

How to Increase Value in the Footwear Supply Chain

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Abstract. The Lean approach has been implemented in many different sectors as a methodology to improve industrial performance at company level. In the latest years this approach has been further developed in literature and in practice to integrate the principles of agility, adaptability and the mass customization paradigm where product and services have to be designed together to meet specific requirements, and where value originated by the supply chain enhance the value of single company thanks to the use of ICT and remote control. In this paper we analyze the Beyond-Lean paradigm and propose a path for companies in the footwear sector to improve their performance based on high-value-added products and processes. A detailed process analysis based on Value Stream Mapping is used to define criticalities and suggest improvements paths both at technological and organizational level.

Keywords: Lean production, Supply Chain, Beyond Lean paradigm.

1. Introduction

Innovative Lean principles have to be defined to attain high flexibility and efficiency, addressing radically new ways to organize production. New methods of organization and flexible equipments are needed to produce very differentiated products, to obtain reduced work in progress, short response time and low production cost. The Lean approach originally proposed in [15] and that bases on increasing the value created by reducing all types of “waste” can be applied in very demanding environment like consumable products. In this case it is important to go beyond the original dimension of Lean, i.e. time reduction, and to take into consideration also constraints of quality and service which are extremely important nowadays to differentiate European products from others.

This paper analyses some relevant issues emerging for Italian firms operating in the footwear industry in a specialized regional cluster. The research has been made

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possible thanks to a Project funded by the Veneto Region conducted by A.c.r.i.b. (Association of the shoe producers of the Riviera del Brenta district in Veneto Region) with the support of Politecnico Calzaturiero. In the footwear district of Riviera del Brenta, the creation of value is guaranteed by strong inter-firm relationships and is based on the formation of temporary Virtual Enterprises according to seasonal production. Production process is very much parcelized across different companies.

In the first part of the work the analysis of the most important actors in the supply chain has been carried out based on data and information collected from footwear producers who are the main tier of the chain. Their suppliers have been investigated as well to understand how problems in communication can affect the performance of the whole system. The supply chain structure has been analysed applying the Value Stream Mapping methodology that allows to discover the most important logistic inefficiencies and to identify the organizational drivers for improving the whole system.

The result of the research consists in a Future State proposition that contains many different opportunities that can bring the supply chain to a new scenario where performance indicators are based not only on time reduction but also on service and quality level both from suppliers and customers. It will be shown how the design and production processes, which are very much modularized, can be improved with the application of the principles of the lean and beyond-lean production.

A practical and affordable framework is proposed to allow a large number of SMEs in the footwear sector to adopt new, flexible and Lean production systems to improve their and their Virtual Enterprise performance.

2. State of the art

2.1. Lean production and beyond

Lean manufacturing can be considered itself an approach to face turbulent environment since it permits to give quick response to the market changes.

Agile and adaptive manufacturing approaches have arisen at the beginning of the last decade as ways to improve the competitiveness of the companies. Adaptive and Agile production is characterized by the integration of the suppliers and customers in the value chain from the design to the production, the marketing and the support services. The focus is not only on time reduction, but also on the provision of high quality and services. Moreover the focus has to go beyond the individual enterprise and involve the whole value chain. Actually, it is not only a matter of improving in a static way the performance of the company as a stand alone entity but it is necessary to consider the creation of a Virtual Enterprise as a coordinated entity which creates value in a dynamic way [16], [17].

There are many works applying different dimensions of the adaptive and agile paradigm like for example in [1], [2] and [3] not only from the point of view of relationship management but also of technology improvements (implementation of

flexibly production systems, adoption of ICT tools, system integration) and people enhancement (competences management, training at all level).

In the latest years the European Commission has promoted the creation of some Technological Platforms among which *Manufuture* (European Platform for High Adding Value in Manufacturing Industries) with the aim to support the manufacturing sector through strategies shared by the most important stakeholders like the implementation of adaptive production systems answering to the changes of the market where machines communicate and are integrated all together and they are easy reconfigurable and they can hold multiple tasks [4], [5], or the implementation of ICT systems to develop the virtual dimension of the factory for co-design and co-planning production. Organizational systems for networked companies are necessary to optimise the operations along the processes and monitor performance.

Moreover producing according to the “Beyond Lean” paradigm means to integrate sustainability goals and promote human resources and use of innovative technologies along the product and process life cycle. It is not only a matter of reducing production costs but also to maximize the value creation along the Value Chain moving the focus from the physical good to product and service solutions.

Suppliers and customers have to work in real time synchronizing their activities. The number of actors (number of tiers) involved in the value chain is larger than in the past because not only traditional suppliers but also advanced technology suppliers are to be considered. Logistics and materials handling are critical factors and have seen the establishment of companies highly specialized on these activities making longer the supply chain. Third party logistics providers typically specialize in integrated operation, warehousing and transportation services that can be scaled and customized to final user’s needs based on market conditions and the demands and delivery service requirements for their products and materials.

2.2. Applications to the fashion sector

The fashion sector (limited in this study to apparel and footwear companies) is characterized by volatile product demand and need of quick planning and production. Companies need to re-define completely new models every 4-6 months using a long supply chain where for each tier level many actors have to collaborate together.

In literature there are not many studies on the application of the Lean and Beyond Lean approach to consumables and in particular to the footwear industry. As a matter of fact, these methodologies have been originally developed for the automotive and the durable equipments; therefore to implement it in the fashion sector needs a “customisation” mainly due to the different company dimension (large vs small), the type of product (durable vs consumable), and the kind of value chain (hierarchical vs. non-hierarchical).

Some works have dealt with the textile and apparel industry which has similar features to the footwear sector for the typology of demand, number of models to be produced, need to develop product by size etc (see for example [8]). Other works have analyzed the application of technological solutions or organizational solutions to the footwear sector but without making explicit reference to the lean or beyond-lean

principles and without giving an overall view on how suggested innovation can bring companies to success from a lean point of view [14].

Recently there have been many papers discussing technological innovation in the footwear sector both in terms of automation and in terms of monitoring and real time control [6], [7] especially with reference to the mass customization paradigm. Rarely this kind of innovation is explicitly part of a strategic vision on the innovation with a Lean or Beyond Lean approach, and the organizational impact and overall performance of the company is not considered.

Lastly, some other works examine the characteristics of the apparel and textile sector to apply the Lean and the Agile paradigm to allow the value chain to answer rapidly to the changes of the market and reduce the lead time [8]. It is worth remembering that the value chain in the apparel sector as in the footwear sector is relatively long, and it includes many actors that may change during the year according to the specific production needs.

3. As-Is Model

3.1 Value Stream Mapping

The analysis of the business processes focused on value created along the Virtual Enterprise in the Footwear sector can be carried out through the implementation of the Value Stream Mapping (VSM) methodology. VSM is based on the evaluation with the company staff of the most important performance indicators like: cycle time for each step, number of people, amount of scraps, batch dimension, WIP, waiting time. The evaluation of these dimensions permits to identify the most important criticalities. VSM allows to separate value adding from non-value adding activities along the production of a typology of product [9].

Many examples are given in literature on the application of VSM to different industrial sectors [10]; [11]; [12]; the application proposed here is based on the analysis of collaboration of many different actors of the Supply Chain. It is not only analysis of internal processes but also relations with suppliers.

In the footwear industry the manufacturing of most products requires the involvement of many departments and partners both up- and down-stream in the value chain creating time by time a virtual enterprise according to the models to be produced. In fact, shoe production can be characterized by the involvement of 20-25 companies, from the designer to the suppliers and the distributors. The result of the VSM is that to deliver a pair of shoes it is necessary a lead time of 140 days out of a cycle time of 4 hours! And this is not uncommon because from previous studies it emerges, for example, that to produce beverage cans there occurs a lead time of more than 300 days with a cycle time of 3 hours [13], or that in many cases the value adding activities are only 10% of the whole [14]. To reduce the non value-adding activities, which are not strictly necessary for the batch under production, it is not sufficient to optimise each Supply Chain actor without considering the system as a whole. On the contrary, application of an integrated system of analysis and evaluation

allows to focus on the whole value chain and on the value flow along the chain, from the customer order to the suppliers to the distributors.

3.2 VSM applied to the footwear sector

During the development of the project we analysed the most important actors of the Value Chain: shoe producers and suppliers (in particular sole and heel suppliers). For each of them, VSM has been designed on the most important processes like R&D, industrialization and production. Also the development and industrialization processes need the involvement of all the suppliers because these phases are given in outsourcing to them for the related part to be developed. For each map, critical points (numbered flash frames) have been identified. For convenience and for space limitations, here we report only one of the maps developed during the study.

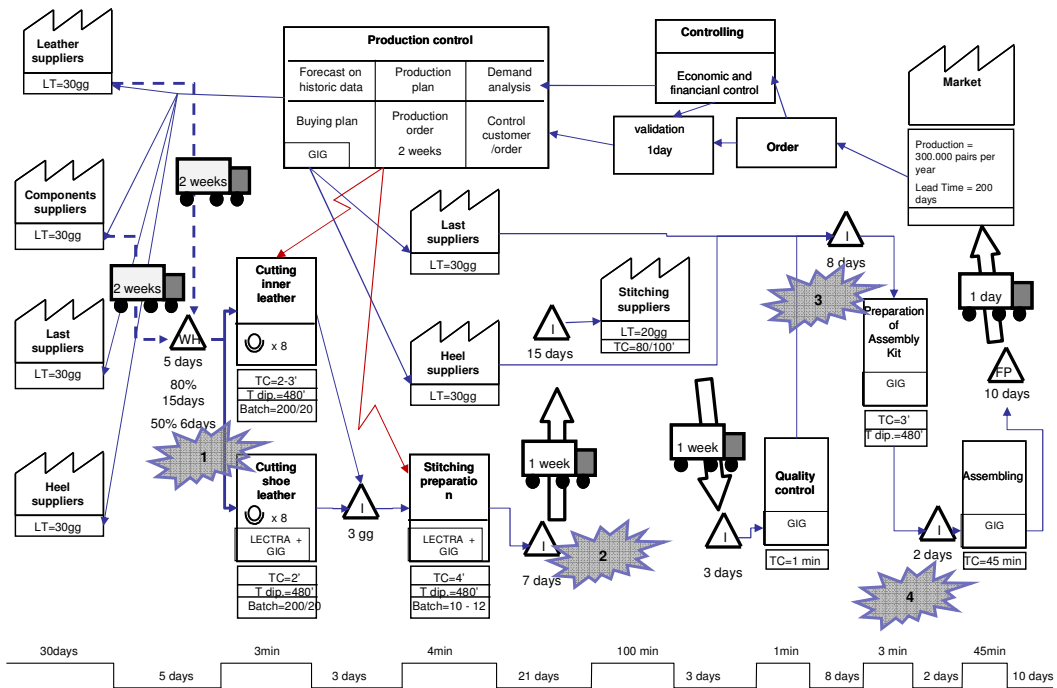


Fig. 1: VSM of the supply and production processes

In order to verify the reliability of the data collected during the VSM analysis it was necessary also to collect data directly from the ERP systems of the companies. What turned out was that most of the companies do not use any performance indicator system to evaluate their internal and external processes. Usually evaluation of each season performance is based only on amount of sold shoes but no detailed evaluation is done about the reason of increasing or decreasing sales.

Our analysis was based on data retrieved from the ERP systems for the production of a whole season and all related sales. Suppliers' reciprocity matrix has also been analysed to understand the relevance of each supplier in terms of materials volume compared to the relevance of the company itself. An example of the reciprocity matrix is given below. According to the chosen dimensions (amount of orders per season compared to the total revenue of the supplier and to the total purchasing of the company), it is possible to see the company under analysis establishes different kind of relationships with the suppliers. In the case of the most important suppliers of heels, leather and inner leather the company has a strong partnership based on strong commitment between the parts. They work at the same level with non-hierarchical relationship. In the case of the second supplier of sole and leather the contractual strength of the shoe company is stronger than the supplier itself.

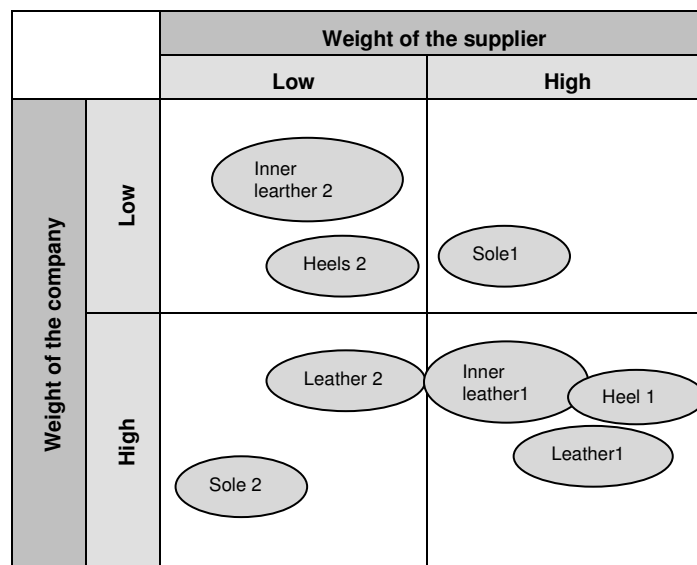


Fig. 2: an example of reciprocity matrix

3.3 Criticalities

The analysis of all the collected maps and data highlights some criticalities for each of the main processes both internally at company level and at supply chain level.

In the R&D process, information to be shared among the companies is not yet formalized and, generally, past season information are not easy to be retrieved. Most of the time, communication with suppliers does not follow shared protocols and this produces several inefficiencies. The VSM, in fact, shows that reiterative process with the suppliers is necessary very often, thus enlarging the time-to market.

Industrialization of the shoe models is too much tied to industrialization of the components (heels, sole, last), which is externalised to suppliers and makes the process very slow and difficult to control by the footwear producer. Moreover supplying process and industrialization of models is sequential and is not coordinated

with the arrival of the raw materials. Sometimes production is also delayed because there are some parts of the shoe which are not yet industrialized and which need to be developed by size.

For what concerns production process, waiting time before assembly process is around 2-3 weeks due to missing appointment of all components to assembly. The arrival of the uppers from the stitching phase (which is most of the time externalised) is not synchronised with other materials and components arriving from other suppliers. Moreover lead time of stitching phase is very much variable due to the fact that working load is not kept homogeneous during the production season.

As regards the supply process, large differences between the planned and effective delivering time from the suppliers has emerged, which make it difficult to manage and synchronise arrival of components for a certain production model. This implies that there is large difference between production planning and delivery time of suppliers. Also there is too much WIP along the production process, especially in the phase of preparing assembly kit when all materials and components arrive from internal departments and from suppliers.

For the suppliers, like for example the heel producer, beside the difficulties of communication due to the lacking of a standard with the shoe producers (each shoe producer send its own information on shoe models and sometimes the same shoe producer does not use the same code system for all its models), they have also a problem with production process. The set up time is very long (15min) compared to the production of each single piece (some seconds) and to have the possibility to reduce the set up time can be very value adding. Moreover missing tools for production planning since heel producer collects orders from all shoe producers and the company produces keeping some unused capability to have flexibly during the peak demand.

4. To-Be Model: how to increase value

The peculiarities of the Riviera del Brenta footwear industry, which allow local companies to be competitive, are linked to the capability to design and produce high quality products and to provide high value service in a value chain of many small companies cooperating together. This is the reason why important worldwide griffes have chosen to produce their shoes in this cluster. But to stay competitive the Riviera del Brenta companies need to maintain the excellent qualitative level of their shoes and relevant services and to improve the performance of the Supply Chain in an even more demanding competitive environment. There is, in fact, the need of more frequent changes in the range of products, and most of the customers are asking for small batches.

The proposed to-be scenario is based on improvements to be implemented at different levels, step by step. Each intervention need to be further developed and designed on the needs of the companies. The integration of more than one intervention can have stronger impact and overdraw the overall impact. In particular we can state the following actions:

- Standardization of some parts of the shoe components: each shoe component can be divided in modules and some modules of heel, sole and some assembly layers are not influenced by the shoe style and can remain the same during the shoe development. It is important that shoe producers, together with the suppliers, standardize these modules and make quicker the development process. The normalization of what is not influence by shoe style permits to dedicate more time to the other shoe components.

- Parallelization of some R&D activities: thanks to the possibility of sharing CAD files and standard modules with the other actors of the Virtual Enterprise like suppliers of soles, heels, lasts it will be possible to define the set of information to be exchanged during development phase between shoe producer and suppliers so that the supplier has standard set of information and some activities can be done in parallel.

- Another important action is based on the introduction of a tool for the prioritisation of the production of the individual shoe models according to two drivers: lead time of production, and lead time of industrialization. Since every season has an average of 300-400 models to be industrialized and produced it is important to create categories of models according to the complexity of production, complexity of supplying (certain materials – especially leather – may need longer delivery time than other due to type of leather or type of operations requested on the leather itself).

- For what concerns production processes, synchronization of materials and components delivery for the assembly of the shoe. In the footwear sector it is difficult to get rid of the “push” model in favour of the pure “pull” one. It can be useful to implement a system to synchronize the arrival of the materials to reduce waiting time before assemble, to reduce lead time and to reduce urgency. This means that it is necessary to control better the driver of production which is, in most of the case, the delivering of the uppers. Since the upper has the longer delivering time, the delivery of the other components (heels, sole, lasts, etc) should be organized according to uppers arrival.

Moreover the definition of a methodology to plan production with real time control of the supply chain can be the way to easily plan production reducing the number of urgency. The introduction of a real time monitoring system in some cases can be anticipated by the introduction of a visual system (kanban style) to allow companies (both producers and suppliers) to know day by day the order status. Another important action is the management of suppliers with anticipation of orders which means that at the beginning of each season a part of supplier production capacity is booked. During the production period, specific orders are released and no delays are expected. Bonus-malus conditions can be established with the suppliers so to guarantee both benefits in case of delivering on time and penalties in case of late or too early delivery. The definition of a delivery programme and organization of products pick up is important to improve delivering. The support of third party logistics can be organized by the SMEs belonging to the cluster in order to reduce logistics costs and keeping high the service.

5. Conclusion

Research on the field shows that there is the need to improve footwear Supply Chain performance in a consistent way. It emerges clear from the collected data that companies performance can be step up with different actions, from the technological to the organizational one according to a structured path. Some of these improvements are thought to be rapidly implemented and are thought to be low cost in order to overcome current difficulties integrating actions in a value chain mainly composed of SMEs.

In the analysed industrial footwear cluster, companies are already working according to the model of the extended enterprise to coordinate activities. Some of these actions are already under implementation in some companies but are not formalized and not part of an overall and shared strategy. For this reason there are always many urgencies to hold on. The matter is to define structured paths and to implement the actions proposed in a coordinated way without allowing modifications to the plans. Each shoe producer can play the role of catalyst for its Supply Chain and propose improvements for the benefit of all tiers.

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