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# EFFECTS OF USING PROCESS MAPPING IN AUTOMOTIVE INDUSTRY. A CASE STUDY.

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***Abstract:*** *Process Mapping is a key methodology to successfully analyze and understand any process in an organization by creating a visual representation of the workflow, with the aim to streamline processes, optimize resource use and reduce waste. Due to its demonstrated effects, Process Mapping is widely used in the automotive field and is recommended be applied in any industry.*
*This paperwork presents a case study of applying Process Mapping methodology, under Value Stream Mapping (VSM) and Metric Based Process Mapping (MBPM) in a respectable automotive company, describing a personalized approach to its needs.*
*After introducing the Process Mapping methodology, the Process mapping approach of the mentioned tools are described, showing in parallel the evolution and the effects of the implementation.*
***Key words:*** *value stream mapping, process mapping, metric-based process mapping, VSM, MBPM.*

## 1. INTRODUCTION

The Process Mapping method is a useful instrument which helps a company to visually represent and map the production, material and information flows with the aim to gain a better understanding of the company processes, of its steps, inputs and outputs. Essential process steps and key figures, e.g. throughput time, are visualized in a value stream map, which fosters the understanding of the actual as-is process and offers a medium of communication [1]. Value Stream Mapping is a Lean method of analysis of the transformation flow, helping to identify problems and make the entire production flow more efficient. This helps to increase the added value. VSM is not something that is applied occasionally, the activity becomes a natural part in a company where the culture of continuous improvement exists [2].

Within this analysis, the current flow of production and transformation of the product is mapped with the aim of developing a new version of the improved flow.

Applying the VSM analysis method, the people participating in the analysis have the opportunity to observe how the product is transformed from the first processes to the end, passing through each transformation phase. Observing how the activities are carried out and talking to the operators who carry out the work helps to collect data and understand the challenges that the employees face [3]. As they already know which are the main transformation steps, the starting point and the end point, the team is ready to "transform" into a product and go through the entire production flow, observing the activities carried out and collecting data related to:

- Use Product type;
- The time required to create a product;
- Inventory of stocks in the production line;
- Identifying problems and possible solutions.

Observation from one process to another can take time and be difficult. In certain situations, teams are created and the work of observation and data collection is divided, either by the number of production processes or by the different subjects or activities that must be collected [4].

After collecting data from the observation stage, tickets of different colors are used to help visualize the collected data more easily (e.g.:

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process steps, lead times, scrap level, stock level, etc.).
In conclusion, the VSM method can be applied to different flows of production, of information and materials, but the most common is performed on the production flow up to the delivery to the customer. Also, the VSM method can be found as an application to the processes: production planning, procurement, staff training, recruitment, delivery preparation, maintenance intervention, etc.
Depending on the size and complexity of an organization, we may have only a few processes, flows that can be analyzed or, in the case of complex organizations, there may even be dozens of processes where the VSM method is or can be applied [5].

A related study associated with process mapping applied in the automotive industry is the Case Study of ThyssenKrupp which demonstrates and analyses the actual state of the material and information flow across the supply chain at ThyssenKrupp. The objective of the prepared VSM is to identify causes of waste and reduce them in order to improve the production processes and meet the customer demands. By developing and implementing of a desired future state map with a more efficient overall production system [6], ThyssenKrupp has the possibility to improve the productivity and remain competitive [7]. The improvements are focused on change over time, takt time and inventory levels, which leads to a reduction of the lead time [8]. The automotive industry is one of the largest and competitive sectors in Germany. It offers great opportunities for the application of lean tools to eliminate waste, improve operational processes and gain competitive advantages. ThyssenKrupp are a key supplier in the automotive industry and utilize Value Stream Mapping (VSM) to highlight and reduce non-value-added activities in their manufacturing operation [9].

The standard belief in books about Lean initiatives and value stream mapping (VSM) is that VSM works well on transactional processes (which are primarily linear processes where handoffs are well defined and the outcome is known) and it is useful for repetitive projects or products [10] [11].

Drawing on more than 40 years of application experience at one of the world's largest chemical and materials manufacturers [12], coupled with 10 years in private practice, Peter King corrects this void by providing the first comprehensive resource written explicitly for change agents within the process industries [13] [14].

A case opportunity to apply the concepts of value stream mapping based on details about a flange manufacturing facility is already documented. Value stream mapping is a fundamental lean tool in which flowcharts are used to show all steps involved, from making a product from incoming raw materials to the delivery of finished goods [15].

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## 2. MATERIAL AND METHODS

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Process Mapping is a process analysis method, regardless of the type of process, whether it is production or support function, within this concept two analysis methods have been defined according to the type of process [16] [17].

In this case study, the definition of a standard for the application of Process Mapping in the Production area and support functions was pursued.

The concept defined by Process Mapping contains 4 development phases. In the first phase the definition of needs is carried out, followed by the selection of the type of method, depending on the chosen process, after which the analysis phase is carried out and finally the new vision of the process is defined and the implementation plan. Their interaction is defined in the below diagram.

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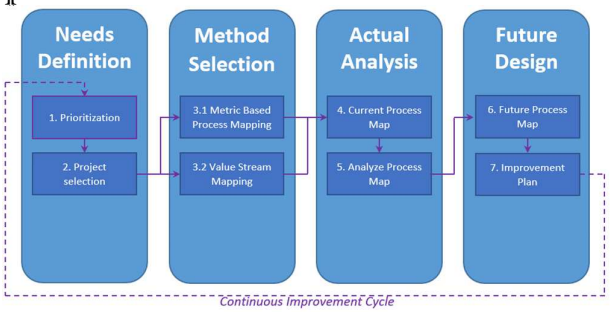


**Fig. 1.** Process Mapping Concept.

### 2.1 Needs Definition

This stage is dedicated to the process of defining the needs within the organization. The processes need to be allocated to different types of processes: basic, support and management ones. Many companies have already these processes defined by the business model. For example, in a production company we can have the following processes in the Business Model:

- Basic processes: Quotation, Product/Process Development, Production and Logistics;
- Support processes: Procurement, IT, Controlling, Human Resources, Continuous Improvement;
- Management processes: Strategy, Innovation, Quality Management System.

Each process defined by the business model has many other sub-processes at different levels, in the end each organization carries dozens or even hundreds of transformation processes, either material or information transformation.

We can take as an example the basic process of "Production", which has the production lines subordinated, the place where the transformation process involves a physical conversion through which the product is made. In this first stage of the entire Process Mapping, the production lines with the greatest criticality and the biggest improvement potential are identified. For this prioritization, the results obtained through the performance indicators can be evaluated, for example, based on the results obtained in terms of productivity, lead time, quality, etc.

After identifying the critical production lines, a planning of all process mapping type analysis projects is carried out. As is the practice in the company where the case study took place, every year, each head of the production department had the responsibility to carry out at least a process mapping analysis for one of the production lines in the production segment. Obviously, in addition to this minimum number of projects that must be carried out, other ones can be carried out as often as necessary, in case a new priority is identified.

After the project has been selected, we proceed to the next stage, namely the selection of the analysis methodology.

## 2.2 Method selection

During this stage, the team decides which analysis method is more suitable for the chosen process. There are two methods within the concept:

- MBPM - Metric Based Process Mapping;
- VSM - Value Stream Mapping.

Metric Based Process Mapping (MBPM) is a method of mapping information processes, suitable for application to support or management processes within the business model. For example, by evaluating the results measured by performance indicators, non-performing processes can be identified, and by the MBPM method, the process is subjected to an analysis to identify and eliminate losses.

Value Stream Mapping (VSM) is an applicable method for mapping the physical processes of product transformation, found within the production processes, having the possibility to include in the analysis the informational flow related to the material process studied. In the process analysis, the entire product transformation flow, each step of the process and interphase transfer is observed with the aim of identifying losses and visualizing the entire flow as an overall picture, thus being able to identify new ways of making the product, more efficient, faster and simpler.

## 2.3 Actual Analysis

This stage is dedicated to the practical analysis of the process, where the chosen analysis method will go through several steps of observing the process, collecting data and analyzing them.

### 2.3.1 Value Stream Mapping Methodology

In the case study, a production line was selected from a production segment, where following the analysis of the previous year's results, it turned out to be the production line that affects the most to the lack of productivity.

The first stage in the development of the VSM project consisted of establishing the team and planning the time allocated for the workshop. The team assigned to the construction site is usually a multidisciplinary one. Thus, chosen members had knowledge related to the

studied production line, they were from the Production, Technical, Quality, Maintenance, Logistics and Lean departments, thus ensuring the necessary skills during the analysis, from as wide a range as possible of expertise. The time allocated for the construction site depends on the complexity of the chosen process, in general for a production line 1-2 days are allocated for this activity.

The first activity carried out on the construction site is the training session related to the application of the Value Stream Mapping technique, where the team members get again familiar with the steps that must be taken on the construction site in order to obtain efficient results that have an important impact on the business.

After the induction session, the product type and/or product family is chosen. In general, it is recommended to select a product that is as relevant and representative as possible of all the products that are made on the respective line. Usually, the product with the highest demand from the customer, called high runner, is chosen.

For a good organization of the activities, it is necessary to group the participants into teams, thus generating 2-3 teams of max 5 members who are assigned to several process phases in the production line, so that at the end of the observation activity, the 2-3 teams cover all steps of the production process, without overlapping on the same areas.

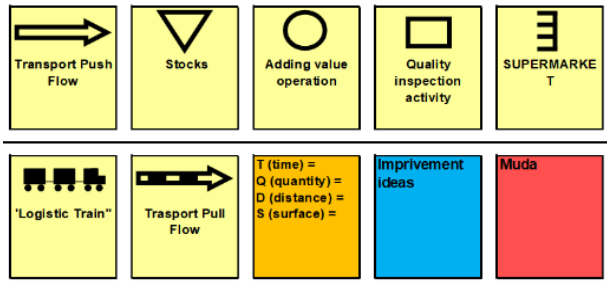


**Fig. 2.** Value Steam Mapping symbols.

After these aspects are clarified and established, we move on to the next stage, namely the stage of monitoring production activities, Muda observation. In this activity, the data collection form is used, for a better data centralization, and the sign convention is explained to all participants.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area : | | | | | | | | | Transformation | |
| Process: | | | | | | | | | Transport | |
| Product: | | | | | | | | | Inspection | |
| Daily quantity requested: | | | | | | | | | Stock / Waiting | |
| No. | Description | Simbols | | | | Date | | | | Observations |
| | | | | | | time | quantity | distance | surface | |
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |

**Fig. 3.** Muda observation/collection data sheet.

The observation and collection activities take place in the GEMBA (production area), having the reverse order of observing the flow, from the last step to the first, e.g., from downstream to upstream. In the observation phase, only the transformation and movement phases of the product are followed, the product is followed. Any identified Muda is described in the collection form and photographed (figure 3). Approximately 1-2 hours are allocated to this stage.

**Fig. 4.** Process observation activity.

After the data collection stage, all the teams gather in the analysis area and start to consolidate the collected data, applying on the wall in the first phase a "yellow" ticket for each step of product movement and on the orange tickets the data related to time, quantities, distances and surfaces (figure 5).

After placing all the tickets on the entire observed production flow, for a better visualization, all the tickets are summarized with the symbols:

- Add value;
- Inspection;
- Storage;
- Transport (see fig.2).

**Fig. 5.** Visualizing the collected data.

The following calculations are also carried out to identify the current level of efficiency and to define the vision:

- VA = Value Added
- LT = Lead Time
- $F_F$ = Flow Factor,

were:

- VA = The added value, represents the sum of all the processing times on the "Adding value" tickets, measured in seconds.

All activities in a company add or do not add value to the business. Companies can apply the VSM method to examine each step in their processes and determine whether each activity adds value to their products or services. When they discover a process or activity that does not add value, the task is to change or eliminate that operation [18].

Value added is appreciated based on what a customer will pay for when acquiring a product or service, which means that ultimately it is the customer who decides whether an activity adds value to the product or service or not.

- LT = Lead Time is the period that passes from the start of a process to its completion. Companies look at manufacturing lead time, supply chain management and project management.

Reducing lead time can streamline operations and improve productivity, increasing output and profits. Conversely, longer delivery times negatively affect sales and production processes. Lead time measures how long it takes to complete a process from start to finish. In manufacturing, lead time is often the time it takes to create a product and deliver it to a consumer [19].

Lean Time can be calculated in four different ways: by marking a product, the sum of the measured times, by the stock level on the flow or by identifying the bottleneck.

1. The first possible way of calculation is by marking a product and following it throughout the production flow, until the end of the process. This way of working is the most accurate, especially if this operation is applied several times, thus succeeding in increasing accuracy. Unfortunately, in many cases, this way of calculation is very difficult or expensive since the Lead Time lasts several days or even weeks.
2. The second method of calculation is by summing all the times recorded in the VSM analysis on the tickets, and in the case of the stock measured in pieces, the time transformation method is multiplied by the time rate from the next process step.

$$LT = S_t + \left(S_{wip} * T_s\right) [sec] \quad (1)$$

$S_t$ [sec] = the sum of times measured for the processes that: add value, transport, quality inspections,

$S_{wip}$ [pcs] = the sum of quantities of products inventoried in the line, interphase stocks,

$T_s$ [sec] = product cycle time from each process step.

Another possible way of calculating the Lead Time is by summing all the products in the flow, multiplied by the Takt Time of the line. Takt Time is the rate at which a product must be completed to satisfy customer demand [20]. For example, if the order of products per week is 1000 pieces and the working time in a week is 5 days with 3 production shifts, then it means that every 432 seconds a product must be made $T_t$= 432 sec, the production team must finish a product in 4 hours or less to meet the demand.

$$T_t = \frac{T_{ap}}{D_q} \quad (2)$$

$T_t$ [sec] = Takt Time

$T_{ap}$ [sec] = Total available Production Time / week

$D_q$ [pcs] = Demand quantities / week

$$LT = S_{wip} * T_t \text{ [sec]} \quad (3)$$

$S_{wip}$ [pcs] = sum of the quantities of products inventoried in the line, interphase stocks.

If the production line is automated, having machines and equipment at all process steps, then the following calculation formula can be applied: the sum of the quantities of products inventoried in the line multiplied by the normalized cycle time from the bottleneck.

The bottleneck represents a blocking operation that is already operating at full

capacity and therefore cannot support any additional growth beyond its current production level. The term refers to the bottleneck of a production flow. A bottleneck is the key problem that interferes with a business's ability to increase its sales and profits. The effects of a cook-off can be reduced by increasing capacity, outsourcing work, reconfiguring products and maximizing cook-off efficiency [21].

$$LT = S_{wip} * T_{sb} \; [sec] \qquad (4)$$

$S_{wip}$ [pcs] = sum of the quantities of products inventoried in the line, interphase stocks,

$T_{sb}$ [sec] = product standard cycle time, from the bottleneck.

$F_F$ = Flow Factor, is the percentage of activity that adds value from the total manufacturing time of the product (Lead time):

$$F_F = \frac{VA}{LT} \text{ x } 100 \; [\%] \qquad (5)$$

where:

$F_F$ [%] = Flow factor

$LT$ [sec] = Lead Time

$VA$ [sec] = Value added, the sum of the times of the processes that add value

***Method of calculation in the case study***

Considering the described calculation methods, the following calculations were made in the case study carried out on one of the production lines with high importance in the factory's result:

- VA = *Adding value*, the sum of all processing times on "Adding value" tickets was VA = 261 [sec];
- LT = Lead Time, calculation method no. 2 was used, thus:

$$LT = S_t + (S_{wip} \, x \, T_s) \; [sec] \qquad (6)$$

$$LT = 3.527 + (5.838 \text{ x } 18{,}63) = 112.311 \; [sec]$$

Note: In the calculation mode for ($S_{wip}$*$T_s$), the specific time norm was used for each process step, respectively the stock inventoried in production.

- $F_F$ = Flow Factor

$$F_F = \frac{VA}{LT} * 100 \; [\%] \qquad (7)$$

$$F_F = \frac{261}{112.311} \text{ x } 100 = 0{,}23 \; [\%]$$

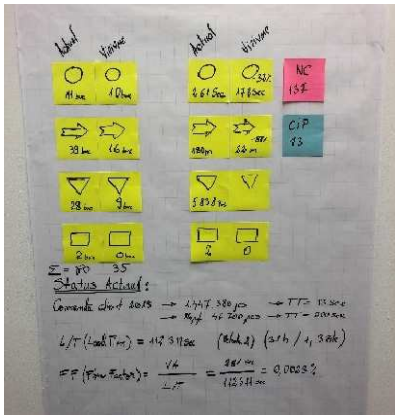

**Fig. 6.** Summarizing and calculating the analysis in the case study

**Vision after the analysis site**

In the case study, 137 non-conformities and 13 ideas for improvement were identified, thus considering the implementation of improvement actions and the elimination of non-conformities, the vision was defined as follows:

- Productivity increase from 83% to 97%;
- Scrap discount from 4.2% to 2.3%;
- 32% reduction of the VA= 178 sec;
- 88% reduction of product travel distance from 180 meters to 22 meters;
- 65% reduction of the interphase stock level from 5,838 pcs to 2,068 pcs;
- Eliminating a process step by combining two process steps into one;
- Elimination of two quality inspection steps;
- 75% reduction of LT = 27.590 sec;
- 277% increase of $F_F$ = 0,64%.

### 2.3.2 Metric Based Process Mapping Methodology

For the analysis of support and management processes, where the flow is one of information, a different analysis approach is needed compared to the VSM method.

In the case study, the monthly bonus closing process from the Production department was chosen.

The first stage in the development of the MBPM project is establishing the team and planning the time allocated for the workshop. The team assigned to the construction site is a multidisciplinary team, having knowledge related to the chosen process since it is part of the process, this being a primordial condition for the success of the construction site. In our case, the participating people were from the Production, Technical, Quality, Human Resources, Financial and Lean departments, thus ensuring the necessary skills during the analysis from a wide range of expertise. The time allocated for the construction site depends on the complexity of the chosen process, in general, for a support or management process, 1-2 days are allocated.

As a preparatory action for the analysis site, the collection of data can be carried out a few days, weeks before the site. In this regard a data collection form is used, which includes the following elements:

- Function that performs the activity;
- Description of the activity;
- Date and time;
- Process time = operation time;
- Total time = process time + waiting times;
- The location where the activity took place;
- The reason for carrying out the activity;
- Other relevant information or the location of other documents if necessary.

All this information is necessary for the time of the data analysis site development.

The first activity carried out on the construction site is the training session related to the application of the Metric Based Process Mapping technique, where the team members get again familiar with the steps that must be taken on the construction site to obtain the best possible results.

After the introduction session, the objective of the construction site is defined, namely "Reducing the closing time from 3 days to a maximum of 1 day". Also, the program of the two days is defined and agreed together with the participants.

Then, the information collected on the form applied in the previous activity of the collection site is viewed. At this stage, a form is used to record and visualize each step, the stage in the analyzed process, using the red tickets are marked, the deviations, identified non-conformities are visualized, and with the yellow tickets, the improvement ideas are visualized.

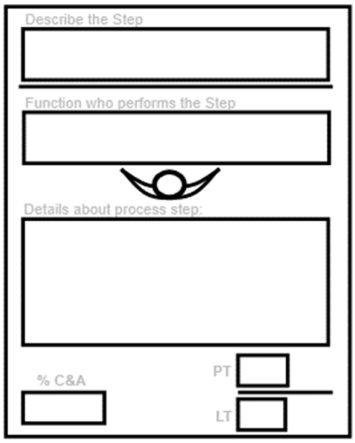


**Fig. 7.** Process step visualization form in MBPM analysis

Based on the collected data, for each process step several elements need to be calculated, for example:

$P_t$ = Process Time - the actual time it takes a worker to complete a task if they work only on that task continuously and if all waiting time is removed.

$$P_t = Touch\ time + Talk\ time + Time\ to\ think \quad (8)$$

LT = Lead Time - time elapsed from when work is made available to a particular worker or team until it is completed and made available to the next person or team in the process.

$$\text{LT} = P_t + W_t + D_t \quad (9)$$

where:

$W_t$ = Waiting time,

$D_t$ = Delay time,

C&A = the estimated percentage related to the quality of the information, meaning how complete and accurate it is. The indicator reflects the quality of the process step output. In order to have the correct C&A information,

consult downstream customers if required for the data provided:

- Corrected, once they have been provided;
- Added information after it was provided;
- Clarifications were made, because they were not easy to understand;

The information visualized for each process step in the MBPM analysis is:

- Description of the process step;
- Function that performs the activity;
- Details related to the process step;
- Q&A;
- Process Time "PT";
- Lead Time "LT";

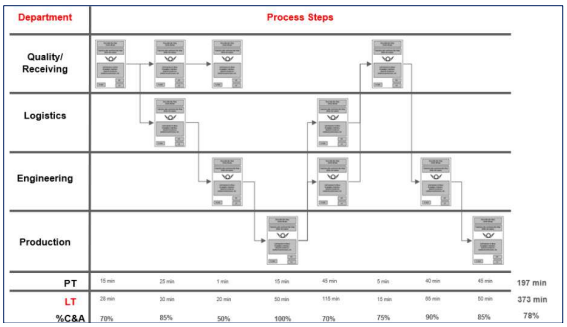


**Fig. 8.** Example of information visualization in MBPM analysis

As part of the analysis, data related to 22 steps necessary to achieve the monthly bonus from the Production department were collected, four different departments/functions being involved in the development of these activities.

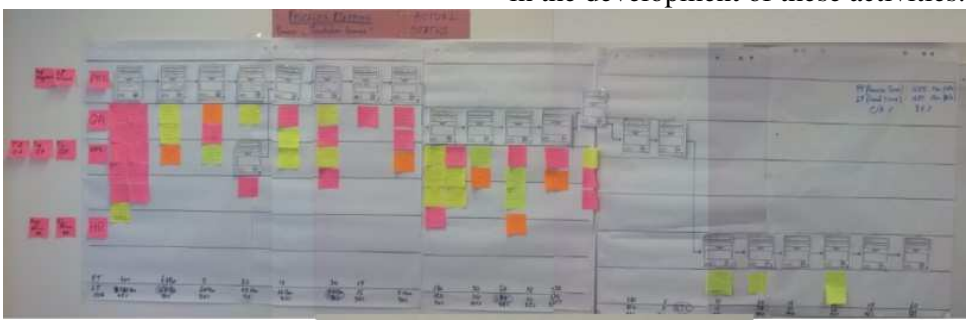

**Fig. 9.** Metric Based Process Mapping for monthly bonus closing system - Actual status

Following the data collected and analyzed, a number of 24 deviations and 22 ideas for improvement were identified, with a:

- PT = 1075 min (18 hours);
- LT = 1685 min (28 hours);
- C&A = 91%.

Based on the team's improvement ideas, five process steps were identified within the construction site that can be eliminated by automating certain activities, so as can be seen in Figure 10, the vision describes a much shorter process.

**Fig. 10.** Metric Based Process Mapping for monthly bonus closing system - Vision

The potential for improvement identified and estimated is the following:

- PT = 485-minutes (8 hours) reduction from 1075 minutes (18 hours);
- C&A = 97% increasing from 91%.

## 5. RESULTS

The methods found in Process Mapping are generators of new improvement projects, in many different categories. By applying these analyses, we have a first phase of improvement through the ideas identified within the construction sites and a second phase of improvement through which new needs for other improvement sites are identified within the construction sites, applying other methods such as: 5S construction sites, optimizations on change over applying the SMED (Single Minute Exchange of Die) method, OPF (One Pieces Flow), and many others.

The indicators by which the results following the application of Process Mapping methods can be measured are:

- Quality: rejected, number of complaints from customers;
- Delivery: OTD (on time delivery), backlog level;
- Cost: $F_f$ (Flow factor), Productivity, Cost rate, level of interphase stocks (WIP), utilization rate of machines (OEE);
- Motivation: number of ideas for improvement.

The performance indicators chosen to evaluate the results of our case study for Value Stream Mapping are:

Productivity [%], Scrap [%], Lead time [sec] and Flow factor [%].

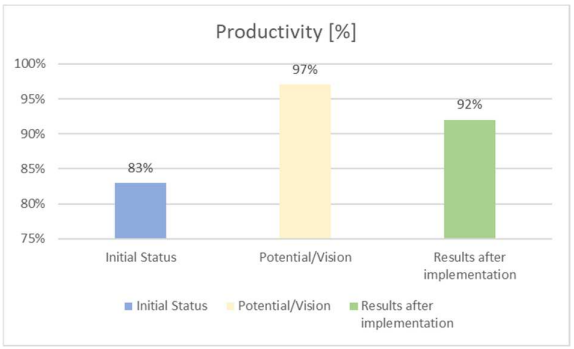


**Fig. 11.** Results obtained in Productivity

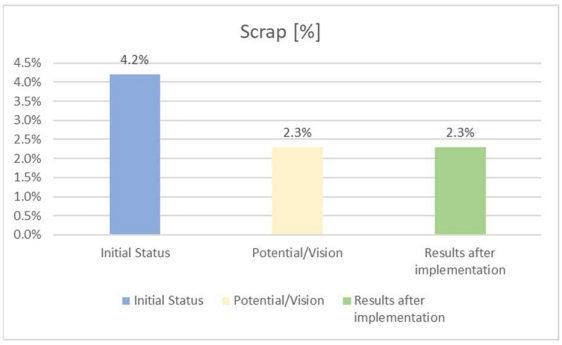


**Fig. 12.** Results obtained: Scrap

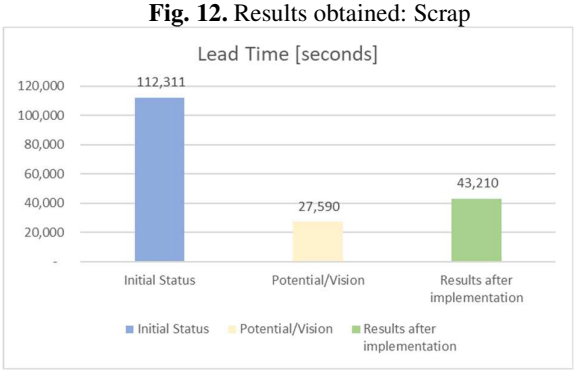


**Fig. 13.** Results obtained by reducing the Lead Time

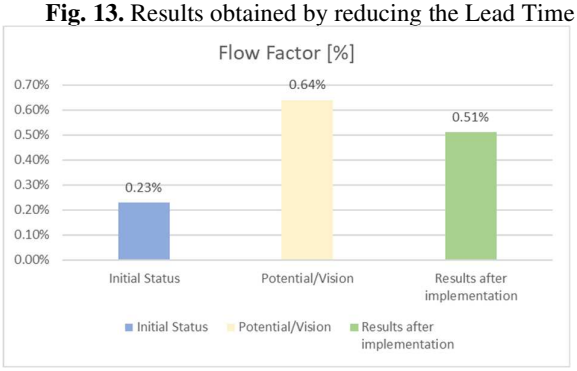


**Fig. 14.** Results obtained in Flow Factor

The performance indicators chosen to evaluate the results of our case study for Metric Based Process Mapping are C&A [%] and Process time [seconds]:

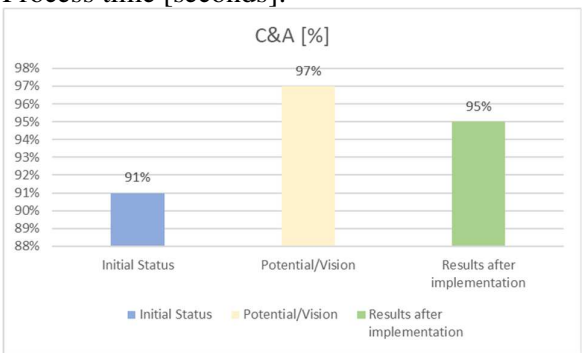


**Fig. 15.** Results obtained for C&A (Complete and Accurate)

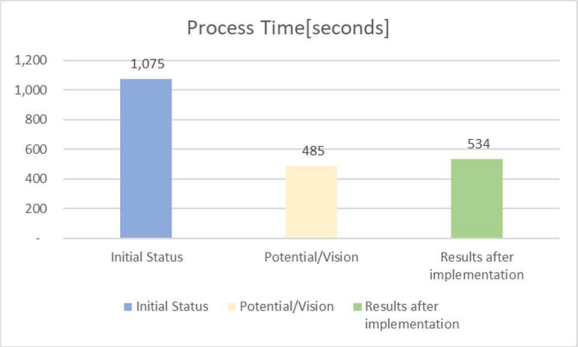


**Fig. 15.** Results obtained Process Time

## 6. DISCUSSION

Process Mapping is a very suitable method for understanding what happens in the organization, analyzing each process separately and clarifying the whole process, whether the activities add value or not. In everyday work, no one takes the time to stop the activity and analyze the entire flow, whether it unfolds in a logical way or not, whether it can be done much simpler and simplified. Through the methods described in the Process Mapping concept, any transformation flow (physical or information) can be easily understood and redefined in a much more efficient way.

In the activities, in which these methods are applied, there is the moment when participants stop what they do every day and allocate time to make a detailed analysis of the activities, being beneficial to understand the overall picture of the whole process. The application of Process Mapping is necessary at least once per year in each area/department and any process carried out within a company should sooner or later be analyzed and improved.

Any organization, regardless of whether they develop products or services, should periodically apply process mapping techniques, thus ensuring a continuous improvement mechanism in a PDCA (Plan, Do, Check, Act) cycle. Applying these methods provides participants with a solid basis in understanding and visualizing the types of activities that add value or not to the company.

VSM and MBPM techniques can be compared to the drone that transmits information in real time from a war zone, so the soldiers fighting in the field have clear information about the general situation but also the detailed situation on the battlefield, knowing constantly the movements of the enemy and being able to anticipate the events that will take place in the next moments. Like the drone, the methods described in Process Mapping offer employees and management a general perspective, but also in detail, what is happening in that analyzed process.

Many times, there were requirements to do "something" additional within a process, that at the time had a justified objective, but later was no longer justified. Nevertheless, there was no one to ask for the elimination of that "something", leading to the fact that certain activities were carried out for a long period of time only because it was requested by a superior.

Process mapping analysis creates moments in which certain activities are discovered that have been carried out for a long time without adding value. For example, during an analysis carried out in 2013-2014 within a production company, it was found during the VSM analysis that a marking was applied to the product in the form of a yellow dot. After this problem was raised, it was found that the point was introduced 4 years before following a customer complaint, and the point attests the fact that the product is visually checked 100%, which was no longer needed in the current situation as there are other quality procedures. Thus, for 4 years every day, someone wasted time by applying that point on the products, and due to the fact that the VSM site was developed, the problem was identified, clarified and eliminated.

A specific recommendation of this case study is the application of the Value Stream Mapping method in each production area, at least once a year as an improvement project led by the head of production in each area. Thus, there is a sustained mechanism for applying continuous improvements in each production area or production line.

A new element brought by the case study is the Concept of Process Mapping that combines two process mapping methods, offering specific solutions, depending on the type of process to be analyzed. It is also offered in a clear and structured form, the methodology for calculating the performance of the process regardless of whether it is a production process, a support or management process.

Through the regular and systematic application of these process analysis methods, a continuous improvement process is obtained, ensuring permanent efficiency.

## 7. CONCLUSION

The application of process mapping methods offers the possibility of understanding and visualization in a very clear and easy-to-understand form for any function within a company, from operator, engineer to management. It is a method by which the types of activities carried out in the processes are highlighted, being categorized into activities that add or do not add value, thus having the chance to reduce or eliminate activities that do not add value and maximize those that add value, thus streamlining the process, as it was demonstrated by the calculation methods provided by this case study.

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## EFECTELE UTILIZĂRII PROCESULUI DE MAPARE ÎN INDUSTRIA AUTO. STUDIU DE CAZ.

**Rezumac:** Maparea proceselor este o metodologie cheie pentru a analiza și înțelege cu succes orice proces dintr-o organizație prin crearea unei reprezentări vizuale a fluxului de lucru, cu scopul de a eficientiza procesele, de a optimiza utilizarea resurselor și de a reduce risipa. Datorită efectelor sale demonstrate, maparea proceselor este utilizată pe scară largă în domeniul auto și este recomandată în orice industrie. Această lucrare prezintă un studiu de caz al aplicării metodologiei de cartografiere a proceselor, prin aplicarea metodelor Value Stream Mapping (VSM) și Metric Based Process Mapping (MBPM) într-o companie automotive respectabilă, descriind o abordare personalizată a nevoilor sale. După introducerea metodologiei Process Mapping, este descrisă abordarea mapării proceselor prin aplicarea instrumentelor menționate, arătând în paralel evoluția și efectele implementării.
Cuvinte cheie: maparea fluxului de valoare, maparea proceselor, maparea procesului

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