are actions that does not bring any value to the process but are still required in order to allow the value adding work to be performed, e.g.
- Waste are actions that does not bring any value to the process nor needed to perform the value adding actions, these actions are therefore seen as wastes which are unnecessary in the process, e.g waiting for dependencies.

Identification of which actions that belongs in each section can done while performing process mapping, this visualizes the processes and makes it easier to recognize which actions that can be labeled value adding, necessary or waste. Within the concept of Lean there is seven actions that is pre-determined to be regarded as waste, overprocessing, overproduction, waiting, defects, waiting, motion, inventory and transport (Liker and Hoseus, 2008).

However, these wastes are more or less common in all kinds of organizations, overprocessing e.g which relates to the effort that goes into actions that are outside of the customers needs does frequently appear and could easily be eliminated by precising the customer needs. This can be traced to a lack of communication, the performer gets a unspecified task and does this do his best ability, although the provider are not in need of such a detailed performance, which makes all of the extra effort to go into the waste bracket. In organizations it's common that the value adding time is representing less than five percent of the process time, thus a huge improvement potential can be found by creating a mindset that concerns value adding time during normal operations (Liker and Hoseus, 2008). Although, one of the main problems that adds to the waste bracket are a mindset of full time utilization, making unexpected value-adding work postponed due to a already packed schedule which is described as the efficiency paradox by Modig and Åhlström (2015).

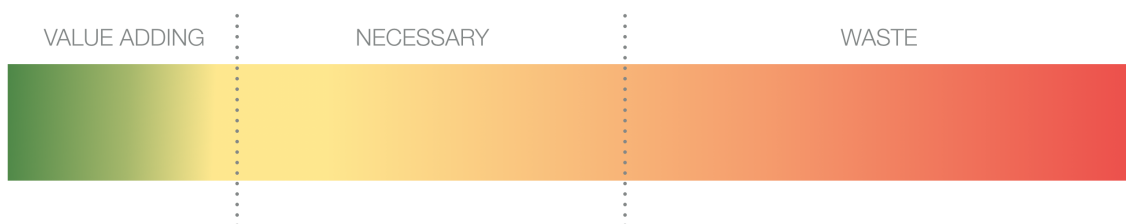


Figure 4.9: Representation Of Value Brackets In A Process

5

Results

The Results chapter contains findings gathered during the research's observation period, the findings is presented and related to the theoretical framework in the Frame of Reference chapter. The chapter addresses findings of current operations in line with the Lean philosophy as well areas for possible improvements.

5.1 Current operations

5.1.1 Daily Management

A practice of daily management is already in operation at the case company although it's not called out, every morning the operators starts the practice during their shift change, activities that were performed during the shift and deviations at their assigned area are informed to the relieving operator. The relieving shift group then discusses deviations that came up during the previous shift and activities that are going to be performed during the day with their shift manager at a 'group level'. After the discussions has been completed the shift manager together with a representative of the shift team continues to a 'department level' meeting which consists of representatives from the other interacting departments mechanics, piping, electricity and instruments as well as coordination engineers, operations engineers and production manager to the assigned area. During those meetings the different departments synchronize and discusses the time plans of coming activities as well as informing about previous performed activities and share deviations to their knowledge.

After the department level meeting has taken place the operations engineers and production managers from the different production areas meets up at the shift operators office together with the operations manager, here the gathered information during previous meetings are presented to the shift operator and others among the group, creating a holistic view of the current status of the production and organization. As the shift operator has the operational responsibility of the production and thereby also the most insight into the current production the shift operator are holding the meeting, the meeting thus acts as the 'factory level' meeting and the end stop for the information which has been flowing from the bottom of the organization up to the top. The factory level meetings has a standing agenda which is determined to be followed by the shift operator that aims to create a type of two-way communication between the meeting participants,

the purpose of this is to connect the information gathered during the daily management meetings with the informational logs to make sure that the organization is synchronized and no area is left out of the information.

The duration of the daily management meetings are quite limited and often ranges in the time frame of ten to twenty minutes depending on the amount of discussion required, although the agenda used at the shift operator meetings are quite different from the other meetings as the needs for discussion is much less, follow up questions to verify that the received information is correct are frequent but the discussions are kept limited. The agenda at the shift operator meeting are kept small to ensure a swift meeting but still manages to include the following items:

1. Safety Deviations
2. Equipment Status
3. Activities
4. Quality Deviations
5. Production Targets

Daily management meetings at the case company has been noticed during the observations to be working exceptional, the operators as well as operations engineers and shift operators has expressed satisfaction with the information flow created during the morning meetings.

"The morning meetings provides great information of the current situation within the organization which would otherwise be hard and time consuming to gather, the newly formed shift operator meetings really brings the information together and provides a holistic view"

Activities are brought to the operators by informational systems built around routines and operations orders, the routine tasks assigned at the specific area are checked by the operator currently stationed at the area, after the operator has completed the routines the status is changed in the informational system by the operator. Operations orders are created by the operations engineers and consists of work tasks that's not included into the routines, the operations orders are thus tasks that can be traced to the needs of the production, i.e tasks to counter production deviations such as unexpected equipment breakdowns. These systems allows for tracking of routines and operation orders, as well as provides a more effective performance by making the operators knowledgeable and independent, thus reducing the needs of guidance from management.

All in all the case company already follows the method of daily management according to the Lean management philosophy. Structured meetings between different organizational levels that provides an organic information flow are in place and activities systems for the operators has been created which reduces the need of guidance from management, thus the company has grasped the fundamental principles of daily management which were observed to be systematically followed throughout the entire observation period.

5.1.2 Key Performance Indicators

Key Performance Indicators are used by the production management to track the progress towards their set objectives, these indicators are updated and discussed at least once a month during one of the production management meetings. All of the key performance indicators used at the case company has a clear relevance to their business objectives and can be traced to performed actions. Production managements choice of key performance indicators can be seen as a combination of measurements for both long term and short term objectives with a extensive focus on performance and safety measurements.

Key performance indicators are shared with the personnel who thus can take part of the organizations progress, several of the measurements are also directly connected to their activities, making them notice the impacts of their performances. During a presentation the participants were asked if they felt that can create an impact on the measurements, a common a response were *"I know that my actions can affect several of those measurements"*. Production management uses this method to influence the behavior of the personnel and create an impact on the work culture, this is seen by the use of strategical measurements that the personnel themselves are responsible to update and maintain to reach an objective. Key performance indicators used by the production management is thus regarded to be well formed to quantify their business objectives and efficiently steer the organization.

5.1.3 Standardized Work

Standardized work are a common occurrence within the case company, almost every process observed during the observation period were influenced by the practice of standardized work. This is particularly noticeable within the production department where tasks has a specific set of guidelines that describes the operation, required equipment as well as knowledgeable risks associated with the operation that's to be performed. Instructions to standardize the work tasks has been constructed by the personnel during decades to improve efficiency and safety, although this has resulted in instructions written with different templates or forms which deviates from the line of standardization. The production management has thus decided to rewrite all of the instructions to a standardized template formed by a specialist in the subject. However, all of its content are still based on the practitioners instructions, but rewritten with an foremost perspective of safety and easy comprehension, all in line with the fundamental principles of standardized work.

Although the use of standardized work permeates in the production department and thus easy to notice it's found other the departments such as education as well. Within the education department it's more subtle but the use of the concept still shows during normal operations, ranging from standardized processes in the recruitment of holiday workers to standardized requirements templates in the handling of pay grade bumps which ensures the quality of the process and

5. Results

increases the performance. Standardization occurs within the production management as well, during their meetings a standardized agenda is used that allows the managers to be more prepared for the content discussed at the meetings which thus improves both the efficiency of the meeting and their preparations.

5.1.4 Continuous Improvements

All deviations from normal procedures that occurs at the company, regardless of location and department, are reported through a system called 'Synergies' which can be seen used with the purpose of creating a culture of continuous improvements, although it may not be recognized as such. Synergies are allowed to be written by all personnel employed at the company with a range from the largest of deviations to small deviations solvable at the spot. Synergies are thereby continuously created throughout the company in an effort to bring up deviations that can be investigated to grasp the occurrence and to improve the processes, whether it might be incremental or breakthrough improvements.

The case company's system of using synergies as a tool for reporting deviations and manage continuous improvement were observed to be working fairly well, most of the fundamental principles of continuous improvement, empowering the personnel closest to the process to report deviations as well as the encouragement of them to recognize and report the deviations were recurrent topics during the observations. Although the fundamental principles are already in place, there is still improvement potential in the way that they are using the system in relation to the concept of continuous improvements. The allowance of all personnel to report deviations in collaboration with the managements constant encouragement of the personnel to do so results in large amounts of synergies to be created, this is not in any way regarded as distressing but creates a huge workload on the synergies recipients.

The mentioned improvement potential comes with the way the synergies are handled rather than how it's reported. The huge workload on the synergies recipients can be traced to the levels of investigation that comes with the synergies, currently there are two types of synergi levels, one lower level which requires a operations engineers or production managers investigation and one extended level which is used for critical deviations that requires a special appointed investigation team. The case company thus misses out on one important aspect, engaging the personnel closest to the process in the investigation of possible improvements, by implementing another lower investigation level where the synergi reporters themselves can investigate and come up with improvements for small deviations and then report to an operations engineer would reduce the workload on the current synergi recipients as well as improve the efficiency of the system.

Synergies that are reported are evaluated by operations engineers and production manager at their respective areas, this is done during a meeting where the participants goes through their received synergies and presents their investigation and can thus be related to a sort of continuous improvement cycle without the implementation of improvements. However, the case company is on the right track, the synergi system includes everything required by the concept of continuous improvements, it's alone the culture of evaluate implementing improvements identified by the investigations that's currently not found in the process.

5.2 Improvement areas

5.2.1 Visual Management

In the production department there is seemingly a huge potential with several parts of the concept, members of the organization has been expressing their concerns of feeling uninformed of other departments operations as well as operations conducted their in own, which could be countered with the use of visual management. These expressions of concerns are not justified while working in the morning shifts but are however for the other two shifts that does not interact with the daytime personnel to the same extent. The lack of information does not come from an unwillingness to share information but rather from the nature of a shift working organization and enclosure of information in unconnected complex information systems. Due to the nature of shift rotations there can be a time frame as long as five weeks where the shift working personnel can possess outdated information or be 'kept in the dark' of information that's not channeled through shift change or documented in the information systems.

These information barriers creates a disruption in the information flow that generates frustration for the personnel, and in some cases even creates a sense of segregation between the production areas and other departments. Visual management can help the production management to create transparency and improve communication between interacting departments and bring the shift organization closer to the daytime organization, and thus counteract the grounds of frustration and segregation. By utilizing the pulse methodology a central dispatch which acts as a platform for interaction and information sharing to operators assigned to different production areas and shifts could be created. Within this platform can operators, operations engineers, and production managers collaborate and synchronize to a greater extent, minimizing the risks for miscommunication and prevent mistakes to be made. Managers in the production organization would also benefit from the pulse methodology by obtaining an better overview of the current activities and process deviations, allowing them to effectively collaborate in the problem solving process and direct the organization.

Furthermore, the expressions of feeling uninformed of interacting departments operations can be counteracted with the use of visual planning. Utilizing visual planning in such a centralized platform as the pulse methodology can interacting departments together discuss the time plan of processes and manage its execution. Visual planning would act as the physical representation of the activities discussed during daily management meetings which enables personnel working afternoon or night shifts to take part of the discussed information, visual planning would thus reduce the information barriers by acting as a gateway between the shift and daytime organization. However, visual planning should not be seen as an replacement to the daily management method already in place in the production organization but rather as a support tool and complement that increases the transparency and stimulates communication between interacting departments.

The usefulness of visual planning has been identified in the education department as well, the education department consists of four members who actively work with interrelated processes which demands a high need for collaboration and synchronization. In the education department the use of daily management meetings is not found, it rather relies on weekly synchronization meetings where the members goes through the current status of processes and their activities. Although there is no notification that this method of management is inflicting a lack of information in it's still possible to benefit from the concept. As there is a small number of members in the education department visual planning could be used as a standalone management platform, removing the weekly management meetings and implementing short planning meetings at a visual board in the morning would increase the departments allowance for plan deviations with faster decision making and dynamic plan handling. Members would get an better overview of the departments current workload and can thus level the tasks among the team to reduce stress levels and maximize the productivity, this would also enable the members to share progresses and discuss real-time information to a greater extent which would allow problems to surface at an earlier stage in relation to the current management method.

5.2.2 Process Mapping

Process mapping were observed to be extensively used to describe processes of the actual production outdoors, the whole production process and its current status are mapped and can be seen with the use of a computer software called IP21. During the observations members of the production organization highlighted that this tool to visualize the production process and its status were one of the most important parts of their operations as it provided them detailed actions of the process flow in an accessible form.

"In this software you can follow the process steps of the production, it's an exceptional tool that i normally use everyday. It provides me information about the current status of the process and allows me to trace the process from start to finish, it's really valuable"

However, with an exception of the human resources department the method of process mapping were deemed to be unused for describing processes in the organization operating indoors. Process mapping could create a support base upon how a process should be performed in which improvements can be identified by analysis of the process, the analysis would provide the organizations members more insight in the reasons behind the process steps and its value. This would come to great use since several of the managers has expressed difficulties to comprehend their involvement in processes and added value due to the information concealment that comes with the nature of computer based tasks, with the use of process mapping this information barrier could be lifted, allowing the managers to lean back upon the process map to act as a guide way in their operations.

5.2.3 Value Added Time

Value added time were observed to be a new term to many members in the production organization, although when explained all understood the concept and it's fundamental principles. Within the production organization there is seemingly a strong work culture where all of it's members wants to perform to their best ability, this is not in any way regarded as distressing but results in tendencies to overprocess work tasks which was also noticed during the observation period. Introducing a mindset of value adding time could reduce the time spent on non-value adding work and thus result in a increased performance efficiency throughout the organization. The efficiency increase is related to the analysis of work tasks and increased communication that the mindset aims to provide by making the organization become more specific in its task assignments and reduce the amount of time spent on performing outside of customers needs.

Members of the production management expressed their concerns with the huge amount of time being spent in meetings, and surely this were noticed during the observation period. Even though several of the participated meetings were essential to the managers operations there is still a potential to reduce the amount, some of the meetings even were pure information sharing that required no interaction from the managers part. Meetings are exceptional to distribute information but the without the need of the managers interaction large parts of the meeting would slip into the waste bracket, managers therefore needs a mindset of regarding their own time as valuable and dare to turn down meetings and ask for summarizes of the information instead. This method of summarizes would reduce the amount of time spent in the waste bracket in an already tight schedule, allowing the manager to both take part of the information and deliver on their other commitments.

"I get a lot of invitations to participate in different meetings, this is sometimes making me rush between different meetings that takes up the whole day, forcing me to push up other commitments or spend time with them at home"

During the observations the managers were seen to be working with a mindset of full utilization, if there was a free spot available at the scheme the managers were not hesitant to accept meeting invitations even though questioning if their participation would make a difference. Their mindset of full level of utilization is regarded as a efficiency paradox as value adding tasks that comes up gets pushed up due to an already packed schedule, changing this mindset to comprehend value adding time would avoid managers to pushing value adding tasks to and improves the efficiency by increasing the amount of time laid in the value adding bracket.

6

Discussion

6.1 Current operations

6.1.1 Daily Management

In the production organization there is a extensive use of daily management meetings as presented in the results chapter, the purpose of this is to create an information flow from the bottom of the organization to the top which provides all members of the organization with information about the current situation. The production organizations practice of daily management were observed to be working according to Levinson (2012) principles, where all members of the organization gets knowledge about the current situation by creating iterative management meetings on all organizational levels. Further, the organization follows the principles of creating activities list that operators can follow who thus become more independent and efficient without the need for management interference. These activities list are represented at the case company as routines and operations orders, this practice also falls under Levinson (2012) thoughts about daily management. Levinson (2012) argues that the goal with daily management can be summarized into ensuring that all members of the organization knows the organizations current situation and are informed of the activities they are expected to perform, all of these points has been noticed during observation period and thus the concept of daily management is regarded to be already implemented and well functioning.

6.1.2 Key Performance Indicators

The production managements handling of key performance indicators were close to textbook examples, their key performance indicators quantified the business objectives and were regularly used to check up their performance and progress as suggested by Parmenter (2007). Further, the observed key performance indicators were related to both own and employee based activities and could be traced to an impact on the measurement, thus their use of key performance indicators are in line with Marr (2015) thoughts on using key performance indicators to affect employee behaviour to reach an objective. Key performance indicators were observed to be a central part of the production managements operations, they followed up on the measurement to show that the organization were moving in the right direction towards their objectives and thus made no assumptions but rather relied on the measurements to support them in their operations as per Parmenter

(2007) requirements. Overall their use of key performance indicators is deemed to be in line with the lean concepts fundamental principles and are thus not regarded as a subject of change.

6.1.3 Standardized Work

Standardized work is not excluded to the practice of introducing instructions to workers, it's all about the culture of iterating the improvement process and urge the members to perform the task to the current best known way of operating as described by Liker and Hoseus (2008). Standardized work is thus found to be followed within the production management group to a great extent according to Liker and Hoseus (2008) thoughts by weekly discussions about updated instructions as well as their commitment to rewrite the instructions to compile a common standard template for all instructions. Production managements purpose with the culture of using instructions has been noticed to be for increasing productivity and quality, but foremost with the purpose of creating a safer working environment which correlates with Patchong (2014) descriptions of long-term benefits. Influences of standardized work are found in processes outside of the production processes as well, an example of this is the standardized templates for pay-grade bumps and recruitment processes as presented in the results chapter. This proves that the production management applies the standardization method in non-production processes as supported by Niederstadt (2016) whom points out its usefulness. Although the production managements does not label their operations as standardized work or talk in those terms the fundamental principles behind their operations and standardized work are the same.

6.1.4 Continuous Improvements

The case company's system of synergies is close to identical of a strategic continuous improvement system, thus it's regarded that a system of using continuous improvements are already in place. As stated by Smalley and Katō (2011) must one be engaged to dig deeper into the process and ask fundamental questions of its execution in order to constitute continuous improvements, changing the way of performing a task is thus not enough. With the case company's use of synergies a culture of getting knowledge about the root cause for deviations is highlighted and can be related to Smalley and Katō (2011) statements. However, as all deviations that occurs in the case company are reported through the system of synergies and consists of two levels of investigations the workload on the synergi recipients are constantly high. The high throughput of synergies can be related to Stewart (2012) thoughts on the balance between the level of recognition for improvements and achieving the ideal state, Stewart (2012) promotes that a healthy balance motivates the organization to develop in a desirable rate as well as increases the quality of the improvements investigation and implementation. By following Stewart (2012) principles with a balance and engaging employees in the improvement process the workload on the synergi recipients could be reduced and create an allowance to produce the best results.

6.2 Improvement areas

6.2.1 Visual Management

In previous chapters there has been a lot of focus on the term visual management, this is because of its ability to highlight abnormalities and bring information about processes to the surface which is regarded as a fundamental part of the Lean philosophy. The two visual management concepts regarded in this thesis, visual planning and pulse, has been chosen as a central part of due to their abilities to highlight process statuses and distribute information in a easy and accessible form that's applicable in a production environment. Although both of the concepts shares the fundamental idea of presenting information in an easier and accessible way by using a visualizing technique they still addresses to different problematics within information sharing between stakeholders (Lindlöf et al., 2013).

Visual planning addresses towards project groups and has more experience in those environments but it's usefulness is not in any way hindered in production settings, organizations with a lot of interaction and dependabilities between departments such as the case company's production organization gains a lot of benefits from the increased communication and transparency the method provides (Greif, 1991). Pulse rooms on the other hand are a well known method to visualize information in production settings, it has evolved from the car manufacturing and been polished and adapted to be applied in various production environments. In line with visual plannings objective the pulse rooms also aims to stimulate communication and create a transparency between stakeholders by visualizing a holistic view of the organization on an aggregate level (Ludvig Lindlöf, 2014).

Pulse rooms abilities to visualize activities in production organizations as Ludvig Lindlöf (2014) describes is regarded to have great potential within the case company, due to the organizations large interaction between departments and continuous shift rotations there is a strong belief that information barriers could be reduced or even removed with the use of a central information dispatch that helps with the collaboration and coordination of processes. Utilizing visual planning in addition to pulse rooms which organizes and coordinates activities that extends through departments could greatly impact the effectiveness of processes and enable a faster decision process when deviations occurs (Jaca et al., 2014). An implementation at the case company should be conducted in line with Holmdahl (2010) thoughts on using visualization as a support tool for all members of the organization, the managers would get an holistic view of the ongoing processes which allows for an more efficient management and the blue collar workers benefits from the increased communication and guidance the concept provides by reducing the information barriers. However, it's regarded to be of utterly importance that the already implemented structure with daily management keeps intact, a visualization concept implementation needs to be viewed as a support tool that further improves the information structure in operation.

6.2.2 Process Mapping

In relation to the case company's outdoor operations the process mapping of indoor operations is regarded to be underdeveloped or in some instances even non-existent, they are however in the works of implementing process mapping according to the ISO-standards 9001 and 14001 and the subject will therefore be a reoccurring topic in the following years. Process mapping is evidently a good method to highlight process actions and find improvement potentials, but the time and effort it takes to create a successful implementation of process mapping should not be underestimated. As explained by Martin and Osterling (2012) process maps should be kept simple but as true to the real environment as possible, but the level of detail needs to be taken in moderation to the time it consumes to create. Troublesome processes would therefore require more details for analysis while others would merely contain the most granular process steps. Martin and Osterling (2012) also stresses the importance of that the process map is regarded as support tool by its users, clear problem identification and usefulness of a process map is therefore important before creation, as it could otherwise easily be a regarded as a burden.

Guidelines argued by Martin and Osterling (2012) for process mapping implementations should definitely be taken into consideration during the implementations at the case company as well, the process industry is hectic and the managers already got a lot on their plate and their time must be well spent. In which order process are to be mapped and evaluated should be determined by their status, processes that are deemed inefficient or troublesome should be analyzed before well-functioning processes, although it's great to analyze well-functioning processes as well due to the information they provide. Introducing the fundamental ideas of process mapping while focusing on troublesome processes at a granular detail level is regarded by both observations and literature as the most appropriate approach, keeping participation and interest in the method high by producing quick visual results would create a larger positive effect on the ability to sustain the case members motivation than a protracted high detail process evaluation.

6.2.3 Value Added Time

Standardized variants of effectiveness methods is demanding to implement throughout an organization, this is because of the difficulties to measure and visualize the performance gains related to a specific method in a suitable way. The perspective of value and effectiveness is also of individual nature, making it hard to boil down into a method that fits all types of individuals. However, there are still often an opportunity for performance gains without large implementations by changing the mindset of the human resources, and this is where the concept value added time comes in effect. Improvement potentials lies in changing the mindset of human resources to reflect upon their own involvement and contribution to tasks, and to specify the task frameworks before getting involved in the process, as Liker and Hoseus (2008) argues there is a strong relation between the mindset of value adding work and the removal of overprocessing work tasks. Modig and Åhlström (2015) describes this as an efficiency paradox, a mindset that does not reflect upon the added value of work tasks but rather uses time utilization as a performance indicator, which causes personnel to often have packed schedules that delays or neglects value adding tasks in favor for meetings where the needs of their presence is questionable.

During the observations at the case company a potential with the use of concept was noticed, some tasks were suspected to be over-processed and the effort that was put down into the tasks long extended the customers expectations. By starting to define task frameworks and customer expectations as Liker and Hoseus (2008) argues in the daily operations the observed wastes could have been removed, not only would this increase the effectiveness of the organization but also reduce the workload on the personnel. Furthermore the observation period noticed trends of time utilization issues, a lot of time went down into meetings where the observed members participation needs could have been questioned, this can be related to Modig and Åhlström (2015) expression of an efficiency paradox. Similarities with the efficiency paradox and the mindset at the case company can be seen, all of the observed members seemed to reflect and question if their presence was needed when receiving new meetings invitations but often accepted them regardless of their conclusion if there was an opening in the schedule. Accepted meetings were seldom reevaluated and changed later on as it was regarded to late to change their mind, causing the observed members to even in stressful times follow an schedule which included meetings themselves had previously labeled as non-value adding or unnecessary.

7

Conclusions

Observations performed at the case company indicated that several actions and processes were similar or even close to identical to fundamental concepts of the Lean philosophy evaluated in the frame of reference. Lean concepts as daily management, standardized work, key performance indicators, and continuous improvements were assessed to be integrated into the normal operations of the organization, although members of the organization did not describe their processes in those terms their actions and purpose were identical. With this aspect in regard there is a conclusion that parts of the Lean philosophy is already implemented in the production organization, but in order for the production organization to be considered as Lean followers there is lot of progress that needs to be made, an extended commitment towards the concepts of visual management, process mapping, and value-adding time has to be implemented and taken into consideration as well as further development of lean integration and mindset in current operations.

7.1 Research Questions

RQ₁ : How can barriers in information flow be countered with Lean?

With the use of the Lean concept daily management an organic information flow is created, the information flow ensures that knowledge of the current situation in the organization is spread between organizational levels and thus information is not hindered by organizational barriers. Implementation of pulse rooms and visual planning boards removes the concealment barrier that comes with the nature of information systems by providing information in a more accessible way by utilizing visualization. The concepts stimulates the communication and information sharing between interacting team members and departments and provides a centralized communication platform that counteracts interaction barriers.

RQ₂ : How can visualization systems affect efficiency?

Pulse rooms affect the organizational efficiency by enabling functional managers and project managers to gain a better overview of organization activities on an aggregate level, this holistic overview of processes promotes efficient communication, interaction and problem solving between departments. Visual planning focuses on enhancing the information flow, prioritization, cooperation

and decision-making of processes by acting as a dynamic support tool that continuously tracks and updates the process plan which allows for deviations while remaining a high efficiency. Pulse rooms and visual planning concepts both increases the efficiency by breaking the information concealment barrier that comes with regular information systems, with visualization concepts the information is much more accessible and can be obtained with just a glance.

7.2 Lean and Sustainability

Utilizing concepts from the Lean philosophy doesn't limit the improvements to the production processes in industries, it has the ability to increase several underlying aspects as well, ranging from the mental and physical health of human resources to sustainable energy consumption and sustainable effectiveness developments which is all included in United Nations Development Programme's (UNDP) global goals. As one of the fundamental pillars of Lean the concept 'respect for people' takes the spot which aims towards these goals by boiling it down to one core belief, respect for people, which isn't limited to represent conditions for people working in the organization but extends it's commitments towards the local community and the world. The mindset of the Lean philosophy is exceptional for a companies that wants be innovative and continuously work towards challenging goals as there is a lot of focus towards waste reduction, as Preem has the vision of being the most sustainable company in the fuel business which drives the change towards renewable fuels they would certainly benefit from the waste reductions of Lean in both their production operations as well as development and environmental processes.

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