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Continuous Improvement beyond the Lean understanding

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Abstract

Continuous Improvement is seen as a cornerstone in Lean Thinking, but the improvement process of operations has been done long before Lean entered companies' agenda. This paper will draw the historical line of continuous improvement in one of Norway's most important automotive industry clusters, where continuous improvement has been an issue over decades. A survey of over 600 respondents shows that continuous improvement is felt like a natural part of the tasks in the daily work-life. But there are differences of what is so natural according to what role a person has in the companies. Similar there are differences between companies in what continuous improvement actually is done when the companies are in the same industry. These results show that the simplified notion of continuous improvement is far from simple and has a cultural foundation in which the Lean tradition speaks little about. Workers union involvement is crucial for success of improvements at the factory floor. This argument will have the Nordic work-life model as a back-drop and help to explain how to deal with cultural foundation in highly automated production lines.

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Keywords: Lean, Continuous Improvement, Survey

1. Introduction

This paper will start by giving a brief historic background for continuous improvement in Norwegian Automotive Industry. Following this short section results for the survey with over 600 respondents will be presented and discussed. The results will show that continuous improvement is a long term, often management driven, effort that has deep cultural implications in the workplace. It also will rather briefly discuss the role and importance of the workers union in a continuous improvement strategy.

1.1. Historic background

The civil production started when Raufoss achieved a contract with Volvo for delivering parts for military vehicles [1], although the real breakthrough came in 1965 when it signed a contract with Volvo to produce 500,000 aluminum bumper beams, with the start of production in 1967. With the development of high-strength aluminum alloys, which can be traced back to military production, Raufoss gained competitive advantages when compared to steel solutions. These alloys offered savings in weight, while simultaneously developing new production methods, including cold and warm forging forming [2]. The strong relationship with Volvo opened up new possibilities with other car manufacturers like SAAB, and new products were developed.

In the 1980s, the company was diversified into the core strategic areas of automotive and defense, but growth and investments in automotive production at Raufoss and abroad led to a growing need for more capital. A partial privatization was accomplished in the 1990s, which meant the arrival of fresh capital, but in a decade with turbulence, problems soon reoccurred. The first step taken towards maintaining a competitive advantage was to sell Raufoss Automotive to Norsk Hydro in 1997. Following this, new strategies were undertaken by investing new capital in European expansion and buying a utility vehicle manufacturer, United Parts. Low profitability throughout the 1990s led to further fragmentation. Despite all the turbulence and problems, Raufoss Industrial Park has about 40

companies today, and employs more people than ever before. Throughout the 1990s, several Lean tools were implemented, which resulted in winning several Toyota prizes. Continuous improvements have been central in the thinking in very company, since they operate from a high cost country and competing in a truly global market.

2. Research Methodology

A case study is one of several ways of doing social science and understanding complex social phenomena, used in many situations to contribute to our knowledge of groups, organizations and related phenomena within a real life context [3]. As Voss [4] has pointed out, case studies have become a very powerful research method, often dealing with growing magnitude of changes over lesser and lesser time. And therefore there are important to conduct such studies in accordance to established reliability and validity claims. Construct validity is making sure that we get the data that describe the phenomena we are investigating and that the data can be separated from other phenomena data [5]. Internal validity is making sure the causal relationship between certain conditions in the case [6]. And on the other hand the external validity claim is how much can be generalized beyond the case itself. Finally, reliability deals with how much of the findings in the case study can be repeated [6]. And it is generally believed that multiple cases have a higher external validity than single cases. But to be able to ask the right questions and focus the case study, a survey with 603 respondents answering 20 questions was conducted. Such a method is believed to be beneficial in two ways; first get objective data on key questions and conditions in the organizations, second having the result to start with when entering the dialogue with key personnel at the companies. The validity of the case study is therefore stronger.

3. Survey on continuous improvement

Since these companies over years have done continuous improvement as a necessity for staying competitive, it is interesting to find out how the employees feel about the intense focus on productivity and improvement over decades; really since the 70s. Five companies participated initially, but one was left out due to low response rate. Totally there were 603 respondents, which represents a response rate that vary from 30% to 100%, and include all of the departments in each of the companies at every level of management. The questionnaire consisted of 20 questions with usage of a Likert scale from 1 to 5.

Using a correlation (Spearman) matrix questions were grouped into two groups; goals and engaged management. By performing a VIF (Variance Inflation Factor) analysis of the variables, which means that an ordinary least square regression analysis is run for each Ri as a function of all the other explanatory variables in the first equation, one can quantify the severity of multicollinearity. The equation is as follows:

$$VIF = \frac{1}{1 - R_i^2}$$

A common thumb of rule is that a VIF value below 5 indicates a low probability of collinearity [7]. The results show values in the range between 1.3-1.6, thereby concluding that the questions inside each group do not overlap each other. A Cronbach's alpha is a measurement of internal consistency, which should be in the range between 0.7 and 0.9 in order to have some consistency, although each question has some individual explanatory value [8]. A factor analysis of the three question groups reveals Cronbach's alpha of 0.783 and 0.863. This analysis also generates a combined factor score for each observation that will serve as the dependent variable in a multiple linear regression with the other questions, which are described below as explanatory variables.

Table 1. Grouping of questions

Questions	Group
How well do you know the improvements goal of the companies	Goal #1
How well do you know the improvements goals of your department	Goal #1
Have you participated in setting the goals (teams or department)	Goal #1
Do you feel that the improvement goals lead you in the right direction?	Goal #1
Do you have any influence on the improvement goals?	Goal #1
Do the management invite to dialogue and participation from the rest of the organization?	Engaged management #2
Is the management visible and participate in improvement work?	Engaged management #2
Are suggestions for improvement taken seriously by the management?	Engaged management #2
Do spending follow efforts of improvements?	Engaged management #2
Do management prioritize improvement work?	Engaged management #2
Are improvement work supported by the top management group?	Engaged management #2

Engaged management and understanding of goals have a direct influence on how the subjective individual commitment to continuous improvement. Goals need to be known in all levels of the organization, and be a good directional guide for the work. Further, the ability to influence the setting of the goals is important. As for the engaged management groups of questions, the survey showed that dialogue and participation are important. Flat and informal organization structure where the management is visible and can be approached on a daily basis is equally important. Support, explaining the prioritizing of suggestions and investing in improvement suggestions are often seen as major factor for successful improvement work. Summarizing the results of the survey is that improvement work is something that is felt as a natural part of the work in modern manufacturing plants. Key elements are how the goals are set and how engaged management are in the continuous improvement work.

Investigating the understanding of goals further the broader part of employees scored higher on the goals close to their work that more general over all company goals. This is not surprising, but there are more to understanding than this. Which forms of meeting are best suited for setting the goals, is also important to know. The overwhelming majority answered team- and/or department meetings. Team meeting consists of 4 to 12 people in these companies and indicate a bottom-up approach. And such approach has its strength in creating ownership to the goals and is a prerequisite for autonomous work groups with potential inter-group coordination problems [9].

What does it mean to be committed and motivated to participate in continuous improvement work? The survey measured this at three levels

1. At company level
2. At team or department level
3. At a subjective level

Generally, the respondents were positive at all three levels, when the leaders were engaged in the work and goals were understood. Looking closer there were some differences among the respondents. Leaders at all levels of the organizations were much more positive towards the ongoing improvement work than the operators, and the most critical were the white-collars. Positive leaders can be explained by the fact that one of the success factors is engaged leadership. And therefore it seems natural that they also express themselves more positively. The white-collars are a different story. Continuous improvement has its foundations at the “factory floor” and therefore is suited to this line of work. But the white-collar also scored low on engaged leadership. They did not think their leaders engaged themselves in improvement work at their department. Likewise, the goals and improvement tools had much more to do with operations than then nature of the white-collar work. And the understanding of these goals scored relatively low compared to operators.

One feature that scored very high overall was the commitment and engagement by the top management. If your nearest leader is engaged and you understand the goals, the feeling of commitment towards doing improvement work will suffer if the top management team does not prioritize it. Combining the commitment of leaders and top management improvement work tend to be a top-down approach. This suggestion is counter to what is written by executives at Toyota [10]. Here is the leader a facilitator and the importance of operators coming with suggestions and solutions is stressed. The notion of Gemba Gembatsu, go and look for yourself, is deeply rooted in this line of thinking [11].

So far, the survey has unveiled some differences form the standard and American understanding of Lean. There are differences among different functions of how they look at continuous improvement work, one standardized tool does not work all over the company, and the bottom-up initiative can be questioned.

4. Case study

The different attitude towards improvement work among different functions, tools are not well suited to work in every part of the companies, and the seemingly importance of the top-down approach will now be discussed.

Looking at the improvement programs at the companies they were rather different both in thinking and the tools used. Further the case study showed that the differences did not only run accordance to functions, but also among operators. One company had a one-piece production with highly skilled workers operating their own machine. The improvement program was a success as long as it was concentrated on keeping things clean, have order in tools and equipment, etc. or 5S as it is called. Operators found this useful and showed eagerness in implementing different improvements. But the improvement program came to a sudden stop with severe resistance when the effort of standardizing the work and setup of the machines. The operators meant that such efforts could not be done and was foolish since the production was characterized by one-piece production where setup was different from piece to piece. But the resistance went further and having a standard for each piece and a standardized setup of the machines to use when producing the piece was also regarded as impossible.

Talking and working with the operators reveled that they looked at themselves as craftsmen and not

operators. Tacit knowledge was therefore highly regarded and guarded as secrets of the trade and of the individual. Incorporating this insight each operator began to write standards for himself that was not shared with others. The same eagerness came back in the improvement work and some operators began to share notes and experiences.

This shows that how people look at themselves is important for implementing improvement work. Cultural aspects must be taken into account when continuous improvement programs are started and at different stages of such programs.

Lean often is based on different tools. Improvement work has several attached to it, like kaizen, SMED, 5S. One of the case companies has won the Toyota prize twice for continuous improvement and SMED. But there is not a copy of what is described in the literature, rather smart solution to practical problems. Copying from others will not have worked said the operators. The argument was that no production line is the same and standardized tools would therefore not work. Talking to operators a cultural condition also revealed itself. The survey highlighted the understanding of goals, and when it came to usage of tools similar underlying precondition was present. Understanding and the ability have influence on the work process itself was deeply rooted in the workforce. A way around the problem was to take the standardized tools as guidelines and let the operators together make small changes to them. In this way the feeling of autonomous working condition is preserved and also the feeling of contribution to understandable goals.

The management approach is in the Lean literature somewhat confusing. Japanese authors go a long way of arguing for a bottom-up approach, but with presence of a strong leader [12]. American authors are more influenced by a top-down approach, where goals and tools are chosen by the leaders [13], but at the same time argue for the importance of workers motivations and participation. In the case companies there are a similar story. Goals and strategy are set by the top management with huge efforts to make them familiar to the entire workforce. Details of how the improvement should be done are most successful when they are decided by the people that are going to implement the improvement. So there is combination of top-down and bottom-up approaches. Important is the focus and pace of the improvement, this is heavily dependent on engaged leadership.

But a more hidden side to successful improvement work is the role of trade unions. Many books have been written about union busting efforts in the wake of implementing lean [14-19]. But in Norway there are strong unions and well regulated work life. This seems to contradict the notion of union busting. In the case companies the shop stewards and the CEOs have regular informal meetings as often as weekly in some cases. In these meetings a common understanding of challenges for the company is reached. If not there are well regulated actions in the common agreement between Norwegian Workers Trade Union and the Confederation of Norwegian Enterprise that will regulate a potential conflict [20, 21]. Having such an agreement on a national level makes it easier for the company parties to reach a common understanding, according to the parties themselves. Interestingly the CEO in one of the case companies said that working closely with the union and having them on the team was a very powerful alliance. Much more improvement work could be done in this way without conflicts. If this is a Norwegian phenomenon or can be generalized is beyond the scope and effort of this paper. But it contradicts the broad literature on critique of Lean Production.

5. Conclusion

Continuous improvement must have a strong local adaptation in order to really work. Standardized tools copied directly from Lean literature are no guarantee for success.

Motivation for doing continuous improvement is built on commonly understood goals and engaged leadership. But it is necessary to have a long time perspective to it with an underlying understanding of people's natural need for achieving goals or goal orientation. Leadership is to cheer and support this orientation and focus the achieving efforts in accordance to company's strategy.

The companies in this survey have done this in many ways and over time shifted their way. Basically, there are 4 categories; education in how to do thing, simplifications of operations or developing a "common sense" approach, close involvement with the unions, close collaboration (both formal and informal) leaders and employees.

Education is about learning the tools, but it also makes each employee capable to work independent and take autonomous decisions.

Simplifications help each individual to remember more easily. And the repetition of simplified messages or procedure will over time become a part of the company / team culture. It evolves to their common sense or the way we do things here with an emphasis on 'WE' to point out the ownership of each message or procedure.

Unions can be a powerful allied. Their participation and collaboration speed things up and support the building of a local common sense. But it needs to be done right with times for discussions and building trust over time.

Leaders in the different companies participate in many of the same course of education along with their employees. They also spend time to informal talks about daily issue in production. It is called Walk-Observe-Communicate (WOC).

Cultural aspects of the work and how people look at themselves are important when local adaptation shall be done. And finally unions can play an important role in the improvement work and thereby helping the company to stay profitable.

6. Further research

Engaged leadership will be investigated further. Companies have something called Walk-Observe-Communicate (WOC) which is used for improvement of standard operating procedures. How this WOC tool works and how it affect the improvement process will be documented.

Motivation for being the best of one's abilities will be investigated as an important driving force in the culture of improvement efforts.

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