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Packages of participation: Swedish employees' experience of Lean depends on how they are involved

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Abstract

Background—Lean Production is a dominant approach in Swedish and global manufacturing and service industries. Studies of Lean's employee effects are few and contradictory.

Purpose—Employee effects from Lean are likely not uniform. This paper investigates the effect of employees' participation on their experiences of Lean.

Method—This study investigated how different packages of employee participation in Lean affected manufacturing workers' experiences of Lean. During 2008–2011, qualitative and quantitative data were collected from Swedish manufacturing companies participating in the national Swedish Lean Production program Produktionslyftet. Data from 129 surveys (28 companies), 39 semi-structured interviews, and 30 reports were analyzed. In the main analysis, comparisons were made of the survey-reported Lean experiences of employees in three groups: temporary group employees (N = 36), who participated in Lean mostly through intermittent projects; continuous group employees (N = 69), who participated through standing improvement groups; and combined group employees (N = 24), who participated in both ways.

Results—Continuous group employees had the most positive experience of Lean, followed by the combined group. Temporary group employees had the least positive experiences, being less likely than their counterparts to report that Lean improved teamwork, occupational safety, and change-related learning, decision making, and authority.

Conclusions—These findings support the importance of continuous, structured opportunities for participation but raise the possibility that more participation may result in greater workload and role overload, mitigating some benefits of employee involvement. Consequently, companies should consider involving employees in change efforts but should attend to the specific design of participation activities.

Keywords

Organizational human factors; macroergonomics; Organizational change; Job design; Quality of working life; Lean Production

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Conflict of interest

The authors have no conflict of interest to report.

1. Introduction

The Toyota-inspired management concept *Lean Production* (Krafcik, 1988; Womack, Jones, & Roos, 1991) dominates the discourse on work design in Sweden's manufacturing industry (Börnfelt, 2006; Johansson & Abrahamsson, 2009). Currently, there is no universal definition of what constitutes Lean Production. However, the concept is often described as a strategy, "philosophy," or toolbox with goals such as maximizing customer value through waste or cost reduction. Typical Lean methods and organizational principles include work standardization, just-in-time production, defect control, and continuous improvement (Pettersen, 2009). Lean change programs are globally prevalent in manufacturing and are spreading fast in other sectors, including healthcare delivery and service (e.g. Holden, 2011; Suárez-Barraza, Smith, & Dahlgaard-Park, 2012). Nevertheless, the question of *how employees experience Lean* has received little empirical attention. Here, we treat "Lean experience" as the worker's personal experience working directly with Lean, their evaluation of it, and its effects on them and their work system.. The worker-centered concept of "Lean experience" can be one part of, but is not equivalent to, the overall success of Lean in improving sustained work system outcomes such as efficiency, quality, safety, profitability, and favorable tangible working conditions.

Some argue that employees experience Lean Production positively: that employees favorably evaluate Lean and that by improving teamwork, learning, and problem solving, Lean results in a multi-skilled workforce that feels (and is) empowered to enact continuous improvement (e.g. Adler, 1995; Adler & Cole, 1993; Berglund, 2010; Liker, 2004; Womack et al., 1991). Others claim that employees perceive Lean Production negatively (e.g. "mean production") and that Lean has undesired employee consequences such as increased mental and physical workload, increased risk for work-related musculoskeletal disorders, negative effects on unions, increased peer pressure and monitoring, work intensification, and stress, all resulting in a perceived undesired effect of Lean on work (Babson, 1995a, 1995b; Brenner, Fairris, & Ruser, 2004; Börnfelt, 2006; Delbridge, Turnbull, & Wilkinson, 1992; Munchus, 1983; Parker & Slaughter, 1995). Reviews of employees' experiences of Lean show equivocal evidence, though mixed or mostly negative experiences are more likely to be reported in the scientific literature than positive ones (Brännmark & Håkansson, 2012; Landsbergis, Cahill, & Schnall, 1999; Westgaard & Winkel, 2011). Further, many of the relevant studies are methodologically and theoretically limited (Brännmark & Håkansson, 2012; Genaidy & Karwowski, 2003). For example, studies rarely attempt to understand the contextual factors or mechanisms that may differentiate between positive and negative experiences of Lean (e.g. Mazzocato et al., 2012; Mehta & Shah, 2005; Sprigg & Jackson, 2006).

A contributing factor to the disagreement over how Lean affects workers is the lack of a universally accepted definition of Lean. Researchers and practitioners disagree on which tools and methods that make up a "Lean" strategy or change program and, in fact, Lean can take on many different forms and uses, from a "philosophy," to "strategy," to use of specific Lean "tools," to various combinations of these (Hines, Holweg, & Rich, 2004; Pettersen, 2009; Shah & Ward, 2003). Here, we use "Lean" to refer to a general production concept differentiated from other specific concepts (e.g., Total Quality Management, Participatory Ergonomics, Six Sigma, etc.) but this does not imply uniformity across different implementations of Lean (in fact, nonuniformity is a key assumption in our hypotheses).

It may be possible to reconcile the seemingly conflicting evidence by introducing moderators of employees' Lean experiences. Specifically, we propose that employees' experiences of Lean depend upon the nature of employees' participation in Lean's implementation. As illustrated in Figure 1, employees in units implementing Lean may

either be *passive* targets of work system change, without input into decisions about change, or they may be *active* participants in decisions about how their work will change. To put it another way, employees may experience Lean indirectly through a work system modified by Lean and/or directly by participating in the Lean modification of their work system (Holden, 2011). There is some evidence that being actively versus passively involved in Lean results in a more positive Lean experience for employees (e.g. Parker, 2003; Saurin & Ferreira, 2009; Scott, Macomber, & Ettkin, 1992). However, for those employees who are actively involved, what specific “package” of involvement predicts their Lean experience?

Among employees who directly experience Lean by being active in its implementation and activities, we distinguish between *temporary* and *continuous* participation packages. Temporary participants are ones who participate intermittently, for example, on ad-hoc projects, whereas continuous participants may be members of a Lean work group or standing improvement group. *Combined participants* are ones who experience both temporary and continuous work with Lean. In this study we test the hypothesis that an employee’s self-reported experience of Lean depends in part on the specific nature of his or her active participation in Lean (Batt & Appelbaum, 1995).

We hypothesized:

- H1** Temporary participants will report the least positive Lean experience compared to continuous and combined participants; and
- H2** Combined temporary-and-continuous participants will report the most positive Lean experience, compared to temporary and continuous participants.

These hypotheses are based on six assumptions. First, while temporary ways of involving employees in Lean may provide positive experiences for them, these experiences may be short-lived and tied to single projects rather than to the Lean program as a whole. Second, experiences of Lean through temporary participation may not offer employees structured and repeatable opportunities to learn, work in a team, or to practice semi-autonomous decision making (Pasmore, 1988). Thus, temporary participants may have additional work duties without much improvement to their job design. Third, whereas some temporary projects may lead to positive experiences, others may lead to neutral or negative experiences, depending on the nature of the project. Negative experiences may be especially memorable as employees formulate their opinions of Lean. Fourth, continuous participation in contrast should provide tonic positive effects and a structured mechanism for involvement and better job design (e.g., learning opportunities; higher decision authority; more teamwork), although continuous participants’ experiences may depend on their roles, teammates, and which projects their improvement group undertakes. Fifth, a combination of temporary and continuous participation may be the best of both worlds, as employees may perceive greater influence and comfort with Lean due to the sheer volume of involvement, while temporary projects provide them with increased variation (Arnstein, 1969). Sixth, combined participation may help employees disassociate their evaluations of Lean from idiosyncratic negative experiences with a single project or improvement group teammate. However, it could also be that the extra work associated with combined participation will increase workload if sufficient time is not set aside for the activities or if employees perceive being “spread too thin” across too many or unrelated duties.

This study is important for its specific Swedish context as well as for all applications of Lean-based production systems. In Sweden, companies implementing change programs based on Lean may already be likely to actively involve their employees in the change process. This is because of the strong tradition of “socio-technical” job design and worker democratization, established legislation regarding working conditions, and strong union

influence that are characteristic of Sweden and other Nordic countries (Björkman, 1996; Johansson & Abrahamsson, 2009). This may explain why, in general, Lean change programs in Swedish organizations may tend to produce more positive employee experiences (Brännmark & Håkansson, 2012). Therefore, in Sweden, the key question may not be about active versus passive involvement but rather, given that employees are going to be actively involved, how do different packages of involvement affect the employee experience? More broadly, companies that are considering actively involving their employees in the Lean program, as suggested by Lean advocates (e.g. Liker, 2004; Womack & Jones, 2003), must decide how in practice they will do this. Companies seeking to optimize their employees' experiences with Lean by actively involving them require guidance on whether to involve them on temporary projects, on continuous improvement groups, or on both. Given that more involvement probably takes employees' time away from core work tasks and may increase employees' workload, companies will want to know whether combined involvement yields benefits that justify these potential costs.

2. Methods

2.1. Design

We conducted a mixed-method cross-sectional study of medium-sized manufacturing companies participating in implementations of Lean, all part of the national program *Produktionslyftet*, described below. This study primarily uses findings from post-*Produktionslyftet* self-administered surveys fielded in 2009 (16 companies), 2010 (13 companies), and 2011 (11 companies). In total, 584 responses were collected from 40 companies; of these, 182 were from non-manager production workers. Of those, 129 respondents from 28 companies met inclusion criteria and were included in the final analysis. The overall response rate for the web version of the survey was 79.8% but the response rate for paper surveys was not known because these were administered by company representatives.

Survey findings were supplemented by qualitative analyses of 39 semi-structured interviews (16 frontline employees, 5 production supervisors, 5 blue-collar union representatives, 12 managers and 1 production technician) and 30 internal reports written by *Produktionslyftet* coaches describing their work with Lean at their respective company. The interviews were analyzed to understand in detail how employees could and did participate in work with Lean-related activities in the companies. These data, together with the *Produktionslyftet* reports, were also analyzed in order to describe the nature of the improvement groups and temporary Lean activities, e.g. projects aimed at redesigning the work space to increase orderliness. In this way, the qualitative interview and internal report data helped justify the quantitative comparison between the three participation groups and to interpret the results of this comparison (Creswell & Plano Clark, 2007).

2. 2. Setting

Participants were production workers with non-managerial roles in medium-sized manufacturing companies that recently completed involvement in the Swedish national program *Produktionslyftet* ("the Production Boost"). This program was intended to aid companies in their implementation of Lean-based production systems through extensive and heavily subsidized consulting and educational support over a 1.5-year period (Brännmark, 2010a, 2010b).

Fifty-two of the 60 companies participating in *Produktionslyftet* during 2007–2010 were contacted for this study. No Lean definition or Lean maturity model were used in the recruitment process for selecting the companies to the study, beyond the company's *Produktionslyftet* program participation. Of the companies contacted, 40 (76.9%) agreed to

participate. The number of respondents per company ranged from 2 to 47 ($M = 14.6$, $SD = 8.7$). Participating companies employed between 20–500 workers. Their production system designs, market focuses, and customer bases varied. Several of the companies were suppliers for the automotive industry, while others mostly produced their own products, selling them to end-customers and users. All studied companies had been using Lean for at least one full year.

2.3. Lean intervention

Each company implemented a version of Lean between 2007 and 2010. Produktionslyftet coaches, external to the companies, assisted the implementations by: (1) introducing a change methodology and strategy for the companies; (2) providing coaching and consulting on Lean tools, the Lean “philosophy,” and related topics (e.g. quality management, change management); and (3) offering a university course for two employees in each company, focusing on Lean Production and related topics (e.g. quality management). Produktionslyftet also organized introduction seminars, in the form of so-called “Lean Lego Games”. These were meant to a) introduce the Lean concept, and b) simulate a “Lean Production System” versus that of a “mass production system” (for a common used distinction between “mass production” and “Lean system”, see Womack et al, 1991). In most companies, all of the managers and workers participated in these seminars.

The most common Lean tools implemented by the companies as part of their Lean interventions were housekeeping (through the tool 5S), improvement groups, and value stream mapping. Also common, though less so, were work standardization and tools for reducing set-up time (e.g., “SMED”). Other Lean tools were used to a much lower degree, though several of them are often integrated, e.g. means for visualization of the work space was often integrated into tools such as 5S. All companies also developed and documented guiding values for the management of production and organizational strategy that served as their interpretation of Lean “philosophy” (Brännmark, 2010a).

Companies’ implementations of Lean commonly included pilot projects and the designation of Lean coordinators. Companies used Lean tools and techniques not only to change the work process and work environment, but also to support the process of change: for example, by using improvement groups to introduce and sustain changes, using 5S as a “pilot project,” redesigning the work space or work process using value stream mapping, etc.

2.4. Comparisons between participation groups

From all respondents, we selected those whose survey response about the nature of their involvement in the work with Lean fit one of three categories:

- **Temporary** ($N = 36$ from 16 companies, 1–5 respondents per company): these workers reported on the survey that they participated in the work with Lean *only* through their role in production. Based on the qualitative data, this likely means intermittent activities such as applying 5S to redesign the physical work space, applying SMED to reduce set-up times, or introducing a new assembly line. These respondents did not participate in standing improvement groups.
- **Continuous** ($N = 21$ from 18 companies, 1–21 respondents per company): these workers reported on the survey that they participated in Lean *only* through standing improvement groups only.
- **Combined** ($N = 24$ from 15 companies, 1–4 respondents per company): these workers reported on the survey that they participated in Lean through *both* their role in production *and* through improvement groups.

Given our research question about differences between packages of active Lean participation, 22 respondents were excluded from analyses because they did not report participating in Lean. An additional 21 were excluded because they participated in Lean in one of a number of other ways that did not fit the above participation categories. This yielded an analyzed N=129 across 28 companies (1–25 respondents per company).

2.5. Survey Instrument

A subset of the full survey was used for present purposes. Six questions measured “context factors”: (1) local management’s perceived interest in Lean and the worker’s (2) interest in Lean; (3) tenure with company; (4) age; (5) gender; and (6) contact with Produktionslyftet Lean coaches. A seventh context factor used in analyses was the time between the respondent’s participation in the survey, and the company’s official starting month in the Produktionslyftet program. Seventeen questions measured each worker’s Lean experience.

- Three asked about the perceived adequacy of participation.
- Four asked about learning (exchanging ideas, lessons learned, feedback/discussion, reflection and learning).
- Ten asked about perceived changes and improvements to the work system in the past year with respect to: (1) teamwork; (2) interdepartmental cooperation; (3) decision making; (4) decision authority (for the workers); (5) ability to deal with unforeseen problems; (6) stress; (7) work for occupational safety has increased during the recent year; (8) the physical work environment; (9) orderliness; and (10) standardization.

For all Lean experience items, the response categories were “strongly agree,” “agree,” “disagree,” “strongly disagree,” and “don’t know.”

The questionnaire was partly based on a previous survey instrument for evaluating the sustainability of a change program in the Swedish school sector (Öhman Sandberg, forthcoming). New questions were also added to the questionnaire for this research project. An initial questionnaire was pilot tested with five individuals in one of the companies in Produktionslyftet: the CEO; the production manager; a production supervisor; the representative of the blue collar union; and a frontline operator. The researchers interviewed these individuals individually to assess how they interpreted the questions and based on this process, the questionnaire was further refined.

2.6. Procedure

A contact person was chosen for each company by Produktionslyftet’s representatives. These were usually, though not exclusively, managers (e.g. production managers). In many cases, they were the Lean coordinators for the companies. They were contacted by telephone and e-mail by the research team to discuss the company’s involvement in the survey. Each company representative recruited respondents, attempting to maximize the number of employees actively involved in Lean implementation (though the number was often limited to what the company representatives considered to be reasonable), company managers, and representatives of blue-and white-collar unions. Participants could choose to complete either a web or paper version of the survey. The company representatives were asked to inform potential respondents about the surveys and the overall study.

Consent to participate was given implicitly by completing the questionnaire. The study was exempt from ethical review by the Swedish human subjects protection entity in place at the time of the study.

2.7. Analysis

Temporary, Continuous, and Combined groups were compared on responses to context and Lean experience survey items. Responses of “don’t know” and missing responses were not analyzed. Group differences were assessed for statistical significance using non-parametric Mann-Whitney U (MWU) tests carried out using SPSS (IBM PASW 18.0.0). To adjust for Type I error inflation due to multiple comparisons (Temporary vs. Continuous; Continuous vs. Combined; Combined vs. Temporary), the α -level was Bonferonni-corrected to $0.05/3 = 0.017 = \alpha_{\text{corrected}}$ (Abdi, 2007). Non-parametric tests were chosen because of the relatively low number of respondents in one of the groups ($N = 24$) and non-normality of the data for several items (assessed using the rule of thumb of skeweness to standard error ratio > 2.0). Due to the low frequency of “strongly disagree” answers, responses were collapsed into three categories: “strongly agree”, “agree”, and “disagree”.

3. Results

3.1. Nature of Temporary Participation

Temporary means for involving employees in Lean took on many forms, consistent with their temporary, project-based nature. Some were Produktionslyftet-related activities such as consulting with Produktionslyftet coaches during the Lean implementation.

For example, an employee responsible for a machine may have been consulted for a machine-specific Lean project. In other cases, employees in the temporary group were assigned to implement a Lean method, for example, using 5S to organize their physical workspace. Those in the temporary group also assisted in the application of Lean changes such as moving machines to create flow in production, rebuilding machines to reduce set-up times (“SMED”), participating in activities to map the process (“value stream mapping”). The common theme of these activities was temporary projects, though some of these may have yielded some ongoing duties such, e.g. maintaining an increased order in the workplace through the Lean tool 5S.

To illustrate, in one company, interviewed employees described participating in Lean through a temporary project in which their company introduced a new manufacturing line. This project was not initiated through improvement groups. The employees were responsible for the planning of the project and in its implementation through tools such as 5S, tools for reducing machine set-up times, and standardization and flow principles. However, once the new line was introduced, the project was finished.

3.2. Nature of Continuous Participation

Employees active in improvement groups (i.e. continuous participation) were involved in the Lean implementation process through several means, including the planning of new steps, methods, and tools (e.g., 5S, quality control) to control and coordinate the work processes and facilities. Group sizes varied between 6–12 employees. Meeting frequency was usually once per week, though some companies had two meetings per week. These meetings usually lasted between 30–60 minutes.

During the meetings, work system changes were discussed, coordinated, prioritized, and planned by the participants. The companies usually had documented standards for these meetings, e.g. a standardized agenda for the meetings or standardized improvement suggestion sheets. Most companies had so-called improvement boards, in the form of whiteboards placed in central parts of the production facilities. These boards were used to post suggestions and monitor the progress of ongoing change activities. Improvement group meetings were held around the boards. Several companies also posted measurements and

production goals on these boards. Furthermore, it was not uncommon to see other forms of information posted at the boards, e.g. the companies' own developed and documented "Lean philosophy".

The work to implement the agreed-upon changes was most often done outside of these meetings. In some companies, time could be set aside or scheduled to implement proposed changes; in other companies, it was done when "there was time left over," a commonly heard phrase. Several companies also had standardized routines for the improvement work. Examples of these were a maximum of three improvement suggestions active simultaneously, that the improvement activities must have an assigned deadline, and each activity must have a worker responsible for it. In some companies, the groups were also assigned a small budget, e.g. for purchasing tools and materials.

In several companies, improvement group were also integrated with other Lean tools, such as 5S, visualization and daily coordinating meetings for the production ("daily steering"). For example, the work with 5S could be coordinated through the improvement groups by assigning one of the workers the role of 5S coordinator, e.g. to do regular 5S audits to inspect that the order in the work place was maintained.

The companies had varying tactics for implementing their improvement groups. In some companies, pilot areas or groups were selected to try out the improvement groups; in other companies, all workers were mandatorily included in improvement groups. Often, the formation of the groups was based on already existing work groups or departments in the companies, for example, a welding work team or assembly team.

The companies' Lean coordinators, managers, and production supervisors often participated in the groups meetings, as did the coaches of Produktionslyftet, who often served as facilitators for the improvement groups. In many cases, one of the workers was assigned the role of coordinating the improvement groups, e.g. leading improvement group meetings.

3.3. Context Variables

Table 1 presents the characteristics of respondents and their companies, grouped by participation group. For the most part, the three groups did not significantly differ on these characteristics, after correction for multiple comparisons. The only exception was that temporary group participants were in companies that had been using Lean for a longer period of time than companies to which combined group participants belonged. Correlation analyses showed that the longer one's company had been using Lean, the less likely was that worker to answer positively to individual Lean experience questions and to report an overall positive Lean experience (Spearman's $\rho = -.241$ for the correlation between company's years of using Lean and a composite index of Lean experience variables in Table 3; $p = .021$; $N = 91$).

3.4. Lean Experience

Table 2 presents responses to questions about participation and learning related to Lean. Compared to temporary group participants, continuous group participants more positively evaluated their opportunities to participate in Lean and to exchange ideas, reflect, and learn with respect to Lean. Combined group participants more positively rated their opportunity to exchange ideas and experiences than those in the temporary group, but this difference was no longer significant after correction for multiple comparisons.

Table 3 presents responses to questions about how the work system changed over the past year. Compared to temporary group participants, continuous group participants were more likely to agree with statements about increased teamwork, improved physical work

environment, ease of “pushing through” decisions, increased occupational safety and health activity, and production workers’ increased authority to implement changes. Continuous group participants were also more likely than those in the combined group to agree that orderliness had increased. There were no other statistically significant differences in perceptions of work system change between groups after correction for multiple comparisons.

4. Discussion

Findings show several significant differences between the three participation groups. Generally, members of the continuous participation group reported a more positive Lean experience than members in the two other groups. In other words, they were more likely to agree and strongly agree with statements about participation, learning, and Lean-related work system improvements. Combined group participants’ experiences tended to be less positive than those of the continuous group and more positive than those of the temporary group, but these differences were typically not statistically significant.

Based on the qualitative data from interviews and internal reports, we propose that these effects are largely driven by the design of the improvement groups to which continuous and combined participants belonged. First, participating in the improvement groups allowed their members to discuss, learn, and coordinate the work with continuous improvement in a team setting, i.e. the groups provided a forum for employee participation and learning (e.g. Honold, 1997; Knudsen, Busck, & Lind, 2011). Second, company managers and coaches of Produktionslyftet often participated in the improvement group meetings. This may have granted improvement group members a sense of “empowerment” and heightened perceived influence over the decision-making process due to their proximity to management-level decision makers (e.g. Alvesson & Sveningsson, 2003; Berglund, 2010). Thirdly, the improvement groups appeared to create a sense of increased teamwork for the participants, which is often associated with positive employee effects in the literature (Busck, Knudsen, & Lind, 2010). These benefits of improvement groups are similar to those associated with participatory ergonomics (Brown Jr., 2002), particularly its stable culture of participation and empowerment (Noro & Imada, 1991) and the opportunities to learn and develop skills through continued hands-on experience with improvement methods (Haims & Carayon, 1998). Notably, conceptual work on participatory ergonomics has yielded frameworks for describing packages of participation (Haines, Wilson, Vink, & Koningsveld, 2002) that go beyond the one presented here (Figure 1) and can therefore inform future work on Lean participation packages.

In general, the results across all the participation groups are similar to those usually found in Swedish companies implementing Lean change programs: increases in participation in improvement activities, teamwork, and orderliness are commonly observed, as are negative effects such as increased stress and higher work pace (Brännmark & Håkansson, 2012). While similar results are seen in non-Swedish studies of Lean’s employee effects, the magnitude of the *negative* effects seems to be lower in Swedish studies. This raises the possibility that “Lean” is implemented and interpreted differently in the Swedish/Nordic context, perhaps in its emphasis on participation (Brännmark & Håkansson, 2012; Seppälä & Klemola, 2004). Lean change programs in the Nordic countries may also differ in their use of Lean tools (e.g., more improvement groups; smaller scale implementations) and in the local context (e.g., more union influence; a socio-technical tradition) (Björkman, 1996; Johansson & Abrahamsson, 2009).

We hypothesized that those in the combined group, exposed to multiple modes of participation (Lean improvement groups as well as ad-hoc Lean projects), would report the

most positive Lean experience, but in fact the most positive experiences were reported in the continuous group, whose members participated only in improvement groups, suggesting that “less is more.” One explanation may be that the workload of participating in both continuous and temporary activities created a “role overload” effect that counteracted some of the improvement gained through increased participation (e.g. Batt & Appelbaum, 1995; Parker, 2003). The following quote from a survey respondent illustrates how improvements may come at a cost of increased workload:

“... I have missed most parts of the work with Lean, but I did notice a great difference when I came back... There was much better orderliness at the work place.

My work colleagues have experienced an increased stress, due to ‘more work’... managing the machines while they have simultaneously worked to implement changes.”

Because self-reported stress did not differ between groups, this preliminary hypothesis about overload should be tested in future work by measuring pre- vs. post-Lean work demands as well as the workload associated with specific Lean-related tasks.

Participating in only improvement groups may have provided boundaries around employees’ responsibilities vis-à-vis Lean, protecting them from being recruited for numerous temporary projects. Employees in improvement groups may also have been more likely to receive the knowledge, power, information, and rewards necessary to contribute meaningfully (Lawler, 1986). Another possibility is that experiences in the combined group were a product *not* of group members’ participation in the Lean-related change but rather their companies’ shorter duration using Lean, consistent with the notion that early, low-level Lean implementations may be more stressful and less rewarding (Conti, Angelis, Cooper, Faragher, & Gill, 2006). To test this last hypothesis, future work should: (a) adjust participation group comparisons by a “Lean maturity” factor (this was not possible in the present design) and (b) conducting longitudinal assessments to see if members of the combined group come to experience Lean more positively with time. Another potential moderator to test in future research is the implementing company’s local context (Hasle, Bojesen, Jensen, & Bramming, 2012).

Findings supported our hypothesis that employees experiencing Lean actively but through only temporary projects would have the least positive experiences among all active participants. This may be due to the design characteristics of temporary projects. Temporary projects may have involved low-autonomy, high-demand, high-stress, and/or unfulfilling new work duties. For example, a temporary Lean task such as installing a new flow-oriented assembly line may have increased workload without serving as an opportunity for participatory decision making, learning, or first-hand work system improvement. Future research should more exactly measure the project characteristics of “temporary group” participants in order to identify which kinds of projects may especially lead to worse employee experiences. Furthermore, those in the temporary group may have had less opportunity to become affiliated (i.e., to identify) with the new Lean concept, and therefore may not have been as committed to the Lean change program as those in formal improvement groups: this possibility assumes that some of the difference between employees’ self-reported Lean experiences are attributable to differences in attitudes toward the concept of Lean.

Considering the potential benefits of participating in continuous, stable improvement groups, future research should explore the sustainability of such groups. Given that formal improvement groups are difficult to sustain over time (Lawler & Mohrman, 1987, 1984),

what steps can be taken to keep managers committed to such groups? Are positive participation and learning experiences (Table 2) and tangible results (Table 3) necessary or sufficient to motivate employees to continue their participation? Furthermore, to judge their value, it is important to know how costly improvement groups are (e.g., in terms of employees' and managers' time, training costs, etc.) as well as what benefits they portend besides a positive employee experience. This is important because the literature on cost vs. benefit of similar improvement methods, i.e. Quality Circles, shows mixed results (Goldstein, 1985; Griffin, 1988; Sillince, Sykes, & Singh, 1996).

Another question for future research is to what extent employees have control over how they participate in their Lean program. It is possible that employees studied here were assigned to their temporary, continuous, or combined temporary-and-continuous activities or that they self-selected. If they were assigned, they may nevertheless have been assigned based on their initial motivation for or fit with the chosen package of participation. Self-selection raises the possibility that those with the most positive outlook toward the Lean program would preferentially choose to participate in improvement groups, accounting for the more positive experience of those in the continuous group. However, if this were the case, we would have expected more positive experiences within the combined group as well. In any case, companies considering involving their workers in Lean change programs may benefit from forming improvement groups and inviting employees to join them. Nevertheless, we caution that simply having improvement groups may not be sufficient, and that it is still important to design these improvement groups well, which includes such considerations as freeing up participants' time for group activities, providing adequate resources (e.g., knowledge, training) to participants, and identifying formal and informal leaders who can coordinate improvement group activities.

In short, more research would be welcome on the dynamics of participation in Lean, in terms of sustaining participation over time, the longer-term costs and benefits of participation, and employees' mandated or self-determined migration into and out of Lean activities. The question of short- versus long-term effects is especially interesting given hypotheses such as Schoutenen and Bender's (2004) that employee participation in Lean may be positive at first but may result in those employees making their own work less stimulating and more routinized in the long term. Future work will also benefit from a more detailed and critical description of how improvement groups structure their activities, negotiate the joint involvement of managers and frontline workers, and make decisions (Holden & Hackbart, in press).

Other future studies should investigate how the success of a Lean change program, in terms of meeting its improvement objectives (e.g., efficiency, return on investment, safety, etc.), affects workers' experiences of Lean. Does overall success breed enthusiasm for and more positive evaluations of a change program, or vice versa? Does success with respect to some company goals (e.g., efficiency) negatively affect how an employee experiences Lean (e.g., increased stress) (Brännmark, Eklund, Håkansson, & Vogel, 2012)

4.1. Limitations

This study had several limitations in addition to those related to cross-sectional research discussed above. First, by nature of the research question, only active participants in the Lean change programs were compared to each other and they were not compared to employees with no active or direct Lean involvement at all. Second, no assessment was made of opportunities for participation versus actual participation; thus, we could not account for differences due to companies giving their employees discretion over how they participated. Third, there was the possibility of selection bias because potential respondents were selected by company representatives; however, although the employees that were

selected and who responded may have had more positive attitudes toward Lean, we have no reason to suspect response bias aligned along participation condition. Nevertheless, the possibility remains because we did not compare conditions on overall attitude toward Lean or other indicators of bias. Fourth, all companies surveyed here were part of a national Swedish program, *Produktionslyftet*: this increases between-company homogeneity and facilitates comparisons but raises questions about whether findings can be generalized to other settings where Lean is being implemented. Within *Produktionslyftet* companies, we did not define differences in “Leanness” or Lean maturity and therefore could not compare companies that differed in which aspects of Lean they implemented. Therefore, it is necessary to investigate whether the participation-related effects found here promote a theory about Lean participation that applies across settings or whether the case of Swedish *Produktionslyftet* manufacturing companies is unique. Fifth, the number of respondents per company was uneven, and one company in the continuous group was especially overrepresented in the analysis. Additional analyses not reported here revealed that respondents from that company tended to have a more positive Lean experience than other companies’ respondents in the same participation group; these differences were statistically significant for four variables, raising the possibility that one company influenced some (but not all) of the positive effect of improvement groups. If true, implications include the need for considering the unique interaction between both *how* Lean is implemented and *where* it is implemented (Mazzocato, Savage, Brommels, Aronsson, & Thor, 2010), the need to identify what “best practices” can be identified from exceptional companies’ approach to Lean and Lean improvement groups (Holden & Hackbart, in press), and the careful consideration of single-case studies that may be describing unique implementations or unique companies.

Sixth, the construct of Lean experience was measured using self-reports. This is a reasonable approach given our interest in employee consequences of Lean, many of which are inseparable from employees’ personal experiences. However, self-report methods are vulnerable to response error (e.g., social desirability effects, recall/memory bias). Lean experience constructs were also measured using single-item measures. This is acceptable when the measured construct is not conceptually multi-faceted and even complex constructs such as job satisfaction and perceived effectiveness have been found highly valid and reliable (Nagy, 2002; Wanous, Reichers, & Hudy, 1997; Wanous & Hudy, 2001). Nevertheless, for some dimensions of the Lean experience, such as perceived stress or safety, other measures—multi-item self-report, physiological, external performance assessment, etc.—may be necessary to complement or verify those used here. For example, future work would benefit from the use of standardized scales of psychosocial worker outcomes (Fields, 2002). The sum of these methodological concerns means that the results and conclusions presented here should be interpreted with caution.

5. Conclusion

There is considerable support in the literature that employee participation in the implementation of change has desirable effects and helps negate some of the undesirable effects of change. This appears to apply to Lean, as well, but we argue that “more participation,” is too vague of a recommendation. In fact, we found that more participation is not necessarily better, and because more participation may increase cost, perhaps “less is more.” At the same time, while active participation is desirable, the nature of that participation must still be decided and well designed. Based on our findings, the continuous, standing improvement group may be a particularly desirable form of Lean participation.

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Occupational applications

The results presented here show that active and continuous employee participation in organizational change programs, e.g. the implementation of Lean, can have several positive employee effects. However, the benefit of participation may depend on “what is inside the package,” which is important for practitioners to know as they decide both whether and how to involve workers in implementing Lean. Structured and continuous “packages” of participation such as improvement groups may provide the most positive employee experience, whereas temporary packages such as intermittent change projects may provide the least positive. Packages combining both continuous and temporary participation may even diminish some of the positive effects of continuous participation, while also possibly being the most costly approach. Just as Lean interventions strive to maximize value and minimize waste, so must organizations planning organization change identify the participatory approaches that will yield the highest value without excess waste.

		<u>Level of participation</u>	
		Active Employees are involved in Lean implementation/ activities	Passive Employees are not involved in Lean implementation/ activities
<u>Package of participation</u>	Temporary	Employees directly experience Lean through temporary projects with Lean (e.g., employee was invited to one-time Lean process redesign project)	Employees indirectly experience Lean because their work has changed as a result of Lean (e.g., employee performs new Lean work process but had no input into its design)
	Continuous	Employees directly experience Lean through continuous participation (e.g., employee serves on a standing Lean improvement group)	
	Combined	Employees directly experience Lean through a combination of activities (e.g., employee member of <i>both</i> ad-hoc project teams and standing improvement group)	No experience (e.g., Lean was entirely isolated to another work unit)
		Employees directly experience Lean as leaders (e.g., are members of Lean steering committee)	

Figure 1.
Different levels and “packages” of employee participation in Lean

Table 1

Context variables and between-group differences

Variable		Participation group			U-value (p-value)*		
		Temporary	Continuous	Combined	Temporary vs. Continuous	Continuous vs. Combined	Combined vs. Temporary
Mean number of years of Lean at respondent's company at time of survey		2.02	1.88	1.73	983.5 (p = .079)	678.5 (p = .182)	255.5 (p = .008) ^a
Immediate manager very interested in working with Lean		% (N)	% (N)	% (N)			
	<i>Strongly agree</i>	28.1% (9)	48.4% (31)	42.1% (8)			
	<i>Agree</i>	46.9% (15)	39.1% (25)	31.6% (6)			
Interested in participating in working with Lean	<i>Disagree</i>	25.0% (8)	12.5% (8)	26.3% (5)	776.0 (p = .037)	531.0 (p = .363)	275.0 (p = .546)
	<i>Strongly agree</i>	34.3% (12)	40.6% (26)	50.0% (11)			
	<i>Agree</i>	54.3% (19)	56.3% (36)	45.5% (10)	996.0 (p = .302)	646.0 (p = .512)	314.0 (p = .194)
Years in company	<i>Disagree</i>	11.4% (4)	3.1% (2)	4.5% (1)			
	2–5	22.9% (8)	19.1% (13)	43.5% (10)			
	6–10	31.4% (11)	11.8% (8)	8.7% (2)	947.0 (p = .079)	644.5 (p = .189)	384.0 (p = .761)
Age	11–15	22.9% (8)	33.8% (23)	13.0% (3)			
	16+	22.9% (8)	35.3% (24)	34.8% (8)			
	20–29	5.7% (2)	15.2% (10)	26.1% (6)			
	30–40	40.0% (14)	31.8% (21)	26.1% (6)			
	41–50	40.0% (14)	34.8% (23)	34.8% (8)	1111.0 (p = .741)	670.0 (p = .385)	338.5 (p = .284)
	51–60	8.6% (3)	15.2% (10)	13.0% (3)			
Gender	61+	5.7% (2)	3.0% (2)	0.0% (0)			
	Male	60.0% (21)	69.1% (47)	78.3% (18)	1081.5 (p = .357)	710.5 (p = .404)	329.0 (p = .151)
	Female	40.0% (14)	30.9% (21)	21.7% (5)			
Frequency of contact with external Produktionslyftet Lean coaches	Many times	23.3% (7)	32.3% (21)	22.7% (5)			
	Some times	20.0% (6)	21.5% (14)	27.3% (6)			
	A few times	33.3% (10)	20.0% (13)	27.3% (6)	898.0 (p = .524)	678.0 (p = .709)	318.0 (p = .818)
	Never	23.3% (7)	26.2% (17)	22.7% (5)			

^a“Don't know” and missing responses are not reported.

* p-values from Mann Whitney U statistical tests were compared to $\alpha_{adjusted} = .017$, an alpha threshold adjusted for multiple comparisons.
 a $p < \alpha_{adjusted}$

Table 2

Participation and learning variables and between-group differences

Variable		Participation group			U-value (p-value) [*]		
		Temporary % (N)	Continuous % (N)	Combined % (N)	Temporary vs. Continuous	Continuous vs. Combined	Combined vs. Temporary
Ample opportunity to participate in decisions about Lean content	<i>Strongly agree</i>	9.4% (3)	26.6% (17)	18.2% (4)	704.0 (p = .007) ^a	577.5 (p = .177)	307.5 (p = .390)
	<i>Agree</i>	40.6% (13)	48.4% (31)	40.9% (9)			
	<i>Disagree</i>	50.0% (16)	25.0% (16)	40.9% (9)			
Ample opportunity to participate in decisions about how to work with Lean	<i>Strongly agree</i>	12.5% (4)	14.5% (9)	9.1% (2)	787.5 (p = .074)	596.5 (p = .333)	320.0 (p = .534)
	<i>Agree</i>	34.4% (11)	54.8% (34)	50.0% (11)			
	<i>Disagree</i>	53.1% (17)	30.6% (19)	40.9% (9)			
Ample opportunity to participate in discussions about experiences from working with Lean	<i>Strongly agree</i>	9.4% (3)	26.2% (16)	22.7% (5)	625.5 (p = .002) ^a	569.5 (p = .253)	285 (p = .199)
	<i>Agree</i>	40.6% (13)	54.1% (33)	40.9% (9)			
	<i>Disagree</i>	50.0% (16)	19.7% (12)	36.4% (8)			
Ample room for exchanging ideas and experiences from working with Lean	<i>Strongly agree</i>	6.1% (2)	35.4% (23)	33.3% (7)	739.5 (p = .006) ^a	682.5 (p = 1.000)	235.5 (p = .024)
	<i>Agree</i>	66.7% (22)	47.7% (31)	52.4% (11)			
	<i>Disagree</i>	27.3% (9)	16.9% (11)	14.3% (3)			
Lessons learned from working with Lean are assimilated and become useful for the company	<i>Strongly agree</i>	18.2% (6)	37.9% (25)	22.7% (5)	893.5 (p = .106)	631.0 (p = .311)	344.5 (p = .706)
	<i>Agree</i>	66.7% (22)	48.5% (32)	63.6% (14)			
	<i>Disagree</i>	15.2% (5)	13.6% (9)	13.6% (3)			
In discussions, we often question each other's way of thinking	<i>Strongly agree</i>	10.3% (3)	24.6% (16)	21.1% (4)	781.0 (p = .137)	497.0 (p = .159)	261.0 (p = .736)
	<i>Agree</i>	62.1% (18)	55.4% (36)	36.8% (7)			
	<i>Disagree</i>	27.6% (8)	20.0% (13)	42.1% (8)			
Time is set aside for reflection and learning in the work with Lean	<i>Strongly agree</i>	12.1% (4)	18.5% (12)	13.0% (3)	697.0 (p = .002) ^a	526.0 (p = .022)	359.0 (p = .687)
	<i>Agree</i>	21.2% (7)	52.3% (34)	26.1% (6)			
	<i>Disagree</i>	66.7% (22)	29.2% (19)	60.9% (14)			

^a "Don't know" and missing responses are not reported.^{*} p-values from Mann Whitney U statistical tests were compared to $\alpha_{\text{adjusted}} = .017$, an alpha threshold adjusted for multiple comparisons.^a p < α_{adjusted}

Table 3

Work system variables and between-group differences*

Variable		Participation group			U-value (p-value)**		
		Temporary % (N)	Continuous % (N)	Combined % (N)	Temporary vs. Continuous	Continuous vs. Combined	Combined vs. Temporary
Teamwork at department has increased	<i>Strongly agree</i>	15.6% (5)	53.0% (35)	30.4% (7)	558.0 (p = .000) ^a	550.0 (p = .031)	293.0 (p = .164)
	<i>Agree</i>	50.0% (16)	39.4% (26)	47.8% (11)			
	<i>Disagree</i>	34.4% (11)	7.6% (5)	21.7% (5)			
Cooperation between our department and the other departments increased	<i>Strongly agree</i>	9.1% (3)	18.5% (12)	4.5% (1)	904.5 (p = .168)	634.5 (p = .387)	342.0 (p = .686)
	<i>Agree</i>	45.5% (15)	47.7% (31)	59.1% (13)			
	<i>Disagree</i>	45.5% (15)	33.8% (22)	36.4% (8)			
Physical work environment improved	<i>Strongly agree</i>	8.8% (3)	32.8% (22)	13.6% (3)	736.5 (p = .002) ^a	507.0 (p = .018)	362.5 (p = .831)
	<i>Agree</i>	50.0% (17)	49.3% (33)	45.5% (10)			
	<i>Disagree</i>	41.2% (14)	17.9% (12)	40.9% (9)			
Orderliness increased	<i>Strongly agree</i>	50.0% (17)	66.2% (45)	34.8% (8)	931.5 (p = .063)	521.0 (p = .006) ^a	344.5 (p = .404)
	<i>Agree</i>	38.2% (13)	32.4% (22)	56.5% (13)			
	<i>Disagree</i>	11.8% (4)	1.5% (1)	8.7% (2)			
Standardization increased	<i>Strongly agree</i>	26.5% (9)	45.6% (31)	13.0% (3)	1042.0 (p = .378)	546.5 (p = .021)	293.5 (p = .064)
	<i>Agree</i>	64.7% (22)	35.3% (24)	60.9% (14)			
	<i>Disagree</i>	8.8% (3)	19.1% (13)	26.1% (6)			
Occupational safety activities increased	<i>Strongly agree</i>	9.4% (3)	30.2% (19)	5.3% (1)	723.0 (p = .014) ^a	412.5 (p = .025)	298.0 (p = .895)
	<i>Agree</i>	53.1% (17)	49.2% (31)	57.9% (11)			
	<i>Disagree</i>	37.5% (12)	20.6% (13)	36.8% (7)			
Stress increased	<i>Strongly agree</i>	28.6% (10)	25.8% (17)	39.1% (9)	968.5 (p = .157)	633.0 (p = .209)	391.5 (p = .852)
	<i>Agree</i>	48.6% (17)	31.8% (21)	30.4% (7)			
	<i>Disagree</i>	22.9% (8)	42.4% (28)	30.4% (7)			
Easier to push through decisions	<i>Strongly agree</i>	3.1% (1)	23.4% (15)	5.0% (1)	712.0 (p = .008) ^a	512.0 (p = .139)	280.0 (p = .391)
	<i>Agree</i>	50.0% (16)	50.0% (32)	60.0% (12)			
	<i>Disagree</i>	46.9% (15)	26.6% (17)	35.0% (7)			
Authority of production personnel to implement change increased	<i>Strongly agree</i>	2.9% (1)	27.0% (17)	30.4% (7)	712.5 (p = .003) ^a	638.5 (p = .364)	328.0 (p = .262)

Variable		Participation group			U-value (p-value)**		
		Temporary % (N)	Continuous % (N)	Combined % (N)	Temporary vs. Continuous	Continuous vs. Combined	Combined vs. Temporary
Ability to deal with unforeseen problems and disruptions in production increased	Agree	58.8% (20)	54.0% (34)	30.4% (7)			
	Disagree	38.2% (13)	19.0% (12)	39.1% (9)			
	Strongly agree	2.9% (1)	12.9% (8)	18.2% (4)			
	Agree	58.8% (20)	48.4% (30)	63.6% (14)			
	Disagree	38.2% (13)	38.7% (24)	18.2% (4)	994.0 (p = .607)	538.0 (p = .105)	266.0 (p = 0.036)

“Don’t know” and missing responses are not reported.

* All work system variables refer to perceived changes during *the recent year*.

** p-values from Mann Whitney U statistical tests were compared to $\alpha_{adjusted} = .017$, an alpha threshold adjusted for multiple comparisons.

^a $p < \alpha_{adjusted}$