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VALUE STREAM MAPPINGIN THE ROMANIAN FOOTWEAR INDUSTRY

Case study

Keywords
Lean
Value stream
Value stream mapping
Footwear industry

JEL Classification
C20

Abstract

Cost reduction, productivity increase and creating value for the client are just a few of the arguments that managers use when they adopt Lean philosophy. Businesses' concern is to create products that have value in the eyes of the client, continuously analyzing the existing value stream in order to improve it. Value stream mapping (VSM) is a technique used to visually present the chain of processes, within the company, necessary to obtain the product. Due to the many advantages and to the ease of use experienced by Toyota since the '80, VSM use has constantly increased as this activity improvement technique was discovered by managers. The article presents a case study of the application of VSM in footwear industry.

1. Introduction

The Romanian footwear industry, has constantly increased lately, from40.431.864 pairs in 2009, to 49.745.937 pairs in 2013. This evolution has determined the consolidation of Romania's position in the word's footwear exporters market, being on the 14th place, in the last 4 years.

The competition is increasingly fierce, so the success of the Romanian footwear companies depends on taking into consideration all factors which lead to the improvement of the production system in an efficient and effective way. The efficiency is obtaining expected products or results in relation with the resources used in order to achieve them; the aim is to minimize the costs of the resources used in order to achieve the objectives.

The effectiveness implies the choice of successful objectives, the great the efficiency may be, it can't compensate the lack of effectiveness. So, the companies must make sure that the two concepts relate to eachother. This relationing can be carried out by using Value Stream Mapping (VSM).

Companies from footwear industry, as well as the ones from other industries, have to rapidly react to market's demand. This implies the use of practical tools which contribute to the process of redesigning the production system, the main objective being to achieve the competitiveness needed in order to stay on the market.

The aim of VSM is to map the value-added and non-value added activities necessary in obtaining a product the aim being that of identifying the improvement opportunities based on Lean philosophy, thus triggering optimization projects based on which future possible situationsare established. The mapping of the activities is made from the acquisition of raw materials to the delivery of the product to the client.

So, using this graphical technique, by using some standardized icons, we integrate in a single figure the logistic flow of materials and operations within the process of obtaining a product or a family of products. The symbols used are simple, so that the VSM users can easily understand the processes and the connections between them. (Figure no. 1)

VSM focuses on the connections and relations between different work units, offering an overview of all the stages, activities, duties, steps and actions of a process being a way of reviewing the processes themselves.

VSM is the basis for Lean improvements, revealing the way different departments, operational units etc relate within a certain process, and it's also used to examine the process in order to detect the possible errors and their causes.

2. Literature review

VSM is an instrument, first used by Toyota automobile factory and which was developed by Rother and Shook in "Learning to see" (1998). They define VSM as a very important instrument which helps improving and redesigning the production systems.

AbuthaKeer et al. (2010) thinks that VSM is a starting point for the companies that want to implement Lean system because, with its help, they can see the activities that add value and those that don't add value to a product which uses the same resources in a similar process.

Arbulo Lopez (2007) presents VSM as an instrument of "paper and pencil", simple and very potent, which helps viewing and understanding the flow of materials and information as the product suffers transformations.

Chakravorty (2010) refers to VSM as to a foundation used by the Lean performance system to promote the successful activity.

The promoter of this method, Taiichi Ohno (1988), refers to VSM as to an instrument that helps the companies to identify the activities that generate loss or that increase production costs but don't cause value growth.

VSM has the capacity to identify loss within company's processes by recognizing and removing the actions that don't add value and waste time and money in every production step (Sondalini, 2012).

Maskell, Baggaley and Grasso (2012) present VSM as a fundamental instrument of Lean manufacturing and Lean enterprises. They state that VSM is a starting point for Lean manufacturing and, like almost every aspect of Lean accounting, starts from value stream map.

VSM creates a one page image of all processes that take place in a stream of value (McVay, Kennedy and Fullerton, 2013). Keyte and Locher (2004) present VSM as being the most important instrument in the documentation and the management of lean transformations.

In what regards the duration of the mapping process, Keyte (2002) states that the mapping of the currentstate can be made in one day and the mapping of the future state in another day.

Our opinion is that VSM is a technique that aims to develop a value stream more efficient and effective with the help of which can be solved the economic difficulties generated by the market changes. The chain of value stream consists of all actions necessary to for designing and providing a product: the production flow from raw materials up to the client and the designing flow from the concept to the product release.

3. The caracteristics of Value Stream Mapping

As Womack and Jones (2003) formulate the principles of Lean philosophy, VSM falls into the second principle:

1. specifying the value of the product from the final client's point of view;

2. identifying the chain of value, removing the loss generating activities;
3. achieving a flow of activities that create value, so the product gets to the client in a continuous process;
4. the client or the beneficiary of the product must be able to apply the "pull" system to drag the product from the production flow;
5. operationalization and improvement of the process until maximum value is achieved, without loss.

They state that the initial objective when creating a VSM is to identify all actions necessary to design and manufacture a certain product, classifying them into three categories:

1. actions that create value in client's conception;
2. actions that don't create value, but which are necessary in the development of the product, management of the demand or production systems (muda type 1);
3. actions that don't create value in client's conception and which cam be removed immediately (muda type 2).

Rother &Shook (1998) lists the main steps within VSM:

I. choosing the family of products;
II. mapping the present state;
III. mapping the future state;
IV. defining a work plan;
V. implementing the work plan.

McVay, Kennedy and Fullerton (2013) present the first step as being the logistic planning of the mapping, and steps IV and V are presented as being the moment when the company must prepare an implementation plan for achieving the future state.

Also, regardless of the approach, VSM requires the mapping of the current state, analzying it and identifying possible improvements, followed by the mapping of the future state and implementing the improvement plan.

The mapping of the current state allows identifying the processes that generate loss or waste, like the overproduction, wasted time, unnecessary transport, unnecessary processing, useless stock, unnecessary movements etc.

The mapping of the future state has as aim the loss removal from the current value stream, to produce only what the client wants and when he wants. It has to be taken into consideration that the improvement process can stretch on a longer period of time and that is why we consider that a continuous improvement is needed. By taking small but secure steps instead of large jumps, that can lead to company's failure. So, once the losses and their causes are identified, the companies have to focus on removing them and triggering the improvement processes.

After a thorough review of the specialized literature, there were identified the following advantages of the VSM:

- provides a clear image of the manufacturing process;
- identifies the loss from the value stream;
- identifies the causes of loss fron the value stream;
- allows visualizing the future effects of the improvement measures;
- allows fast and efficient actualization of the processes within the company;
- identifies the opportunities of improving the processes;
- uses a common language for all the processes that take place within the company;
- can be used as basis for an improvement plan;
- facilitates the understanding of product's cost components;
- allows quick reaction when it comes to product's quality issues ;
- allows a quick reaction to demand fluctuation;
- facilitates the growth of contribution to added value ;
- has as effect the reduction of production time;
- standardization of production processes;
- provides an overview image by integrating different subjective opinions.

The possible limits of VSM can be:

- in case of a large manufacturing nomenclature VSM is hard to achieve;
- in some cases, for certain companies, the symbols used can be inadequate, but there are solutions more suitable in specific cases;
- VSM presents the situation technically, regardless of the human resources.

4. Case study

In the following case study we will present VSM application in footwear industry.

The operations of the technological process in manufacturing footwear are:

1. preparing the raw and auxiliary material for cutting and stamping;
2. cutting and working the details from the upper side of the footwear;
3. sewing;
4. stamping and working the details of the lower side of the footwear;
5. assembling the footwear;
6. finishing.

Current state mapping (Figure no. 2) is made by presenting the following indicators:cycle time, takt time and lead time.

Cycle time represents the time that an employee needs to finish the given operation
Takt time is the indicator that helps the company to adjust the production rhythm so that to satisfy clients' demand.
Lead time measures the time that the company needs to manufacture the product, from the acquisition of raw materials to its delivery to the client.
In the presented case study, for the operations of the technological footwear manufacturing process, we have:

Cycle time Preparing	=	280 seconds
Cycle time Cutting	=	460 seconds
Cycle time Sewing	=	720 seconds
Cycle time Manufacture	=	680 seconds
Cycle time Assembling	=	790 seconds
Cycle time Finishing	=	380 seconds
Total Cycle time	=	3.310 seconds

Takt time is calculated by reporting the available production time to the quantity of manufactured production, as it follows:

$$Takt\ time = \frac{Available\ production\ time}{Customer\ demand}$$

The quantity of manufactured production is of 3000 pairs/week, so an average of 600 pairs/day. The available production time is determined in the seconds, hours worked being 7,5 hours (they work in an 8h shift and we take out the 30 min lunch break).

$$Takt\ time = \frac{7{,}5 * 60 * 60}{600} = 45\ seconds$$

This means that to a quantity of an average production of 600 pairs/day, needed to honor the orders, the company has to produce a pair every 45 seconds in order to be able to cope with the demand.
We calculate Lead time total of the product as being the product's necessary time from entering the productive system to its delivery.

$$Lead\ time = (30 + 1 + 1 + 2 + 2 + 2 + 5)\ days = 43\ days$$

If we analyze the employees needed for the manufacturing process, it can be determined as it follows:

$$Crew\ size = \frac{Total\ Cycle\ time}{Takt\ time} = \frac{3.310}{45} \cong 74$$

The employees needed in manufacturing the quantity of products that the company needs is of 74 employees instead of 82 as they are now. They can be re-distributed to other sectors or they can be used to increase the quantity.

Future state mapping (Figure no. 3) has to take into consideration the existing improvement possibilities.
One of the improvement possibilities refers to reducing the Lead time, this being one of the objectives of Lean philosophy. The time that the company needs from delivering the raw materials to the delivery of products (43 days) is too long in order to quickly cope with new possible orders. In order to increase the flexibility and the rapidity in delivery, we identify the following improvement measure: supplying every week (instead of monthly) with all materials necessary in the manufacturing process, reducing in this way the existent stock.
Also, in order to eliminate intermediary stock, the operations of cutting, preparing sewing and manufacturing will be made by the same work team, reducing the space by putting the units in a "U" shape. The manipulation of the product is reduced to the minimum and so, we reduce the manufacturing time.
Some changes can be observed, in comparison with the current state:

- ✓ flow time through the value stream was reduced from 43 days to 15 days;
- ✓ the Cycle time for the operations of preparing and cutting is reduced from 740 seconds to 680 seconds, and for sewing and manufacturing operations, from 1400 seconds to 1120 seconds;
- ✓ in agreement with the suppliers the raw material will be delivered weekly in smaller quantities, reducing the stocking time from 30 days to 5 days;
- ✓ in the condition of productivity growth and product demand, the quantity of manufactured and sold products increases to 700 pairs/week, using the same number of employees.

5. Conclusions

VSM is a fundamental instrument in analyzing the processes within any company. The purpose of the analysis is that to identify those activities that can improve company's activity, helping it to develop a competitive advantage.
The need of mapping the chain of value stream comes from the major advantage provided by knowing the current situation of activities within processes which helps to identify the existent opportunities and using them in a future direction.
VSM allows an overview of the entire value chain and not only of a singular process, being able to identify, not only loss but also their origin.VSM contributes to setting up the company's strategy. Comparing current VSM with future VSM, we can establish what are the essential differences and what needs to be changed in the future.Showing the bound between information flow and materials

flow, VSM is using a common language within the manufacturing process, being a starting point in making a plan of implementing foreseen solutions.The same as lean improvement efforts, the value stream mapping never ends; the map of the future state becomes the map of the current state and a re-mapping is needed in order to create a new map of the future state which is the basis for the improvement plan.

6. Acknowledgements

This work was supported by the project "Excellence academic routes in the doctoral and postdoctoral research – READ" co-funded from the European Social Fund through the Development of Human Resources Operational Programme 2007-2013, contract no. POSDRU/159/1.5/S/137926.

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Appendix A

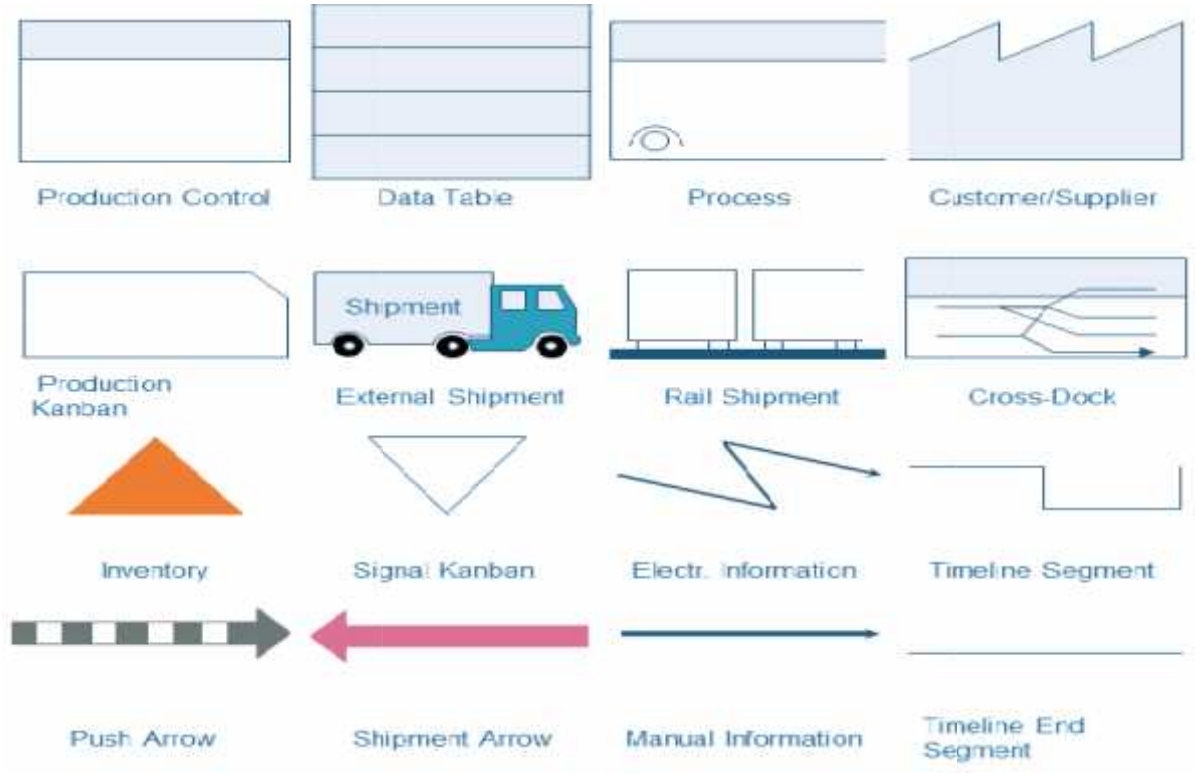

Figure No. 1. Icons Value Stream Map

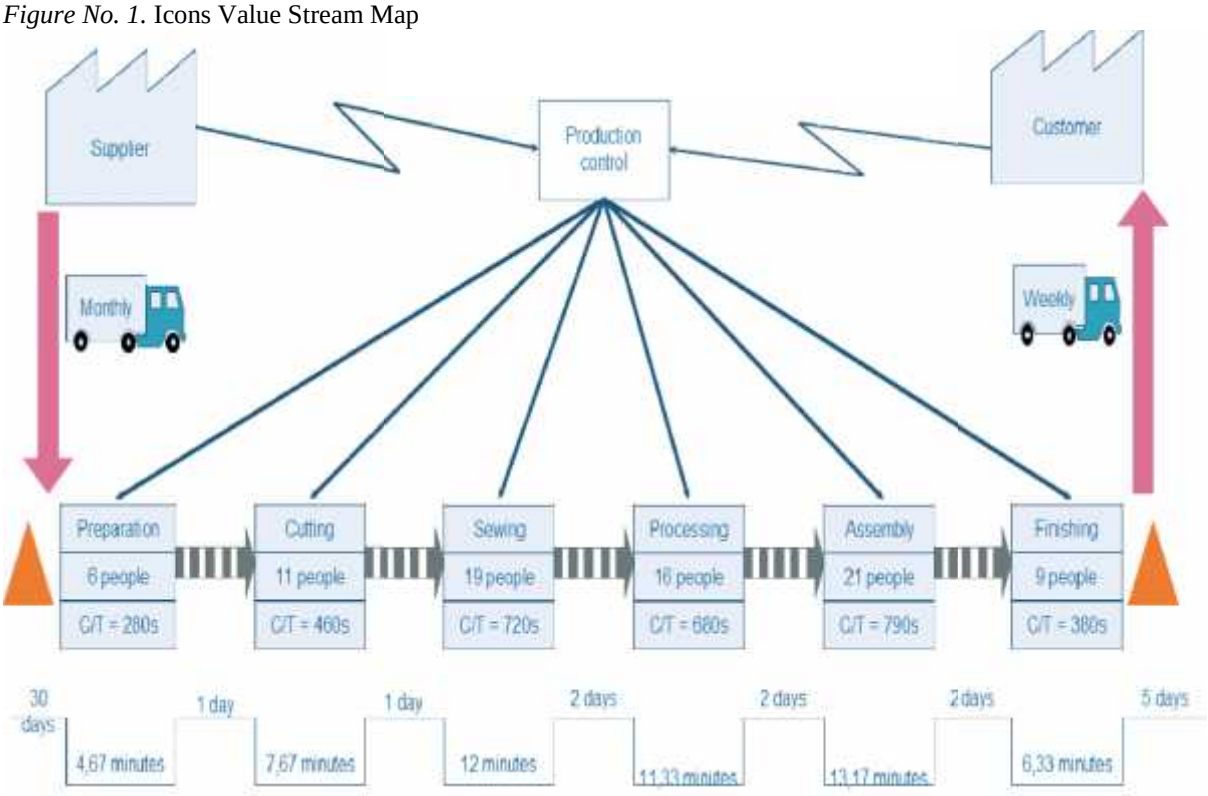

Figure No. 2. Current state value stream map

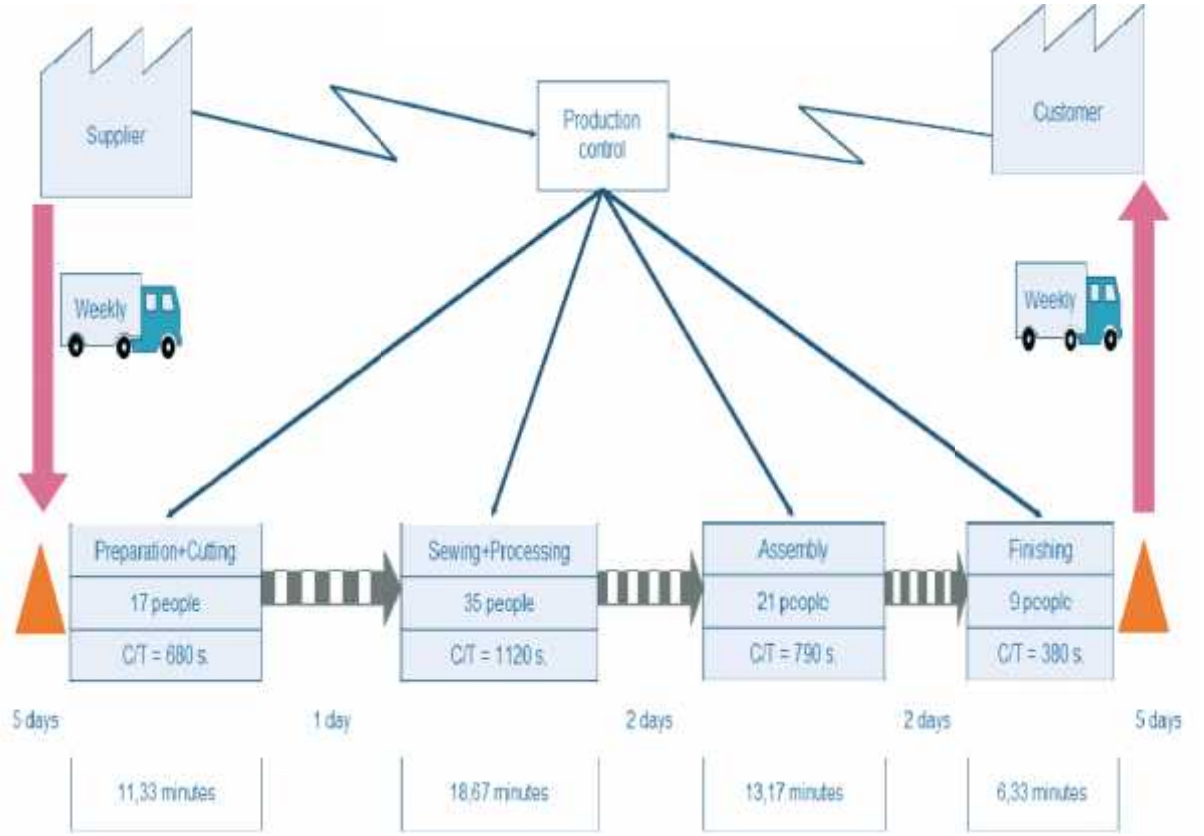

Figure No. 3. Future state value stream map