VALUE STREAM MANAGEMENT IN THE PRACTICE

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Abstract

The effort to long-term prosperity of companies and the achievement of high productivity is the goal of the enterprise managers for decades. More than 100 years ago the first effort to introduce scientific practice in corporate governance can be traced and through them achieved the maximum productivity during the elimination of wasting of any kind. The current trend of customer requirements of fulfillment entails the increase of production variability. Purely serial production shifts their demands closer towards the custom production. Nevertheless, customers and management of enterprises expect maximum quality, speed and reliability of supply but if it is possible for the costs of mass production. If we want to be successful and compete in this field, it is necessary to know how and under what conditions the companies operate including the difficulties associated with their management. There is a number of technical publications where it is widely described a variety of methods and techniques that can be used on the way to a lean company. One of these techniques is also Value Stream Mapping (VSM).). This paper presents an example of the use of VSM in a company that is the leader of steel producers and owns the largest metallurgical complex in the Czech Republic. VSM method was applied in the manufacturing process of seamless steel tubes.

Keywords: Management, Value Stream, Productivity, Competitiveness, Practice

1. INTRODUCTION

The implementation of methods of lean production means to carry out only those activities that are necessary and do them right at the first time with minimizing of the time and especially financial losses. Required investigation can be counterproductive if it does not comply with the close links between product development, preparation of technical production, logistics and not least with the administration of the company. Rother Mike, the author and promoter of the value stream management, describes the notion of investigation (minimizing costs) or lean manufacturing. He says: *"Lean manufacturing is a paradigm and the way of thinking about production. It's a philosophy that reduces the elapsed time by eliminating the waste to be shipped high quality products at low cost on time. "*

Relatively large and stable interest from businesses is reflected especially in the areas of modernization of system management, development of new products, restructuring of processes and cost reduction. It is evidenced by regular surveys conducted by EY (formerly Ernst & Young) in the Czech Republic. [1] The business interest in solutions of given problems can also be traced in connection with the topics of processed of final bachelor's and master's theses of university students in recent years. Topics appear repeatedly from the areas of rationalization, modernization, innovation, cost reduction, logistics, supply, maintenance, management processes and systems, including the management of projects with an impact on achieving high quality in all directions and not only in manufacturing but also in providing services.

The notion of lean production has been associated with Toyota's production system which developed it after World War II known as the Toyota Production System (TPS). Lean manufacturing or lean enterprise uses of many techniques, tools and methods such as 5S, Kaizen, Kanban, Total Productive Maintenance (TPM) etc. for its functioning. One of these methods is Value Stream Mapping (VSM) and depending on it Value

Stream Design (VSD). The advantage of these tools is that they can be used in any field of business in principle as the manufacture of automobiles as well as in mechanical or metallurgical production.

This paper presents an example of the use of VSM in a company that is the leader of steel producers and owns the largest metallurgical complex in the Czech Republic. VSM method was applied in the manufacturing process of seamless steel tubes.

"Company profile: production activities of the company are focusing mainly on production and processing of hot metal and steel and rolled products production. The largest share of rolled products is represented by long and flat rolled products. Mechanical engineering production is focusing mainly on production of mine supports and crash barriers. Maintenance and servicing activities are ensured mostly by internal service plants [2]."

1.1. Value Stream Mapping (VSM)

Value Stream Mapping (VSM) consists of all the processes leading to the creation of the final product of your customer. The activity or activities involving the transformation of inputs into outputs can be considered as the process. There are also variants where the output from one process is input to another following process. Individual processes contribute to the creation of value of the production of a greater or lesser extent or it even not contributes at all. The effort of businesses is focused on implementing only those activities that add value to production and eliminate any wastage.

VSM can help us to identify and quantify the waste in the process, to eliminate hidden costs which do not add any customer value and to shorten the lead time process in a graphical representation of all key of streams and metrics in the process. It is based on the analysis of the current state of the production process during mapping. The result of value stream mapping is a clear graphical representation, determination of order lead time and so called Value Added Time Index (VA Index). VA index expresses the ratio of times that add value to the times that do not. The implementation of measures can be proposed in reaction to the detection of incidence of shortcomings. Those measures will lead to more efficient flow of values that can be represented in a new graphic expression of Value Stream Design (VSD). Value Stream Mapping can be considered as a suitable technique leading to continual improvement of processes, which is one of the fundamental principles of quality management system. VSM is a technique that can be used in any value chain i.e. in the analysis of production but also non-production processes, especially for repeated rhythmic production.

1.2. Value Stream Design (VSD)

Value Stream Design - it is based on the design and evaluation which come from pre-built Value Stream Mapping during compiling this chart. In most cases there are the information flows changed minimally in VSD. Different methods are used to production flow improvement, e.g. One Piece Flow, Kaizen, Kanban, FIFO, SMED etc. The process of creating VSD is similar to the VSM. At first, the information flows are shown (supplier - manufacturer - customer), which are the same in both diagrams in the key points. Then the drawing of the form of transport of the material from supplier to manufacturer followed. Another part is compilation of a complete manufacturing process, which includes all proposed measures, which were discovered in VSM and determination of the product shipping to the customer. The last part is the timeline based on which the main variables of VSD are calculated, i.e. Average time of production and VA index. Improving of these factors is considered as a success by the management. Usually, these indicators will significantly reduce Average time Production and raise VA index. After the final processing is the complete VSD diagram forwarded for review and evaluation to personnel of management. If there are not any erroneous measures, VSD can be implemented into production.

2. THE USE OF VSM AND VSD IN PRACTICE

Practical use of Value Stream Mapping will be described in the following lines based on an analysis of the current status relating to the preparation and cutting of billets material in the company and identification of any issue, which slows the process considerably. VSM is focused on mapping of the value stream in the hall called "Billet preparation" and it is aimed at employees who work on the machines in this hall. Those machines cut and transport billets to the grates of furnaces. It was proceeded according to the following steps during the Value Stream Mapping:

- to prepare the necessary forms, diagrams and templates, including symbols and marks for creating the maps (see Fig. 1),

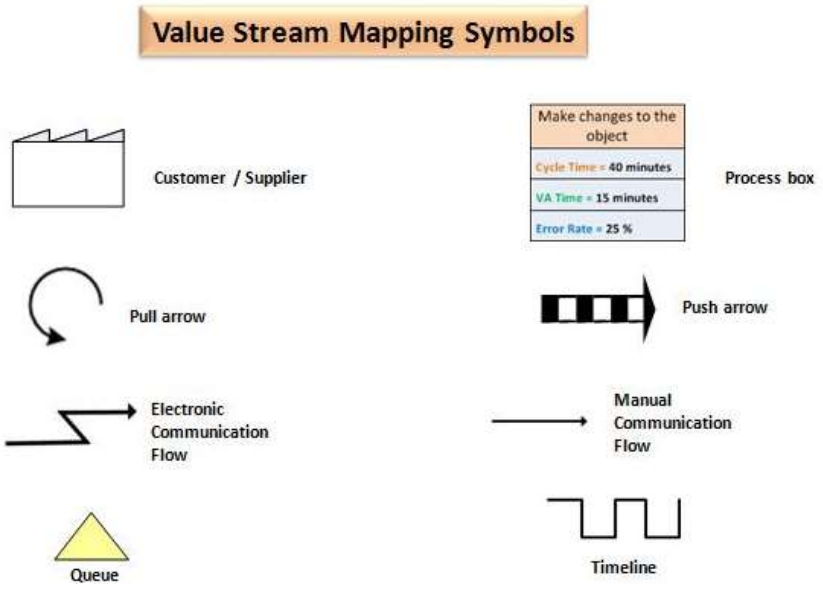

Fig. 1 Symbols of Value Stream Mapping and Value Stream Design [3]

- to determine the type of representative - in this case, billet of 210 mm diameter was elected, because this one came out as the most producing (production volume is ca. 180 kilotons per year) compared with other production volumes of diameters of individual billets,
- to write the flow of processes - to identify the main processes and customers and to place them in the map of the specific order,
- to place the flow of materials (including the suppliers) into the map after their mapping (to find out how often and in what quantity come the materials and semi-finished products into the company, to identify and to record supply of the given workplace),
- to map the information flow between activities and its subsequent writing in the map,
- to gather the data of the whole production process, such as: the number of operators, type of process, C / T (Cycle Time), C / O (Change Over Time), the time of handling, the time fund of workplace, the number of product variants , shifts, the size of batch, machine utilization, etc. Every company writes only the information it considers relevant in its maps,
- finally, to submit created VSM diagram to control by independent but the operation skilled workers to correct all detected deficiencies. [4]

Description of material flow

The casted billets in Steel Plant (area AMO a.s.) are transported to the dock of billets (area AMTPO a.s.) on the railway wagons. The billets are stored at this place and getting cold until the contract of their cutting in the "Billet preparation" Hall is scheduled. The billets are transported by cranes to the grates of cutting lines

(Lisinger and Messer) or they are transferred into the individual storage located within the building. The billets are sent to grates of lines after the cutting process on basic lengths and then they are inserted into the carousel furnaces or into the storage (transport of billets is shown in Fig. 2).

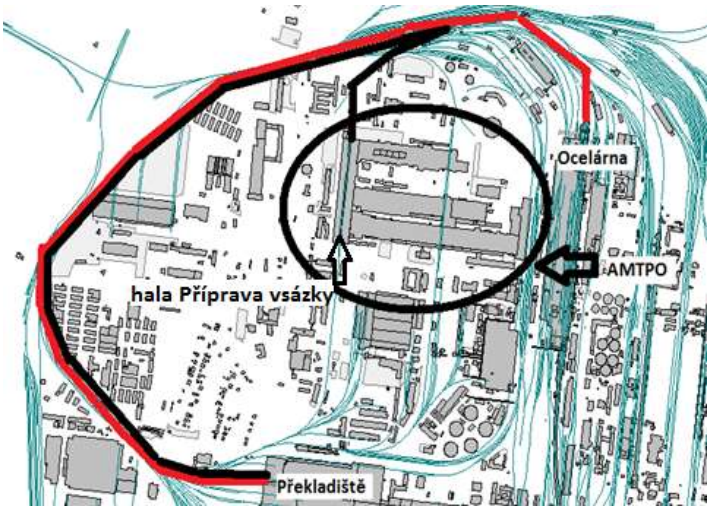

Fig. 2 Transport of billets in AMO a.s. and AMTPO a.s. areas

The "Billet preparation" Hall is divided into a northern part (preparation of material for production of seam-welded pipes), the middle part (the saw Lisinger and the flame cutting line Messer are located here) and the southern part (the warehouses of cutting billets are occupied this part). Packages of billets are delivered from the dock and unloaded at warehouses in the area of the "Billet preparation" Hall or they are exported to 9 outdoor sectors around the area of AMTPO a.s. using the train service.

The foreman makes the inventory of the wagon into the inventory book after every change of wagons (he does the measurement of billets length, he checks their markings and the record of transport with the real physical state) and finally he uploads all the data into the VAX / IBM system. Workers put the billets on the grates or into the warehouses within the building using overhead cranes. The saw Lisinger operator or flame cutting line Messer operator cuts the billets, but first he does the check of quality, smelting, etc. with the data in the system VAX / IBM. A worker, who sorts and stores cut billets, marks the forehead of billets and he exports billets using the crane and sends them to the grate of lines or into the dedicated warehouse. A worker must check the movement of the billets again and uploads the data into the VAX / IBM system. The storing of billets is controlled by fundamental rule, which is: to preserve the coherence of the smelting. The entry of every manipulation must be recorded in the control VAX / IBM system. Graphic representation of material flow is shown in Fig. 3 and Fig. 4 using a Sankey diagram.

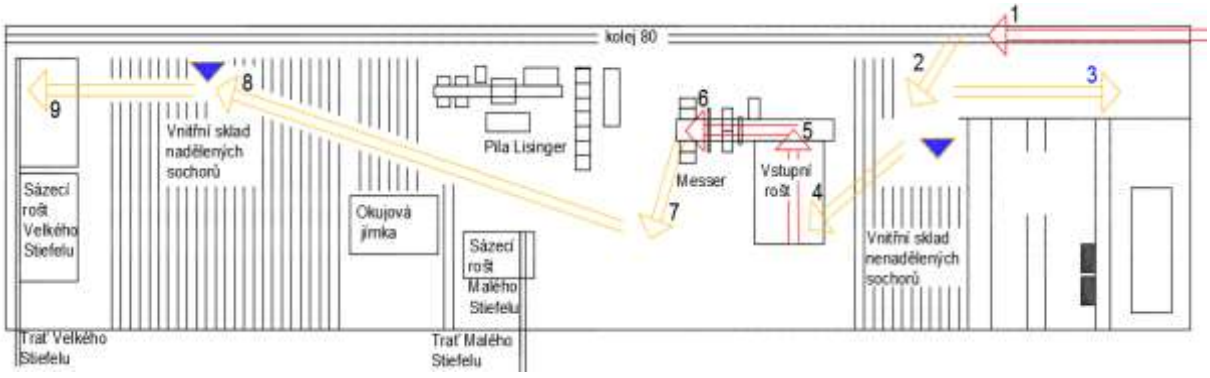

Fig. 3 Sankey diagram for determination of the distances and the necessity of material flow in the "Billet preparation" Hall

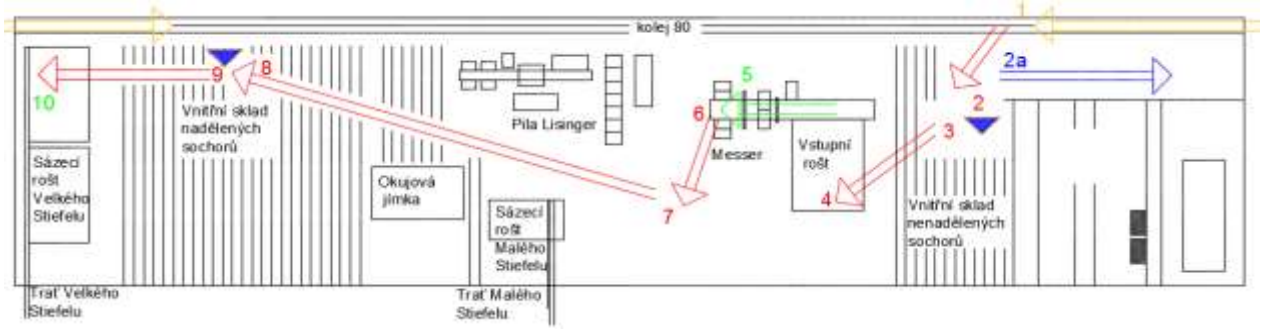

Fig. 4 Sankey diagram for transport of material in the „Billet preparation“ Hall

Description of information flow

Information flow begins with the initial document called the Order and issued by the Steel Plant or by the external customer. The Schedule of billets supply is subsequently developed based on the order for the specific period. Planning department of the company manage the entire flow of information relating to the production of billets and pipes. It is a planning and management of wagons moving to the "Transverse Hall" and out. The Master of “Transverse Hall" plans the preparation of billets for every month in advance according to a document issued by the planning department called "Campaign" (this is the time of the products of one dimension or of finishing diameter of pipes). The information flow in the "Billet preparation" Hall is oriented by the VAX / IBM computer software and both of cutting equipment are equipped with this system in this hall (the saw Lisinger and flame cutting line Messer). The information of the weighed wagons and cutting of billets, storage of cut and uncut of entire billets are sent directly to the original software. This information come directly from the plan of pipes production and workers of cutting equipments must cut the billets to a specified length to the pipes required by the customer can be rolled. Planning department and master of "Billet preparation" Hall decide about the capacity of material for cutting equipments.

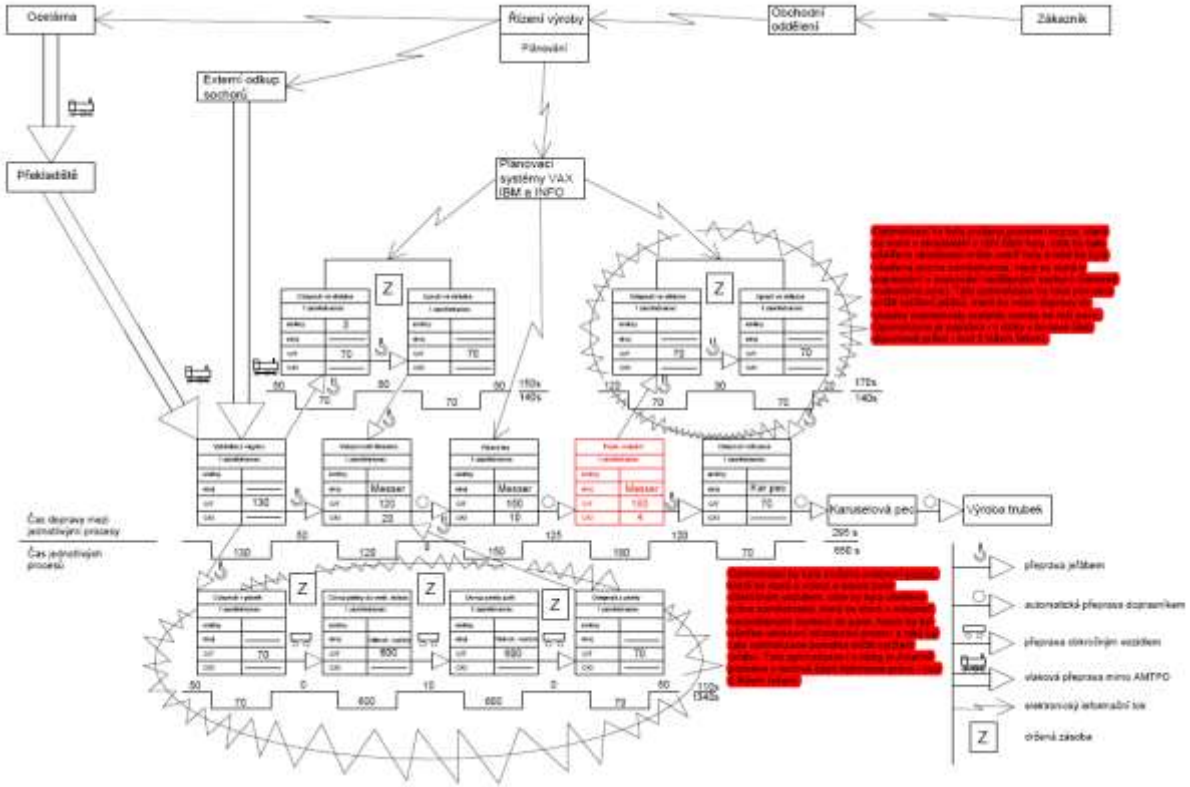

Fig. 5 VSM a VSD diagram of flow of value in "Billet preparation" Hall

CONCLUSION

Following improvements consequent from the VSM and VSD diagram shown on Fig. 5 (proposals are marked in red) will not only save space and time, but also finance:

- the total length of the line (which is travelled by wagons with billets produced in Steel Plant) is 7 430 meters from the dock to the "Billet preparation" Hall, so dock located next to the hall was set up. This dock has sufficient capacity to accommodate all required capacity of billets. More than 7 km is saved.
- finished i.e. cut billets are stored in outdoor warehouses around the hall, and then they are imported back to be inserted into the carousel furnaces. The proposal is to increase the capacity of internal storage, which is real, because there are empty places in that area for example warehouses space for the welding shop. This would cancel the position of worker, who imports and transports cut billets. Moreover the outdoor warehouses space was spared and the workload of cranes would also be reduced.
- another improvement is the cancellation of internal storage of uncut billets, because it would be directly imported according to the plan from the dock (which is currently located next to the hall according to the proposal) to the cutting device. This would cancel the position of employee who keeps of storage uncut billets inside the hall, it would be spared the storage space inside the hall and once again the workload of cranes would be reduced.
- the above diagrams show a range of further improvements for example the purchase of new machines, which would reduce the lead Average time of production and thus would increase the VA index. Another suggestion would be construction treatment, which would accelerate the transport of uncut billets from the warehouses into the "Billet preparation" Hall to the cutting equipment and then to the insertion into the carousel furnaces, etc. All these proposals are realistic and can be implemented, which was confirmed by employees of middle-management of the company.

The senior management of each organization has the right to choose strategy and tactics, which will be implemented in the operation of company. If the organization wants to be permanently successful in their field, one must try to not only keep up with competitors, but, if possible, be a step ahead of them. Therefore it is important to know your weaknesses and potential external threats and to know your competitors, but your partners as well. If it is possible to apply the principle of learning from the others, the better, through the use of best practices, we can avoid a series of mistakes but we can easier, faster and more effectively improve own performance.

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