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Continuous Improvement Processes and Learning Climate as Antecedents for Learning and Motivation in Production Teams

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Abstract. The manufacturing industry is facing a transformation, driven by an increasing technological development. This leads to major challenges at various levels in companies and organisations, not least increased demands on production staff, to handle digitalisation and new technology. Work content is changing, as are roles, and it is becoming increasingly important for organisations to take advantage of and develop the skills of their employees.
With growing rate of change, human factors such as motivation and learning become increasingly important. For sustainable production and a sustainable working life, the work environment needs to ensure development and learning, from the perspective of both individuals and companies.
With this background, the aim of this paper is to better understand how learning climate and continuous improvement processes affect learning and motivation in production teams. Four Swedish industrial companies were included in the study. Observations and interviews were used for data collection.
The results from the study show that continuous improvement processes have the potential to increase learning and motivation but are not always utilised in this way. We could see a focus on short term gains in productivity, rather than on long term reflection, development, and learning. Training and dedicated time needed were not prioritised enough to actually reach the potential of such processes.
We find that there is a substantial potential for development of these factors, which can aid industry in meeting the challenges that companies face in the rapid technological development. Examples of areas to improve are structure and processes for continuous improvement, as well as enhancing the learning climate within teams and organisations.

Keywords. Learning in organisations, Motivation, Continuous improvement, Self-Determination Theory, Production teams

1. Introduction

The manufacturing industry is on the verge of a new industrial revolution with new possibilities of digitalisation [1]. Further, companies face increased global competition

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with turbulent market situations [2]. Digitalisation, global competition, and turbulent market situations require companies to be flexible and adaptable. Focus on individual expertise in organisational silos is not enough in this type of business environment, instead it is required that production team members have the capability and the right conditions to quickly adapt to new technology or changes in market. Thus, with rapid technological development and changing markets, the ability to innovate is needed and need for learning in organisations and its employees increases [3]. Here, time for learning, through e.g. experiments and reflection, is needed to react on changed conditions in the environment.

Team learning has long been considered an important building block in organisational learning, although there are relatively few studies that have empirically clarified this relationship [3]. However, learning and needs vary in different types of teams, e.g. when focus is on efficiency compared to innovation [4]. Previous research on learning in industry work has mainly focused on improvements in efficiency and performance, but more focus should be spent on innovation to cope with the new business situation [3].

Beraldin and Danese [5] describe the effects of involvement in problem solving by highlighting that it often leads to perceived satisfaction through the exercise of autonomy and expertise. Gibson et al. [6] describe that in organisations with more autonomy for team members, more learning is achieved than in organisations with more control. According to Ryan and Deci [7], learning opportunities and relatedness together with autonomy are nutrients for having a good work environment and work engagement. With a growing rate of change, human factors such as engagement, motivation, and learning become increasingly important. For sustainable production and a sustainable working life, the work environment needs to ensure learning and development, from the perspective of both individuals and companies. Thus, the purpose of this paper is to increase the understanding of how operators' learning climate and continuous improvement processes impact their learning and work motivation.

2. Frame of Reference

2.1. Learning Climate

A positive learning climate is often mentioned as an important prerequisite for learning, at work and in other contexts. Learning climate in an organisation influences learning in different directions, a positive climate can support and encourage learning while a negative climate is inhibitory. As Wallo [8] points out, employee learning does not arise on its own. It needs to be supported, made visible and spread throughout the organisation.

Development of employees' skills and knowledge as well as opportunities for learning are crucial for improving organisations performance [9] but also for creating workplaces that are sustainable and healthy. Different factors affect learning at work; one is how managers arrange opportunities for learning through formal (such as classroom based) learning and informal learning activities, i.e. through participating in work activities that offer rich learning experiences [10]. The level of learning that is possible to achieve is influenced by a set of conditions for learning, such as content and nature of work tasks, work organisation, management's support for learning, opportunities for feedback, and workplace culture [11].

Nikolova et al. [12] found three aspects of learning climate: facilitation learning climate, appreciation learning climate, and error-avoidance climate. Facilitation learning climate concerns employees' perception of the organisational policies and practices aimed at providing access to educational resources. Learning climate for appreciation highlights perceptions of the material and intangible incentives for employees' learning behaviours. Error-avoidance climate can be described as a working atmosphere dominated by anxiety or fear of making errors during work, this climate indicates a lack of psychological safety in the work process.

Edmonson [13] highlights team psychological safety and defines it as shared beliefs, taken for granted, that the team is safe for interpersonal risk taking.

2.2. Kaizen – Continuous Improvement

Kaizen *("Kai – do, change, Zen – well"*) is a way of thinking that is used in the management field [14]. Suárez-Barraza and Lingham [15] summarise kaizen methodology as: involves all employees in the organisation, improving methods and process of work, improvement is small and incremental, teams are the drivers of these incremental improvements. However, at Toyota the idea with kaizen was never to improve processes to become lean, instead it was to "develop thinking people who learn how to learn and grow and continually challenge the current work methods" [16]. Singh et al. [14] show in their literature review that continuous improvement evolved from manufacturing (reducing waste and improving product quality) to systematic methodologies for the entire organisation. Thus, continuous improvement requires commitment to learning from the organisation and works best in organisations that value "experimentation, learning, risk taking, teamwork, empowerment, sharing of knowledge, improvement, and customer feedback" [17]. Joergensen et al. [18] have in their literature review found enablers for continuous improvement, where strategy and objectives for continuous improvement on an organisational level are important, as well as training in using tools for improvement processes. Other enablers mentioned are team development and mechanisms to support learning and knowledge sharing.

2.3. Learning at Work

In understanding learning in the workplace, it is important to separate formal learning from informal [19]. Informal learning takes place in a wide variety of settings, in the spaces surrounding the workplace, in the events and activities of everyday work whereas the formal education or training is structured and often limited to certain times and places. Informal learning can also be considered as complementary to learning from experience [19]. Informal and formal learning are not to be seen as opposites, they are ends of a continuum where characteristics of the informal end include implicit, unintended, and unstructured learning. In the middle of the continuum come activities like mentoring, while coaching is considered to be formal [19].

Learning and knowledge can be of different nature. Garavan and McGuire [20] point out that employee learning can be adaptive, developmental or a mix of the two, and it takes place within a context, a learning environment. Argyris [21] separates learning into two different types, single-loop when learning leads to error adjustment, and double-loop which means deeper analysis that can lead to more radical changes. Knowledge can be tacit, hidden and difficult to convey to others, or explicit, and thus both visible and

communicable [22]. Through socialisation, internalisation, externalisation, or a combination of the three, it is possible to convert tacit to explicit knowledge and vice versa [23].

In creating favourable working conditions, such as job satisfaction and well-being, continuous learning and development activities are important [24]. Leadership and contextual factors play important roles in promoting continuous learning at work [25]. Development-oriented leadership entails developmental learning and preparedness to question, analyse, and reflect upon – as well as, if necessary, changing – established practices into new solutions or ways of working [26].

Activities that are commonly used to promote learning at workplaces are [8] job-rotation by assigning new tasks and designating time in meetings for discussions and reflections aimed at promoting learning. As well as promoting learning within the workplace, there are conditions that may hinder learning; shortage of time working with learning issues, employees' lack of commitment and willingness to engage in learning activities, and shift work hindering managers to interact regularly with all employees.

2.4. Work Motivation

Motivation in the workplace affects well-being as well as performance [27]. Within the Self-Determination Theory, motivation is viewed as being on a scale from entirely extrinsic to fully intrinsic, where the more intrinsic types are associated with more positive outcomes [28]. The quality of motivation one is feeling is decided by how internalised and integrated the value is of performed tasks [27]. The more autonomous types of work motivation are characterised by employees performing their work by free will, because they experience them as important and meaningful. Similarly, controlled motivation is associated with doing tasks because of external reasons such as feeling coerced or obliged to do so [27].

The type of motivation one experiences also depends on whether three basic psychological needs are met – competence, autonomy, and relatedness. These factors are influenced by work design and leadership [27]. In this context, competence is the notion of feeling that you are good at what you do and feeling that you are able to learn and develop your skills without feeling overwhelmed or having too difficult tasks. Autonomy is feeling that you can influence you work situation, such as when or how you perform different tasks or doing things that you fully stand behind. Relatedness is feeling a sense of belonging, being listened to and that people around you care about you [27].

When job resources increase and job demands decrease, better need satisfaction leads to more autonomous motivation and higher levels of effort [29]. Leader autonomy support also influences need satisfaction, which has effects on motivation as well as positive work behaviour, well-being, and decreased distress [30]. Within lean production, job characteristics can negatively influence intrinsic motivation, although this depends on how production is designed. Important aspects to consider are training of personnel and making sure that they are provided with some degree of autonomy in their work [31].

3. Methodology

Four industrial companies were included in this qualitative multiple case study. All companies had mass production applying Lean production principles, although the

degree of implementation varied. As seen in table 1, the case companies varied in size and production design.

To ensure that collected data showed not only the improvement processes and climate that were expected and/or communicated as preferred within the companies, a decision was made to focus the data collection mainly on observation in production teams. To complement the observations, interviews with production personnel were performed, mainly as spontaneous conversation during work tasks. Due to the spontaneous character of these interviews, combined with the noise level within production, interviews were not recorded nor transcribed. Instead, extensive field notes were used to document both observations and interviews/conversations.

Parts of the data were collected by students in their thesis work, supervised by the authors. Observations focused on one production team in each company, with students as well as the authors spending several days observing work tasks and meetings. Writing and analysis was performed by the authors, based on collected field notes from both authors and students. Data analysis consisted of several steps. First, field notes were reread and sorted into categories for each case company. Within-case analyses were first conducted to identify emerging patterns, then a cross-case analysis to confirm these patterns. After this, an iterative process followed where data was related to theory.

Table 1. Description of case companies included in the study.

	A	B	C	D
Employees	2 000	2 000	100	60
Type of production	Assembly	Assembly	Machining	Machining
Urban - Rural	Urban	Urban	Urban	Rural
Levels of managers	4	4	3	3
Team leaders	Yes	Yes	No	No
Production design	Line	Line	Job shop	Job shop

4. Results and Analysis

4.1. Learning at Work

Continuous improvement processes give opportunities to reflect and analyse in search of better solutions or performance, as well as opportunities for development of personnel's skills and knowledge [16].

All companies in the study work with continuous improvement processes in their production, but how the work is organised varies widely. Observers noted that both managers and production personnel talked about the importance of continuous improvement and usage of Lean tools but acted differently. In two of the companies, it was found that improvement work was institutionalised with routines for continuous improvements, daily meetings with the staff, and routines for catching and documenting improvements and new ideas. In the other companies, observers found that the work with continuous improvements was harder to identify. Observers noted that in all companies, there were gaps between what was said and documented on one hand, and what was realised and performed on the other. Ideas of improvements could be brought up by the

production personnel in conversations, but systematic processes were lacking and there was a gap between what was said and what was performed:

> There was standardisation in working methods through work instructions at each station that belonged to the detail that was currently being produced. The stations had marked areas where maintenance logs were placed (documentation of completed maintenance) and other things that could be needed at the station, such as smaller tools or plastic parts for finishing, i.e. work that the operator needed to perform due to correctable manufacturing defects or limitations in the machine… But there were a lot of cartons, oil spills and leftover plastic in various places around the production environment.

Continuous improvement work is important and must include everyday work as well as documenting; words must come into action.

Meetings are used to share information and depending on time and setting they can give possibilities to share and create knowledge. Having short regular meetings on a daily basis is a way to brief staff and capture everyday problems and ideas. In both assembly line companies they had similar meetings in terms of frequency and structure. Short everyday meetings, where the production's situation defines meeting content, with reoccurring points such as deviations, problems from the previous shift, and quality issues. The meeting time was short, just a few minutes, with no time for reflection and discussion.

> In conversations with one operator, it emerged that operators receive new information through morning meeting and through their colleagues. Furthermore, one operator mentioned *"I wish they had been ten minutes to have more discussion".* Another operator said, *"I think the meetings are good, if we want to raise something we can, but more time would have been better".*

In meetings where communication is mainly one-way, and where there is little or no time for discussion and reflection, opportunities for both learning and knowledge sharing are undermined. Communication is central as means to achieve both knowledge sharing and learning, essential parts for realising continuous improvements [18]. Time constraint inhibits these meetings from being knowledge sharing arenas for everyday incidents, as Wallo [8] highlights, employee learning does not arise on its own, organisational support is needed.

Locke and Jain [17] describe the value of sharing information and Nonaka [24] how it is possible to convert tacit knowledge to explicit knowledge. Some of the companies had longer meetings once every other week (approx. 45 min) where different teams met with team- and production leaders. The longer meetings were aimed for raising thoughts and discussing possible solutions to problems or other issues. In reality, these meetings were frequently used for other purposes such as information from management or formal learning activities.

Meetings can serve as an arena for informal learning offering rich learning opportunities [10]. Longer meetings do not outweigh deficiencies in everyday meetings, but could serve as complementary actions for more extensive discussions about larger problems and development issues. Both these types of meetings are important from a learning perspective, short meetings for everyday issues, and longer meetings for more extensive discussion.

In all companies in the study, new operators learned from those with more experience. In the assembly companies this was supported by a training programme. However, in the machining companies it takes longer to achieve required skills, and the mentoring was more extensive. Following and learning from colleagues contributed to a permissive culture, where mistakes were met with understanding. Cooperation amongst

different roles and competencies was common and production personnel pointed out that this contributes to learning processes.

Time set boundaries for possibilities to interact in the assembly line companies. The production staff work in teams, and communicate and share information with each other when needed, but production pace and high work rate limits the extent to which it is possible. Operators expressed a supportive and friendly atmosphere but pointed out that earlier when the work pace was somewhat slower, they had more opportunities to reflect, communicate, and learn.

In the smallest company, there were opportunities for experimenting in work. When help was needed, employees helped each other and if something went wrong, and when needed, they turned to their manager. Some workstations in this company were more stressful than others, and to even the production rate operators assisted each other. The atmosphere was observed and expressed as friendly, and many workers had been with the employer for the main part of their work life.

> In conversations with operators, they described that the work environment in the company was positive in the form of good colleagues and a relatively calm pace. The work rate, on the other hand, differed between the different departments, where one was more stressful. All operators explained how they, with experience, made their own assessments in work. They explained that there are measuring instruments for most steps but that these were not always used because operators, over time, learn to see what is within the tolerances. On the other hand, it was described that there were elements that lack clear tolerances. In cases where operators couldn't assess whether the material was approved or not, the supervisor was consulted.

In everyday work informal learning is important [19], not only explicit knowledge but also tacit knowledge can be shared when working side-by-side or when observing a more experienced colleague [23]. New knowledge can also be developed and shared through mutual experience and interpersonal reflections. In order to achieve this, production personnel must be given opportunities to interact during workdays. A supporting and open learning climate gives space to open discussions where ideas are not only valued, but seen as fuel to creativity, sharing and learning.

Standardisation of work is an important concept in modern production. It provides production technical advantages by uniform design to eliminate the possibility of errors, clearer conditions for planning smooth production flow, and simplicity in learning new tasks. However, low level of autonomy has an inhibiting effect on learning [7]. When work is performed repetitively and at a high pace, it risks preventing the individual from reflection and idea creation.

In the companies with machining production and shop design, instructions for standardising design of work and tasks existed. Production staff did not engage nor feel responsible in development of instructions aiming for standardisation. In one company instructions were created by the manager and filed digitally, but rarely used. Instead of working according to standard, production staff relied on their experience and professional knowledge. As long as products met requirements in specification regarding quality and packaging this way of working was accepted.

> The operators mentioned that there were not many possibilities to experiment with working method. However, there was some variation in the operators' methods, and several pointed out that *"people work in different ways",* the most important thing was that the quality measure was kept and that the packaging was uniform according to customer's expectations. There was a standardised way of working for each component, but the operators did not feel particularly involved in the development of the way of working.

Variation, experimentation, and trial-and-error in practical context provide opportunities of reflection for development and problem solving. According to Locke and Jain [17], experimentation is an important value for successful continuous improvement work. If the production staff is deprived of this opportunity, there is a risk of limiting the learning to be, at best, adaptive or single-loop [21]. Repeating the same work tasks in a high production pace risks reducing reflections and conversations with colleagues, reducing important basic components in learning processes. Standardisation of work and tasks is a way of assuring quality and production flow. When personnel are given opportunities to reflect and contribute to development of instructions and ways of performance it offers a valuable possibility to learn [8].

4.2. Motivation

Standardised production is generally a work environment which provides little *autonomy* to operators, being characterised by short and standardised tasks with time constraints. However, including other tasks in daily practice, such as improvement work, can increase autonomy by providing meaningful choices and a way of influencing job design [31]. As can be seen in the case companies, these opportunities are not always met.

> In one of the companies, operators expressed that they feel like robots, having more and more monotonous tasks but little room to participate in changes *"I feel like a robot when everything is controlled and under time pressure"*. In another company, operators chose to not follow standards but instead do tasks their own way as a means to gain autonomy *"There are better ways to do the tasks, we do it our own way, so we get some variation"*.

This can of course mean that some tasks are not optimally performed. To avoid these issues, a potential remedy may be to provide autonomy by participation in improvement work.

To fulfil the psychological need for *competence*, employees need to be able to develop and learn in their job. It is also important to be able to do tasks which are not too difficult but still pose some type of challenge (i.e. not too easy) [27]. In production, this can be achieved by learning new tasks and rotating to different workstations. Another way is to meet this need by making room for problem solving, such as can be done in improvement processes. In the case companies, several different strategies were used, such as using test phases in production readjustments, team problem solving meetings, and using quality improvement tools such as PDCA forms. However, it seemed to sometimes be the case that a few employees engaged in this type of work while others participated less. Having a clearer structure and expectations could be beneficial to increase learning further. It seems clear that both the needs for autonomy and competence could be better met by strengthening and developing the improvement processes, such as a focus on continuous improvement where the whole team contributes.

The need for *relatedness* is related both to the leader and the team [27]. In many of the production teams in this study, a positive group climate was observed, where operators were friendly and positive towards each other.

> Observations showed that it was common that team members helped each other when needed, even if this was not formally required. However, in a few cases there also was a jargon of getting negative remarks when giving e.g. improvement suggestions. This was also mentioned by operators, *"sometimes when we present an idea it's just criticised by others"*.

These tendencies are important to mitigate to reach psychological safety [12,13]. What mainly stands out however are the positive aspects that could be seen in all case

companies, that the teams seemed to provide extensive relatedness support. The support from first-line managers was also experienced as positive, although sometimes hindered by time constraints and a large span of control. An improvement aspect is individual feedback and support in learning and development.

5. Conclusion

As we can see in this study, continuous improvement processes and learning climate can become antecedents for learning and motivation, although this potential is often not fully met. By developing these processes, there is a possibility to increase learning and meet the psychological needs of workers. In the case companies in this study, observations show that there is a gap between intended Lean processes and those actually achieved in reality. Daily pulse meetings are commonly used within continuous improvement work, and the companies in this study all have them. Some also have complementary longer meetings, but none of them use the potential of meetings as learning opportunities for operators or teams, which also obstructs organisational learning. Meetings are mainly used for reporting production issues rather than for reflection and problem solving.

Continuous improvement focusing mainly on developing standardised work may achieve higher speed in production but not capture the opportunity for questions and reflection, being important factors for learning. When working pace is high and time for daily interaction between production personnel is limited, problem solving tends to strive for quick solutions and adaptive learning rather than questioning and reflection, necessary for double-loop learning. In this study we see that development of standardised work has a limited involvement of operators and experimentation is not encouraged. By using the knowledge from those who perform the work, the development process can be a way of supporting learning at several levels and contributing to organisational learning. Standardised production work tasks give limited support for autonomy and competence. To increase motivation, there is a potential to meet these psychological needs by increasing involvement of production staff in continuous improvement processes. Demands for fast deliveries in every part of production is a hindering factor for learning. It creates an atmosphere of stress and quick solutions valued higher in a short-term set of minds, at the expense of reflection and searching for knowledge and understanding. A supportive and friendly atmosphere, on the other hand, creates a psychologically safe climate built on mutual trust, where experiments, failures, and questions can be nourished into shared experience and new knowledge/learnings. A positive climate in the workplace, with psychological safety, will also support the psychological need for relatedness. Together with a good team spirit and supportive leadership, this will have favourable effects on motivation.

Important aspects for improvement are to make sure that all production personnel are active in improvement efforts, as well as increasing the opportunities for reflection and discussion. At the same time, it is also important to ensure that the learning climate is constructive, and that psychological safety is high enough to make employees feel safe to express their views and present ideas.

6. Discussion

Digitalisation, global competition, and turbulent market situations require companies to be flexible and adaptable. This requires production team members to have the right capability and right conditions to innovate, which highlights the need for learning in organisations (see e.g. [3]). Therefore, the concept of learning organisations, popularised by Senge [32], has become even more central. However, in our study we can see that even when continuous improvement processes have been structured by routines, daily meetings, and documenting improvements, companies are still far from reaching learning across the organisation. Instead, many learning opportunities in continuous improvement work are yet to be explored, using the potential in operators and production teams.

The study shows that there are differences between the management's objectives of the production staff's working methods, and actual implementation in production. Opportunities for motivation, learning and development for both the individual and the organisation depend on how the work of the individual and team is organised, such as room for reflection and discussion. When learning is limited, it hinders organisations from developing and making the necessary transformation to meet future demands for adaptation to increasing digitalisation.

According to the theoretical framework, continuous improvement processes should focus on developing people and challenging current methods, rather than just improving processes to become lean [16]. However, in the case companies, focus of continuous improvement work is still very much on eliminating waste and deviations, but less focus is put on more complex problem solving. Consequently, the process design leads almost exclusively to single-loop learning and only sporadic double-loop learning.

In organisations with autonomy rather than control for team members, more learning is achieved [6]. A positive learning climate and opportunities to participate in continuous improvement can aid in supporting operators' basic psychological needs satisfaction. In a work environment characterised by being controlled by the technical system, a sense of autonomy is often lacking [5]. Operators may therefore find opportunities to increase their autonomy in other ways such as deviating from standardised work tasks. From this perspective, providing autonomy in other ways (e.g. giving the possibility to participate in improvement processes) can also lower the risk of employees acquiring autonomy in less beneficial ways. Including continuous improvement work can support autonomy by providing choices and influencing work environment. Continuous improvement work where the whole team contributes can also support the need for relatedness, because of the interdependence between the team members to solve upcoming problems. A prerequisite for reaching this is a positive learning climate with psychological safety. Opportunities for learning also increase the feeling of competence for those involved in those processes.

In this study, we find that there is great potential to increase learning and motivation in production teams by developing the structure and processes for continuous improvement, as well as enhancing learning climate within teams. This has the potential to help companies meet the challenges that the manufacturing industry faces in the rapid technological development of today.

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