

The duality of lean: organizational learning for sustained development

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ABSTRACT

This paper explains how lean management transitions become more sustainable through enacting lean operating structures while simultaneously developing continuous improvement capabilities. Most papers have either focused on the implementation of lean operating structures to show that these increased performance and developed improvement capabilities, or on developing continuous improvement capabilities to develop a lean organization. This paper adopts an organizational routines perspective to explain how lean operations and CI are needed simultaneously to enhance each other in a delicate interplay of material interventions and organizational development. A comparative analysis of three case studies illustrates this view and provides insights in what companies did to develop them concurrently. The findings suggest that lean management needs a better understanding of this dynamic interplay of structural interventions and continuous improvement.

Keywords:

lean operations; continuous improvement; organizational routines; organizational learning; comparative case study analysis.

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INTRODUCTION

Developing a lean organization requires a balance between the implementation of lean operating structures and the development of continuous improvement (CI) capabilities (Liker, 2004; Teece et al., 1997; Womack and Jones, 2003; Zollo and Winter, 2002). Lean operations is defined as an organization's primary activities that realize flow and pull, CI is defined as employee initiated activities to improve on the primary activities (Nelson and Winter, 1982; Womack and Jones, 2003). Though lean operations and CI are inherently interrelated, the nature of this interrelation is insufficiently addressed in the literature (Schonberger, 2007). Of the papers that explicitly distinguished them at all, most focused on the implementation of lean operating structures assuming that employees would continue to improve on those operations (see for example the sequence of the principles flow, pull and CI of Liker, 2004; Spear and Bowen, 1999; and Womack and Jones, 2003). Others focused on developing CI capabilities assuming that a lean operating structure would follow from those (Anand et al., 2009; Bessant and Caffyn, 1997; Peng et al., 2008; Rother, 2010). Only a few papers showed empirically that lean operations and CI are best performed when integrated (Cua et al., 2001; McKone et al., 1999; Shah and Ward, 2003), yet the actual nature of their interrelation are left unexplained.

This paper takes an organizational routines perspective (Feldman and Pentland, 2003) to show *how* the implementation of lean operating structures and the development of CI capabilities reinforce each other in a delicate interplay of organizational learning and development. In their seminal work on organizational routines, Feldman and Pentland (2003) explain how these routines are both a source of stability and change as they differentiate between the ostensive aspect (related to understanding) and the performative aspect (related to actual performance) of

these routines. A routines perspective on lean management thus provides more detail than a philosophical perspective (e.g. Schonberger, 1986; Spear and Bowen, 1999; Womack and Jones, 2003) which is often too abstract for this level of analysis, or a meta-routines perspective (Adler et al., 1999; Hackman and Wageman, 1995; Peng et al., 2008; Teece et al., 1997), a practical perspective (Li et al., 2005; Shah and Ward, 2003), or an infrastructural view (Anand et al., 2009; Sakakibara et al., 1997), which do not allow to understand the micro dynamics at play (Liker and Rother, 2011). This paper investigates the interaction between the ostensive aspect and the performative aspect of routines with the aim *to explore how actors developed their lean organization by managing the ostensive aspect and performative aspect of both lean operations and CI.*

This paper contributes to the literature on how to develop a lean organization (most notably Liker, 2004; Ōno, 1988; Rother, 2010; Womack et al., 1991; Womack and Jones, 2003) as the literature so far provides two more or less focused views (Schonberger, 2007). Following widely acknowledged lean principles, rules and dimensions (Liker, 2004; Spear and Bowen, 1999; Womack and Jones, 2003), the first view leaves the impression to implement lean operating structures before focusing on capabilities to continuously improve on those operations.

Employees are assumed to learn from management initiated implementations in the operations environment which trigger employees to continuously contribute to improvements themselves (Womack and Jones, 2003). Instead, the second view focuses on developing continuous improvement capabilities to increase performance (Anand et al., 2009; Peng et al., 2008; Rother, 2010). Employees are assumed to learn from performing their own improvements and to continue their search for perfecting the lean organization (Hines, 2010; Hines et al., 2004).

This paper explicitly combines these two views using an organizational routines perspective. This contributes to our understanding of developing a lean organization in three ways. First, this novel

perspective on lean management shows the importance of differentiating between the ostensive aspect and the performative aspect of lean management routines and related artefacts, as changing one does not automatically imply change in the others. Take for example standard operating procedures (SOPs), which are tangible forms of how the work ought to be done. These SOPs frequently differ from how the work actually is done as employees disagree on how their work is best performed. Second, we provide insights in the link between lean operations and CI, explaining that improvement occurs through cycles of understanding routines and performing routines using related artefacts. Take for example work in an assembly line; improvements to reduce takt time can be made because employees repeatedly perform the work at each work station and because they are trained to think of potential process improvements. And third, integrating the implementation of lean operating structures and developing CI capabilities provides insights in how to create lasting development towards a lean organization. That is, how employee understanding can be developed, how their performance can be changed, and how related artefacts can help to achieve both. These contributions will guide future research into this area and will ultimately help managers to continue to develop their own lean organization. We first develop an organizational routines model of lean management that explains how to continuously develop a lean organization. A comparative analysis of three case studies illustrates this view. Finally, we explain how this results in a delicate interplay of organizational learning and sustainable development that questions existing unilateral research on either lean operations or CI and suggest a more complex, dynamic approach, which we think is required for future research to better understand and manage the development of lean organizations.

MANAGING ORGANIZATIONAL ROUTINES IN LEAN MANAGEMENT

To shed more light on the relationship between lean operations and CI (Liker, 2004; Spear and Bowen, 1999; Womack and Jones, 2003), we first explain the difference between

operating routines and improvement routines, we then take an organizational routines perspective to show how lean operations and CI mutually enact and reinforce each other, and finally we explore interventions to manage this interaction to sustainably develop towards a lean organization.

Operating routines and improvement routines

Organizations act and change based on certain routines (Nelson and Winter (1982). Organizational routines are defined as “a repetitive, recognizable pattern of interdependent actions, involving multiple actors” (Feldman and Pentland, 2003, p. 96). Nelson and Winter (1982) differentiate routines regarding day-to-day operations (e.g. flow and pull) and routines regarding improvements on those operations (e.g. perfection). Routines regarding day-to-day operations are called operating routines. They relate to what an organization does given its customer requirements, capabilities, stock, procedures, equipment etc., and follow a sequence of steps, with each step triggering another, based on tacit knowledge, and following numerous choices made in a more or less automatic way. It is these operating routines that ensure the short-term survival of the organization. Routines regarding improvement are called search or improvement routines and focus specifically on developing these operations (Nelson and Winter, 1982). These routines are part of an organization’s dynamic capabilities, that is their capabilities to do different or new things (Anand et al., 2009; Peng et al., 2008). Improvement routines can be developed through a recursive pattern of production, learning or better understanding and reproduction of either actual operations or actual improvements (Zollo and Winter, 2002).

Organizational routines, artefacts and learning

Ostensive and performative aspects of routines

Feldman and Pentland (2003) further distinguish the ostensive and the performative aspect of routines. The ostensive aspect is considered “the ideal or schematic form of the routine. It is the abstract, generalized idea of the routine or the idea in principle” (Feldman and Pentland, 2003, p. 101). This ideal form always exists inside an actor, it is her understanding of the routine, rather than a theoretical ideal of the routine. The performative refers to the actual performance of routines, the “specific actions, [done] by specific people, in specific places and times. It is the routine in practice” (Feldman and Pentland, 2003, p. 101). Rather than seeing them as two opposing phenomena or a dualism, Feldman and Pentland (2003) view the ostensive aspect and the performative aspect as a duality, influencing each other in each and every performance. The ostensive aspect of the routine is both the input and the outcome of the performative aspect of the routine (Feldman and Pentland, 2003). This duality of routines is derived from Giddens’ (1984) duality of structure and agency or structuration theory. The duality of routines thus means that the abstract idea of the routine guides its performance while the performance at the same time constitutes the schematic form that we understand of it.

In lean management, examples of the ostensive aspect of lean operations are an actor’s *ideal form* of the lean practices developed by Shah and Ward (2007). Examples of the ostensive aspect of CI are an actor’s *ideal form* of the improvement routines developed by Bessant et al. (2001). A clear example of the performative aspect in lean operations are the *actual performances* of the lean practices developed by Shah and Ward (2007), specified to an actor’s context (e.g. “We use Kanban, squares or containers of signals for production control”). A clear example of the performative aspect in CI are the *actual performances* of the improvement routines developed by

Bessant et al. (2001), again specified to an actor's context (e.g. "Employees initiate and carry through improvement activities").

Artefacts and organizational routines

Organizational routines are related to artefacts (D'Adderio, 2008; Pentland and Feldman, 2008). Artefacts are defined as structures external to actors, either physical (most often material) objects (such as machines and products) or intangible (such as software and standards) and can range from single documents to systems of interdependent artefacts (Cacciatori, 2012; Hutchins, 1995). Artefacts relate to both the ostensive aspect and the performative aspect of routines. Take SOPs, which are tangible forms of how the work ought to be done. These SOPs help to develop the ostensive aspect which improves the performance, while the performance develops the ostensive aspect and ultimately changes the SOPs. To better understand the link between artefacts and organizational routines, Nicolini et al. (2012) classified them in a three-level hierarchy; the first level consists of tertiary artefacts that form infrastructure (e.g. buildings, rooms, furniture, ICT, documents etc.), the second level consists of secondary artefacts that facilitate work (e.g. production orders and SOPs), and the third level consists of primary artefacts that are used to do work (e.g. machinery and tools). All three levels are important to perform routines and to learn (Nicolini et al., 2012). In addition, Cacciatori (2012) suggested two dimensions for artefacts. The first regards speaking artefacts, which can be textual or visual for products (e.g. prototypes) or processes (e.g. organizational or specific procedures), versus silent artefacts (e.g. furniture and tools). The second regards artefacts generic to occupations (e.g. organizational procedures and furniture) or specific to occupations (e.g. prototypes and tools). Using these dimensions, she explains that not all artefacts influence behavior in the same way and that routines are developed using a system of artefacts.

For lean management, examples of physical systems of artefacts are lines and cells and Kanban

and ConWIP card-systems. Examples of intangible artefacts are tools such as takt time, cycle time, visual management and standard work (Bicheno and Holweg, 2016), though the latter two can also result in physical artefacts. Examples of physical artefacts of CI are performance boards and eight-discipline (8D) and A3 problem solving reports. Examples of intangible artefacts in CI are tools such as plan-do-check-act (PDCA), define-measure-analyze-improve-control (DMAIC) (Bicheno and Holweg, 2016).

Learning through reflexivity in experiments and in performance

Organizational routines nor artefacts are static. Organizational routines can be modified as a result of deliberate problem solving (Adler et al., 1999; Hackman and Wageman, 1995) as well as through ongoing performance (Feldman and Pentland, 2003; Giddens, 1984). Deliberate problem solving is strongly related to CI. When employees perform specific improvement activities, they experiment and learn and can alter the lean operating routines (more radical improvement, not innovation). This process of trial-and-error learning relates to employee reflexivity (Feldman and Pentland, 2003; Giddens, 1984; Rerup and Feldman, 2011) which is performance based improvement of understanding or learning which results in improved performance. Routines also change continuously in each and every interaction (Feldman and Pentland, 2003; Giddens, 1984). This change occurs when employees perform their day-to-day operating activities and adjust them to both the circumstances at hand and their understanding (Rerup and Feldman, 2011). This incremental improvement also occurs due to employees' reflexivity (Feldman and Pentland, 2003; Giddens, 1984).

This double reflexivity not only goes for lean operating routines, but also goes for CI routines. CI routines too are continuously changed both as a result of their performance, learning and change, and as a result of improvements on the improvement system (Bessant et al., 2001). So, the interaction between the ostensive aspect and the performative aspect both of lean operating

routines and of CI routines continuously results in learning and improvement. This is something different from single loop or double loop learning (Argyris, 1976). In both incremental and radical improvements there can be single or double loop learning. But it is this reflexivity or employees' personal learning that, through time and space, results in organizational learning and actual improvements, both in lean operating routines and in CI routines (Argote and Miron-Spektor, 2011).

The duality of lean: an organizational routines model of lean management

Our model of organizational routines for lean management is based on the premise that lean management can also be conceptualized as a duality in terms of the ostensive and performative aspect of both lean operating and CI routines. This perspective implies that the ostensive aspects of lean operations (*understanding* of lean practices) and of CI (*understanding* of improvement routines) influence each other, and jointly produce the performative aspect of lean operations (*performance* of lean practices) and CI (*performance* of improvement routines). These performative aspects of lean operations and CI in turn produce the ostensive aspects of lean operations and CI respectively. Artefacts related to lean operations (e.g. cells or lines and pull systems) and artefacts related to CI (e.g. improvement cycle-reports) not merely influence each other, but more importantly, are the medium as well as the outcome of the ostensive aspect and the performative aspect of lean operations and CI respectively. The renewed performance of the lean operating routines leads to an increase in operational performance, but also leads to employee learning and thus continues to alter the ostensive aspects of lean operations and CI. This social production and reproduction of operations and improvement enables further development of lean practices and improvement routines, increases in operational performance

and learning. This iteration results in endless cycles, through time and space, and results in a process of improvement of both lean operations and CI, as shown in FIGURE 1.

[Insert Figure 1 about here]

Managing sustainable development towards a lean organization

The improvement explained above can take an evolutionary form (Nelson and Winter, 1982; Schein, 2017) but can also be initiated in a more deliberate way (Feldman and Pentland, 2003; Giddens, 1984). The extent to which this development moves towards a lean organization depends on the management of lean/CI routines. Sometimes, managers take the principles of flow and pull to develop espoused schemata (how the work ought to be done) of operating routines, like specific assembly lines. All too often, these schemata as well as related artefacts (like working with Kanban card-systems) are implemented in the organization (Rerup and Feldman, 2011), at best using improvement workshops (Done et al., 2011), but neglect development of the ostensive aspect of the routines. Employees try to perform the espoused schemata as they try to cope with the changes to their environment. However, they also enact their work as they seem fit, that is according to their traditional understanding and traditional enactment of the schemata (how the work used to be done). In the end, this discrepancy between espoused and enacted schemata results in implementation failure and management-perceived resistance of employees. Following this example using organizational routines, we see that changing one aspect does not necessarily lead to a change in the others. Overestimating the importance of espoused schemata or artefacts leads managers to underestimate or even neglect the importance of the ostensive aspect, let alone provide what is necessary to let employees perform according to these new understandings (Feldman and Pentland, 2003). Not distinguishing these three aspects also prevents researchers to analyze the relationship between them while understanding this

relationship is crucial for us to understand how to develop a lean organization. When studying lean operations, it is often the artefacts and performance that is studied (presence of flow and pull). And when studying CI, it is often the performative aspect that is studied (way and degree of employee involvement). This paper aims to find what managers did to manage all three aspects of lean operations and CI.

To manage the development of lean/CI routines, several authors showed that it is important to develop lean leadership (e.g. Liker and Convis, 2011). Following Feldman and Pentland (2008) we assume this leadership needs to attend the ostensive aspect, the performative aspect and the related artefacts of employee routines. Furthermore, several authors showed that it is important to engage employees on why and how espoused routines ought to be applied (e.g. Courpasson et al., 2012). This engagement helps employees to develop their ostensive aspect in line with the espoused routines. Next, several authors showed that it is important to provide employees with what is necessary as they perform their improved routines (e.g. Amabile and Kramer, 2011; Knol et al., 2018, 2019). Providing employees with what is necessary does not lead to development, but absence does lead to failure. And several authors showed that it is important to determine the appropriate lean operating and CI related artefacts (e.g. Bicheno and Holweg, 2016). As there are many, misalignment between an organization its context and the envisioned artefacts again results in failure. Because of this complexity, balancing the management of these three aspects requires feasible, short-cyclical patterns rather than company-wide and quick implementation (Mann, 2014; Rother, 2010). In our empirical study, we will illustrate the organizational routines model of lean management.

METHODS

To investigate how actors managed the interaction between the ostensive aspect and the performative aspect of lean operations and CI routines as well as related artefacts, we first

explain why we conducted a retrospective analysis of three strategically selected cases, we then elaborate upon our case selection and data collection and finally we explain how we iteratively compared the case data with each other and the literature.

Retrospective case studies

Retrospective case studies allow for great insight to explain how organizations developed over time (Pettigrew, 1990). Given the complexity of the research setting, that is the interaction between the three aspects of both lean operations and CI routines, multiple cases were needed (Eisenhardt and Graebner, 2007; Meredith, 1998). Comparing multiple retrospective case studies gave insight into how the cases used the mutual enactment of lean and CI to sustainably develop towards a lean organization. Contrasting this insight with the literature enabled us to find why this worked and helped us to generalize our findings (Glaser and Strauss, 1967).

Strategic case selection

To select cases for this study, we started with a quantitative inquiry of candidate case characteristics (McCutchoen and Meredith, 1993). Because the challenge to develop a lean organization is especially hard for small and medium sized enterprises (SMEs) (McGovern et al., 2017; Shah and Ward, 2003; White et al., 1999) and because lean originated in the manufacturing industry (Krafcik, 1988; Sugimori et al., 1977), we asked multiple respondents of 42 manufacturing SMEs to fill in a self-assessment on presence of three relevant conditions: lean practices (Shah and Ward, 2007), improvement routines (Bessant et al., 2001) and success factors (Knol et al., 2018). Based on these findings, we selected three cases which covered all dimensions of our interest (see FIGURE 2). Case A featured high on improvement routines and success factors combined with advanced lean practices (dashed circle), while case B featured some improvement routines and success factors combined with some lean practices (dotted

circle). These cases were supplemented with one extreme case C, which showed advanced improvement routines and success factors but little lean practice implementation (dashed-dotted circle). A summary of the three case characteristics is given in TABLE 1. Given this diverse selection of cases, covering lean practices, improvement routines and success factors, three is considered sufficient to explore organizational routines in lean management (Eisenhardt, 1989; Stuart and McCutcheon, 2002).

[Insert Figure 2 and Table 1 about here]

Data collection

We used an embedded case study design; we studied more incremental improvements in each case its operational processes as well as more radical improvements on those processes (Yin, 2013). To create three longitudinal cases, we gathered retrospective data; from the first lean initiatives until the current state of improvement interventions, focusing on important recent (past two years) activities to limit recall bias and enhance accuracy (Golden, 1992). There were no functional boundaries; both production and office were subject to our study. We collected data using interviews, archives (internal documents and websites) and observations (Jick, 1979). Interviewees ranged from employees and team leaders till managers and CEOs. All were highly knowledgeable about lean operations and CI in their organization as they were sampled for their involvement in lean interventions as well as their insights in the strategic overview (director), tactical occurrences (managers) and/or operational implications (team leaders). Interviews developed from open, such as “How did you develop the critical conditions?”, to semi structured, such as “How did you try to overcome employee resistance in this department?”, as our insights increased (Eisenhardt, 1989; Glaser and Strauss, 1967). As our data collection developed, we also developed a code book to maintain more focus (Van Maanen, 1979) (see next paragraph).

Interviews took one hour on average. They were recorded, transcribed and discussed with fellow researchers afterwards to increase reliability and enhance data analysis.

Documents were used to establish the chronology of improvement interventions, build the process models, guide the interviews and counteract any biases originating from the interviews.

Observations were conducted as an observer focusing on experiences in the operational processes as well as improvement interventions. For example, we studied the work in the different cells of Case A, the work at the production machinery in Case B and the work at the work stations at Case C as well as the stand-up and improvement meetings at all cases. All findings were presented to and discussed with the case participants afterwards to increase our understanding of the case as well as the quality of the data gathered (Jick, 1979).

Data analysis

We combined induction and deduction into an abductive analysis of each case (Ketokivi and Choi, 2014) and traced the process of developing towards a lean organization (Langley, 1999; Mohr, 1982). As a first step, each case was analyzed by three groups of four different researchers (not the authors, 12 researchers in total) using Qualitative Group Analysis (Stappers, 2012). Following this method, the researchers individually read 2 of the 10-11 interviews per case (creating some overlap resulted in 6 interviews per group, 18 interviews in total) and selected relevant quotations related to the research aim. These groups of researchers then met in a two hour session, shared their findings, created themes of quotations and thus developed preliminary concepts and rough explanations (Braun and Clarke, 2006; Dalkey and Helmer, 1963).

We continued with within-case and cross-case analyses ourselves using different coding techniques (Eisenhardt, 1989; Eisenhardt et al., 2016; Eisenhardt and Graebner, 2007). Open

coding of the interview transcripts helped to identify first-order constructs regarding lean/CI routines. Axial coding helped to develop constructs or second-order constructs to come to phases and themes regarding lean/CI routines. Causal coding helped us to identify linkages between lean/CI routines and their results. Contrast coding between the different cases helped us to compare and analyze between cases as we juxtaposed the two diverse cases with each other as well as the extreme case. To map the chronology of each case, we created two-page written narratives and process models for each case (Miles et al., 2013). To increase validity these were reviewed by the production managers of each case (Jick, 1979).

Using the themes from each qualitative group analysis as well as our own analysis of each case, we contrasted the data with the literature to build and periodically refine our code book (TABLE 2) (McCutchoen and Meredith, 1993). This code book was key to further analyze the case data (Van Maanen, 1979). The case data helped to come to literature on organizational routines, ostensive and performative aspects, artefacts, organizational learning, lean practices, improvement routines, success factors, lean leadership and process perspectives, which acted as a framework with which to compare the empirical results of the case studies, which in turn again helped to develop our theoretical framework (Yin, 2013). Asking what was similar to or contradicting this broad theoretical framework enabled theory-building from our cases and eventually led to a model on what actors did to manage the interaction between the ostensive aspect, the performative aspect and related artefacts of lean operations and CI (Meyer, 2001).

[Insert Table 2 about here]

WITHIN-CASE ANALYSIS

In this section, we describe the narratives of each case in terms of what actors did to manage the ostensive aspect, performative aspect and related artefacts of lean operations and CI to sustainably develop towards a lean organization.

Narrative Case A – Advanced lean practitioner

Case A started managing the three different aspects of lean/CI routines in 2004, when a new lean minded Managing Director headed the company. In 2009, two major improvement projects were started at the operations of two selected departments to overcome a sudden large growth in demand. Lean games were played to improve the ostensive aspect, that is understanding of lean operations. After these, an external consultant guided the department managers to engage employees to reorganize their traditional operating structures and artefacts into lines to improve the performative aspect, that is the performance of lean practices, to improve product quality, increase flow and reduce product lead time. When major successes were achieved, the manager of the first department moved to a third and later a fourth department to repeat the trajectory (the manager of the second department unfortunately left the company). In 2011, a CI manager was appointed. She still is actively engaged in coaching employees in developing the ostensive and performative aspects of lean operating and CI routines. Coaching this interplay between explaining lean operating structures, doing improvement projects and letting employees learn from these projects to perform their own, is considered key to internalize improvements in the organization. “You can guide people a lot more, without having to prescribe the route they take. They must make mistakes to learn why a 5-why is carried out in one way and not the other. The moment they run into something you can send them in the right direction. The progress is much better and the effect too, people are more positive about it.” (CI Manager Case A).

Part of coaching regards the ostensive aspect, that is engaging employees, so they understand the importance of lean operating and improvement structures. As the Manager Sales of Case A said: “We must sell it. If people believe it, then it will happen. If they do not know why and do not

believe in it, then it will not happen.” Another part regards the performative aspect, that is helping them and triggering them to start their own improvements: “So do not say: ‘You must do this differently’, but just ask: ‘How could that mistake happen, how was that possible?’ Then slowly try to get things better, without throwing anyone under a bus.” (Manager Engineering Case A).

In 2015, a new lean minded Operational Director joined the company and tried to implement 5S structures company-wide. 5S is a workplace organization method aimed to increase productivity. To implement 5S structures, all employees were trained to develop the ostensive aspect, but there was little follow-up on this training as they were imposed to perform weekly 5S actions. Furthermore, there was no coaching to assist trained employees in the performative, hence they experienced this imposition as forced and for eye service only. Because of this lack of managing the ostensive aspect and the performative aspect, the attempt was not well received and was not sustained.

The new Operational Director continued to jointly develop cells responsible for their own process. “Remove the functional in production and start thinking in cells. ... So, I asked the teams which production cells they see. So, we have given a guideline and told them, ‘You can build a cell in it.’ ... and they slowly grow into it.” (Operational Director Case A). Engaging employees developed the ostensive aspect and providing employees with what was necessary improved the performative aspect. These combined sustainably developed cell structures which improved communication and again improved product quality, improved flow and reduced product lead time.

The Operational Director also introduced slack capacity to enable performing improvements.

“There was no slack capacity for people. This has changed in the last couple of years. ...

Previously it was thought that if we have slack capacity, then someone is hanging around in the

canteen, doing nothing.” (Team Leader Case A).

Narrative Case B – Moderate lean practitioner

Case B started improvements (at first not attending the different aspects of lean/CI routines) with the arrival of the current Plant Manager in 2001. After some years of incremental improvement, other managers got interested and attempts were made to implement 5S structures company-wide. However, like Case A, there was little guidance on the ostensive aspect nor the performative aspect hence employees were hesitant. Even after much training and other investments, resistance remained and little sustained. The implementation was experienced as forced.

Management of lean/CI routines started in 2013, as a new lean minded Operational Director and CI Manager joined the company. With them came a focus on flow. Furthermore, the arrival of the lean minded Operational Director in the board enabled the Plant Manager to work on Sales related improvements, the Manager Maintenance to work on predictive maintenance, and the Manager Expedition to integrate their external transporters into their logistics processes. More improvement projects also required better improvement artefacts such as the use of A3. This led them to do Green belt trainings of specific employees. These trainings were not always received enthusiastically because of the high workload of the employees. To overcome this resistance, the CI Manager of Case B really focused on developing the ostensive aspect of CI as he started a discussion to clearly explain the need:

When I asked [him] if he wanted to do the course, and that he would also do two or three projects every year, he was very hesitant, he was very busy already. He saw it as extra work. ... While I was talking, I tried to make it clear to him, you are doing those projects already, only now you get a tool to do it in a structured way, with a head and a tail, to efficiently manage your projects. Then he understood that he did not have to do anything extra but that his current work would be done in a more structured manner. Now he is almost done with his first project which is going very very well! (CI Manager Case B)

In 2017, management decided to introduce 5S structures again, however not company-wide, like previous managers did, but team by team. The first team was chosen based on their dissatisfaction with the current way of working and their willingness to participate. This time, and like with the Green belt training, they focused on managing the ostensive aspect: the need for 5S was clearly explained, upfront as well as during improvement activities. However, all went not so smooth. Employees said that it was forced, like the first time, to which the CI Manager of Case B replied:

At that moment it brought a lot of resistance because the employees said, "We are told that we can set our own pace but now you are pushing us." Then there was a heated discussion, where I said, "You must set the pace, but we also have to take steps because right now we have been on the same level for months." ... The agreement we made afterwards is that the plant manager goes to the shop floor every Wednesday afternoon to do his 5S round and to understand how best to facilitate them. ... After we made that agreement, you saw it progress very quickly. ... (CI Manager Case B)

Through this discussion, the CI manager developed the ostensive aspect and even more so improved the performative as he explained the need and provided employees with what was necessary for them to perform improvements. After some time, audits were introduced, sustaining the achieved results. When the second team was next, they were already interested in doing 5S because of the results at the first team. Currently, both teams are running 5S in a sustainable way.

Managing employee engagement, amongst others through attention for employees, by now is considered of major importance to develop employees' ostensive aspect of routines. "R: In the past, you often saw projects where people were not engaged, then as soon as you are gone, they fall back again. If you do engage them, it is more likely to succeed." (Manager Quality Case B). When this engagement lacked, suddenly everything protracted. In the Expedition department for example, employees were not always engaged in the process of decision making, leading to resistance and neglect. "People are not talking to each other. ... [Manager Expedition] was

appointed over our heads. ... Then when they come back for something else, you think like, ‘whatever’.” (Expedition Employee Case B). This issue was recognized, and discussions and engagement begun.

Next to attention for the ostensive aspect, managers continued to provide time and other resources necessary to facilitate the performative aspect of routines. “I: How important is [the Plant Manager] in this story? R: Not necessarily the driving force, he is no longer involved everywhere. But he does provide what is necessary, so others can work on it.” (CI Employee Case B).

Narrative Case C – Ineffective lean practitioner

Improvements at Case C (rarely attending the different aspects of lean/CI routines) started with the arrival of the current Manager Engineering and the current Team leader Aluminum in 2007. To start their efforts, they first engaged the Manager Production using a lean game. To develop the ostensive aspect in the entire organization, they played the game with the entire company; first the Management Team, then all team leaders and finally all remaining employees. However, there was little follow-up hence no guidance in the performative aspect of improvement. As such, the training helped to make people aware but did not help to get everyone started. The efforts of the two were experienced as ineffective, expensive and pushy.

At the Aluminum department, improvements did continue using flow as improvement indicator. Among other things, the Team leader Aluminum tried to implement 5S structures. Like Case A and the first attempt at Case B, there was the organization of 5S artefacts but little attention for developing the ostensive aspect or improving the performative aspect. Hence 5S was not internalized by employees and did not sustain.

A major improvement activity at the Aluminum department came from a situational lean team,

when they did a so-called “coup”. After two months of preparation, they structured (i) prioritization of orders, (ii) a limit on the number of orders as well as (iii) a limit on the size of orders in the system. The implementation of this lean operating structure however was less ideal:

Then we figured it out, the way we produce here must be done completely different, this must be done with a ‘train system’. We changed this through a coup. ... We presented the idea in a presentation to the MT and the team leaders and explained that this is how it will be done. ... But what happened? I came to the production manager on Friday and asked if everything was prepared. “No”, he said, “not yet”. I said, “This is not what we agreed upon.” He asked, “Can we talk about this with the rest of the team leaders?” We then gave everyone instructions. I went to the planner to ask if he was ready, but he was very busy and not prepared. I said, “There is no choice, we agreed upon this, we are going to do it!” Within four hours we changed everything to the new system with a different planner. (Manager Engineering Case C, emphases by authors).

Though the lean operating structure appears suitable, there was little attention for the ostensive (presentation only, no engagement) and performative (forced implementation regardless of readiness) leaving the team leader and planner unprepared.

After the coup at the Aluminum department, management wanted to continue improvements to other departments and asked them to also reduce their lead time by half. Employees however did not experience the need to do so, indicating a difference between the espoused and existing schemata, and no attempts were made. After a few months of muddling along, the Managing Director instructed all Team leaders to reduce their lead time *on paper*. “When we started with that, I asked him, ‘[Managing Director], would you like to hand the team leaders an envelope with the assignment “Go quicker!?”’ He did that. Then there were discussions of people saying, ‘What a nonsense’.” (Manager engineering Case C). Like the coup, there was little involvement and clear indication of resistance hence little attention for developing the ostensive aspect. After pushing this assignment anyway, improvement meetings were performed every day for a year. These meetings and improvements were facilitated by “expensive” external consultants, required strict business cases and yielded some results. However, when time passed, the frequency of

these meetings was reduced until they fell back completely.

What is striking is the entire lack of managing the development of the ostensive aspect, the improvement of the performative aspect and the implementation of related artefacts on the side of CI, that is efforts to develop understanding of and guidance to use and perform improvement structures. There was no sign of coaching, performance meetings nor templates such as FMEA, A3 or 8D like in Case A and B.

At this time, improvements occurred only from time to time, done by a small number of employees. If this improvement group failed for whatever reason, nothing happened at all. And in general, the improvement group failed often because of a lack of guiding the performative aspect. Like the Manager Engineering at Case C said: “You know, I work behind this desk again. I am engaged in engineering. I do not have time to do that anymore. ... So, it is an extra job and we are busy, it falls back again.” (Manager Engineering Case C).

CROSS-CASE COMPARISON

In an iterative fashion, the three case studies led to and were compared with our theoretical framework, the inductive qualitative group analyses as well as our own case analyses. In the end, the case data illustrates our assumption derived from the literature review that the ostensive aspect, the performative aspect and related artefacts of both lean operations and CI mutually enact and reinforce each other resulting in organizational learning and sustainable development towards a lean organization.

Ostensive lean/continuous improvement aspect

In the two successful cases A and B, one or more lean coaches in leadership positions in the organization (General or Operational Director, Managers Engineering, Production, Logistics etc. or Team Leaders) were key to the improvement process, engaging colleagues to help them

understand the importance of lean operations and CI. To this end, different approaches were used: lean games (Managers Engineering and Production Case A and C respectively), internal or external excursions (first two departments at Case A, first 5S department of second attempt at Case B and “train” at Case C), training (5S at Case A and B and Green Belts at Case B), data (5S audits at Case B), or involvement in improvement projects (Manager Engineering and employees at first departments as well as for cells (Case A) helped to show the importance of lean practices and improvement routines. However sometimes this was not enough. To engage employees that did not see the importance of lean operations and CI, the CI Manager of Case B provided two excellent examples (importance of Green Belt and second attempt at 5S) of what to do: open the conversation, ask what bothers them, convince them otherwise and trigger and facilitate them to try.

In the unsuccessful Case C, the lean coaches acted more like lean drivers, pushing and implementing the change rather than maneuvering employees to initiate the change themselves. Like the coup and 5S-examples show it was the idea and implementation of the lean drivers while employees were not engaged hence convinced. The social effect was rather destructive, and it certainly did not lead to engagement and CI. Forcing a company-wide target of reducing lead time did not help either.

Performative lean/continuous improvement aspect

To improve the performative aspect of lean/CI, lean coaches first engaged employees in management-initiated improvement activities before providing employees with what was necessary to do their own. Like the CI Manager at Case A explained, you must let people experience their impact in a small project, so they pick up the idea of improvement and continue their selves. In general, CI managers in the successful cases guided people in performing

improvements. Like the CI Manager of Case A said, you want to guide employees in the right direction, without saying what it is they must do so they can make mistakes and learn from those mistakes, resulting in a sustainable transition.

To perform improvement activities, certain preconditions were always required. Most importantly, time and budget were freed and given to employees provided its cause was substantiated (such as the slack capacity in all operations in Case A and later in Expedition in Case B). For the unsuccessful Case C, lack of time was, amongst other indirect reasons, a direct reason for improvements to stall. Another important precondition mentioned was communication, or more broadly, a healthy atmosphere amongst the employees. Absence of communication frustrated all efforts as far as stalling the CI process (even in Case B, where Expedition employees were neglected and managed behind their backs).

Lean/continuous improvement related artefacts

Improvements were done using lean operating and CI artefacts as much as possible. In lean operations, the principles of value stream, flow and pull were important guidelines for improvement. To reduce lead time, increase flow and increase product quality, Case A introduced cells and cross-functional teams and tried to introduce 5S structures, Case B introduced 5S, predictive maintenance and JIT deliveries through smaller series and transporter integration, and Case C, despite its lack of attention for the ostensive aspect and performative aspect, introduced a limit on number of orders (pull using a train as well as Kanban), a limit on size of orders and order priority. These artefacts were seen at different levels in different areas as this helped to improve product quality, reduce lead time and sustain their implementation.

Regarding CI, Case A and B used different but similar artefacts to approach improvements; Plan-Do-Study-Act cycles for simple improvements or more advanced A3 or 8D formats for more

complex issues. What is striking however is the considerable lack of improvement artefacts at Case C. No improvement artefacts, no attention for the ostensive aspect of improvement and no guidance in the performative aspect of improvement. For some time, there have been daily meetings to think of and implement improvements, however there was no sign of a structured approach, guidance or providing employees with what was necessary during our presence.

Sustainable development through time/space

To sustainably develop towards a lean organization, the successful cases took feasible steps in a consistent way. It was perceived as challenging to continue this process when demand was rising, and capacity was short, but the successful cases did so anyway. The feasibility of these steps was often discussed (such as by the CI Manager and the employees Case B), but through this discussion, issues came about, agreements were made, and progress continued. Whereas the unsuccessful Case C tried to realize company-wide improvements which, even though many investments had been made, resulted in no sustainable improvement. Eventually, this company-wide approach led them to halt further investments, stalling the entire CI process. For the successful cases, maintaining frequent feasible steps eventually (often sooner than later) led to successes on the shop floor. Like Case A who achieved a major increase in output after the first externally guided improvement project was done, and subsequently engaged a third and later a fourth department. Employees, seeing that their work became easier, understood the reason for lean operations and CI, reducing their initial resistance and increasing their motivation to join.

DISCUSSION

The aim of this study was to explore how actors developed their lean organization by managing the ostensive aspect, the performative aspect and related artefacts of lean operations

and CI. In this section we contrast the comparative study of three cases with the literature leading to an approach to manage the development of lean/CI routines.

Three aspects of lean operating routines and continuous improvement routines

In line with others (Liker, 2004; Nelson and Winter, 1982; Spear and Bowen, 1999; Womack and Jones, 2003) we conceptually distinct lean operating routines and CI routines but at the same time find them to be inextricably linked. Furthermore, like Adler et al. (Adler et al., 1999) and Hackman and Wageman (1995) and many others, we saw improvements as separate activities but, like Feldman and Pentland (2003), we find that improvement also takes place during the performance of lean operations. All managers tried to find suitable lean/CI related artefacts. Managers of successful cases did not merely implement these artefacts but engaged employees to let them understand these first and adjust these to their context while this understanding and adjustment subsequently enabled smooth performance and sustainment of newly developed routines. As such, we counter the notion of change as merely an evolutionary process of uncontrolled mutation (Nelson and Winter, 1982; Schein, 2017) and, in line with others (Feldman and Pentland, 2003; Giddens, 1984) found routines also to be diverse and ever changing depending on managers ability to engage employees and employees' reflexivity to their (new) structural context.

Managing lean and continuous improvement routines

Regarding the process of developing lean/CI routines, we found that managers of successful cases worked on all three aspects (ostensive aspect, performative aspect and related artefacts) of lean operations as well as CI routines to develop towards a lean organization. This discourages the use of standardized and rapid improvement workshops (such as by Done et al.,

2011). It confirms the importance of lean leadership (e.g. Liker and Convis, 2011). And it specifies the actions that managers need to take:

1) To develop the ostensive aspect of lean operations and CI routines, managers engaged employees. This is in line with Latour (1986) who argued that change is a result of enrolling, convincing and enlisting people as well as with Dutton et al. (2001) who showed that change originates from the micro processes of issue selling, that is the interaction and action between managers and employees to determine a suitable shared direction. In line with more recent developments (Sonenshein, 2012) we see this process go two ways, from employees to managers and from managers to employees. This selling is in line with findings that show the criticality of data, performance management and training to be able to develop a lean organization (Achanga et al., 2006; Knol et al., 2018; Saraph et al., 1989) as these help to engage actors. In general, the process of developing the ostensive aspect confirms the work of Courpasson et al. (2012) on productive resistance as we found that rather than a static situation where employees try to frustrate change, resistance is a dynamic process in which employees try to include their own understanding into the moves an organization makes.

2) To improve the performative aspect of lean operations and CI routines, managers needed to provide time and resources for employees to internalize and perform improvements. These findings confirm findings of Knol et al. (2018, 2019) regarding the relative importance of improvement routines and critical success factors for lean management, such as resources, as it shows that successful organizations focus on developing employees to initiate and perform improvements themselves and need resources to do so. This also confirms the progress motivates-model of Amabile and Kramer (2011) as people's improvement activities are strongly guided by a shared improvement direction as well as visibility of employees' performance.

3) To organize artefacts related to lean operations and CI, managers searched for suitable

structures, tools and systems while they continually engaged employees on the need for and suitability of these artefacts. This counters the literature that suggests to start merely with implementing lean operating artefacts (Liker, 2004; Spear and Bowen, 1999; Womack and Jones, 2003) as changing artefacts would change behavior. And this elaborates on the literature that focuses only on developing CI capabilities to conduct improvement activities (Anand et al., 2009; Bessant and Caffyn, 1997; Rother, 2010). It shows that simultaneously organizing lean operating and CI artefacts as well as engaging employees to think of and suggests improvements themselves reduces employee resistance and improves the applicability and sustainability of such artefacts.

Managing all three aspects of lean/CI routines is difficult which is why managers of successful organizations took the time to focus their activities rather than tried to implement lean operating and CI routines quickly and/or company-wide. This is in line with Mann (2014) and Rother (2010) who argue for short-cyclical patterns of lean development. In general, we show that to develop a lean organization, managers balance the interaction between the ostensive aspect, the performative aspect and related artefacts of lean operations and CI routine into a delicate process of organizational learning and development.

An organizational routines approach to develop a sustainable lean organization

The findings of the three case studies combined with the discussion led to an elaboration of FIGURE 1; an organizational routines approach to sustainably develop towards a lean organization. This approach is given in FIGURE 3. It shows that managers simultaneously 1. engage employees for them to understand the importance of and develop lean operating and CI routines in their work as well as improve the schemata initially espoused. They do this among others using lean games, internal or external excursions, training, data, involvement in

improvement projects and coaching. Furthermore, managers 2. provide among others time and resources to let employees improve the performance of their work during operational activities and during separate improvement activities. Although providing is no guarantee for success, absence does ensure its failure. And rather than merely implementing artefacts, managers 3. find and organize suitable artefacts both in lean operations and in CI. In sum, to sustainably develop towards a lean organization, managers initiate structured improvements themselves and engage employees knowledgeable of the process and willing to improve to develop them as lean agents. Maintaining these activities in a feasible way, over time, develops employee understanding of lean operating and CI routines, employee performance of these routines and suitable lean operations and CI related artefacts, resulting in organizational learning as well as increased operational performance.

[Insert Figure 3 about here]

Practical implications

Managers and consultants that intend to develop a lean organization are advised to focus on the cohesion between lean operations and CI through the ostensive aspect, the performative aspect and related artefacts. Attention might be focused on the aspect that is least developed. Initiative can be taken by management, but not without careful engagement and learning of both managers and employees. This can be done for example by initiating and thinking through an improvement project, but rather than implementing the designs or even ask employees to help think about the designs, managers might better engage employees to think about the background, current situation and problem first for them to understand the reason for change. Managers and consultants already working on developing a lean organization are advised to carefully reconsider their efforts. There appears to be a tendency to focus on the implementation

of lean operating structures, lagging the development of lean/CI routines hence learning. If this is the case, attention might be shifted, attending to employee learning which absence can constrain the sustainable development towards a lean organization. The previous example holds here as well.

Our findings go beyond the field of operations management. For example, as lean and continuous improvement is not merely blind experimentation, strategists might carefully think about the direction that these experiments unfold. Different operating practices might have different effects on employee and organizational learning. Or HRM managers might carefully think about and select employees based on their capability to participate in the continuous improvement process. Different people are fortunately needed for different activities, but their mindset to continuous change and engagement is very important.

Educators teaching lean operations and/or CI might reconsider the attention and order given to the latter as well as the interacting effects between the two. Though implementation, sustainment and perfection oftentimes come after designing the lean operating structure, realizing this structure cannot be achieved without upfront employee engagement and attention to organizational learning. We think this requires a different approach to teaching as well. For example, regarding theses, rather than writing one that reflects on certain situations, students might engage employees in a company project while they write on occurrences during and outcomes of this project.

Future Research

As the routine perspective shows that the ostensive aspect, the performative aspect and related artefacts of lean operations and CI routines are not the same and as actors in successful cases work on balancing all three, future research on lean operations and CI benefits from

distinguishing their position to these aspects and explaining how it relates to the others; does it regard lean/CI artefacts or structure, does it regard (conditions for) performing lean/CI routines or does it regard (developing) the ostensive aspect of lean/CI routines, and how does the intended study influence the other aspects? As research on lean operating and CI artefacts and structures as well as linkages between performing lean operations and CI and operational performance is abundant, more focus needs to be given to developing employees' ostensive aspect of lean operating and CI routines.

Regarding the ostensive aspect of lean operations, several lean practices and bundles of lean practices have been identified (Shah and Ward, 2003, 2007) As these and other studies provide very good insight in the importance of these practices and bundles, future research might focus on developing the ostensive aspect of these practices and bundles in employees, that is finding how the understanding of these bundles is developed in employees as well as how they are developed within organizations. For example, which CI approaches work best to develop TPM, JIT, supplier or customer related (bundles of) lean practices? Without insights in developing this understanding it appears to be impossible to develop these practices and bundles for them to be effective.

Regarding the ostensive aspect of CI, again many studies have been done focusing on the importance and use of dynamic capabilities in general (e.g. Anand et al., 2009; Peng et al., 2008) and improvement routines in specific (e.g. Bessant et al., 2001; Bessant and Caffyn, 1997). As these and other studies provide great insight in the importance of these capabilities and routines, future research might focus on their link to employees' ostensive aspect of lean practices and bundles as well as how they are developed in organizations. For example, which (bundles of) lean practices work best to internalize Kaizens, A3s and 8Ds or Toyota Kata? Again, without insights in developing this understanding it appears to be impossible to develop these capabilities and

routines for them to be effective.

Finally, we studied organizational routines in relation to lean management and CI in a manufacturing industry using qualitative research. Though plenty of work remains to be done in this area, future research might also extend its scope towards different concepts, (such as lean management and strategy, HRM, innovation or accounting), different methodologies (qualitative approaches such as more longitudinal (process) and more detailed (video observations) as well as quantitative approaches), and different industries (such as healthcare, education, public and commercial services and finance). These will most certainly provide different insights for us to better understand the nature and development of lean/CI routines.

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TABLES AND FIGURES

FIGURE 1
An organizational routines model of lean management

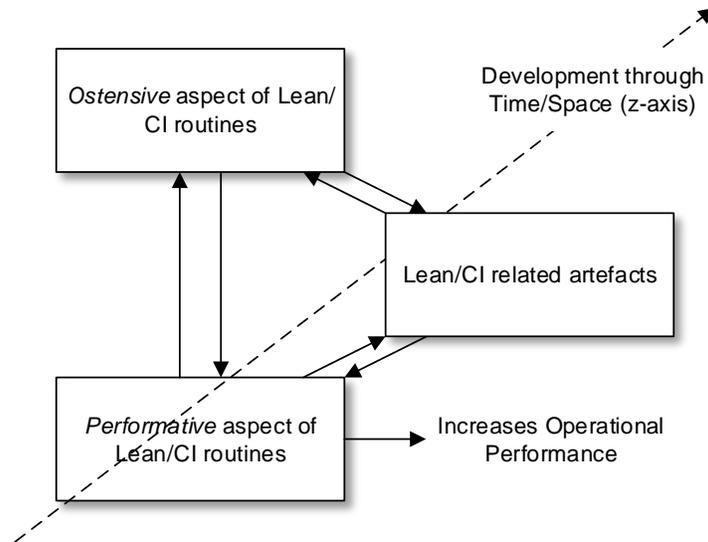


FIGURE 2
Case selection strategies: diverse (A. dashed and B. dotted circle) and extreme (C. solid-dotted circle)

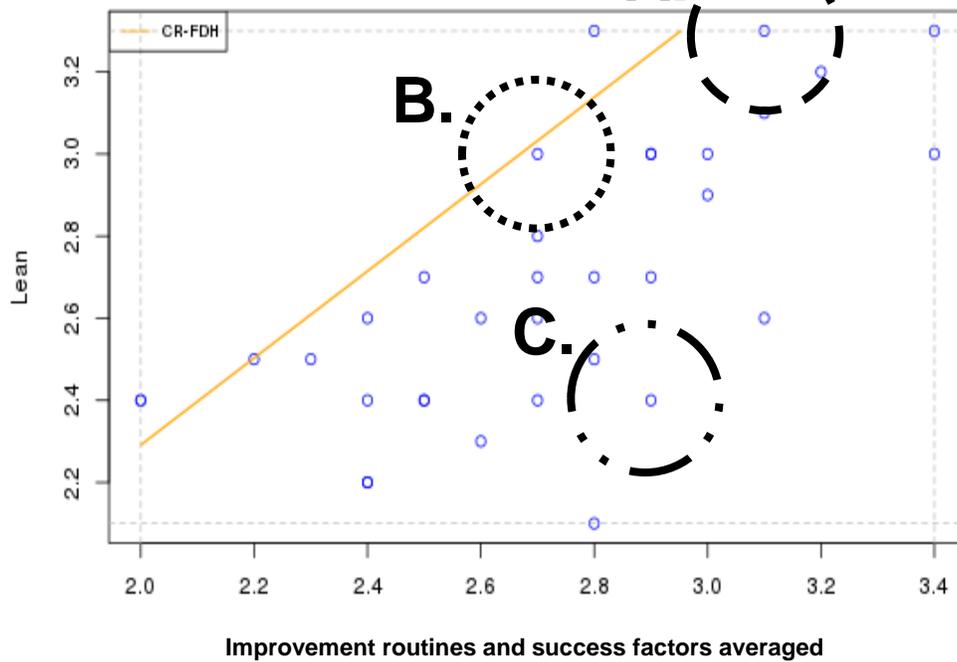


TABLE 1

Summary of the three case characteristics

Selection strategy	Case	Presence of lean practices	Presence of improvement routines and success factors	Industry/products	Layout	Number of employees	Interviewees
Diverse	A	Advanced	Extensive	High-tech electronics	Cells	400	11
	B	Some	Some	Concrete paving materials	Mass-product ion line	40	10
Extreme	C	Few	Extensive	High-quality metal building materials	Functional	100	11

TABLE 2

Code book on interventions to sustainably develop towards a lean organization

Aspect	Intervention	Definition	Quotation
Developing the ostensive lean/CI aspect	Engaging employees to develop understanding of the principles and ideas of lean/CI routines	The importance of lean and CI structures is sold to employees through lean games, internal or external excursions, training, data and/or involvement in improvement projects, and if necessary, discussions	When I asked [him] if he wanted to do the course, and that he would also do two or three projects every year, he was very hesitant, he was very busy already. He saw it as extra work. ... While I was talking, I tried to make it clear to him, you are doing those projects already, only now you get a tool to do it in a structured way, with a head and a tail, to efficiently manage your projects. Then he understood that he did not had to do anything extra but that his current work would be done in a more structured manner. Now he is almost done with his first project which is going very very well! - CI Manager Case B
Improving the performative lean/CI aspect	Providing employees with what is necessary to improve lean/CI routines	Employees are triggered and empowered to initiate and carry through improvement activities using measurement, tools and techniques and they are guided during the performance of these improvement activities.	I: How do you get people so far as that they do it themselves without you looking at it? R: I think they must experience it. ... When you approach relatively simple problems, you can show them the kind of influence they have themselves, so that they can pick it up themselves easily. – CI manager Case A
Implementing lean/CI	Finding and organizing	lean operations and CI structures, objects, tools	Here we came up with the train system. This is the pillar of our new method. ...

related artefacts	artefacts related to lean/CI routines	and systems are searched for, found and used to guide operations and improvement activities	If we expand this with hand scanners and we ensure prioritization through a funnel, where you throw everything in and then only one thing comes out, we are golden. - Manager Engineering Case C
Managing lean/CI routines through Time/Space	Maintaining feasible steps through Time/Space	Lead time of improvement projects is reduced by choosing manageable scopes, doing them sequentially and following up on them on a frequent basis for employees to experience that their efforts lead to a better workplace, understand the reason for improvement, reduce resistance and increase motivation to participate and thus keep momentum	At that moment it brought a lot of resistance because the employees said, "We can set our own pace but now you are pushing us." Then there was a heated discussion, where I said, "You must set the pace, but we also have to take steps because right now we have been on the same level for months." ... The agreement we made afterwards is that the plant manager goes to the shop floor every Wednesday afternoon to do his 5S round and to understand how best to facilitate them. ... After we made that agreement, you saw it progress very quickly. – CI manager Case B

FIGURE 3

Routines approach to sustainably develop towards a lean organization

