## VALUE STREAM MAPPING - A LEAN PRODUCTION METHODOLOGY

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#### Abstract:

Our paper wishes to present a strategy used to create an image about the informational and material flows of products and services. Value Stream Mapping is not a project that covers a specific period of time; instead it is a working methodology to differentiate activities that add value compared with the non-value added, and is addressing to all employees, to the management, suppliers and customers. Many companies are using this improving method because it identifies the problems from the production process, analyze them and provide some potential solutions for a better process.

Keywords: Value Stream Mapping, Lean manufacturing, waste, implement, Kanban

**JEL Classification:** L23

### **INTRODUCTION**

Value Stream Mapping is a Lean technique used to analyze the current material and information flow necessary to bring out the products or provide services for the customer. This technique includes all the activities that follow the product from the customer order, going through the entire production process and the finally delivery to the customer. Value Stream Mapping is the perfect argument for Lean practitioners to show where data comes into play, how it is collected quickly and efficiently, and how Lean project action plans are created from this data. Because anywhere is a process there is also waste, it is our concern to find the best solutions and techniques to reduce it or even eliminate waste at all. The advantage of using this method allows anybody to "see" both process flow and communications flow within the process or value stream [1]. Because of this ability to gather, analyze and present information in short period of time, this method has rapidly gained popularity in the process of continuous improvement. The most important goal of Value Stream Mapping method is that identifies opportunities for improvement for future periods of time.

Regarding the main domain of using the Value Stream Mapping methodology, it can be applied to direct production activities (known as: Door-to-Door method) and include all the process steps from the daily production, and non-production activities (known as: Order-to-Cash method), referring to those supporting activities or processes for daily production needed the enterprise [2] – [4].

We can use VSM as a Lean method to identify the opportunities of improvements for future periods of time.

VSM method is also associated with production activity, being used for:

- efficiency of production activities;
- logistics activities;
- supplying activities;
- software development;
- developing new products;
- industrial activities related.

Because the VSM is an analytical method, and is based on details, depending on the level of details, the VSM can address only to a process step, to one or the production lines, or to the entire factory.

# THE VALUE STREAM MAP DESCRIPTION

Henry Ford made the following statement: "Before everything else, getting ready is the secret of success". Therefore, using a method like this one requires some preparations, meaning to collect as much information possible about the company situation.

Defining the current situation and knowing the places that need and can be improved, represents the starting point for improvement process. As we show earlier, for drawing a Value Stream Map it is very important to use your observational skills and show how the company looks like by the time is documented, not to hide or neglect the real situation.

Before we use this method we need to respect a set of rules [5]:

- The map should include all actions (both value added and non-value added) currently required to make the product to cover the main processes.
- Usually, use a pencil and paper to draw the Value Stream Map. The next step refers to the analysis of current state, finding solutions to improve the current state map, to prepare and implement an action plan for improvement (with deadlines, responsibilities, required resources and clear targets).
- The time which adds value is important compared to the total time needed to achieve the product or providing a service, from customer order until delivery.
- It is usually necessary to work in a multifunctional team to understand and draw the observed situation.

- Value Stream Maps are drawn as pictures of the process and used to document both Current State Map (reality) and the Future State Map (the goal).

- The Current State Map is the baseline view of the existing process from which all improvements are measured.
- The Future State Map represents the vision of how the project team sees the value stream at a point in the future after improvements have been made.

A Value Stream Map is divided into three sections: Process or production flow, Communication or informational flow and the Timeline wich are presented in figure 1.

# Material flow

For a better defining of the company value stream, the team who is responsible with the map drawing needs to identify some key elements from the production flow: the starting and ending points of the flow, description of each process step, the movement of the products, and the placement of the operators.

### **Communication flow**

Communication represents any kind of informational flow between all the parts involved into the process and more then that into the entire company. Because communication is crucial, by using a proper and simple way to communicate with employees, customers, suppliers and anyone else involved, the company will avoid created by excessive or ineffective communications throughout the process. Also, communications must have place at all levels of the organization, starting from operators heading to superiors and vice versa.

# Time line

The time diagram shows the disproportion between the time needed for product to pass through production and cycle time. The top line measures the process lead time ( meaning the total elapsed time from the moment raw material are received to the time the finished good are sent to the customer) and the bottom line represents total cycle time (total amount of work from each process steps).



Figure 1. The structure of Value Stream Map

## **Current State Map**

To describe clearly the company situation at the present time and for the future, the easiest method is by using VSM as a graphic instrument representation.

For the Current State Map this principle is based on:

- observing the process of making a particular product or providing a service
- recording specific data (performed operations, inputs, outputs, performance indicators, parameters of work, workplace organization, other necessary information)
- representation of all the results of these observations using the specific graphic symbols

# Value Stream Map drawing steps

When the project team starts to draw the current flow map it is better to have some guiding steps to make sure that the team include all the required information, presented in figure 2:

- 1. 1 Draw customer, supplier and production control icons.
- 2. Enter customer requirements per month and per day.
- 3. Calculate daily and/or monthly production.
- 4. Draw outbound shipping icon and truck with delivery frequency.
- 5. Draw inbound shipping icon, truck and delivery frequency.
- 6. Add process boxes in sequence, left to right.
- 7. Add data boxes below.
- 8. Add communication arrows and note methods and frequencies.
- 9. Obtain process attributes and add to data boxes. Observe all times directly!
- 10. Add operator symbols and numbers.
- 11. Add inventory locations and levels in days of demand and graph at bottom.
- 12. Add push, pull and FIFO icons.
- 13. Add other information that may prove useful.
- 14. Add working hours.
- 15. Cycle and Lead Times.
- 16. Calculate Total Cycle Time and Lead Time.



Figure 2. The Current State Map

Is well known that the most important element from any process is the customer. He is buying the company products, and according with his demands each unit is organizing his production. That is why we have to produce the specific number of goods or provide a service, at the specific time, to the required quality and with lower costs [6].

For this reason, many companies started to use this daily demand rate, known as Takt Time. To calculate the Takt Time we can use the following formula:

$$Takt Time = \frac{Net availabile time}{Customer demand}$$
(Eq. 1)

The net available time is the total operational time during a specific period of time, meaning the total amount of time witch adds value to the value stream (without breaks, meetings, lunch or downtime). This customer demand can be determined on customer forecast or based on the currently customer order. Usually the Takt Time is calculated on shift or on day and it gives to the company a good opportunity to determine where the production process can be improved.

As looking to gather more data about the process flow, the easiest way to put them together is to create a data box for each process step, presented in figure 3. This contains five information that should review every process step:

- the number of operators,
- the cycle time,
- changes over time,
- uptime (reliability of the equipment),
- availability of the equipment (shared equipment).

The number of operators is depending of the company structure, of the process complexity, the number of the equipments used and the production capacity. In the data box, the number of the operators is represented with a symbol right under the process name. The cycle time - C/T - is the average elapsed time from the moment one good piece is completed until the moment the next good piece is completed. Change over time - C/O - is the elapsed time from the moment the last good

piece of one product run is completed to the moment that the first good piece of a different product is completed. Uptime - U/T - is the percentage of time that a piece of equipment works properly when the operator uses it for the prescribed task. The availability of equipment – Avail - is the percentage of time that a piece of equipment shared between two or more value streams is available for production of parts in the value stream being mapped.



Figure 3. The process data box

Depending of the company structure and process complexity, the Value Stream Map can appear simple or complex. A more diversified map can have subtasks and parallel flows, but even in this case the principals are applied exactly the same like any other map. In both cases the main target is to improve the process by eliminating errors and defects. To ensure an accurate knowledge of the current company situation, are necessary information about the customers, suppliers, about the entire production flow and the process control. Thus, about the customer you should know the customer, his demands, how often he orders, and what quantity and how often do we deliver to the customer.

Also, the information about the supplier is very important, for example: who is the supplier, how often do we order from him, how often he delivers, and if the supplier sends us the quality we required.

When we talk about a customer we do not have to think directly to the final customer, but also, the customer can be the next operation from the production flow. For the supplier is the same, a supplier can be the anterior operation or working post. On the map, the internal or external customer / supplier are represented by separate icons [7].

About the production process is important to know the daily time of work, how many breaks there are, how many stops are into the process, how long are the maintenance stops. The control data can be associated with monitoring the entire process: the control is made by a person or a department, what kind of system the company uses for production control, how the production control system operates. Working with the customer synchronized tact is based on three principles of a lean production: Pull system, Push system and Takt time.

On the **Pull** system each process drags a new order only when the old order is finished. Many companies are using this system because it has a few advantages: it produces just what was consumed, the stocks are retrieved, and the supermarket has well-defined areas for each product and ensure application of the "First In First Out" method.

The **Push** system ensures uniform outputs by a correct process succession and not through technological improvements. To obtain a flexible production it is recommended to have an interconnected flow and to process a batch of one piece per.

Working on customer **Takt time** provides to the company information about the exact number of workplaces and makes the balance between cycle time and takt time. From the data that we have gathered until now, we can start drawing the connections between the customer, supplier, control point and production scheduling [8].

### **Future State Map**

Once the current state map was presented, the team members can begin the real work associated with Value Stream Map, presented in figure 4.



Figure 4. The Future State Map

The Future State Map can be shaped to guide the positive changes that are desired for the future. The future state map includes essential actions to continuously improve the project. Lean practitioners can rely on this map because it is a process in which action plans can be created by the mapping team. In the Future State Map are also used a series of symbols to help the working team to identify elements that require some changes and how to achieve them, presented in figure 5. One of the best symbols highlighting the need for change is Kaizen Burst. This symbol is placed on the map where ever an improvement can be made along the production process. When a Pull system is used, other important icons can be used on the map, for example: Supermarket icon, Withdrawal kanban icon and Production kanban icon [9] – [10].

**Supermarkets** are a controlled inventory where maximum levels are established and replenishment is signaled through the use of kanbans.

Replenishment signals (kanbans) are used to visually inform workers within the process when replenishment is required.

A **withdrawal kanban** is used to inform an employee that raw material, WIP (work-inprocess), or finished goods should be pulled from a supermarket and returned to the next step of the value stream to have value added.

**Production kanbans** are replenishment signals sent from a downstream supermarket back upstream, informing a process step to produce additional product or parts and move it into the supermarket.



**Figure 5. Future State icons** 

After the Future State Map was created it needs to be presented to everybody involve into the process flow. During the presentation it is recommended to encourage the team to talk freely and maybe to show some changes or additions to the map [11] - [15].

#### IMPLEMENTING

After the Future State Map developing, in most cases the map does not remain as it was drawn. The map can suffers some changes because new problems or improvements appear. Remember that the Future State Map is the starting point for a good plan of improvements. Regardless of the discipline or methodology used by each company to create her own planning and improvement program, the first step is to develop an action plan or a project outline that includes all process improvement tasks. All the actions added to the plan should be focused on improving the entire process by eliminating waste. To implement successfully, the project team should follow a standardized approach to implementation of the action plan. Lean implementation provides a great number of the tools and concepts required to make change a reality, and it implements change at the same speed as mapping the process.

For eliminating errors and defects, each company has her own quality systems for detecting and minimizing the actual problems or potential ones. These systems can be directed just for a product, a process step or for the entire flow, by checking the product at each step of the production line by implementing checking plan or placing an extra person which can supervise the stream flow. It is not everything to find and isolate the defects, but it is necessary to find the cause leading to these problems. To encourage employees to participate actively in creation and implementing VSM, the best method to gain their trust is to show them that their input is value and their ideas are appreciated [16].

### CONCLUSION

The efficiency of Value Stream Mapping is revealed when the team goes to the production process, talks to workers and observes how the product is actually made from the beginning to the end.

Value Stream Mapping must be drown in such a way that can be understood by anyone: all the operators, the management, suppliers and the customer. Only on this condition the team can discover the real problems from the current process flow and create a vision of how the process should look like by making improvements. Value Stream Mapping methodology cannot be used by itself, that is why for obtaining this improvements are necessary other methods like Kaizen, 5 S, Total Productive Maintenance, Setup reduction and others.

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# INVESTMENTS – MAIN VECTOR OF ECONOMIC GROWTH IN THE REPUBLIC OF MOLDOVA

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#### Abstract:

The investment is an engine of economic growth and development, because it acts both on supply and aggregate demand. To invest is to create new, modern means of production, which promotes technical progress in the economy and leads to some productivity gains. Investment acts and on the labor market, permanently changing the occupational structure. So, investments can be defined as those capital expenditures that are made in order to create, build durable goods that will be the hope of getting support in the future, a profit / income expected, a value, that some useful advantages desirable, necessary. Thus, changes in investment largely explain the economic conjuncture fluctuations. The Moldovan economy, one of the reasons economic and social situations is serious in that we are insignificant volume of foreign investments. They contribute positively to economic growth and development of the country without its own financial resources for investment, with a positive correlation between the stock of FDI per capita and national economic competitiveness. Precisely because of this, world countries compete to attract direct foreign investment.

Key words: foreign investments, own financial resources, means of production, economic growth, economic development, labour market.

JEL Classification: 011, E22, O16, R53.

### **INTRODUCTION**

In any economy, investment is a special phenomenon with its own characteristics, different compared to other activities. However, this phenomenon is a manifestation not automatic and is always dependent and subordinate development strategies and policies of companies, sectors, communities, etc.

Purpose of the scientific article is highlighting the importance and benefits of foreign investment in economic growth and development of the Republic of Moldova, lack of own financial resources. Research has been conducted in the study and systematic literature materials and statistical data in this field. Based on this research, the paper stated the following highlights:

- 1. The importance of foreign investment in the economy of a country;
- 2. Advantages of foreign investment;
- 3. Dynamics of foreign investments in Moldova;
- 4. Ranking of foreign investors in Moldova;

5. The measures taken by government to improve the business climate and attracting foreign investments;

6. News of foreign investment in the national economy.

### **CONTENT OF THE ARTICLE**

# THE IMPORTANCE OF FOREIGN INVESTMENTS IN THE ECONOMY OF A COUNTRY

Investments are needed to launch any activity of economic concepts. Deciding on optimal investment must be analyzed and considered developments following parameters:

- a) The anticipated demand
- b) Return on investments
- c) Rates of capacity of product's utilization
- d) The company's debt
- e) The relative cost of inputs

Moldova, like other countries in the early 1990s, has undergone unprecedented economic conditions. One of the most countries in South Eastern Europe and CIS as they entered the transition period without foreign investment stocks, relying only on their own resources in financing the economy. The failure to attract foreign investments in national economy in the early transition period was related to lack of natural resources, but also of inadequate or nonexistent policies in this area. Thus, it was missed the first wave of privatization has brought countries of the region close scale investment. Unfortunately, even after notification of the importance of foreign investment in transition economies by society and government, including undertaking certain measures to improve investment climate in the country still does not benefit from inflows of foreign capital compared to countries in the region. This is explained both by previous failures that worsened the country's image to investors, and the competition between the states to attract foreign capital [5]

### **ADVANTAGES OF FOREIGN INVESTMENTS**

The notion of investment is characterized as an active means of creating sustainable assets, increase, growth and development, and rehabilitation, replacement value of assets in operation, in line with strategic goals and needs of present and future undertakings.

The Moldovan economy, one of the reasons economic and social situation is serious we are insignificant volume of foreign investments. They contribute positively to economic growth and development of the country without its own financial resources for investment, with a positive correlation between the stock of FDI per capita and national economic competitiveness. Precisely because of this, world countries compete to attract direct foreign investment. A time when investors were looking past where they can place their capital, and countries receiving or not receiving these investments only. Today, states apply various methods to attract foreign capital, offering different advantages and facilities to foreign investors. This competition, even if it was not always able to attract foreign investment proportion, to help many transition countries to reform, to improve legislation in the field of entrepreneurship, a climate conducive to business brains. Thus, the flow of foreign investments in economy of a country targeted degree of development shows the degree of credibility in this state.

It can also be established a direct link between investment and innovation, as noted above, that investment is the means to disseminate technical progress, so innovation. For Joseph Schumpeter, innovation is the first function of the entrepreneur. Profit as long as competition rewards innovative advance has not recovered economically obtained. A leap in innovation may explain, in fact, a growth phase flow in the economic cycle. But invention is not only the techniques but also new products or new methods of work organization. Today, after a wave of technical modernization accelerated innovation lies in the mobilization of human capital, investment in human competence, responsibility and creativity. [6]

Thus, foreign direct investment in their lack of financial resources, offers the following advantages:

- Obtain and implement new technologies;
- Create new places of labour force;
- Development of new branches of the economy;
- Access to the new export markets.

Along with the benefits FDI does not create foreign debt and therefore to be considered very attractive economies in transition. However, there are some risks in attracting foreign financing for economies in transition, especially for governments which do not create an environment conducive to their attraction. Of these we mention:

• Competition established local companies, which often do not provide the same quality of products and services.

• Salaries offered by foreign investors might be higher than those offered by the national economy.

• Free capital transfer reduces the stability of national currency.

• High monopoly price stability by companies operating in the host country, which is not in the state.

• Even innovative large companies usually focus scientific research and technical development base in the countries and, as a result, host countries lag behind in terms of development in science and innovation.

### DYNAMICS OF FOREIGN INVESTMENTS IN THE REPUBLIC OF MOLDOVA

FDI in Moldova began to be attracted in 1992, when it was adopted the Law on foreign investment. By 1997 these flows were minimal, the government putting more emphasis on obtaining loans than on attracting outside investment.

Although after 2005 foreign investment flows have increased, they were significantly affected in 2009 by world economic crisis (Table 1).

FDI Flux	1995-2005 (annual	2006	2007	2008	2009					
	average)									
Republic of Moldova	92	233	539	708	86					
FDI Stocs	1995-2005 (annual	2006	2007	2008	2009					
	average)									
Republic of Moldova	97	449	1848	2566	2604					
Sources UNCTAD World Investment Deport 2010, unweren stad one/win on unwere unoted one/fdicted										

 Table 1. Dinamics of Foreign Direct Investments (FDI) Flux, mil USD

Source: UNCTAD, World Investment Report 2010; <u>www.unctad.org/wir</u> or www.unctad.org/fdistatistics.

A major shortcoming of the Republic of Moldova during the initial transition was a lack of investment strategies. There was a deep analysis on the medium and long term, which would establish priorities, directions of development of the country and would give investors a clear picture on who could enter the market. Investment policies were not developed clear that characterize the investment priorities.

The share of foreign direct investment in fixed assets had a maximum of 13.2% in 2008, when in 2009 a slight decrease to 9.5%, but it is also about double the 2002 level (Table 2.).

current prices											
	2002	2003	2004	2005	2006	2007	2008	2009			
Investments in fixed assets – total	2804,2	3621,7	5140,0	7796,5	11012,3	15335,8	18224,8	10878,9			
from which:											
Public	1090,2	1254,4	1676,1	2552,2	3702,8	3845,9	4307,1	3152,2			
Private	936,8	1319,1	1655,0	2741,1	4026,2	6346,1	7899,7	4497,6			
Mixted (public or private), without foreign participation	76,0	118,1	187,1	262,0	316,7	289,4	265,0	223,0			
Foreign	145,6	179,2	497,2	686,4	1399,8	1957,3	2406,8	1041,8			
Of mixed enterprises	555,6	750,9	1124,6	1555,0	1566,8	2897,1	3346,2	1964,4			

 Table 2. Dynamics and structure of investments in fixed assets by ownership, mln lei, current prices

Source: National Bureau of Statistics of Republic of Moldova

### **RANKING OF FOREIGN INVESTORS IN MOLDOVA**

Analyzing foreign investment in Moldova since 2001, one can mention the following: Romania ranks 8 with only 45 million invested by 2008. However, it seems amazing that the country has invested most in Moldova's economy in 2001 until 2008 the Netherlands. The top 10 investors included the following countries: Netherlands-181, 82 million
 Cyprus-125, 00 million
 Italy-119, 32 million
 Russia-73, 86 million
 Germany-56, 82 million
 Spain-56, 7 million
 UK-52, 73 million
 Romania-45, 7 million
 US-43, 92 million
 France-36, 28 euro million

According to Export Promotion Organizations and Investment (MIEPO) in late 2007, foreign investments in Moldova were in 86 countries, most coming from the European Union, followed by CIS, USA and Canada. Netherlands is the country with the largest investments in the Moldovan economy at a rate of 21.5%. Relatively large flows of foreign investment in the EU show favorable geographical position of Moldova, located near this region. EU financial resources and the Republic of Moldova should take advantage of the proximity of this to attract these resources. At the same time and within the EU there are countries that still need external resources to finance the economy. Large capital flows in the EU are directed to more distant states, but offers high reliability and greater advantages to foreign investors. This thing demonstrates the fierce competition of the Republic of Moldova to creating a favorable image to foreign investors [5].

# THE MEASURES TAKEN BY GOVERNMENT TO IMPROVE THE BUSINESS CLIMATE AND ATTRACTING FOREIGN INVESTMENTS

Thus, to improve the business climate and attracting foreign investment, the government has taken the following measures:

Creating the Agency in 1997 to attract foreign investment, this in 2001 became part of the Export Promotion Organization.

1. In 2001 Moldova became a member of International Trade Organization.

2. Initiate regulatory reform that aims to reduce dependence on administrative regulation of businesses, reduction of financial costs and time permits, certificates and other permissions.

3. In 2001 the first investment strategy was approved in Moldova for 2001-2005. Currently there is strategy to attract investment and promote exports for a longer period for 2006-2015 adopted by the Ministry of Economy and Trade.

4. Adoption of other national strategies and programs that provide implementation of measures that will contribute to economic growth.

5. In 2007 the National Agency for Protection of Competition as a permanent authority in the public. Administration planning is required by the Action Plan EU - Moldova.

6. Have concluded bilateral agreements with 35 countries to protect investments [5]

# NEWS FOREIGN INVESTMENTS IN NATIONAL ECONOMY

Despite actions by the government, foreign investment flows were reduced in Moldova, and the stock of FDI per capita remains low compared to other countries regiune.Ca Therefore, the above actions, although are welcome, did not have a significant impact on the country's investment attractiveness, or other negative factors exist which are major barriers to investment decision than shares already undertaken by the government.

So, in attracting FDI in Moldova, it was created an unfavorable situation. This is observed in comparison with the countries of South Eastern Europe and CIS, low economic performance of national economy, low level of income reinvested small number of projects.

Therefore, the need to attract investment in the national economy comes from the following reasons:

- Moldova reduced its investment potential, lack of internal resources of the private sector.
- The need for integration of Moldova into the world economy on favorable terms.
- Creation of a competitive environment with the participation of foreign investors, increasing competitiveness of national production.
- The existence of a large number of enterprises operating at public losses that highly leveraged hedge against budget. Their privatization and sale of foreign investors will bring a new business culture and the concept that a company must make money; otherwise it is not the benefit of society.
- The need of implementation, the Moldovan economy, advanced technologies and knowhaw's economic activity, which becomes possible with the arrival of foreign investors.

# CONCLUSIONS

Currently, Moldova is one of the most disadvantaged countries in terms of foreign direct investment flows, the main causes are the following:

- Lack of strategy for attracting investment in the initial transition period.
- Lack of natural resources.
- Missing the first wave of privatization and lack of transparency in the privatization process.
- The high degree of competition between countries in the region of Southeast Europe and the CIS to attract FDI.

However, the proximity to the EU, which is moving outward and FDI inflows demonstrate to offer advantages to be properly explored. For it is not enough there is a strong legal framework to attract investment, but important is the rule of law.

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