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Facilitating Operator Participation in Continuous Improvement: An Investigation of Organizational Factors

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Abstract. Continuous improvement (CI) is a fundamental part of lean thinking and practice and will remain critical for the success of manufacturing firms during the fourth industrial revolution. The realization of CI is based on the active participation and involvement of the firm's entire workforce – with everybody making incremental improvements, every day. This of course includes shop floor operators. In this paper, we explore various aspects that influence the successful involvement of shop floor operators in CI activities, by adopting a case study approach. The case company has achieved only partial success with CI on the shop floor, despite repeated efforts. As a result of the study, several organizational factors emerge as critical success factors for securing involvement and engagement of operators in CI, with positive results. Raising awareness of these critical factors may help manufacturing firms adopt an alternative approach to CI which promises to increase the level of operator participation in CI.

Keywords: Continuous Improvement, Operator, Shop Floor, Case Study.

1 Introduction

The increasing challenges faced by manufacturing firms in the global marketplace are currently forcing companies to think in new directions. To remain competitive, the continuous improvement of manufacturing processes is necessary. As a result, manufacturing companies have introduced lean as a management approach, with the aim of improving competitiveness by creating and delivering value to customers, while continuously eliminating waste in the organization [1]. Lean thinking and practice, which is primarily inspired by the successes of Toyota Production System (TPS), has to some extent been introduced by the most significant actors and is known as a crucial strategic weapon [1, 2].

Despite an abundance of research within the field of lean production, there is no clear consensus among the research community on a common definition or approach to lean. However, one of the most commonly used approaches is based on a framework developed in [1]. This framework presents five principles with the aim of helping organizations to realize lean production as a coherent system:

- Identify customer value
- Identify and manage the value stream(s)
- Create flow
- Achieve pull
- Strive for perfection

The core objective of applying these principles is to provide customer value and to increase the ratio of value-added activities in the value stream. In practice, this includes identifying all types of waste and continuously looking for improvements to eliminate them. Hence, integrating a culture of sustained improvement is of highest importance, targeting the elimination of waste in all systems and processes of an organization [3]. In organizations, this means implementing continuous improvement (CI) by involving everyone to make incremental improvements through ongoing efforts.

Much research has been conducted on CI success factors and enablers [4]. However, there has been little focus on how to succeed with ensuring the active participation and involvement of shop floor operators in CI activities, given that operators are essential in the day-to-day success of CI. Against this background, this paper aims to answer the following research question: *how can an organization successfully involve shop floor operators in the process of CI, targeting the elimination of waste in the value stream?*

The article is structured as follows: First, we provide an outline of the theory of CI including a review of select literature regarding how to organize for CI. Secondly, we present a case study from a company specializing in the development and manufacturing of products for the automotive industry. The results of CI initiatives at the case firm are mixed, with only partial involvement of shop floor operators. Thus, we identify opportunities for successfully engaging operators in the process of eliminating waste and improving the CI process itself. Finally, we present conclusions and implications for both researchers and practitioners.

2 Continuous Improvement

CI is a core principle regardless of which kind of management system the organization has chosen [5]. There exist several definitions of CI, for example: "*A continuous stream of high-involvement, incremental changes in products and processes for enhanced business performance*" [6], and "*A company-wide process of focused and continuous incremental innovation*" [7]. Both definitions emphasize the involvement of everyone in making improvements, including shop floor operators. This is in accordance with the following definition of lean manufacturing: "*...the systematic removal of waste by all members of the organization from all areas of the value stream*" [8]. Waste is defined as unnecessary activities that do not add value for the customer.

CI may occur through incremental improvements or through radical change [3]. Incremental improvements refer to small and gradual improvements, while radical change refers to improvement based on new, innovative ideas or new technologies that may require investments. Moreover, an extended period with several incremental improvements may result in major improvements or a radical change. Consequently, CI is a change process in which superior performance is achieved [9].

3 Organizing for Continuous Improvement

The organization of CI activities transpires over at least three levels: management level, team level and the individual level. Firstly, CI at management level involves the organization's strategy. Secondly, CI at team level involves all kinds of tasks, broadly defined. Finally, CI also deals with improvements in day-to-day tasks at individual level [10]. [3] suggests that it is management's responsibility to address CI at each of these levels. In a manufacturing organization, shop floor operators may be involved both at team level and at the individual level. More specifically, a shop floor team will be responsible for improving day-to-day operational activities, in addition to their own practices aiming to improve overall equipment efficiency (OEE) [11].

Designing, executing and achieving CI represents a variety of challenges [12]. Fortunately, there are several known factors that influence successful implementation of CI. Among these are management commitment and involvement, leadership, cultural issues, a need to measure the progress, motivation of workers, resources and working in cross-functional teams [4].

In the literature, management commitment and involvement are highlighted as the most important success factors in CI [4]. Hence, without visible, committed and active support and engagement from management, CI is unlikely to succeed. Improvement programs will suffer where there is an absence of strong leadership. As such, the existence of a charismatic leader will contribute in a positive way [4, 13]. In addition, it is important to understand that CI leadership must be performed by all managers, not only the top management. Furthermore, good leadership will influence the motivation for shop floor operators in a positive manner [14]. Consequently, when considering implementing CI in an organization, the management team must not underestimate the managerial effort required.

Like any change program, the implementation of CI will require change management. This requires available resources, and at the same time, people in a position of influence. These people must work consciously to develop the ability to implement and to sustain CI in the organization. Another important factor is involvement of operators to ensure that improvements in the CI implementation process influence and reach work practices [4]. For most people, it is easier to accept changes when personally involved in the process. This view is supported by [15] which points out the importance of gathering and involving relevant experts, and consequently ensuring acceptance through participation. Through involvement, employees gain a sense of belonging and satisfaction, and are allowed to put their creativity, knowledge and skills to good use. The intrinsic motivation of individual team members is another factor that influence CI implementation [19].

CI may be achieved through the application of a number of methods and techniques [3]. If the overall goal is to reduce waste, streamline the flow of the manufacturing process and improve product quality, then a systematic approach to problem-solving is required. A systematic approach helps people stay focused on completing the improvement initiative, by carrying out pre-defined steps until goal satisfaction prevails [16]. A study by [17] points out that an effective communication channel between management and employees working with CI is important to ensure sustainability. At

the individual level, improvements are normally driven by a suggestion system. The actual implementation of the improvement ideas can be carried out by shop floor operators or can be left to specialists. [18] points out that shop floor operators are the experts within their work area and are therefore those who can best solve their own problems, though they may require support in the process.

4 Research Design

We adopt a case study design, the purpose of which to better understand how to successfully involve shop floor operators in CI work to target the elimination of waste in their value streams. A case study can use an appropriate approach when the area being studied is in progress or has recently been in progress, and where research variables cannot be controlled [19]. The case company had an ongoing CI program which could be studied, and consequently met these requirements.

Operators working in different shop floor teams, but within the same manufacturing department, were interviewed to identify success factors regarding involvement and active participating in their ongoing CI process. Ten semi-structured interviews were carried out across five shop floor teams. They had a range of work experience from 1 to 30 years. Five of the interviewees had a combined shift leader job in addition to their regular work at the production line.

The questions were formulated to cover both how they approach CI activities and to gather their opinions of what could have been done differently. Face to face interviews is a commonly used method to collect information. Well-informed interviewees can provide important insight into facts and opinions [19]. The actual interviews were conducted as semi-structured conversations, in which the informants were asked predeveloped questions. The informants were allowed to answer freely. The aim of the conversations was to create an informal setting in which the interviewees would open up and provide rich data. All interviews were recorded and later transcribed to provide an accurate representation of the conversation [19]. All interviews were conducted at the company's production site. In addition, observations were made during frequent company visits, as well as examination of written documentation (minutes of meetings, procedures, improvement database etc.) to allow for triangulation.

5 The case: The Process of Continuous Improvement

The case company is a large subsidiary of a global corporation located in Norway. It operates as a first-tier supplier to original equipment manufacturers (OEMs) in the automotive industry and has a long term and strategic relationship with customers worldwide. The production is highly automated and has a functional structure with eight different production lines. This case is limited to one of the production lines only. The production line is operated in five shifts with three operators at each the shift. One of the operators at each shift also has the function of shift leader, and consequently has the responsibility for organizing the shift and the work in the production line.

The case company has been working with lean as a management approach for decades. One of the main purposes of their chosen lean approach is to systematically reduce waste in the workplace and to improve the manufacturing processes by working with CI. To address progress, they measure the overall equipment efficiency (OEE) a product of the availability of the equipment, the actual operating speed compared to ideal speed, and the quality of products (measured as right-first-time).

Every morning they have a team meeting, where the shift leader, team leader, process engineer, quality engineer, maintenance workers, logistic planner and production manager participates. The core activity is information exchange regarding production performance for the last 24 hours, in addition to planning for the next 24 hours. A standardized board is used to follow up on OEE and accompanying activities. Major outputs from these meetings are the identification of problems and areas for improvement.

The team board used in the meetings has a pre-defined area dedicated for improvement suggestions. Suggestions may come from everyone, including operators that do not participate in the daily team meeting. Before the meeting starts, the shift leader has a discussion with the other two operators about issues which are important to address. For example, small improvements at the individual level and more complex suggestions which need to be solved at a team level.

Improvement suggestions from both the team members and from other operators is divided into two levels: individual- and team level. At individual level it is decided in the team meeting the responsible person and due date. All suggestions involving more complex issues are transferred into a system for escalating the improvement. This is taken care of in an additional improvement meeting once in a week with a cross functional team, where the participants are those responsible for issues in addition to the production manager and logistics planner. In addition, other functions are invited where it is necessary to solve the improvement issues.

6 Case analysis and discussion

Everyone is expected to contribute with suggestions covering all kinds of operational problems and improvements in their daily work. As a rule, both minor and large improvements are implemented every day. Still, the teams experience that the same type of problems and quality issues repeat themselves, often on multiple occasions. This finding indicates that the company may in fact struggle to identify and eliminate the actual root causes, or rather struggles with learning, standardizing and communicating the results of the improvement activities.

6.1 Management support

All informants claimed that many of the improvement initiatives experienced problems. For example, operators explained that their improvement suggestions were at times not followed up in a serious and systematic manner. In some cases, they experienced little or no information about what happened to their suggestions after a

decision had been made. In other instances, the implementation period for a solution was considered too long. This is in line with the experience of disappointment and failure with CI reported by shop floor operators who highlight that this derives mainly from limited support and commitment from managers [20].

6.2 Involvement of operators

All ten interviewees highlighted the importance of their individual involvement in CI. In addition, CI was regarded as a useful approach for their desired results. This is in line with recommendations in literature which emphasize CI as useful if the aim is to reduce waste, streamline the flow of the manufacturing process and improve the quality of the product [3]. Nevertheless, the shop floor operators reported that they were only partly involved in systematic CI activities. Shift leaders were currently more involved in dealing with improvement suggestions due to their daily participation in the team meeting.

However, it was apparent that the operators in the case company were motivated to produce high quality parts in an efficient way to meet the customers' requirements and expectations. This is a good starting point for improvement activities. These findings may indicate that the organization has not sufficiently reflected on how to organize for CI at the shop floor level.

6.3 Knowledge and skills

The findings indicate that CI training at this level is inadequate. To improve the situation, the case company may allocate more managerial time at shop floor level to communicate, discuss and listen to operators. Such activities are known to lead to empowerment [14]. Additional training should also be considered to make both shift leaders and shop floor operators aware of how they can work with CI together. In this respect, it is interesting to observe that most of the operators did not see the need for training in the use of improvement tools and practices. Although none of the informants were willing to miss the opportunity to expand their knowledge about CI tools and practices if asked. Existing research shows that an important driving force for successful CI is knowledge of CI techniques, combined with the knowledge and skills to perform necessary activities [20].

6.4 Communication interface

The interviews with the shift leaders and operators revealed that the list of improvement suggestions was not actively used outside the team board meeting, as intended. Consequently, many opportunities for discovering problems early on and working with CI is lost today. Investigating this issue further, it appears that most of the operators and shift leaders did not see the need of a common system to document improvement suggestions.

A common opinion prevailed among the interviewees, concerning that verbal messages to support functions and leaders was considered enough. These functions are

responsible to decide whether a suggestion should be put into effect, and who should be the person responsible for this. A plausible interpretation of this insufficient documentation and information handling may be that many operators at shop floor level are still quite unfamiliar with CI as a concept and practice. Consequently, they do not know what to expect.

7 Concluding remarks

Worldwide, CI is regarded as a valuable approach to increase the competitiveness of organizations. However, implementation of CI at the shop floor level with the active participation of all operators is not a trivial task.

This study indicates that identifying and understanding organizational aspects is a critical success factor for involving shop floor operators in CI activities. The case study findings point towards managerial efforts as the most vital organizational aspect to consider. More specifically, facilitating and engaging operators are vital to enhance proactive improvement initiatives on the shop floor. Managers cannot give the full responsibility to the shop -floor operators and expect them to succeed without support and engagement. Standardized work requires capabilities and mindsets for routine processes, while CI activities have a non-routine character and require a greater level of thinking and analysis. Due to the non-routine character of working with all types of incremental improvements, operators will need management support in their CI work until a culture of common and systematic way of thinking and acting have been rooted in the entire organization.

Moreover, the study illuminates the importance of having a digital system to document all improvement suggestions with easy access for the entire shop floor team. More specifically, – a digital communication interface facilitating communication, planning, executions of actions and monitoring the progress of the CI activities

Raising awareness of these organizational factors may help manufacturing organizations to arrive at the correct approach and increase the odds of a successful CI program in a lean perspective. These indicative findings may be used when launching CI activities in a lean context. Notwithstanding, more research is needed to enhance the result and to increase generalizability. The future research should include multiple organization trying to implement and improve their CI process in a lean perspective.

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