



## Researching Lean: Methodological implications of loose definitions

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### Abstract

**Purpose** – Lean Production has in Sweden become the dominating ideal for ‘best practice’ in rationalization, organizational development and how to organize the work system. However, research into the effects of Lean for different stakeholders has produced ambiguous results. Furthermore, Lean practices seem to overlap with other popular management concepts, such as High Performance Work Systems, World Class Manufacturing and Total Quality Management. This confusion, combined with different methodological and theoretical traditions, has led to much debate and contradictory conclusions regarding Lean.

The purpose of the paper is to illustrate some key methodological issues that need to be considered in future Lean research to allow increased understanding of Lean effects for different stakeholders, primarily meaning the customer, employer and employees.

**Design/methodology/approach** – The paper is based on a multiple comparative case study, in which five Lean case studies are presented. All of the studies are of recent origin, and based in Sweden. The cases have been compared and contrasted based on the approaches to Lean, in terms of local ideals, operationalization and implementation.

**Findings** – The findings from the case studies are in line with the existing literature, indicating that Lean has changed over time and that operationalization of the concept varies considerably between work life sectors. The findings demonstrate that approaches related to Lean differ significantly between the studied organizations and stakeholders. This applies to both the interpretations of the Lean concept itself, but also of the operationalization of Lean and implementation design.

Although the cases show great similarities in the Lean ideals, the concept takes on many different forms when operationalized, which makes it very difficult to study through a priori definitions.

**Practical implications/recommendations** – The large variation in interpretations of Lean complicates meta-analyses regarding potential impact of Lean on the primary stakeholders of an organization, i.e. the customer, employees and employer. Based on the case studies, we suggest that future investigations describe the Lean interventions in more detail. General descriptions or analogies, e.g. ‘learning organizations’, presumably increase the present confusion regarding Lean impact on different stakeholders.

The case studies also illustrate the importance of describing factors that may mediate the effects of Lean, e.g. the local context of the investigated organizations, implementation design. More research is needed to identify these factors, how, and to what degree they mediate the consequences from Lean.

**Originality/value** – The multidisciplinary approach of the included case studies provides an empirical richness that allows us to address the specific issues that need to be focused in the various disciplines investigating the impact of Lean on different organizational stakeholders.

**Keywords** – Lean, methodology, stakeholder effects, mediating factors, validity

**Paper type** – Research paper

## Introduction

The use of Lean Production, or Lean-related methods and practices is currently common in the Swedish manufacturing sector. 'Lean'-labeled change programs has also become increasingly common within healthcare, construction and the service sector (e.g. SALAR, 2012, Arlbjørn et al., 2011, Börnfelt, 2006, Johansson and Abrahamsson, 2009).

Despite an extensive amount of Lean research, there is at present no consensus regarding a definition of Lean. Researchers and practitioners disagree on both the nature and content of Lean. As demonstrated by Pettersen (2009), there is considerable variation in academic presentations of Lean, and the concept is seen as either a philosophy, toolbox, strategic goal or a change process. Rather than focusing on a single property, Pettersen (ibid.) argues that Lean can be seen as a multi-dimensional concept that comprises all of these aspects. Further, Hines et al. (2004) have shown that Lean has changed over time, from specific shop-floor practices to a more general concept, and further onto the more abstract 'Lean thinking'. This notion resonates with the finding that Total Quality Management has moved from rational to normative control (Giroux, 2006). Other studies have shown that this kind of transition is normal for management concepts in general (Barley and Kunda, 1992). This variation is likely caused by influence from a variety of stakeholders, such as researchers, practitioners, management consultants and 'Lean gurus' (Kieser, 1997, Giroux, 2006).

The conceptual 'fluctuation' of Lean has several important consequences for researchers. First of all, in order to better understand Lean programs, it is important for researchers to describe the interventions in detail. Currently, this is rarely the case (Brännmark et al., 2012). Consequently, it becomes difficult to assess, or even understand, what type of organizational activities that are labeled as 'Lean'. General principles, such as 'customer focus' or 'just in time', can have many different meanings (Alvesson et al., 2008). There are also myths and misunderstandings about the origin of Lean, i.e. Toyota and Japanese companies approach to Lean manufacturing (Mehri, 2006, Karlsson, 1999, Masami, 1994). This further adds to the 'fuzziness' of the Lean concept. Thus, we need a better understanding of what organizations actually *do*, when they 'do Lean'.

Furthermore, when studying effects of Lean programs, several 'non-Lean' factors need to be considered, since they are likely to have a stronger impact on the outcome of Lean for different stakeholders compared to the concept itself. These factors include implementation design; management style; relationship between management, unions and the personnel; important stakeholders interpretation of the Lean-concept; the context of the organization; product life cycle; innovative capability; product characteristics, e.g. volume and customer adaptation (Brännmark et al., 2012, Westgaard and Winkel, 2011, Landsbergis et al., 1999, Hampson, 1999, Hasle et al., 2012, Berggren, 1993, Shah and Ward, 2003, Fullerton et al., 2003, Langstrand, 2012).

Thus, in order to better understand the operationalization of Lean and its potential impact on various stakeholders, theoretical and methodological clarifications are in order. This applies to the concept itself and the causal link between Lean and organizational outcomes. Such clarifications do not, however, imply a conceptual definition of Lean. Instead, new methodological approaches must be capable of handling the varying and often vague nature of the Lean concept. Although some attempts have been made in this regard (e.g. Hasle et al., 2012, Genaidy and Karwowski, 2003, Westgaard and Winkel, 2011), this area requires more research.

The purpose of the paper is to illustrate some key methodological issues that need to be considered in future Lean research to allow increased understanding of Lean effects for different stakeholders, primarily meaning the customer, employer and employees.

## Method

### *The Swedish Lean Research Network*

During 2010, the *Swedish Lean Research Network* was initiated. The Network focuses on Lean Production and Japanese Production Systems, and consists of scholars from many different disciplines, using different scientific approaches and theoretical backgrounds.

The common frame of the Network is aspects of Lean Production and Japanese Production Systems, e.g. the nature of Lean, how to implement Lean and potential effects of Lean (e.g. impact on the working environment, innovation effects, quality effects, etc.). Today, the Network consists of about 40 scholars.

An initial research issue raised by the Network is the ambiguous Lean concept and the resulting research problems as discussed above. This paper is a joint project from several of the members of the network.

### *A case study approach*

The empirical basis of this paper consists of five Lean case studies performed by the authors of this paper, all members of the Swedish Lean Research Network. The case studies have not, however, been designed or performed with the specific purpose of this article. The cases are of recent Swedish origin, though the local context, the rationale for adopting Lean and also the type of organization varied. Consequently, the cases reflect a wide selection of different organizations and stakeholders and their interpretation and operationalization of the Lean concept.

As a consequence, the original research purpose, design and methods for data collection varies between the cases. A number of considerations have been made in order to reduce the negative impact of this variation. Firstly, a conceptual framework for the subsequent analysis in this paper has been created. This framework comprises four categories.

1. influential Lean models for the operationalization of Lean in the specific case study, if this information was available (i.e. general ideals);
2. aims and goals of the Lean initiatives as perceived by the initiating organizations in the case study (i.e. the local ideals);
3. the operationalization of Lean in the case studies, e.g. Lean tools, methods and strategies;
4. the implementation strategies used in the case studies.

The aim of this framework is to create a basis for making cross case analyses of recurring patterns and possible inconsistencies across the cases. Hence, this framework will help illustrate the level of variability in Lean ideals and operationalization between the studied organizations. The logic behind this approach is to provide specific descriptions of

organizational practice rather than rely on general and vague terms such as ‘Lean Production’. The second part of the research process has involved careful selection of cases to ensure that a sufficient amount of information on each category of the framework. The third step has been to extract information from each individual case study, to form a basis for the subsequent analysis. This was achieved by transforming the conceptual framework into a cross-case matrix (Miles and Huberman, 1994) that encapsulates the various elements of each category (see table 1, below). Based on this matrix, the case descriptions in the following chapter were created.

Details regarding the methodological approach of each case study may be retrieved from previous publications referred to below.

### *Analysis strategy*

Based on the four categories described above, the case studies were first analyzed for internal consistency. The local ideals were compared to two existing influential Lean ideals, i.e. the models proposed by Liker (2004) and Womack and Jones (2003). While there are many other Lean models, these two are plausibly among the most influential models (Pettersen, 2009). Therefore, they serve well as ‘reference models’ for the local ideals used in each case study. The operationalization, i.e. the choice of principles, practices and techniques, were compared to the local ideals and the espoused goals of the Lean initiative. Finally, the implementation strategies were compared to the elements of the operationalization.

In the second stage of the analysis, the case studies were compared and contrasted to each other, with respect to the four categories of the framework. Any differences and common aspects of the local ideals, operationalization and implementation strategies were noted and discussed further. Finally, the outcome of these discussions formed the basis for the categories presented in the discussion chapter of this paper.

‘Organizational stakeholders’ will here primarily refer to Eklund’s (1998) definition of the three main stakeholders of most organization. These are the customer, the employees and the employers, representing the owners. Consequently, ‘stakeholder effects’ could also be expressed as effects on system performance and the sustainability of the work system (e.g. Westgaard and Winkel, 2011).

## **Results**

### *Case study 1: a Swedish national Lean program (Brännmark, 2010, Brännmark and Eklund, forthcoming)*

The Swedish national program named ‘Produktionslyftet’ (‘The Production Boost’, in English) aims at supporting medium sized manufacturing companies in their Lean implementation processes. Rationale for the program, i.e. the program ideology, is that Swedish industry is losing its competitiveness against other countries, e.g. low cost manufacturing nations. Hence, they must become more effective to survive. According to the program’s inspiration seminars, the solution is for them to adopt Lean Manufacturing. In terms of Lean, the program representatives are heavily inspired by Liker’s (2004) Lean interpretation presented in book *The Toyota Way*.

To assist the companies in their Lean implementation process, a heavily subsidized change program is used. ‘Produktionslyftet’ aims at recruiting companies with a management

commitment to Lean. The selected companies are then supported by an extensive consulting approach, consisting of both courses, coaching in Lean techniques and methods, as well as other related methods, e.g. change management, quality management. Commonly used Lean tools are, with a few exceptions, housekeeping through 5S, improvement groups, value stream mapping, standardization and methods for set-up time reduction (usually summarized under the acronym 'SMED', i.e. 'single minute exchange of die'). All companies also develop and document their interpretation of the 'Lean philosophy'.

The implementation design is similar to classical project management; Lean coordinators are appointed, operative steering groups are used, most of the work is initiated through pilot projects, etc. However, several of the Lean tools are often integrated into the implementation design; e.g. pilot projects based on 5S or value stream mapping, improvement groups being used to introduce and maintain new Lean tools, etc. The program initially sought to create a broad commitment in the company for Lean, through methods such as Lean Lego Games, etc. It is also an aim to adapt the program's approach to the included companies, though the program has now become more normative, instead prescribing what the companies should do, e.g. their selection of Lean tools.

***Case study 2: a large Swedish manufacturing company (Langstrand, 2012, Langstrand and Elg, forthcoming)***

HiTech Inc. (a pseudonym) produces, sell and service complex machinery for industrial applications. The company is located in the middle part of Sweden, and the main site has approximately 2000 employees, which makes HiTech one of the largest companies in the region.

The initiative to introduce Lean came from the corporate head of production in 2003. In a series of discussions with the production manager at HiTech, they agreed on a number of principles that would form the basis for their Lean initiative: standards, continuous improvement, teamwork, leveled workload and takt production flow (i.e. a production pace in sync with customer demand).

The HiTech management team felt that they did not have the capacity to drive the change process on their own. Therefore, a 'Lean coordinator' was brought in as an advisor, and an external consultant was invited to assist the management team.

With the help of the consultant, an implementation plan was designed. According to this plan, HiTech would initiate the change process by implementing a few basic methods – 5S and Visual Management – and use these as a base for successively implementing other methods associated with the Lean concept.

Early in the process of introducing Lean, the management team realized a need to create reference areas for testing of Lean principles. This led to a pilot project in one of the production units. The project was initiated with a value stream mapping, which was performed during 2005. Based on the results of this analysis, a project plan was designed, with the aim of introducing kanban and to reduce the lead-time and production cost within the unit. A project team was installed to manage and monitor the project.

The change has been managed as a typical top-down process. All managers have received extensive training in Lean, while operators have only received general information about the concept.

***Case study 3: an union approach to Lean (Johansson, forthcoming)***

IF Metall organizes 350.000 workers within different sectors in the Swedish industry where Lean production is found to be the leading management concept. The trade union recognizes the need for an effective industry in order to maintain and increase the competitiveness of Swedish industry, which in return secures their members employment. In order to ensure that the implementation of Lean does not deteriorate their members working conditions, their aim is to take an active part of the implementation process. The concept of 'The Sustainable Work' provides guidelines for trade union representatives, aspiring at developing the work organization as a mean to obtain an enlarged work content and development in work, leading to workers motivated to engage in the development of the company. In order to achieve this win-win situation, partnership between employer and trade union is stressed as necessary, as found in 'Produktionslyftet' or in the on-going European Social Fund project 'Sustainable Development and Competitive Strength'.

In the latter, nine companies with a background in Lean production, in some cases obtained through 'Produktionslyftet', participates. The goal of the project is to increase productivity and enlarge the work content obtained through for example work rotation and new or enlarged roles at the shop floor, initially implemented in pilot groups. Competence development is a significant part of the project, for example in leadership, preceptorship and team building. The project is based on the idea of partnership on three levels, central/regional and local, where steering groups consisting of participants from different trade unions and management representatives owns the change process at each company. Local change leaders/Lean coaches or trade union representatives are responsible for the implementation, supported by an external coach with deep knowledge in development processes, trying to adapt this new way of working to the companies' existing values, visions and strategic plans.

***Case study 4: a Swedish municipality (Brännmark et al., 2011)***

A medium sized municipality currently runs a program to introduce Lean in its welfare section. The program's rationale is that less money will flow into the system due to changes in demography. This occurs at a time of change towards a more elderly population, presumably with different needs and expectations than today's old age pensioners. The program is influenced by the 'Verksamhetslyft' – an education program catering to the public sector.

The implementation of Lean is designed and executed by a support team, consisting of two Lean leaders and a number of Lean coaches recruited within the organization. The program was requested by the director of social welfare. The aim is to implement Lean thinking to increase efficiency, provide appropriate service for care takers and clients and to make better use of existing competence and skills among employees. The Lean support team is monitored by the top management steering group, but up until now the Lean support group has been rather self-steered, answering to the director of social welfare and the chief executive of Social Welfare development only.

In the implementation phase, along with massive promotion work from top management and the support team, all managers, on all levels, are educated and trained in Lean philosophy and Lean tools. Each work unit is then supported by Lean coaches. Value stream mapping is the first and most commonly used tool, often followed by the introduction of improvement groups. Other tools such as 'five why', A3, 5S, and visualization are used on a smaller scale. The introduction of Lean is made in a similar way, by support from the Lean coaches, in all work

units. After the initial months the units can choose more freely how to adopt Lean. It is however not negotiable to say no to Lean thinking.

***Case study 5: medium sized manufacturing companies (Abrahamsson, 2009, 2002)***

Case 5 is a longitudinal study of eight large and medium sized industrial companies (pulp and paper, electronics, food) attempts to implement something that can be described as ‘a modern organization’. The first study was conducted 1994-1998. Although the studied projects had not been entitled Lean they had many in the first years a clear inspiration from the ‘first wave’ of Lean and they combined this with the ideas of learning organization and flow organization. The projects aimed to achieve better product quality and organizational effectiveness by creating production flows from order to customer. The main approaches were 5S, shorten lead times and remove bottlenecks in production. There was also a lot of talk about focusing on core processes, continuous improvements and flexibility. More concrete the project attempted to introduce job rotation, self-managing teams and delegation of white-collar work-tasks to blue-collar workers. The companies also refurbished machines to follow the flow organization. An important part of the projects were different internal courses designed to broaden the skills of the employees, but also induce co-creation, change readiness and a sense of ownership among all employees. It was a clear top-down-approach, but all the companies made their implementation projects in cooperation with the unions and in a positive spirit in order to do good for both the company and its employees. Despite this the organizational changes proved difficult to implement and the change processes was characterized by problems and restoring responses.

The follow-up study 2004-2005 included return visits to three of the previously studied companies (two pulp and paper and one electronics) and their change projects. The organization projects that the companies now were working with were to a high degree a continuation or rather a reboot of the change projects they had ten years earlier, but with the difference that now the projects had names with the word ‘Lean’ in. The projects contained different types and combinations of the usual tools and elements of Lean, but also organizational ideas, for example cross-functional process teams. The companies were in this way, examples of the ‘second wave’ of Lean. This follow-up study showed that some of the restoring responses found in the first study had had temporary duration and the companies now implemented parts of what they were talking about ten years ago.

## **Discussion**

A comparison of the cases shows that they share a similar rhetoric; an outside ‘threat’ causes a need to increase efficiency. The expected effects of Lean are also similar. However, when reducing the level of abstraction in the analysis, the variation across the cases increases in terms of how Lean is interpreted and operationalized, though this does not seem to apply to implementation design. In fact, it seems to be relatively homogenous across the cases. This may not be surprising, given that they mostly conform to ‘classical’ project management models and methods (Winter et al., 2006).

When comparing these results to the models proposed by Liker (2004) and Womack and Jones (2003), there are noticeable similarities as well as differences. Operationally, the studied cases seem mostly influenced by Womack and Jones, exemplified by the wide-ranging use of value stream mapping. These results are similar to studies of common tools

and approaches used in Lean Healthcare and Lean applications in municipalities (Poksinska, 2010, Mazzocato et al., 2010, Brännmark, 2012, Arlbjørn et al., 2011). Apart from value stream mapping, there are few similarities between the case studies. Even within similar contexts there is substantial variation in the operationalization of Lean.

Both Liker (2004) and Womack and Jones (2003) share a similar rhetoric: They argue that the Lean concept will create the most efficient organizations, while simultaneously providing better jobs and increased customer satisfaction (Womack and Jones, 2003, Liker, 2004). Clear traces of this rhetoric are evident in all of the included case studies, albeit with some variation. For instance, in the case of the national program 'Produktionslyftet', the importance of industrial competitiveness is stressed, while the importance of creating good jobs and sustainable work systems are emphasized in the union case. However, the common theme is still increased efficiency, though the argument for increasing efficiency varies.

Consequently, based on the included case studies and the comparison to the most popular Lean ideals (i.e. Liker and Womack and Jones), there are reasons to argue that the main 'theme' in these case studies are organizations seeking means for becoming more efficient, though for differing reasons. Although all the studied organizations claim to be working with 'Lean', this seems to mean 'seeking increased efficiency through value stream mapping and X', where X can have a wide range of meanings. This is summarized in table I, below.

These aspects raise several highly important methodological issues. Given the significant variance in these organizations' operationalization of Lean, the mere fact that they all label their change programs as 'Lean' tells us little about their actual contents. It may, however, say something about the expected output and rationale for the change programs, i.e. seeking increased efficiency. Methodologically this has at least two implications.

Firstly, it means that we need to describe the Lean interventions in detail, if we are to understand what these organizations actually *do* as part of their Lean programs. Simply relying on the label 'Lean' tells us little about the Lean interventions. This also applies to our understanding of the causal link between Lean programs and specific organizations outputs, in terms of impact on system performance and employees. As an example, in literature reviews evaluating effects from organizational models and change, it could make more sense to group publications based on used (Lean) tools and methods, rather than different management concepts.

Secondly, the large variance in different organization's operationalization of Lean means that studies lacking a detailed description of the Lean interventions and the applied methods will have little scientific credibility. Hence, more vague and general descriptions of Lean, relying on 'Lean principles' or analogies (e.g. 'learning organizations'; Hines et al., 2004), are not a viable way to handle the vagueness of doing research on the Lean concept. Conversely, more methodologically rigorousness, including better descriptions of the case studies and Lean work, would be the best way to handle research on concepts using loose definitions, e.g. Lean Production.



Thirdly, the case studies also implicate the need for proper assessment of key mediating factors when evaluating the success of Lean programs. In the case studies we have large contrast in some of the factors previously shown be crucial for the outcome of introducing Lean: stakeholders initiating the change program, the type of organization and type and degree of participation in the change process. In a Scandinavian context these modifying factors seem to be particular favorable (Winkel, 2009, Björkman, 1996, Johansson and Abrahamsson, 2009) suggesting more sustainable advantages for Lean practices in this part of the world. For instance, in several of the case studies, there is a focus on creating a ‘win-win’ situation for all stakeholders, or even using Lean as a strategy for optimizing between individual, social and financial/competitive demands in the organization, i.e. increasing the sustainability of the production system (cf. Westgaard and Winkel, 2011).

**TABLE I COMPARISON OF CASES**

	<i>Case 1</i>	<i>Case 2</i>	<i>Case 3</i>	<i>Case 4</i>	<i>Case 5</i>
<b>Local ideal</b>					
External threat	●	●	●	●	
Value generation	●	⊙	●	●	
Increased efficiency	●	●	●	●	●
Higher motivation	⊙	⊙	●		●
Improved working conditions	○	⊙	●		●
Systems thinking	●	●	●	●	●
Influence from ‘gurus’ (e.g. Liker)	●	●	⊙	⊙	
Customer satisfaction	⊙			●	
<b>Operationalization</b>				○	
Value stream mapping	●	●	⊙	●	●
5S	●	●	⊙	○	●
Standardization	●	○			●
Just in time/Kanban	○	●			●
Setup time reduction	●				●
Visual management	○	●		○	●
<b>Implementation</b>				●	
Values and culture	●	●	●		●
Improvement teams	●	●	●	●	●
Steering groups	●	●	●	●	
Consultant support	●	⊙	●	⊙	●
Lean coordinators	●	●	○	●	
Pilot projects	●	●	●		
Education/courses	●	●	●	⊙	●
Active ownership	⊙	○	⊙	●	
Local adaptation of concept	⊙	○	○	○	
○ Limited; ⊙ To a certain extent; ● Extensive					

## Conclusion

Future Lean studies need in particular to include more detailed descriptions of the investigated Lean interventions and key mediating factors in order to enable subsequent scientific meta-analyses regarding impact on different organizational stakeholders.

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