

Is Lean No Longer Mean?

- *A Study of the Consequences for Working Conditions in Companies Implementing Lean*

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Abstract

Lean is today becoming increasingly popular in Swedish manufacturing industry, and the concept has also started to spread to other sectors, such as administration, healthcare and the municipal sector. However, previous studies have suggested that Lean can become “mean”, creating working conditions that are bad for the employees. Conversely, other studies instead suggest that this has less to do with Lean, than with the implementation of Lean. Thus, this paper aims at studying the implementation of Lean in eight medium sized companies over a two year period, using qualitative and quantitative data. First, the results from the qualitative data suggest that these companies implementation of Lean is characterized by Lean coordinators, pilot projects and improvements groups, while the Lean tools mostly used are 5S, SMED, standardization and means to improve the production flow. Second, the perceived effects on working conditions, based on the quantitative data, suggest an improvement in the working environment, an increase in the work with safety and some degree of increase in stress for the workers. Consequently, the implementation structure of these companies does not indicate a “mean” production system, although the long term effects on working conditions cannot be determined, based on these data.

Introduction

Lean Production is a Toyota-inspired management concept, first introduced by Krafcik (1988) in his article *The Success of the Lean Production System*, and later developed and made famous by Womack et al. (1991), in the by now classical book *The Machine that Changed the World*.

The concept has recently, during the last decade, become very popular in Swedish society, and has also given rise to concepts such as “Lean Administration”, “Lean Healthcare”, “Lean Product Development”, “Lean Construction”, etc. Also, the presence of famous Swedish companies, such as Scania, Astra Zeneca and Electrolux, who attributes at least part of their successes to their work with Lean, together with a growing Lean consulting industry, does its share in aiding to the popularity of the concept in Sweden.

Lean Mean Production

Lean has, however, not always had the positive associations that it is often given today in popular media, although there are still critics of Lean. It was not that long ago that you in Sweden spoke of so-called “Lean Mean Production”, or “anorectic production”. The argument was that Lean causes “mean”, or “anorectic”, production systems, which are bad for the employees’ health and working conditions. For instance, several previous studies reports problems created by increased job intensity and higher demands, ergonomics problems (such as musculoskeletal disorders) without increases in the positive aspects of work, such as a broadened set of work duties, work rotation, increase in team work, etc., when Lean has been implemented (Berggren, 1994; Björkman, 1996; Haynes, 1999; Landsbergis et al. 1999). As Berggren put it (1993), Lean is often, by the advocates of the concepts, described as meaning working *smarter*, not harder – but usually, according to Berggren, it means *both*.

Of course, this does not stand unchallenged; for instance, some researchers has argued that Lean creates less interesting and monotonous work, although the chance of influencing the working situation does exists in a Lean production system (Schouteten & Benders, 2004) and one study performed by Womack et al. (2009) indicates that Lean working systems does not create worse working conditions than non-Lean automotive assembly plants.

Other researchers, such as Womack and Jones (2003), Womack et al. (1991) and Liker (2004), has instead argued that a “true” Lean production system will in fact create *better* working conditions, than non-Lean system, through increases in team work, job rotation, participation in work with continuous improvement activities, increased skill level and broadened work responsibilities for the workers, etc. However, empirical research supporting the argument that so-called “true” Lean systems creates positive working conditions appears to be scarce (Genaidy & Karwowski, 2003).

The Implementation of Lean

One interpretation of the studies reporting negative consequences of Lean is that the “meanness” is not actually associated with Lean *per se*, but rather, that they are the consequences of a wrongful implementation of Lean (Björkman, 1996; Womack et. al, 2009). This has also been suggested by Swedish researchers, such as Berglund (2006), although he at the same time speculates that there is an inherent risk for bad working conditions when companies implement Lean, if it is done in an incomplete way, or without sufficient management support and

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commitment. Another aspect of this, suggested by some Swedish researchers, is the notion that if you do not implement “the whole” Lean concept, but instead, only pick “pieces” of Lean (such as specific Lean techniques), the risk of unwanted consequences of a Lean implementation increases. This is referred to as the “Frankenstein trap”, by some researchers (Blücher et al., 2004). However, there is little empirical evidence supporting this argument, i.e. that an “incomplete” Lean system will be “Frankensteinian”.

Nevertheless, the importance of the implementation structure is vital here, since one needs to differentiate between which working conditions effects that the *implementation* of Lean has, and which effects arise from the *future development* after Lean has been implemented (i.e. the long term effects of a Lean production system). One such example of the importance of studying the implementation phase is Adler and Cole’s (1993) study of NUMMI, which suggest that the Lean production system in that factory created a “satisfying” work system for the employees, through a high level of worker participation in the implementation. However, other researchers have argued that NUMMI has had many ergonomically related problems during launches of new car models (Adler et al., 1997) and Landsbergis et al. (1999) have also argued that the high level of worker participation, during the implementation reported by Adler and Cole, were in fact not upheld after the implementation phase was over.

Another example of the importance of understanding the implementation of Lean, but also of the *context* in which Lean is implemented, is Seppälä and Klemola’s (2004) study of Finnish companies, working to implement Lean. Their study suggests that Lean in these companies takes on almost socio-technical forms, which could be interpreted to support Hampson’s (1999) argument that social factors, such as the strength of the union, together with the unions power to actually implement their demands, determine if Lean becomes mean.

Purpose of this Paper

The discussion above suggests that the implementation structure, when Lean is introduced into an organization, is highly important in order to determine if Lean becomes “mean”, although the implementation in itself does not appear to be the whole explanation for when Lean becomes “mean” or not – other factors is at play, as well. Nevertheless, in this paper, the focus will be on studying the implementation phase. Thus, put another way, the purpose of this paper is to study the implementation of Lean in eight medium sized Swedish manufacturing companies, together with the perceived changes on working conditions, over a two year period in order to see if these companies approach to Lean becomes “mean”.

Method

Definition of “Working Conditions”

The definition of “working conditions”, used in this paper, will be broad one; both physical and environmental aspects, together with psychosocial aspects of working conditions will be used. However, the focus will mainly be on the participants, in the studies, *perception* on the working conditions and work environment; thus, no objective measurements will be used, but rather, they focus will be on how the employees, managers and production supervisors perceive three aspects of the working conditions, within these companies. These perceived aspects are 1) the physical working environment, 2) the level of stress and 3) the level of safety work for the personnel.

The Eight Companies in the Study

Common Features of the Companies

The eight companies included in this study have several common features:

- They are all medium sized, i.e. they have been approximately 50 and 250 employees.
- They all have a focus on industrial manufacturing.
- They are all located in Sweden, although in different geographical areas of the country.

The following can be said about the product and market segment of the eight companies:

- Companies A, B and F are working as suppliers for the automotive industry.
- Companies C and E are mostly acting as subcontractors, although not for the automotive industry.
- Companies D, G and H are manufacturing their own products, although these products are sold to different market segments.

External Support for the Companies

The eight companies in this study have all been involved in a Swedish national development program, called Produktionslyftet (“the Production Lift”, in English); for more information about the program, see www.produnktionslyftet.se. The reason why this is mentioned in the method chapter is because the program’s approach to Lean and the support given to these companies by the program, likely affects these companies approach to Lean and their implementation.

Produktionslyftet is focused on supporting medium sized manufacturing companies in their implementation of Lean, during approximately a 1.5 year period. This is done through an extensive program of consulting aid; for the companies included in this study, this has meant a total 500 hours of consulting per company, which is complemented with educational support; two employees per company are allowed to take a university course in Lean. The consulting aid, and the university courses, is highly subsidized for the companies. The program’s approach to Lean is heavily inspired by Liker’s (2004) interpretation of the concept, but also of Scania’s approach to Lean, i.e. the Scania Production System (or “SPS”).

Also worth mentioning, is that Produktionslyftet includes, in their program and their activities with the companies, several activities designed to create a more participatory approach to the implementation. Such examples are “Lego games”, which the employees and management play, intended on simulating the difference between a “Lean” and a “mass-production” system. Other examples are Lean lectures for the employees, and several of the companies also involve operators and production personnel with a key role in the steering groups for implementing Lean.

Structure of the Two Studies

The study consists of two phases; first, a *qualitative process study*, focusing on the implementation structure, i.e. which Lean tools are implemented, what organization is used, and how the work is done, and to some degree, how the working conditions have been affected, one year into the implementation. This is followed by a *quantitative outcome study*, based on a questionnaire distributed to the companies approximately one year later, studying the outcome of the implementation.

The Qualitative Process Study

The qualitative part of these case studies is based on semi-structured interviews (Kvale, 1997), performed on sight at the eight companies. This meant that there was an interview guide with questions, which guided the interview process. However, though the interview persons were allowed to speak freely regarding the questions, some questions were always asked, such as which Lean tools were implemented, how the work was organized and how the implementation had affected the working conditions, so far.

In order to create a broad understanding of the companies' implementation process, persons from many hierarchic levels of the organization were interviewed; from the operator level to that of the top management of the company. In total, 41 persons at the eight companies were interviewed. Notes were taken, and the interviews were also taped, when approved by the interviewee persons. Table 1 below describes how many persons per company that has been interviewed.

In this paper, results regarding the following will be presented; the organization of the implementation (table 3), the Lean tools implemented (table 4) and how the interviewed persons perceived that the implementation of Lean have affected their working conditions (table 5).

The Quantitative Study

The questionnaire questions, presented in this paper, are part of a larger questionnaire send out to these eight companies. Although the questionnaire is extensive, only part of the collected material has been included in the analysis done for this paper. These are questions focusing on how the employees perceived that their working conditions have changed. The following three statements below, i.e. statement 1-3, which the respondents could agree or disagree with, were part of the questionnaire, and thus, the results from the respondents answers regarding these statements will be included in this paper:

- 1) The physical working conditions have improved during the recent year.
- 2) The work with safety, for the personnel, has increased during the recent year.
- 3) The level of stress has increased during the recent year.

Five categories were used, as possible answers to statements 1-3 above; "concur strongly", "concur", "disagree", "disagree strongly" and "don't know". The answers will also be broken down into three categories; answers from *managers*, *production supervisors* and *operative personnel* ("workers"). In order to present the data, a weighing of each group (i.e. managers, production supervisors and operative personnel), for each company, will be presented, using the following formula:

$$W_{a,b} = \frac{2n_A + n_B - n_C - 2n_D}{n_A + n_B + n_C + n_D}$$

$W_{a,b}$ is the weighing for group b , within company a , n_A are the number of persons concurring strongly with the statement, n_B are those concurring, n_C those disagreeing, n_D those disagreeing strongly. n_E is those who do not know; these persons will not be included in the weighing above. Consequently, the formula above gave a weighing, ranging between -2 to 2, for each group in each company. The reason for choosing this formula, was that it allowed for a "pedagogic finesse"; if a majority the respondents disagrees, the results will be negative, while if they agree, the results are positive.

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The instruction, to the companies, was that those who had been actively involved in the Lean implementation, together with the whole company management group and representatives of the blue and white collar union, was the intended target group for the questionnaire. However, which these persons actually were, for each individual company, was determined by the companies themselves. Table 2, below, describes how many persons per company that answered the questions 1-3 above.

<i>Table 1: No. of interview persons for the companies.</i>		<i>Table 2: No. of persons answering the questionnaire regarding the working conditions.</i>	
Company	No. of persons	Company	No. of persons
A	4	A	9
B	6	B	5
C	6	C	11
D	5	D	18
E	4	E	7
F	5	F	5
G	6	G	19
H	5	H	8

Results

The Lean Implementation Structure

Table 3 and 4 below summarize the implementation organizations used by the eight companies (table 3), and which Lean tools that the organizations, during the process study, claimed to have been working with, during their implementation of Lean (table 4). However, only tools used by at least three of the companies will be presented in the table below. Note also, that improvement groups, often called *kaizen groups* in the Lean literature, are not considered as Lean tools in for the sake of this analysis; instead, they are considered to be part of the implementation organization.

Regarding the implementation structure, the results in table 3 show that the implementation structure and most companies have used are *Lean coordinators* (persons within the companies with the responsibility of coordinating the implementation of Lean), *improvement groups* (groups in which the employees participate in the work with continuous improvements); seven of the eight companies have used these implementation structures. Lastly, six of the eight companies have also used a *pilot project* or *pilot area*, for their implementation, i.e. the implementation has likely not affected the whole organization simultaneously.

The results, regarding the Lean tools used (table 4), show that the most common Lean tools are 5S (a systematic approach to increase, and uphold, the orderliness of a work place), *SMED* (“single minute exchange of die”; methods to reduce the set up-times of machines, etc.), means to increase the *flow* (such as value stream mapping) and also of *standardization* (methods to create more standardized work procedures and routines in the production). Lastly, the data (table 5) also show that six of the eight companies report an improvement in the physical work environment, due to increased order and structure, resulting from the work with 5S.

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Table 3: Implementation organization of the companies

Company	Involved owners	Steering group	Manag. respons.	Improv. groups	Union repr.	Pilot area/project	Lean coordinator
A		X		X	X	X	X
B			X	X		X	
C	X		X	X		X	X
D	X		X	X		X	X
E		X		X	X	X	X
F	X		X	X	X		X
G		X		X			X
H		X			X	X	X

Involved owners: if the owners of the company are involved in the Lean implementation; **Steering group:** if a separate Lean steering has been used, operatively; **Manag. respons.:** the Lean implementation is operatively performed by the management; **Improv. groups:** improvement groups has been used; **Union repr.:** if a union representative has been included in the group managing the Lean implementation; **Pilot area/project:** if a Lean pilot project or areas has been used; **Lean coordinator:** if a Lean coordinator has been used.

Table 4: Lean tools used by the companies

Company	5S	SMED	Standardization	Flow	VSM	Visualization	Leadership
A	X	X	X		X	X	
B	X		X	X		X	X
C	X	X		X			
D	X	X		X			
E	X	X	X	X			
F	X		X		X	X	X
G	X		X		X		X
H	X	X		X			

5S: tool to improve order and structure in the work place; **SMED:** “single minute exchange die”, i.e. technique to reduce setup times; **VSM:** value stream mapping. **Leadership:** training/courses in leadership has been included as part of the work with Lean, for these companies. However, what these leadership courses/program includes, are unknown.

Effects One Year into the Implementation

Table 5 (below) describes how the eight companies perceive that the physical working conditions have been affected, one year into the implementation of Lean.

The results show that a majority (six out of eight companies) perceive an improvement in the working conditions. These improvements seem to be connected to the work with 5S, to create a more orderly workplace. Some of the interviewed persons also see a connection between this work and the safety of the workplace, arguing that the more orderly workplace means a reduced risk of accidents, etc.

Table 5: The interviewed persons perception off effects on working conditions, one year into the implementation.

Company	Effect on working conditions	Comments
A	None	The approach has not affected the working conditions of the company.
B	Improvements	Some associates the improvements with the work with Lean, others do not.
C	Improvements	Varied opinions; those who concurred stated better overview in the production, more even work flow and a more fun place to work in.
D	None	The approach has not affected the working conditions of the company.
E	Improvements	Improved order, a more "fresh" work place, better lightning and working smarter, not harder.
F	Improvements	Better order, leading to a reduced risk of falling, and some degree of work rotation.
G	Improvements	Increased order, leading to less risk of falling, a nicer working environment. However, increased stress for some work groups.
H	Improvements	Some improvements from work with 5S, such as better lightning, etc.

Effects Two Years into the Implementation

Below, figure 1-3 describes how the three groups for each of the eight companies, perceived that the physical working environment, the level of safety work for the personnel and the level of stress has changed during the last year, i.e. approximately 1.5 to two years into the implementation.

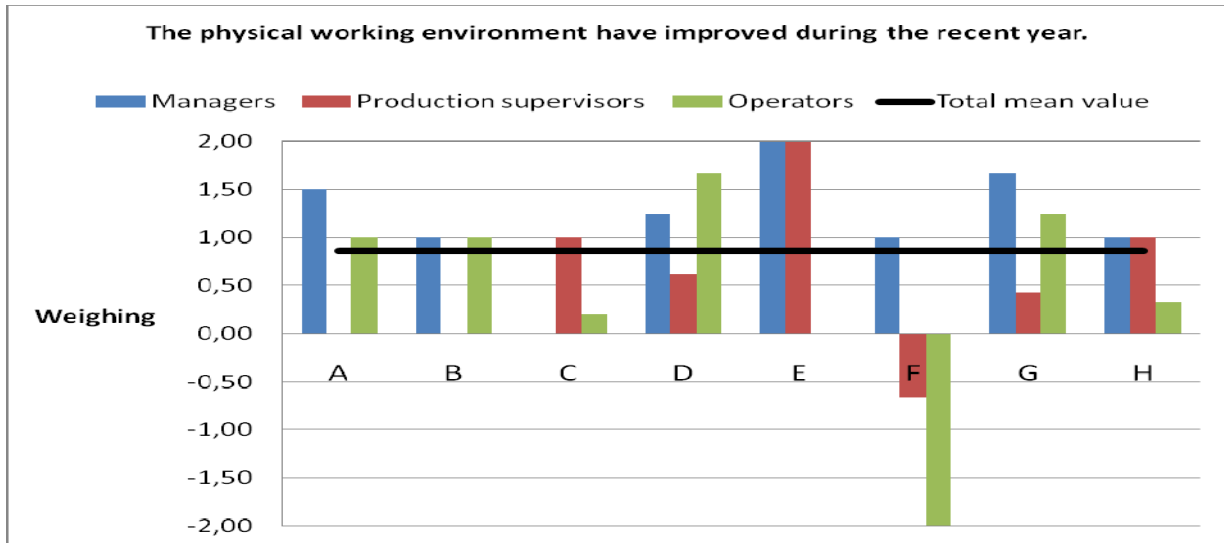
Changes in Physical Work Environment

Figure 1 (below) describes how the persons answering the questionnaire, from the three groups concurred or disagreed in the statement that the physical working environment had improved during the recent year.

One person out of 72, answering the question regarding the physical work environment, answered "Don't know" (one of the managers).

Based on these data, we can see that the general consensus among the eight companies, with one exception, is that the physical working environments have improved, during the recent year, although to a varying degree. However, in company F, the results indicate that the physical working environment have not improved, during the recent year.

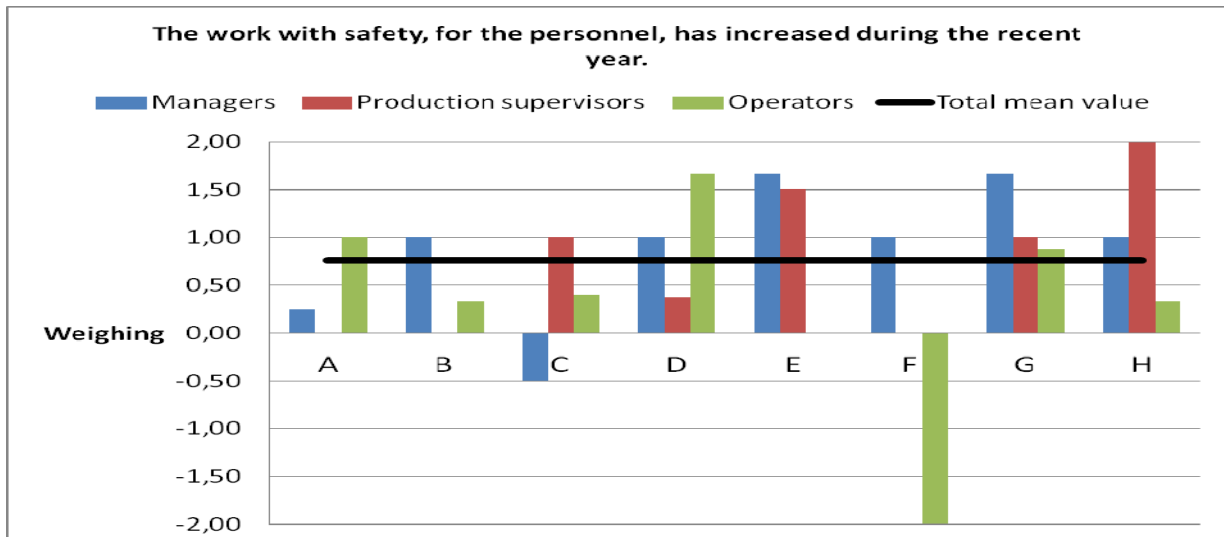
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Work with Safety for the Personnel

Figure 2 (below) describes how the persons answering the questionnaire concurred or disagreed in the statement that the work with safety for the personnel had increased during the recent year. Five persons out of 72, answering the question regarding the work with safety for the personnel, answered “Don’t know” (two of the managers and three of the operators).

Based on this, we can see that the groups, with two exceptions concurs to the statement that the work with safety for the personnel has increased during the recent year, though the level of concurring does seem to be slightly lower here, than in figure 1.



Changed in Perceived Stress

Figure 3 (below), describes how the persons answering the questionnaire concurred or disagreed in the statement that the level of stress had increased during the recent year.

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Two persons out of 72, answering the question regarding the work with safety for the personnel, answered “Don’t know” (two of the managers).

The data show that the variance between the companies is high, and so is the variance between the groups. However, the workers in four of the six companies perceive an increase in stress, while in three of the five companies the production supervisors perceive an increase in stress. Conversely, only in two of the companies do the managers perceive an increase in stress, while five does not.

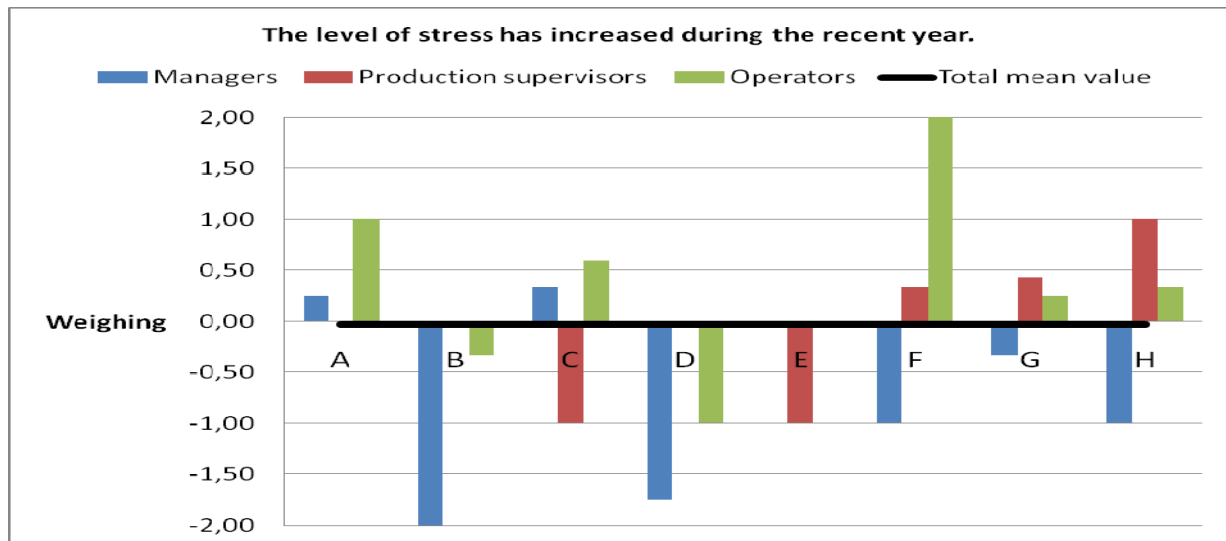


Figure 3: Perceived effects on level of stress

Discussion

The results, presented in this paper, show several interesting things. First, regarding the approach to Lean that these companies are using, in general it can be said to be dominated by six factors; improvement groups, Lean coordinators, pilot projects, 5S, SMED and standardization. Improvement groups provides a means for the employees to participate in the implementation, 5S creates a more orderly work environment (i.e. it effects the work environments in these companies), SMED reduces set up times thus providing more time for production (possibly increasing the work intensity), standardization likely means less variance in the work routines and procedures, and Lean coordinators provides steering of the implementation.

Thus, in total, this approach to Lean, and the Lean techniques, suggests a production system (or, more correctly, a *pilot* area or project), and therefore, a work environment, which is more orderly, with a higher production “flow” and some degree or worker participation. However, it is important to stress, that since a majority of the companies have used pilot projects in their Lean implementation, it is difficult to assess how, if at all, these results have spread through the companies production facilities. This, since an empirical study of Norrgren et al. (1996) show that that good results are unlikely to spread by themselves and the idea of “the power of the good example” are highly exaggerated.

Second, regarding the perceived outcome, concerning the working conditions in these eight companies; 1) the physical working environment in a majority of these companies has improved,

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2) the work with safety has increased for the personnel, and 3) the level of stress has increased to some degree for the workers, although not for a majority of the managers and the production supervisors. Thus, the questionnaire data regarding the working conditions, confirm the view of the production system which the dominating Lean tools and techniques suggest that it could create. Therefore, it does seem reasonable to assume that the improvements in the order and physical work environment, has continued for a majority of these companies.

Interestingly, these results seem to confirm Scouteten and Benders' (2004) conclusion, that a Lean production system means a more standardized and uniform production system, with some means for the worker to influence their own working situation. Also, the results here seem to confirm Adler and Cole's (1993) conclusion that a more participatory approach to implementing Lean means better results, regarding the working conditions for the employees. However, the results could also be interpreted as a confirmation of Berggren's (1993) conclusion, i.e. that Lean means working smarter *and* harder, due to the increase in stress that the workers perceive. Nevertheless, the results presented in this paper do not seem to confirm the idea that these companies approach to implementing Lean creates "mean" working systems.

It is, however, important to stress that while these data suggests that changes has occurred, in the production systems in these companies, conclusions from these data should be viewed for what they are; not an exact measure of the changes in the working environments and working conditions, but rather, data suggesting a direction (or more correctly, the *perception* of one), not establishing one. For instance, objective ergonomic measurements (Osvalder et al., 2008) are missing in this analysis, meaning that these results only show the subjective side of the working conditions; for a more complete picture, objective measurements are also needed. Also, the focus in this paper is on the short term effects of Lean, or put another way, the implementation phase of Lean, and these data does not tell us anything about the long term effects of Lean, nor do they reveal the long term outcome on the health and safety for the workers, in these eight companies.

Conclusions

The conclusion, from the results in this paper, suggests several things. First of all, the companies are using an approach to Lean which suggests a more orderly work environment, with increased flow; this is also confirmed by the perceived changes in work environment, level of safety work and stress that the groups in the companies report. Thus, the results of the qualitative process study of the implementation seem to be confirmed by the outcome of the questionnaire study, suggesting a similar development for a majority of these eight companies.

Second, while the data show some level of increase in stress for the workers, these results hardly seem to create "mean" working conditions, jeopardizing the health and wellbeing of the employees – at least from a short term perspective. Therefore, the conclusion from these results is that these companies approach to *implementing* Lean does not seem to be mean. However, these results do not tell us anything about the *long effects of Lean*, i.e. of the objective outcome of a Lean production system, only regarding the implementation of Lean.

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