

REINGEENERING OF THE PRODUCTION SYSTEMS USING LEAN PRODUCTION CONCEPT

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Abstract

The philosophy of lean production offers a wide variety of advantages. Lean production concept is understood as the realization of lean principle through the efficient application of methods and tools, faster and more effective discovering of wastes and mistakes in the production systems. This paper deals with the possibilities and effects of usage of certain principles of lean production concept in the shipbuilding industry in Croatia. A graphic description of work process and Value Stream Mapping analysis are bases for encouragement of managers to make decisions about increasing production effectiveness. For this analysis the software tools electronic Value Stream Designer has been used.

Keywords:

Lean production concept, shipbuilding industry, Value Stream Mapping.

1 INTRODUCTION

At the turn of the third millennium the world industry has found itself in probably the largest restructuring since the first industrial revolution. The progress is determined by two trends:

- dynamic progress of information and communication technologies which have enabled the creation of new markets and the redefinition of entire professions,
- globalization of economy thanks to new purchasing and selling markets.

Such a progress forces enterprises to modify their production strategies. New competitors, greater changes in demand in the course of time in market stagnation present enormous cost pressure upon many enterprises. In order to meet customers' needs everywhere in the world, the enterprise should increase its flexibility.

The main requirements put upon industry are the following:

1. Cost pressure:

- stagnant markets
- great changes in demand
- producers with cheap working labour

2. Economy globalization:

- new selling markets (Asia/Eastern Europe)
- new purchasing markets
- new competitors

3. The third industrial revolution:

- new potentials obtained by the application of information and communication technologies,
- structural changes of the entire professions,
- new products and markets [1].

Nowadays, the main conditions for a successful enterprise are the following:

- the existence of products/ideas/services,
- the existence of the market,
- maximum fulfilment of customers' requirements,
- minimum use of resources.

A long lasting success will be achieved only by the enterprises that will, besides the necessary optimization of production process, identify and conquer new markets as well.

One of the possible conceptions for the survival in a turbulent world market is the introduction of new technologies and organisational structures (for example fractal factory [2], network enterprises [3], lean production [4], six sigma [5], business process reengineering [6] etc.). In this paper is shown the reengineering of one production system in Croatian shipbuilding industry using lean production principles.

2 LEAN PRODUCTION

2.1 Lean principles

Methods and tools used in lean concept modelling can be described as important elements in manufacturing system construction (Figure 1).

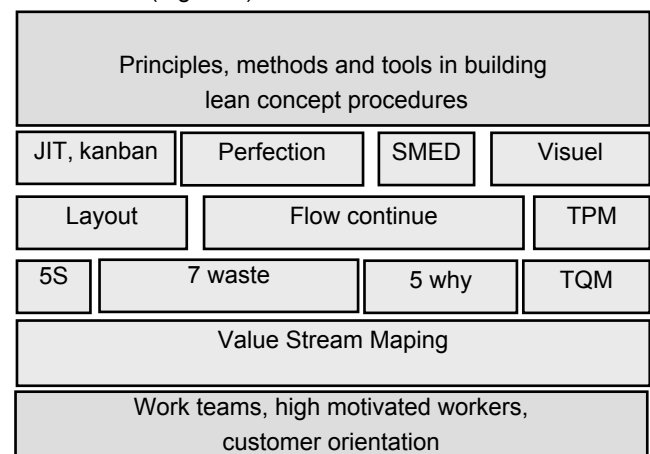


Figure 1: Lean concept principles, tools and methods [7].

As shown in Figure 1 that symbolically represents a house, the base of everything are: work teams, highly-motivated workers and the principle "5x why-1x how" which warns about the seriousness of every decision that lead to a goal. As all tools are important, they are arranged at random.

Beside these tools there can be produced and shaped others which in certain conditions give better results.

A graphic description of results and work process, and also Value Stream Mapping analysis are bases for encouragement of managers to make decisions about loss reduction and lean concept modelling with given tools and methods.

For this analysis the most efficient are software tools such as electronic Value Stream Mapping and statistical software MINITAB.

2.2 Value-Stream Mapping

Value-stream mapping can be a communication tool, a business planning tool, and a tool to manage a change process. Value-stream mapping is essentially a language and, as with any new language, the best way to learn mapping is to practice it formally at first, until it can be use intuitively [8].

Value-stream mapping initially follows the steps shown in Figure 2.

The first step is drawing the map of the current state, which is done by gathering information on the shop floor. This provides the information needed for developing a future state map. Notice that the arrows between current and future state go both ways, indicating that development of the current and future states are overlapping efforts. Future-state ideas will come up after mapping the current state. Likewise, drawing of future state will often point out important current-state information overlooked before.

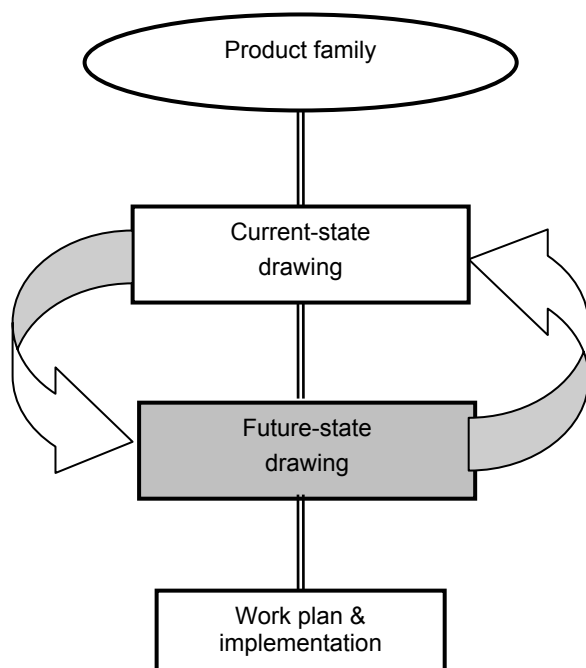


Figure 2: Initial Value-Stream Mapping steps

The final step is to prepare and begin actively using an implementation plan that describes, on one page, how it is planned to achieve the future state. Then, as the future state becomes reality, a new future-state map should be drawn. This is a continuous improvement at the value-stream level. There must always be a future-state map.

3 CASE STUDY

In this paper, the case of one production process in Brodosplit – Shipbuilding of special objects (BSO) factory is used for drawing the current-state explanation.

First, all the necessary data related to the selected production process has to be gathered.

The product family, for which the value stream will be monitored, is a group of pylons for gas platforms, produced in two versions. One version is for platforms Ida-A and Ida-B, and other version is for platform Ida-C. The pylons are used for strengthening platforms at the bottom of the sea. Gas platforms are positioned at two different sea depths in north Adriatic Sea, which is the reason for building the pylons of two different lengths, but of the same diameter.

The range for value stream for Brodosplit BSO will be at the “door-to-door” level, and starts from the main supplier of raw material (steel plates), which is the steel factory Makstil A.D. Skoplje – Duferco group. The value stream finishes with shipping to the customer, North Adriatic Offshore (NOA).

Current-state map is in Figure 3.

Information flow is drawn from right to left in the top half of the map space. In pylons production process in Brodosplit BSO case, the flow of information is drawn back from the customer (North Adriatic Offshore) to the Production Control department and from there to the steel plate’s supplier (Makstil A.D. Skoplje – Duferco group). There are separate lines for the synchronization of dimensions, quality and deadlines, for orders (contract and deadlines) and for daily quality control, as these are different information flows.

In the current-state map it is shown that material movements are pushed by the producer, not pulled by the customer. Push means that a process produces something regardless of the actual needs of the downstream customer process.

Push typically results in producing according to a schedule that predicts what the next process will need, which leads to inventory growth. Unfortunately, this is nearly impossible to do consistently because schedules change and production rarely goes exactly according to a schedule. When each process has its own schedule, it is operating as an “isolated island”, disconnected from any sort of downstream customer. Each process is able to set batch sizes and to produce at a pace that makes sense from its perspective, instead of the value stream’ perspective.

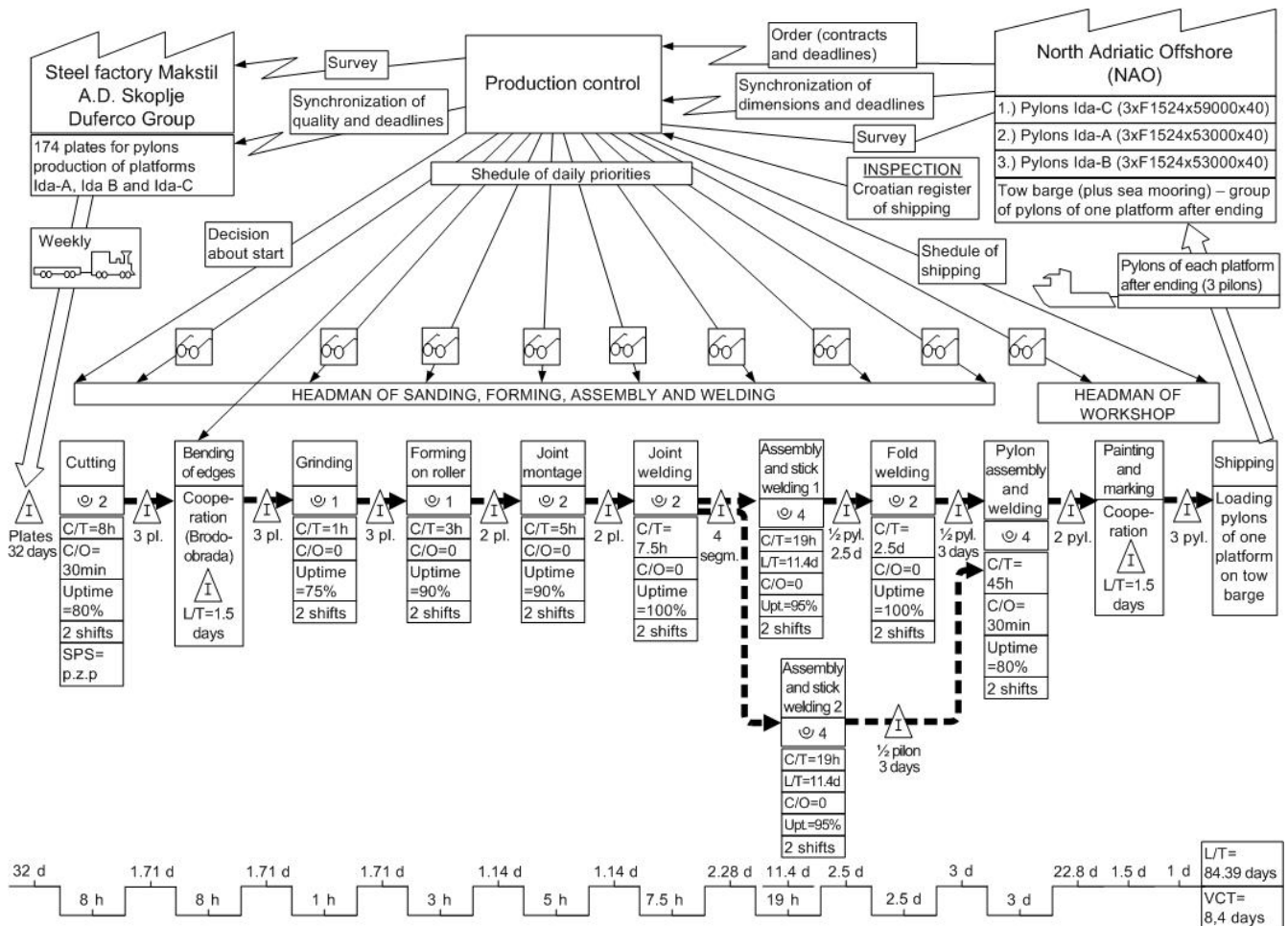
In this situation, the supplying processes will tend to make parts their customer processes do not need now, and those parts are pushed into local storage or, at the end, into storehouse without purpose.

This type of “batch and push” processing makes it almost impossible to establish the smooth flow of work from one process to the next that is a hallmark of lean production.

In pylons production process in Brodosplit BSO lead time is 84.39 days. For the production of one pylon 126 hours (8.4 days) are needed. The essence is to find out where 84.39 days are spent during the production.

The aim of the lean manufacturing is to get one process to make only what the next process needs when it needs it. It is necessary to link all processes, from the final customers back to raw material, in a smooth flow without detours that generates the shortest lead time, highest quality, and lower cost.

In order to succeed in implementation of lean manufacturing, the foreign experiences, like Toyota experience, are used.



Legend:
 C/T – Cycle time
 C/O – Changeover time

Figure 3: Current-state map with lead-time bars & data

In the future state developing process, the following guidelines are used:

1. Produce to the tact time
2. Developing continuous flow wherever possible
3. Use supermarkets to control production where continuous flow does not extend upstream
4. Try to send the customer schedule to only one production process
5. Distribute the production of different products evenly over time at the pacemaker process (Level the production mix)
6. Create an „initial pull“ by releasing and withdrawing small, consistent increments of work at the pacemaker process (Level the production volume)
7. Develop the ability to make „every part every day“ (then every shift, then every hour or pallet or pitch) in fabrication processes upstream of the pacemaker process.

Statistical comparison of the current state and the future state is given in Table 1. In future state process, lead time and total production time is about three times shorter than in current state process.

Steel plates lead time, before entering the Brodosplit BSO production process, makes the largest part of the saved production time (32 days).

Beside that, it is obvious that it is a big step forward in lead time and overall production time reduction achieved by the implementation of lean production process for the

future state design. Now, the plan how and when to implement this lean production on the shop floor of Brodosplit BSO is the next obligatory step for achieving more effective production system.

4 CONCLUSION

Lean concept has a powerful set of tools, methods and principles that when adopted can achieve superior organizational-management and also financial results. Its implementation principles must be applied in the whole industrial system to get more significantly the effects in work units and effective production systems.

Lean concept can neither be copied from other systems nor can implementation procedures be bought. This concept must be built in one system, in one Stockholder's community and kept constantly as a prevention measure on a way to perfection. The main bearers are people who lead the company to high-effective and efficient lean industrial system.

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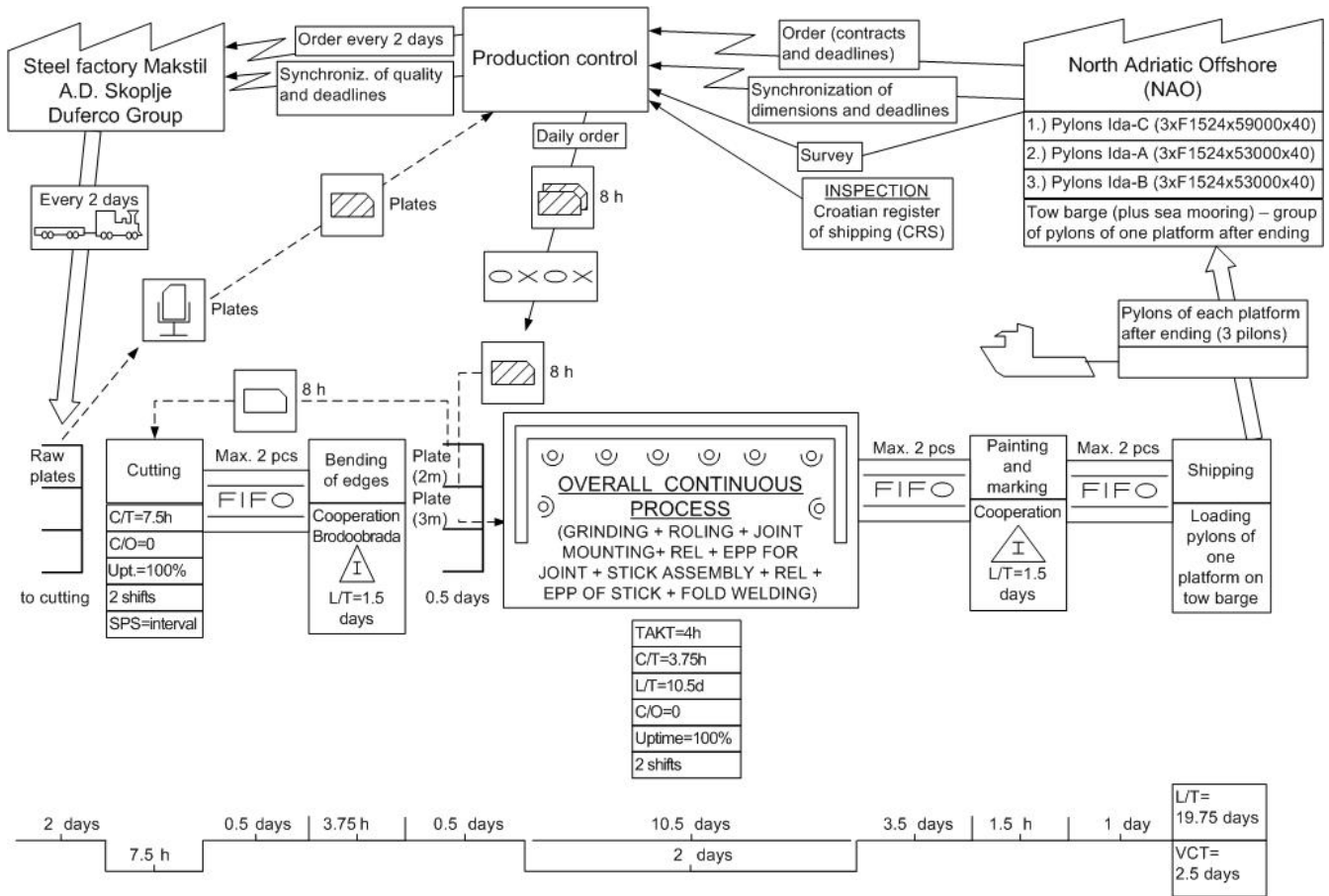


Figure 4: Future-state map with lead-time bars & data

Table 1: Comparison between current-state and future-state processes

	Incoming plates	Cutting	Bending (cooperation)	Overall continuous process	Painting and marking (cooperation)	Finishing pylons	Overall lead time L/T	Overall manufacturing time	Number of inventory turnovers
Before	32 days	1.71 days	0.5+ 1.71 days	23.17 days	1.5+ 22.8 days	1 day	84.39 days	152.79 days	3
Continuous flow and pull system	2 days	0.5 days	0.5+ 0.25 days	10.5 days	1.5+ 10 days	1 day	26.25 days	51.75 days	3
With production levelling	2 days	0.5 days	0.5+ 0.25 days	10.5 days	1.5+ 10 days	1 day	19.75 days	50.75 days	5

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