

IMPLEMENTING OF LEAN MANUFACTURING IN SME COMPANIES

Søren Højmark JENSEN*, Kristian Haahr JENSEN**

* University of Southern Denmark, Denmark

** Alfa Laval Kolding, Denmark

Abstract. The start-up phase is a decisive step to achieve success when implementing Lean in the company. The paper demonstrates how the implementation of Lean Manufacturing can be approached, illustrated by comparing and analyzing two distinct companies and their different approach to start-up the implementation of Lean Manufacturing. The two industrial companies are a small company employing 40 people and a medium sized company employing 630 people (40 to 50 people are employed in the present department).

Keywords: Lean implementation, SME companies, motives and achievements, start-up procedures

1. Introduction

It has previously been pointed out, that Companies working according to the LEAN concept achieve remarkable improvements in efficiency [4].

“Lean Thinking” states five elements to implement lean [3]:

1. Specify Value
2. Identify the Value Stream
3. Flow
4. Pull
5. Perfection

To help not to skip the most critical element 2: Value Stream Mapping“, “Learning to See” was launched [1]

The Main activities here are:

1. Identify *product families*
2. Map the existing flow, *Current State Map*
3. Map the ideal flow, *Future State Map*
4. Prepare the *action plan*

It is already known, that Lean philosophy originates from larger scale productions in automotive industry. This paper, however deals with a small industrial company employing 40 people and a medium sized company employing 450 people (whereof 60 people are employed in the present department) and demonstrates how the implementation of Lean Manufacturing can be approached. This is illustrated by comparing the two distinct companies and their different approach to start-up the implementation of Lean Manufacturing.

2. The medium size company

Alfa Laval Kolding A/S is part of Alfa Laval Corporate AB (Sweden). Products are pumps, valves, etc. for fluid handling. Total People in Kolding: 630 (40 to 50 people in the present department).

2.1. Motive

In beginning of year 2006 the company was in a crisis. There were lack of competitiveness, and lead times so long that manufacturing of the majority of parts was in risk of being outsourced, resulting in closing down of departments and making people redundant. Furthermore 80% of customers demanded delivery within 2 – 3 days. This could not be complied.

These threats ought to be complied by introducing Lean Manufacturing; naturally the company’s need for introducing Lean Manufacturing could not be neglected.

2.2. Starting up

The start up procedure was a success, and the company attaches importance to the fact that the process was initiated bottom-up. During a 2-day workshop for all blue- and white-collar people in the department, the potential of implementing Lean Manufacturing was estimated. The workshop gave information in basic lean principles and training through a classic lean game. Hereby the employees gained experience in lean, kanban, flow, the seven wastes (Muda) and kaizen (continuous improvements) and made Value Stream Mapping (VSM) for roughly defined product families in the whole factory. This stated

the basis for estimation for the potential for introducing LEAN Manufacturing in the whole factory through reduction in stock, work in progress, standard times, etc.

The report was presented for the group management and made basis for a plan of implementation over a three-year period.

Implementation was now started up top-down, following the five elements procedure [3].



Figure 1. Pictures from the workshop

2.3. Create conditions for flow

After VSM the next step was to create pull. Analyzing and improving the flow involved dedication of machinery to product-families in flow type of product layout instead of the traditional job-shop type of layout previously. SMED-activities (Single Minute Exchange of Die) did improve machinery changeover times, and released capacity from these reductions in changeover times has been applied for reductions in batch sizes, now equivalent to one-day production. Lead times have considerably decreased.

The flow-type layout has been worked-out in co-operation between blue- and white collar employees and involves:

- Parts are now handled in boxes placed on carts, and moved by the operators (previously parts were handled on EUR-pallets, and batch sizes were tailored to these pallets, forklifts and stackers are no longer needed for handling work in progress)
- Work in progress is no longer held on racks in warehouse but kept on carts on floor level
- General overview is now formed without use of computers

The result of this new flow-type layout was that the relocation of 12 to 14 machines and workplaces could be done one machine/workplace a day.

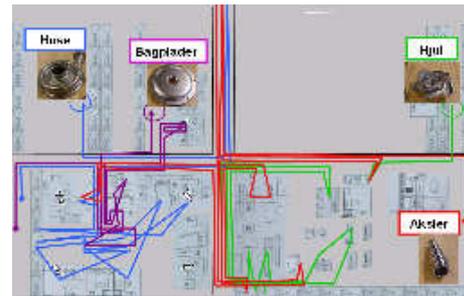


Figure 2. String diagram before: 1340 transport meters in total

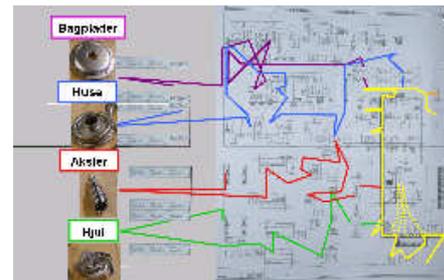


Figure 3. String diagram after: 630 transport meters in total

2.4. Create pull

Next step was to introduce Kanban to only produce parts after customer demands.

Content of one box is the Kanban Card. These boxes are held on carts and moved by operators. Parts remain on floor level, boxes acts as Kanban Card and work in progress is no longer put on shelves. Planning of the production is minimised, and visually follow-up is possible for everybody.

Production control papers are now out of use and the MRP system no longer needed for planning between operations.



Kanban Box



Cart with Kanban Boxes



The Lean setup: Kanban and Supermarket
Figure 4. Stock methods

2.5. Perfection

After the first rollout focusing on creating Flow and Pull (Kanban), there is now a demand of implementation of Kaizen (continuous improvements) and stabilisation the production process.

A great challenge is to make Kaizen part of the culture and to supply responsibility to the operators to make them run the minor projects derived from kaizen. It is not sufficient that operators create good ideas; they also must be given roles and responsibility to make them run the implementation of these projects. Operators now make contact to needed suppliers independently to implement their own kaizen projects. Otherwise these minor kaizen projects could be delayed in offices or repair departments. Idea-box is not in use. A great challenge is therefore to make the operators feel responsible for these kaizen projects. Problems and proposals are debated in short morning meetings of max. 15 minutes.

2.6. Achievements from implementing

	Current situation	Phase I Short term Fulfilled	Phase II Long term (1-3 year)
Internal Transport distances	100 %	50 %	30 %
Lead time			
Pump shaft	100 %	47 %	< 25 %
Pump impeller	100 %	61 %	< 25 %
Back plate	100 %	73 %	< 20 %
Pump casing	100 %	85 %	< 15 %
Work in Progress	100 %	58 %	36 %
Stock and work in progress	100 %	49 %	39 %
Productivity	100 %	107 %	130 % (Fulfilled)

2.7. In Phase II (1-3 years) focus will be on: Ergonomics, Balancing, Kaizen activities, 5S and on-going implementing of Kanban.

2.8. Recommendations from the company:

Start out reading the book "learning to see" [1] and get busy in a happy way.

Had we started out with 5S-activities without creating flow and pull in the first hand, the whole lean project would have failed and should be closed down without creating any valuable improvements.

Realize that implemented improvements must be of a size great enough to draw the need for more improvements! An example of this is Kanban (pull). Kanban depend on low variation in Lead Time. Implementing of kanban therefore draw the

need for creating low variation in lead-time, giving need for other kaizen activities, etc.

Focusing on flow and customer (Kanban) bring heavy effect on lead time and stock and again draw the need for stabilizing through 5S, TPM, SMED, Kaizen and balancing

The major challenge was how to involve all partners or the whole organisation, as Lean involves the entire chain from purchase to sale. There is need to organize the entire chain into the lean project.

3. The small company

SKIOLD MULLERUP A/S, a small company employing 38 people in total. was founded in 1901 under the name "Plovfabrikken Mullerup", has lived more than 100 years as one organisation. For several generations, the company has developed and manufactured machinery for the Danish agricultural sector. Today the company exports more than half of its output, and approximately 50% of the products sold have been introduced to the market within the last five years.

3.1. Motive

A newly developed product didn't match too well to the existing facilities. The oldest parts of the buildings date back to 1916, and the company was in need for making the production more effective, to avoid outsourcing of the production.

3.2. Starting up

In beginning of year 2005, the production manager attended the "Getting started" seminar of the course unit: "Analysis of Production Processes of Industrial Companies (LEAN manufacturing)" for 4.th and 5.th semester students of the B.ENG. in Manufacturing and Management at SDU. The seminar is named "Four Days with World Class Manufacturing Principles" and is run over four days. This seminar inspired to have a group of 5 semester students doing their semester project in the company.

The project pointed out potentials for developing the production. Subsequently a strategic plan for developing the production over the years 2005 to 2008 was prepared by the company. The plans incorporate/involve new production principles and technologies to improve productivity and reduce waste and investment.

A proper VSM was skipped in favour of activity/relationship analysis based on production orders in the previous year (2004). In total 13.500 production orders were analyzed.

3.3. Step 1

All arrangements of the production were marked by adaptation to products already phased out. The decision was to skip VSM and start up 5S activities.



Figure 5. Before: 20 m shelves with outdated drilling jigs.

After: Requisite number of drilling jigs on rack, close to machinery

3.4. Step 2

Continue to improve operator involvement by introducing idea box.

3.5. Step 3

Improve flow by reorganizing the job-shop layout to a flow optimized product layout based on optimizing of flow based on analyzing of 13.500 production orders in 2004 in Relationship diagrams.

Before reorganizing, the layout involved 27 machine tools and workstations. After reorganization the number is 13 in total.



Figure 6. Preparing for flow optimized layout

3.6. Objectives and achievements for the years 2005 and 2006

Objectives	Achievements
Reduce stock by 15%	Reduced by 15%
Raise productivity by 7% or raise sale and keeping costs	Productivity raised by 10%
Reduce production area by 1500 m ²	Reduced by 1500
Rent out of emptied area	800 m ² now rented out
Reduce cost for heating, illuminating and maintenance	Oil consumption reduced by 16.7%

3.7. Objectives for 2007

Implementation of KanBan.

Electronic production control rather than paper based.

Introduce new ERP system.

Extended use of conveyors for handling of parts.

4. Conclusion

The small company omits to prepare a proper Value Stream Mapping in favour of starting out with 5S activities before creating flow, as the arrangements of production facilities were marked by adaptation to products already phased out. This company use Idea Box to maintain operator involvement.

The medium sized company claim that if they had started out doing 5S activities, without creating flow and pull in the first hand, the whole project would have failed and should be closed down without creating any valuable improvements. This company follows the five elements plan mentioned in the introduction but omits Idea Box as a tool for operator involvement.

Both companies achieve good results and it must be pointed out, that the approach on how to start up implementing Lean manufacturing must be adapted to the situation in the company. It is the authors' recommendation, however to follow the five elements plan, and only on very specially occasions omit the important step to make a Value Stream Mapping.

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