

Sense of Coherence and Lean-based leadership and alterations in sick leave and productivity at a steel wire manufacturing unit

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Abstract.

BACKGROUND: Managers have an important role in the creation of workplace conditions that prevent sick leave and lead to high performance. In Lean, the assumption is that people are the source for continuous improvements. There is a need for more knowledge about what kind of leadership can help managers in a Lean context to create workplace conditions for less sick leave and higher performance.

OBJECTIVE: The purpose of this study was to examine how productivity and rate of sick leave changed at a stainless wire manufacturing unit after implementing a new leadership approach based on Sense of Coherence theory (SOC) and Lean philosophy.

METHODS: In this case study, interventions coupled with productivity, quality and sick leave evaluations through the company's key performance indicators were performed. The follow-up was also based on narrative descriptions from the management team in the course of four meetings during the intervention. Notes were taken and analyzed regarding perceived outcomes of the intervention.

RESULTS: The results showed that leadership based on SOC and Lean philosophy is positively correlated with productivity per worker, as was the amount of yearly production that met the quality specifications. The amount of sick leave decreased during the period of the intervention compared to before the intervention.

CONCLUSIONS: Changes in management contribute to productivity. Combining Lean tools and Lean philosophy with the Sense of Coherence theory (SOC) as a base for leadership can influence productivity and decrease the rate of sick leave.

Keywords: Leadership, Lean, productivity, Sense of Coherence theory, sick leave

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1. Introduction

Human resources and worker health are important factors for production in industry. It is therefore important to involve workers in that work, reward them and promote the improvement of working conditions [1]. Both managers and employees are important stakeholders when creating a system for healthy and productive workplaces [2, 3]. Dul et al. argue that if the work environment is fitted to humans, two related system outcomes may be achieved: performance and wellness [2]. Sense of Coherence (SOC) has been described as a source of health at work [4]. In this study a leadership intervention was implemented in order to find out if SOC theory combined with Lean can contribute to managers' ability to create workplace conditions that prevent sick leave and exhibit high performance. Lean is rooted in the concepts of using resources well and reducing the time from when customers place an order to the point when the company receive the payment from the customer, and that time is reduced by removing all non-value-adding wastes [5].

People are the source for continuous improvements and the development of production and performance [6–8]. It is also meaningful to develop cooperation between workers and between managers and workers within an organization for performance [9]. Antonovsky found that health promotion practice should be based on a salutogenic perspective such as the Sense of Coherence (SOC) theory [10]. Performance can then be measured by productivity and quality, whereas health in a working context may be measured in terms of sick leave, absenteeism or attendance. If there is a lack of support in the work environment to give space for people's requirements, they may perform below their capabilities [2] and even take sick leave to escape from their workplace. This was the thinking behind the intervention presented in this study, focusing on the managers' role. The purpose of this study was to examine how productivity and rate of sick leave changed at a stainless wire manufacturing unit after implementing a new leadership approach based on SOC combined with Lean philosophy.

1.1. The managers' role

Managers have an important role in the creation of workplace conditions that prevent sick leave and exhibit high performance [2]. That is in line with Tappura et al., who assert that quality of working life, innovativeness, and an organization's performance

can be improved if managers' competence about occupational health and safety issues is developed and displayed [11]. That means that managers, aligned with HR representatives, must have knowledge about health promotion and act to foster the relationship between health and performance. Health promotion knowledge among managers enables them to create the conditions for employees to perform well at the workplace and prevent sick leave. Drucker has described managers as the life-giving element that through leadership makes resources productive that otherwise never would be [12]. Several writers have highlighted distinctions between leadership and management [13–17]. Emiliani et al. agree with Drucker, arguing that a manager's primary job is to provide leadership that helps people perform at work [18]. Neumann et al. advise trying to embed ergonomics into existing groups and processes and not create new groups focusing on ergonomics [19]. In this intervention the intention was to adopt health-enhancing leadership, more specifically taking inspiration from the theoretical framework Sense of Coherence (SOC) as a basis for managerial behavior.

1.2. Sense of Coherence theory

Antonovsky [10] described the SOC theory as consisting of components that are more or less present in our daily life at work. Those three basic components are *meaningfulness*, the motivational component; *comprehensibility*, the cognitive component; and *manageability*, the behavioral component. Researchers have found the salutogenic SOC theory to be relevant to the work context [20–22], justifying the SOC theory as a base for the intervention in this study. The idea was that managers have a role in the creation of workplace conditions that prevent sick leave and potentially lead to high performance. A further assumption is that people are the source for continuous improvements in the development of production [23–26]. However, Lean has evolved, and for example seven "schools" of Lean have been identified: systems engineering, systems architecture, operations research, organizational development, contingency systems, socio-technical systems and evolutionary. In addition, practical problems that are persistent should guide production and operations management research, such as the difficulties companies have with adoption and sustainability of Lean practices [27].

The idea behind the intervention was that the salutogenic SOC theory, in combination with Lean, could

be the basis for changing managers awareness of their role as creators of SOC and better workplace conditions.

1.3. Implementing change and the rationale for the intervention

Change in organizations generally is a difficult task to succeed with [28], and change efforts in organizations often fail to reach their goals. This has been extensively studied, in the management literature [29, 30]. Previous research has studied the translation of Lean to organizational practice [31] and use of the Lean approach in business management [32]. If the intention is to create workplaces that might affect sick leave, it is important to have tools to encompass physical, psychological, and social factors [33, 34]. When implementing Lean, the greatest challenges are changing the mind-set, motivation and behavior; that is, using Lean tools and Lean philosophy [35–37]. However, other researchers have found that implementing Lean in manufacturing can result in increased risk for work-related musculoskeletal disorders [38] and health problems [39–41]. Seppälä and Klemola conclude from their study that the critical factors when implementing Lean are the management of change, the opportunity to develop oneself at work, and the social climate [42].

Lean is predominantly supposed to be a philosophy influencing the way people think and behave [24, 25]; accordingly, the manager's role becomes to focus on coaching and developing people [24, 26] for continuous improvements and a Sense of Coherence.

A new leadership approach based on SOC and Lean at the case company's stainless wire manufacturing unit was implemented. A similar initiative has found synergies between ergonomics and Lean production [43], although not explicitly using SOC.

The aim was to explore if a leadership intervention based on Lean and the theoretical framework Sense of Coherence changed the key performance indicators: productivity, quality and sick leave.

In the next section the company, the intervention and the data collection will be presented.

2. Material and methods

Both qualitative and quantitative data were collected. The company's key performance indicators (KPIs) were collected, further qualitative measures such as walks on the assembly line and interviews with managers were conducted.

2.1. The case study

This study was conducted at a wire mill unit in a Swedish company producing stainless steel. All the company's production takes place in one geographical place in Sweden, where the head office, wire rod mill and wire mill are situated. The wire rod mill produces about 60,000 tons annually, of which more than 10,000 tons are further refined into wire in the wire mill. The products are sold around the world directly or via a network of representatives. The company had a total of 251 employed people in 2014; that number decreased to 244 in 2015 and further decreased to 243 people in 2016. The company's turnover decreased between 2014 and 2016 [44]. The company's wire mill had for years had low productivity and high rates of sick leave among the workers on the production floor. According to the sick-leave statistics, the high amount of sick leave was due to many short-term, self-certified sick-leave periods and not long-term sick leave or rehabilitation.

2.2. The intervention

Details on the intervention are to be found in Table 1. The intervention contained several steps. First a new production manager was hired to change production systems, followed by the creation of a new management team. It was decided to inspire their leadership on Sense of Coherence theory and Lean philosophy. The new management decided that all personnel should have a common framework on how to work regarding Lean and SOC. Managers spent time on the production floor and introduced new ways of acting in line with Lean tools, such as introducing whiteboard meetings, standardizing the procedure of deviation, common areas to interact, flexible work schedules, eliminating night work and reacting directly to sick leaves to speed up rehabilitation.

All personnel at the wire unit went through a one-day education and training program. The seven changes the managers described that they implemented were: Time on the production floor, introducing whiteboard meetings, standardized procedure on deviations, building a common coffee and lunch area, flexible crew, eliminating night work if possible, acting on sick leave as quickly as possible. The process of data collection from the management team is shown in Table 1, and the results are shown in Table 2.

Table 1
Description of the Intervention and the seven changes implemented

The intervention implemented changes	Description of the change
<i>A new production manager</i>	Due to the years of low productivity and high rates of sick leave among the production workers, the company's top management team decided to hire a new wire unit production manager to tackle the problems.
<i>A new management team. New management based on Sense of Coherence theory and Lean philosophy</i>	The first step undertaken in the intervention was to hire three of the production workers as production leaders, creating a four-person management team. The decision was made to try new management based on SOC and Lean philosophy. The new hired managers was said to be hired to spend much of there time in production. Before that had been no managers at production floor.
<i>Education/training program</i>	Education program for all personnel with both theoretical and practical components. The two-hour theory part was about health and its relation to productivity and Lean philosophy. This was followed by four hours practicing Lean methods and tools in relation to health promotion, working at a pedal-cart assembly line. After the program all personnel were involved in discussions about what changes they should do to promote feelings of meaningfulness, comprehensibility and manageability.
<i>Time on the production floor</i>	Before the new management team took over at the wire unit, there were no production leaders and only one production manager, resulting in limited time that the production manager had spent on the production floor. One early change was to ensure that the production leaders could spend as much time as possible on the production floor to be able to grasp the real situation experienced by the production workers. This was seen as important to enable the production leaders to support the workers from the facts and workers' real needs. The managers assumed time on the production floor would enable the production leaders to support the workers to feel meaningfulness, comprehensibility, and manageability at work.
<i>Introducing whiteboard meetings</i>	At the beginning of every shift, a whiteboard meeting was introduced where a production leader informed the personnel about the current situation of production in relation to planned production. Information was also provided on problems with quality, delivery and machines. It was assumed to be important for the production workers to feel part of a production team with knowledge about the entire unit, not only at the machine they worked at. So the introduction of whiteboard meetings was seen as a way to enhance the employees' feelings of meaningfulness, comprehensibility and manageability through information.
<i>Standardized procedure on deviations</i>	A step-by-step procedure was created to deal with deviations, whether they related to machines and production processes or to humans and behavior. The standardized procedure consists of three steps: <ol style="list-style-type: none"> 1. Find facts by going to the machine or individual and finding the root cause of the deviation. 2. Plan an intervention that will eliminate the root cause, so the deviation never appears again. 3. Decide when to evaluate the action to find out if it worked or if there is a need for another action. The new procedure was intended to be a way to make deviations more manageable.
<i>Building a common coffee and lunch area</i>	Previously there had been small huts used by one or two people located in different parts of the production area. Once it was found that workers still did not know each other's names even after 20 years of working at the wire unit, those huts were removed and a big coffee and lunch area was built. This common area can accommodate all the workers at the same time. The hope with this change was that the workers would get to know each other, creating a team feeling as a way to create a new culture without the bullying communication they have had at the unit, thus enhancing a feeling of meaningfulness and thereby motivation at work.
<i>Flexible crew</i>	Since life events both at work and outside work affect the workers, it was decided to always try to be flexible with work times if an individual had a problem working during normal hours. To enable this flexibility, the workers' old way of thinking about their machines had to be changed to a sense of belonging to a work team. That also meant that they had to be prepared to learn and work at other machines. It was thought to create a feeling of meaningfulness and motivation to learn to operate more machines as a team.
<i>Eliminating night work if possible</i>	Because night work was thought to be negative for workers' health, the management team decided to eliminate night work at all machines if possible. The project to eliminate night work was continuing when this study ended; the goal was to carry out production in two shifts with no night work at all at the unit.
<i>Acting on sick leave as quickly as possible</i>	It was seen as important to always react to a notice of sick leave as quickly as possible through contacting the individual, when possible with a telephone call on the first day of sick leave. The individual was always offered a chance to work on an alternative task if that was possible. The reasoning for that is that the management team thought it was better for an individual to maintain contact with his or her colleagues than to stay isolated at home, if possible. This approach also became used in normal work situations where a worker might have problems and not feel able to work at normal capacity. The intent was to help people feel that they were needed at work, thereby creating a feeling of meaningfulness and motivating people to maintain contact with work and get back as soon as possible.

Table 2
The collected data

Year	Workers	Production (measured yearly)	Productivity per worker	Quality	Sick leave	Narrative descriptions of effects
2014 <i>Baseline</i>	Average number of workers	Production in tons/year	Number of production workers/year	Amount of yearly production that meets the quality specifications	Sick leave/year, in relation to total amount of planned work time	
2015 <i>Intervention started</i>	Average number of workers	Production in tons/year	Number of production workers/year	Amount of yearly production that meets the quality specifications	Sick leave/year, in relation to total amount of planned work time	
2016 Outcomes	Average number of workers	Production in tons/year	Number of production workers/year	Amount of yearly production that meets the quality specifications	Sick leave/year, in relation to total amount of planned work time	3 meetings with management team to collect data about perceived outcomes of the intervention Walk on the production line and talk with assembly workers
2017 Outcomes	Average number of workers	Production in tons/year	Number of production workers/year	Amount of yearly production that meets the quality specifications	Sick leave/year, in relation to total amount of planned work time	1 meeting with management team to collect data about perceived outcomes of the intervention

Table 3
Results for KPIs, 2014 to 2017

Year	Workers	Production	Productivity/worker	Quality	Sick leave
2014	49	7760 tons	158.3 tons	95.3%	15%
2015	45	8898 tons	197.7 tons	95.4%	7%
2016	40	8198 tons	204.9 tons	96.9%	3%
2017	42	9588 tons	228.2 tons	97.2%	2.5%

The role of the first author was to initiate the intervention and take part in the discussions with the company's top management during the planning phase. He was also teaching in six one-day education and training programs for leader and assembly workers, together with an assistant. The author did not take part in the implementation process in any other way, aside from the data collection phase. The intervention was to implement a new leadership approach based on SOC and Lean at the case company's stainless wire manufacturing unit. The management team at the wire mill started to behave according to Lean philosophy and use Lean tools, working to create meaningfulness, manageability and comprehensibility (see Table 1 for more details of the intervention). For example, the new management approach based on Sense of Coherence theory implied that it became the management team's primary work to help the workers to feel that their workday was characterized as meaningful,

comprehensible and manageable. To reach that goal, frequent discussions at the wire unit involving all personnel, such as at daily whiteboard meetings, were seen as important to make both the management team and the workers feel that they were participating and could influence the changes, thereby also creating a feeling of ownership and meaningfulness.

2.3. Data collection and analysis

Details of the data collection are summarized in Table 3. A baseline of KPI measures was collected in 2014. The measures were production in tons/year, number of production workers per year, amount of yearly production meeting the quality specifications and sick-leave rates. The same figures were collected for the years 2015, 2016 and 2017. There is an array of methodologies available to measure productivity [45]. Productivity at the organizational level can be defined as how well a system uses its resources to

achieve its goals [46]. Interest in measuring health effects on productivity has resulted in the development of numerous instruments [47]. Karasek and Theorell have reflected on how to create productive work, and they address how a reconstruction of work might lead to productivity. For that reason, it is important to measure both productivity and health when measuring an organization's performance [48]. Thus, we decided to use the company's own KPIs, since they were related to the company's goal of yearly production, meeting the quality specification. To this, sick leave was added, since that factor had been found to be too high before the intervention. Both the first author and the assistant from the education/training participated during data collection. The first author had the role of leading a conversation with the wire unit's management team. At those four data collection sessions, information on the procedure and its effects was collected from the management team using an unstructured dialogue method. On those occasions, the management team also demonstrated the changes that had been done, such as the whiteboard that had been introduced and the new common coffee and lunch area.

The company's KPIs were analyzed descriptively. The most common indicators were extrapolated from the company's KPI system, and the basic data were summarized to describe the data. The analysis was about the tendency of decrease or increase.

The qualitative data were analyzed in two steps. Both the data collectors took notes and compared them. Contents were grouped regarding the managers' perception of the intervention and its outcomes. Categories occurred; nevertheless the perceptions were consistent, as described in the results.

All respondents in the qualitative part of the study had agreed to participate in the study.

3. Results

3.1. Results on productivity and sick leave

Table 3 shows that productivity per worker increased from 158.3 tons in 2014 to 228.2 tons per worker in 2017. Quality, measured as the amount of yearly production that meets the quality specifications, increased from 95.3% in 2014 to 97.2% in 2017. In 2014 the amount of sick leave was 15%; that decreased to 2.5% in 2017. The number of production workers overall decreased from 49 the year before the intervention to 42 workers in 2017. Analysis of the

statistics show that the reason for the decrease was retirements and other jobs. This was confirmed by the management team, who revealed that none of these individuals were often on sick leave.

3.2. Results of the qualitative data collection

The main finding from the qualitative data was that the work intervention (as described in section 2.2) contributed to a new culture, for both managers and workers. During the data collection occasions during 2016 and 2017, after the intervention, the management team at the wire unit described the intervention as having changed the culture at the unit. This was visible in both the behavior and talk of the people at the unit (see an example below). The management team described how the harsh exchanges that were previously common between the workers were no longer heard, and that the workers now supported each other; The managers said that a "*team culture has been developed.*"

The managers further expressed that there has been a change in people's way of thinking and behaving, i.e. the culture, and that had an impact on productivity and health at the unit.

One change that the management team perceived as important, was to ensure that the production leaders could *spend as much time as possible on the production floor* to be able to grasp the real situation experienced by the production workers and thereby enable them to support the workers from the facts and their needs. The managers said that to be on the floor as much time as possible was essential for the production leaders, because they could find out, through questions and observations, the current situation among employees and thereby help the workers feel *meaningfulness, comprehensibility, and manageability* at work. Similarly, fitting the work environment to humans has positive effects on both health and performance [2]. Fitting the work environment to humans requires knowledge of what they need, and as the management team expressed, those needs might be identified if managers spend time on the production floor communicating and observing to find out if people find their work meaningful, comprehensible and manageable, or why they do not.

The introduction of *whiteboard meetings* at the beginning of work shifts to provide the workers with relevant information was seen by the managers as important for the production workers' feeling of being a part of a team with knowledge about the situation at the entire wire unit, not only at the machine

they were working at. To be part of a team and have the opportunity to take part in decisions is in line with Antonovsky, who stated that the strength of SOC is influenced by participation in socially valued decision making [10]. The information at the whiteboard meetings is also a way to strengthen individuals' understanding of the current situation and thereby increase their ability to manage the situation.

Building a common coffee and lunch area instead of the small huts previously used by one or two people was considered important. The result of this change was that the workers got to know each other and could build team cohesion. The management team described this change as successful. Moreover, if the work environment is fitted to humans, two related system outcomes may be achieved: (1) improved performance in terms of, for example, productivity and quality and (2) wellness and health [2].

A step-by-step *standardized procedure on deviations* was implemented to deal with deviations and used regardless if the deviation was about machines and production processes or about humans and behavior. Neumann et al. point to the importance of accommodating personnel changes during the change process [19]. Creating a step-by-step managerial behavior procedure for managers to follow can be a way to cope with that. In fact, Kotter argues that a change is fulfilled only when it has become a new behavior that is rooted in a culture within the organization that is naturally expressed as “the way we do things” [29]. The managers expressed that the standard procedure helps them to take action when deviations occur.

It was seen as important to always *act on sick leave as quickly as possible* through contact with the individual and when possible with a telephone call on the first day of sick leave. The individual was always offered a chance to work on something other than the ordinary work if possible, because the management team thought maintaining contact with colleagues was better than staying at home. This approach of finding an alternate task is also used in normal work situations where a worker might have problems and not be feeling able to work at normal capacity.

To have *flexible working schedules for the crew* was described as important according to the management team, because life events both at work and outside work affect the workers. They decided to always try to be flexible with work times if an individual has a problem working during scheduled hours.

For health reasons, the management team started to *eliminate night shifts where possible* for workers.

4. Discussion

The results confirm previous research that asserts that with the Lean concept the manager's role becomes to coach and develop people [26], and previous results showing improvements in health when Lean and OHS is adopted in manufacturing [49]. Further information gathered in meetings with the management team confirmed the statement by Tappura et al. that life quality and organizational performance can be improved if managers develop competence and knowledge about occupational health and safety issues [11]. To this we can add a leadership based on SOC and Lean philosophy.

The management team found that higher productivity and decreased sick leave resulted from the new leadership approach and the seven changes; there were no changes in machines or other technical changes. The decrease in sick leave can be described as moving in the opposite direction from the average increase of sick leave in Sweden during 2010–2016 [50, 51], and at the same time the wire unit raised productivity and quality. Based on the findings, working conditions such as flexible schedules and fast reacting and acting on sick leave seem to be an important factor behind sick leave. Changes in working conditions can help organizations to reduce the amount of self-certified sick leave. However, it is also important to acknowledge that life events can influence participants and thereby the intervention as a whole. Examples of life events that can influence workplace interventions are changes in career, illness, injury, death, divorce, marriage and retirement [19]. For the future management paradigms to improve performance could also add other sustainability factors as suggested by Figueira [52].

The result is based on a single case intervention; the method of the study does allow pursuing results based on KPIs and perceptions rather than statistical analysis of causalities. However, some support for the results could be found in interviews with workers at the unit after the data collection was completed. The workers described in the Swedish personnel and leadership journal [53] that the new way of working has been positive and the harsh exchanges that were previously common between the workers are now seldom heard. Instead, the workers now support and help each other. They expressed how they felt more involved in planning production and more responsible for the whole production flow [53].

4.1. Method discussion

The methods used in this study have limitations. Measuring the rates of sick leave can be argued to have limitations because there are many causes for a worker to call in sick [54]. The number of sick-leave days varies among countries [54] and gender [51]. Sick leave might be affected by more than work, but since there is generally no large variation in sick leave from one year to another [51], this was regarded as one conceivable indicator as complement to the others. For further research it would be interesting to measure whether SOC increases or decreases both among managers and workers before versus after an intervention. If it had been a large industry having many settings it would also have been desirable to design the intervention with a control group.

In the study at the wire mill, the company's own measurements was used to study if the level of sick leave decreased after the new leadership approach combining SOC with Lean philosophy was implemented. As there were no changes in machines or technology, the managers unanimously perceived that the changes in productivity and sick leave rates resulted from practicing the new leadership. That view was also expressed by the workers after the intervention. In future research, to gain a better understanding of the mechanisms of the this leadership approach that combines SOC and Lean philosophy, we suggest a combination of KPI measurement with qualitative measurement, for example SOC questionnaires and interviews involving personnel from all hierarchical levels. Also, the changes may be dependent on individual managers. In this study, the four-person management team was dedicated and put effort into changing the situation at the wire unit, and they involved personnel as participants in the change process, which they felt was essential for the results.

The meetings were not recorded but are only saved as notes the first author and the assistant took, so there is a shortcoming that implicit changes were not recognized or noted completely verbatim. For further studies, recordings are recommended in order to make sure no details are missing during four-hour-long data collection sessions. On the other hand, the opportunity to participate in meetings allowed us to exchange information with the management team, and the authors benefited from talking to them regularly. To our knowledge, the case in this paper is the first time a new leadership approach for managers based on the combination of SOC and Lean philosophy and Lean tools has been implemented with

the purpose of enhancing productivity and decreasing sick leave. For further research, the monitoring could involve all kinds of personnel rather than exclusively managers and production measures as in this study. According to Eriksson and Lindström, one important immediate research focus is to implement the SOC theory in practice [55]. This case study was an attempt to respond to that request.

5. Conclusion

The purpose of this study was to examine how productivity and rate of sick leave changed at a stainless wire manufacturing unit after implementing a new leadership approach based on Sense of Coherence theory (SOC) and Lean philosophy. The results indicates that implementation of a leadership approach that combines Lean with Sense of Coherence theory (SOC) can positively influence productivity and decrease the rate of sick leave. The combination of Lean and SOC theory can be a managerial tool to creating the best possible work environment to make it possible for people to do their best at work every day. The results indicate that concerns for performance need to start with concerns for the people creating the output. In organizations working according to Lean principles it can be argued that a health promotion approach is essential, because it aims to reduce waste in human capability and optimize human capability and thereby productivity. As further research, we suggest testing the principles in several production areas and settings. The long-term effects of the study are also important to evaluate to validate the significance of the identified managerial approaches.

Conflict of interest

None to report.

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