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VALUE STREAM COST ANALYSIS IN THE ROMANIAN FOOTWEAR INDUSTRY

Case study

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Abstract

Once the Lean philosophy is developed and implemented to all levels in a company, a new accounting system appears: Lean accounting. Value Stream Cost Analysis is the main and the most powerful instrument of Lean accounting. Because of the fact that VSCA allows us to identify the company's performance at the proper time, we can rapidly intervene to make the adjustments needed. The Romanian footwear industry is competitive worldwide (14th place in the top of exporters), but in order to improve, it has to rapidly react to clients' expectations. In the case where the companies have a production system based on Lean philosophy, the implementation of VSCA does nothing but improve the obtained results. This article presents a case study of VSCA application in footwear industry.

1. Introduction

Lately, the technological evolution has improved and in order to withstand on the market, Romanian companies have updated the manufacturing processes. What wasn't achieved yet is the implementation of a modern accounting system which is needed in order to keep up with the changes and new tendencies and which to reflect the improvement possibilities and the impact of new technologies over the company's results. Is like changing the computer with a latest version but using an operating system from 20 years ago. That is the issue with the traditional accounting, an old accounting system, whose yield is questionable in the actual economical context.

Lean thinking changes the traditional approach regarding the manufacturing process, the instruments and methods used as a process support.

In order to help the implementation of Lean philosophy within a company, Lean accounting has appeared, as a support for continuous improvement of the company and for a simple visualization of the financial impact when changes are made.

Applying the proverb "In new times, new people", within a company we could say "better technology, better processes, better accounting".

If in the case of technology and of manufacturing processes the things are easier, in the way that better means more efficient, a "better accounting" is a simple accounting, easy to use and which shows how one can be more efficient. This is Lean accounting; an accounting that focuses on Value Stream and with the help of which the results obtained are shown in a simple format, easy to understand, facilitating optimal decision making.

Using Lean philosophy within the company implies improvements in terms of productivity, quality of products and competitiveness. So, the products with similar flows are grouped in flexible manufacturing cells as a value stream, costs analysis being made in a integrated way, as Value Stream Cost Analysis (VSCA).

VSCA comes from Lean thinking, and is based on creating value for the client. It is very important that the value created exceeds the necessary costs of this value and VSCA has the objective to pursue this goal.

In Romania, Lean accounting approach by the researchers is almost inexistent (Creţu, 2010; Ofileanu & Topor, 2014) while the study of Lean production system aroused more interest. This can be explained by the the relative degree of novelty of Lean accounting to Le/an production system whose beginnings as a concept date back from the 90' and whose benefits are generally known.

Due to its undeniable advantages, Lean accounting was given deserved consideration mostly since 2005, since Lean Accounting Summit is organized annually in the U.S.A.

2. Literature review

Womack and Jones (2003) defined the five principles of Lean thinking as being: value creation, value stream analysis, flow, pull, perfection. They see VSC as a way in which the company's employees can see if their collective efforts imply higher costs than the value or the other way round. Value Stream Cost has been developed by Brian Maskell and Bruce Baggaley (2003) as an instrument which facilitates the calculation of production cost when the implemented Lean manufacturing methods are in a significant maturity state. In other words, Value Stream Cost Analysis can be successful used when the company is organized along value stream, has low stocks and has significantly improved the lead times.

Maskell and Kennedy (2007) say that VSC is the most appropriate system to present cost and profitability within Lean philosophy.

Maskell, Baggaley and Grasso (2012) present VSCA as an important instrument of Lean accounting, which shows how resources are used within value stream.

Arbulo Lopez and Basurto Uraga (2007) compare VSC with the traditional cost systems, presenting as main advantage the simplicity in use.

McVay, Kennedy and Fullerton (2013) present VSC as an instrument which simplifies data collection and helps reducing waste. The authors present two major reasons why companies should implement VSC: changing the organizational structure, from a vertical to a horizontal structure, the payment, where the information sustain decision making by value stream managers and change of controls, from controls that watch the results after a certain period of time, being too late to react, to current controls, so that the intervention can be made before the end of the month.

Arbulo Lopez (2007) defines VSC as a methodology which helps companies focus on resources used within the whole process, calculating value stream costing instead of seeing the processes in an isolated way.

Li et al. (2012) says that VCS is a bridge that connects the financial and operational aspects of Lean approach, facilitating the transfer of information to the management level.

In our opinion VSCA represents the most important instrument of Lean accounting being an operative feed-back of the performance of value stream based

on which the managers can make decisions in real time, and the impact of those decisions can be continuously tracked.

3. The characteristics of Value Stream Cost Analysis

We established that VSCA is the most important Lean accounting instrument. McVay, Kennedy and Fullerton (2013) present the Lean accounting principles as being the following:

1. value streams;
2. flow and pull;
3. customer value;
4. employee empowerment;
5. continuous improvement.

They establish that the first step in implementing Value Stream Costing is to identify all resources consumed within the value stream.

Value stream consists of the specific actions required to transform a product:

- from the concept to launching (troubleshooting flow);
- from the order to the delivery (information flow);
- from raw material to finished product (physical flow).

The value for the customer is created during these three flows.

The value of any product is established by the customer of that product. If the client is willing to pay for the product, then that product has value.

The value is important because justifies the price, and does not only cover the costs but also permits obtaining a profit.

The more the company knows better the value that the client gives to a product and identifies the value stream of the product, the more will be competitive and profitable.

In the logic of developed and competitive economy, the customer is willing to pay only for the activities that add value to the product, so only for those activities considered necessary for the manufacturing of the product. It is very important to identify losses and their removal because the client won't be willing to pay for them.

Taiichi Ohno (1988) identifies 7 types of waste:

1. waste from production surplus;
2. waste of time;
3. waste of transport;
4. waste of processes;
5. waste of inventory;
6. the waste movement;
7. waste of defects.

The activities identified along value stream can be:

- activities that add value to the product;
- activities that don't add value to the product and which can be::
  - necessary activities;
  - activities that can be removed.

The activities that don't add value can be removed if they don't affect, in a negative way, the other value adding activities.

All losses within value stream can be reduced, this being the objective of VSCA and one of keys of Lean philosophy – continuous improvement.

Traditional cost systems follow the costs in every step of the production, are complicated, generate a lot of useless information and with high costs. Instead, VSC collects the costs along the value stream; all costs inside value stream are considered to be direct costs (Figure No. 1). No distinction is being made between direct and indirect cost, and the costs outside the value stream are not included. Because is the basis in decision making, this instrument gets more effective if the costs collection is made at shorter periods of time, usually weekly.

For VSC to work the company has to be organized along the value stream and the level of stocks used in the manufacturing process have to be small and stable. This is because the cost of raw materials within value stream consists of all costs of raw materials that have been bought in the given period and this way the raw materials that are bought have to be consumed in that period. The same is done when calculating the cost of materials used.

Because the aim of the value stream is to use as less resources and eliminate waste, the cost of the surface is included in VSC depending on the surface used by the given value stream. In footwear industry, the manufacturing process generally implies that the manufactured products have the same manufacturing route. So, they can be grouped in the same value stream, and the manufacturing cost is calculated along the value stream. The question is how can we determine the cost of each product within the same value stream? This is not necessary because the companies that are organized after Lean principles make the decisions based on the value that the client gives to the product and the price that he is willing to pay at that time. This way, the price of the product is established by the client and not by the cost of the product and the value stream profit is calculating by subtracting the value stream costs from the selling value. For the ones that are not familiar with Lean thinking, the following question will rise: How do you know if a product is profitable and if it's worth to continue manufacturing it since the result calculated cumulative on the entire value stream? The answer is that there is no use for that because the decision to further manufacture is made depending on the overall value stream result. This decision is made depending on how the result is being influenced by the renunciation to manufacture that product.

Lean philosophy implies maximum efficiency within manufacturing processes, their analysis being made by using VSCA.
VSCA shows in a simple formula, easy to understand, what capacity (productive or unproductive) is used and what capacity remains available, for each activity within the company. So, if there is available capacity, it can be decided the introduction in manufacturing of new products for which there is demand or the increase of the production volume for the current production. Also, it can be decided to use the available capacity in a different way, for example the integration in other value generating activities.
Once the data is collected, VSCA permits the identification and the removal of activities that don't add value. This way, based on Current State VSCA, Future State VSCA is drawn taking into account the identified improvement possibilities.

4. Case study

Footwear manufacturing is one of the most competitive activities in Romanian industry, being on the 14th place worldwide. That is why it is very important that the industry uses the newest instruments that allow maintaining and improving its competitiveness. VSCA is one of the instruments of Lean production system and its use is going to be presented next.
The company in the case study has implemented Lean production system and the manufactured products are grouped in a single value stream.
The manufacturing processes are: preparation and cutting, sewing and processing, assembling, finishing. The other processes within the company are: design engineering, manufacturing engineering, maintenance, customer service, quality assurance, purchasing, shipping, and accounting.
The VSCA methodology from the case study is the one presented by Maskell, Baggaley and Grasso (2012). Once the processes within value stream are defined, Value Stream Costs Process is drawn based on the resources consumed within every process (Table No. 1).
For every process within value stream, the analysis of use of employee capacity and use of machine capacity is made, where appropriate. The time spent on a shift (usually minutes or seconds) is multiplied with the number of shifts per day, the number of people from a shift and the number of days from the selected period and then the lunch break period is subtracted from that number and this way is obtained the total time available for use. From total time available for use is subtracted the total current time used and it is obtained the total time unused. This time can be used for other activities.

We analyzed every process within value stream for a week and we present here the analysis of the Purchasing process (Table No. 2).

$$TTAW = DWW * P * (HS * 60 - NSD * MBS)$$

where:
TTW – total time available per week in minutes
DWW – days worked per week
HS – hours per shift
P – the number of people per shift
NSD – the number of shifts per day
MBS – minutes of breaks per shift

The company works in one shift, 5 days a week, the lunch break is 20 minutes and 4 people work within the purchasing process. We have:

$$TTAW = 5 * 4 * (8 * 60 - 1 * 20) = 9.200\ min.$$

Within value stream analysis, for Purchasing process we have the following activities:

- establishing the supply needs;
- evaluation of suppliers;
- drawing offer applications;
- analysis of offers;
- processing the offers;
- remaking the orders;
- stocked products reception;
- resolve gaps in reception.

After the analysis of current state, it is established that certain activities can be removed, and in the case of others the time can be reduced. So, once the production leveling system (Heijunka) is implemented, for future state, the time allotted to establish the supply needs is reduced, and by a rigorous selection of suppliers and establishing contracts with the remaining ones we remove the activities of analysis of offers, drawing offer applications, remaking the orders and of resolving gaps in reception. All this measures lead to a available capacity of 82 h/week. So, from the 4 employees only two are needed and 2 of them can receive other tasks within the company.
The same happens with all the processes within the company, and after the data is processed, Current State Value Stream Costing Analysis (Table No. 3) and Future State Value Stream Costing Analysis (Table No. 4) are being drawn. The data in is put in the table in the form of percentage for an easier understanding of available capacity.

$$PCPW = \frac{PTW}{TTAW} * 100 \quad NPCPW = \frac{NPTW}{TTAW} * 100$$

$$ACPW = 100\% - (PCPW + NPCPW)$$

where:

PCPW – productive capacity percentage per week
PTW – productive time per week
NPCPW – non-productive capacity percentage per week
NPTW – non-productive time per week
ACPW – available capacity percentage per week

For the data presented in Table No. 2, we have:

- for current state:

$$PCPW = \frac{4.650}{9.200} * 100 = 50{,}54\%$$

$$NPCPW = \frac{3.950}{9.200} * 100 = 42{,}93\%$$

$$ACPW = 100\% - (50{,}54\% + 42{,}93\%) = 6{,}53\%$$

- for future state:

$$PCPW = \frac{3.720}{9.200} * 100 = 40{,}43\%$$

$$NPCPW = \frac{540}{9.200} * 100 = 5{,}87\%$$

$$ACPW = 100\% - (40{,}43\% + 5{,}87\%) = 53{,}70\%$$

5. Conclusions

VSCA is a simple and useful instrument which can be easily used to measure the value stream behavior. This instrument can only be used when the company has implemented a Lean production system, so that it represents the support needed for the Lean system to work properly.
VSCA permits the evaluation of activities within every process of value stream and the identification of improvement possibilities.
VSCA facilitates the understanding of information which is presented in an accessible visual form and so the company's employees will rapidly understand the results of their work and they will be stimulated to work more efficiently.

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Appendix A

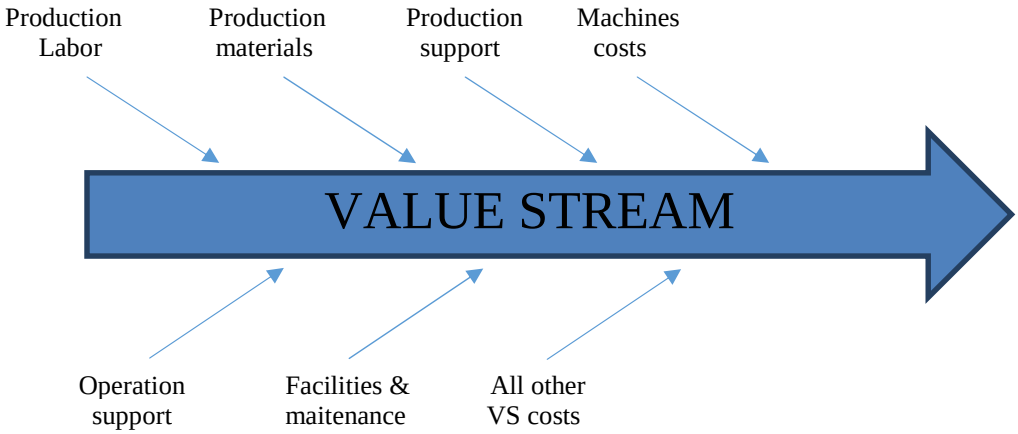

Figure No. 1. Value Stream Costing
Source: Maskell, B.; Baggaley, B.; Grasso, L., 2012, Practical Lean Accounting, Second Edition, CRC Press, New York, page 159

Table No. 1. Value Stream Costs Process

Process	Material Costs	Employee Costs	Machine Costs	Other Costs	Total Cost
Preparation and cutting	460.000	8.500	2.800		471.300
Sewing and processing	19.000	16.000	3.660		38.660
Assembling	32.000	11.000	1.400		44.400
Finishing	24.000	3.900	890		28.790
Design engineering		1.700		5.200	6.900
Manufacturing engineering		2.900			2.900
Maintenance		1.100			1.100
Customer service		1.400			1.400
Quality assurance		1.600			1.600
Purchasing		2.100			2.100
Shipping	800	450			1.250
Accounting		2.400			2.400
Total	535.800	53.050	8.750	5.200	602.800

Table No. 2. Value Stream Study Process per Week

Process	Activity	Current State		Change	Future State	
		Non Productive	Productive		Non Productive	Productive
Purchasing 4 persons 1 shift 7,67 hours	Establishing the supply needs (5*60 minutes)	300		Is made once a week, Heijunka use	60	
	Evaluation of suppliers (62*10 minutes)	620		Is made once a month, 7/week	70	
	Drawing offer applications (62*5 minutes)	310		Removed	0	
	Analysis of offers (62*25 minutes)	1.550		Removed	0	
	Making the orders (31*30 minutes)	930		Time is reduced to 20 minute	310	
	Remaking the orders (3*30 minutes)	90		Removed	0	
	Stocked products reception (31*150 minutes)		4.650	The reception time is reduced to 120 minutes		3.720
	Resolve gaps in reception (3*50 minutes)	150		Suppliers will be rigorously selected, this way the gaps disappear	0	
Total time by value creating category		3.950	4.650	Released time: 4.340 minutes	540	3.720
Total time used		8.600			4.260	
Total time not used		600			4.940	
Total time available for use		9.200			9.200	

Table No. 3. Current State Value Stream Costing Analysis

	Total	Preparation and cutting	Sewing and processing	Assembling	Finishing	Design engineering	Manufacturing engineering	Maintenance	Customer service	Quality assurance	Purchasing	Shipping	Accounting
EMPLOYEES													
Cost	53.050	8.500	16.000	11.000	3.900	1.700	2.900	1.100	1.400	1.600	2.100	450	2.400
Productive	38%	46%	48%	39%	26%	0%	0%	63%	6%	0%	51%	86%	0%
Non-Productive	42%	33%	34%	37%	43%	75%	72%	18%	76%	93%	43%	0%	79%
Available Capacity	20%	21%	18%	24%	31%	25%	28%	19%	19%	7%	6%	14%	21%
MACHINES													
Cost	8.750	2.800	3.660	1.400	890	-	-	-	-	-	-	-	-
Productive	53%	58%	62%	54%	41%	0%	0%	0%	0%	0%	0%	0%	0%

Non-Productive	36%	37%	28%	35%	47%	0%	0%	0%	0%	0%	0%	0%	0%
Available Capacity	11%	5%	10%	11%	12%	0%	0%	0%	0%	0%	0%	0%	0%

Table No. 4. Future State Value Stream Costing Analysis

	Total	Preparation and cutting	Sewing and processing	Assembling	Finishing	Design engineering	Manufacturing engineering	Maintenance	Customer service	Quality assurance	Purchasing	Shipping	Accounting
EMPLOYEES													
Cost	53.050	8.500	16.000	11.000	3.900	1.700	2.900	1.100	1.400	1.600	2.100	450	2.400
Productive	33%	42%	44%	36%	24%	0%	0%	63%	0%	0%	40%	86%	0%
Non-Productive	20%	9%	11%	15%	19%	75%	72%	6%	90%	93%	6%	0%	79%
Available Capacity	47%	49%	45%	49%	57%	25%	28%	31%	19%	7%	56%	14%	21%
MACHINES													
Cost	8.750	2.800	3.660	1.400	890	-	-	-	-	-	-	-	-
Productive	53%	58%	62%	54%	41%	0%	0%	0%	0%	0%	0%	0%	0%
Non-Productive	15%	14%	11%	19%	13%	0%	0%	0%	0%	0%	0%	0%	0%
Available Capacity	32%	28%	27%	27%	46%	0%	0%	0%	0%	0%	0%	0%	0%