Process mapping: a research of the main tools

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ABSTRACT

Being competitive is essential and crucial for companies to stay in business. Thus, process mapping is an indispensable management resource for identifying and optimizing company processes. The purpose of this paper is to review the literature on the main process mapping tools. In order to achieve this goal, a survey of the main authors on process flow mapping and the structure of their tools was made. From the analysis of the main authors, it was concluded that each tool has particularities that distinguish them from each other, all of which contribute to process improvement, adding value.

Key Words: Process mapping, optimization, continuous improvement, competitiveness.
INTRODUCTION

The goal of this research is to review the literature about the main tools of process mapping.

Being competitive is essential for businesses to remain in the markets. Therefore, for businesses to follow-up the evolution of the markets and remain competitive, they must identify opportunities to improve their cost structure across the different areas, functions and processes. This means that incremental and radical improvements are key for a business to be successful. Improvements depend on a good definition of what is to be improved in the first place. If a business does not have the knowledge about their internal processes, how can they know where to place an improvement effort? So, the mapping of processes is an indispensable resource in facilitating a good problem definition, which will further lead to a more in-depth analysis of weaker business sections and the following optimization of them. Since the process mapping activities are usually represented by symbols, they stand as one of the most visual ways to represent an entire business under the form of process-based symbols.

Following the idea above, process mapping activities allow the visual representation of the different processes of a business by describing the several stages that can, or not, add value to the business and its customers. In resume, process mapping is essentially a planning and definition tool. Due to its symbology and the use of it towards differentiating which processes add, or not value, process mapping can also be considered as part of some of the most popular improvement philosophies.

According to Jorge and Miyakea (2016), there are several tools that contribute towards process mapping business activities. These are: SIPOC, Flowchart, Blueprint, PCN, Consumption Map, SERVPRO, and Activity Network Diagram.

This paper is structured in two chapters. The first is dedicated to the fundamentals of process mapping. The second chapter is dedicated to the presentation of the main process mapping tools. This paper then ends with the main conclusions from the research of the topics above mentioned, and the bibliography.
1. FUNDAMENTALS OF PROCESS MAPPING

The process map is a simple, but effective, tool used in many different areas that allows us to represent a process by describing the various steps, steps that may, or may not, add value. Thus, a process map is essentially a planning tool that describes the workflow, showing a series of activities, or processes, that produce end results. Note that the process flow map shows which processes are essential, and which ones add value, or not.

Process maps are so important that many ISO standards (International Organization for Standardization) require an organization to structure its business as a process. The great advantage of these tools is the visual representation, and their communication to all stakeholders, including the people who operate it, manage it, or simply need to know more about it. Also, in the process of continuous improvement, the mapping of process flows is essential, because only after understanding it is possible to optimize it.

Usually in the early stages of process flow mapping the level of complexity is low, but regardless of its complexity, the most basic process map should first define the process as it is, not as it is intended to be. This assumption ensures that we have a reliable starting point, and even things that should not be in the process should be considered. To make sure that the process map is correct, the person who designs it from "walk the process" may have made changes, add or remove items since the last version of the process map that was made.

According to Gummesson (2008), the use of mapping tools is widely used to prepare process maps of organizations that provide products or services, as well as allowing to know the flow of activities performed by consumers.

According to Jorge and Miyakea (2016), there are several tools used to prepare process maps, namely, SIPOC, Flowchart, Blueprint, PCN, Consumption Map, SERVPRO, and Activity Chart.
2. PROCESS MAPPING TOOLS

2.1. Suppliers, Inputs, Process, Outputs, Customers (SIPOC)

SIPOC is a map that allows the observation of the studied process and its main components, according to Jorge and Miyakea (2016). It is structured in five columns, which display, from left to right, the suppliers involved (suppliers), the necessary inputs (inputs), the process under analysis (process), the process outputs (outputs) and the customers involved in the process (customers) - SIPOC. This tool is aimed at process improvement based on Lean, Six Sigma, and Lean Six Sigma methodologies, and can be applied in all areas (George, 2003; Koning, Does & Bisgaard, 2008). Marques and Requeijo (2009) indicate that, specifically in Six Sigma, this tool is used in the DMAIC (Define, Measure, Analyze, Improve, and Control) methodology for problem solving, particularly during the Define phase.

According to Salgueiro (2018, p. 20) in SIPOC the “Suppliers and customers are the “Who”, inputs and outputs are the “What” and the process is the “How””. These authors also add that these tools have several advantages, namely, allow us to perceive how various entities interact with the process, dividing its scope into several segments; helps the responsible team to define the process’ scope and understand its purpose; also allows us to think the process in terms of the inputs needed to get the intended outputs.

According to Jorge (2013), the structure of a SIPOC is,

![Figure 1 – Structure of a SIPOC](image)

Source: Jorge (2013, p. 61).
Let's also see an example for a process of elaboration of frames in wood,

**Figure 2 – SIPOC for a process of making wooden frames**

<table>
<thead>
<tr>
<th>Suppliers</th>
<th>Inputs</th>
<th>Process</th>
<th>Outputs</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier A</td>
<td>Package Wood</td>
<td>1. Unpacking</td>
<td>Unpacked materials</td>
<td></td>
</tr>
<tr>
<td>Supplier B</td>
<td>Cutting saw</td>
<td>2. Cutting wood according to the required dimensions</td>
<td>Documents</td>
<td></td>
</tr>
<tr>
<td>Supplier C</td>
<td>...</td>
<td>3. Sand the parts</td>
<td>Remains of materials such as wood scraps and empty cans</td>
<td></td>
</tr>
<tr>
<td>Supplier D</td>
<td>Nails</td>
<td>4. Assemble the parts</td>
<td>Assembled parts</td>
<td></td>
</tr>
<tr>
<td>Supplier E</td>
<td>Wood varnish</td>
<td>5. Varnish the parts</td>
<td>Varnished parts</td>
<td></td>
</tr>
<tr>
<td>Supplier F</td>
<td></td>
<td>6. Drying</td>
<td>Dried parts</td>
<td>Company that needs wooden varnished frames to show information to their customers</td>
</tr>
</tbody>
</table>

Source: Own elaboration (2019).
2.2. Flowchart

According to Jorge and Miyakea (2016, p. 596),

“The Flowchart is a widely used tool that can be applied to describe various types of sequential flows, such as the flow of activities that make up an organizational process or project, materials in manufacturing processes, instructions that make up an algorithm, and data flowing into a system through the chaining of symbols, such as the rectangle to represent activities and the diamond to represent decision making.”

The definition of flowchart presented above is also supported by Krajewski, Ritzman and Malhotra (2009), and Nakatsu (2010). Jorge and Miyakea (2016) clarify that organizations can apply flowcharts objectively to both existing and new processes in order to map flows. Let's look at an example for the process of sending an email.

![Flowchart Diagram]

Source: Own elaboration (2019).
2.3. Blueprint

According to Jorge and Miyakea (2016), Blueprint is a map, or flowchart, of all operations that are part of a given process of producing a product or providing a service. These same authors indicate in their study that, being a process mapping tool, considering the interactions between the different actors involved, helps in identifying opportunities for improvement. This map presents, horizontally, the activities that are part of the process, and vertically, the activities performed by the different parts involved in the process. Thus, we have:

a) **Activities performed by the consumer** and his participation to obtain the desired result;

b) **Front office or Onstage** of the organization, that are perceived by the customer;

c) **Back office or Backstage** of the organization, which are perceived by the customer;

d) **Support processes**, which constitute support processes so that the provision of the service or product sale may occur;

e) **Physical evidence** that shows what experience the consumer has had with providing the service.

According to Jorge (2013, p. 64), “the key innovative feature of this mapping tool is the adoption of the so-called “line of not perceived by the consumer and that occur in the back office.”. Let's look at Jorge’s example (2013),

Figure 3 – Blueprint of the repair of a product within warranty

Source: Jorge (2013, p. 67).
2.4. Process-Chain-Network (PCN)

According to Jorge and Miyakea (2016), the Process-Chain-Network (PCN) tool was developed by Sampson (2012) to represent processes that involve interactions between service, providers and consumers. Given the limitations of the Blueprint and Flowcharts tools in exposing the complexity of these interactions, the PCN allows you to overcome that difficulty.

Following also Jorge and Miyakea (2016), the complexity of interactions comes from the fact that there may be several intervening entities, and it is necessary to represent the actions performed by all of them. In this way, the PCN is not limited to just showing the processes but showing the network that is established between the different entities involved. This is where the process-chain-network name comes from.

Based on this explanation of the essence of PCN, we easily realize that Blueprint distinguishes between onstage and backstage, but only from the vendor perspective, on one hand. The PCN, on the other hand, distinguishes the nature of the activities performed by all entities, including customer’s activities, not only showing but characterizing the degree of interdependence between the activities. Let's look at the structure of the PCN tool according to Jorge and Miyake (2016):

![Figure 4 – Structure of the construction of the tool (PCN)](source: Jorge and Miyake (2016, p. 597).

2.5. Consumption Map

The Consumption Map, within the Lean methodology, serves to identify the activities executed at the gemba of the customer, such as indicated by Jorge and Miyakea (2016). The application of this tool allows us to visualize the activities executed by the customers, enabling the improvement of its execution in terms of effort and time. Jorge and Miyakea (2016) further
remark that it is important to represent the flow of activities of a company on a map named Provision Map, and the flow of activities of the customer on the Consumption Map to allow the possibility of the acknowledgement of improvement opportunities on the flow of both parts. Both maps are visual representations of the interaction between the customer and the supplier. Specifically, on the Provision Map the time spent by the customer on activities that are important to have needs satisfied is represented or the time spent by the supplier on efficient and effective activities. Parallely, the time spent on ineffective activities is also represented, which do not generate added value. On the Consumption Map, Jorge and Miyakea (2016) indicate that the intention is to analyze the times spent by customers and the quality of those times, to avoid wasted time.

According to Jorge (2013), to make a Consumption Map we must,

- List all the tasks made by the customer and connect them;
- Insert the execution times for each task;
- Separate in each task the part that aggregates value to the customers and the one that does not;
- Insert the “degree of dissatisfaction” for the customer to make each task. This degree of dissatisfaction or satisfaction can be visually represented in the shapes that follow:

Figure 5 – Visual scale that translates the degree of satisfaction or dissatisfaction of the people involved in the process

Source: Jorge (2013, p. 72).
Jorge (2013) emphasizes in his study that this tool, besides allowing the visualization of the process, also shows the effort and customer satisfaction in the execution of tasks. To have this perception you can: quantify the number of tasks to be performed, the time devoted, and the degree of discomfort or satisfaction in performing these tasks.

2.6. SERVPRO

According to Santos and Varvakis (2002), SERVPRO is a process mapping and diagnosis tool focused on the activities performed by the consumer throughout it. This tool involves the construction of a diagram that presents the flow of activities performed by the consumer, graphically and sequentially, using:

- & (“and”), when related activities occur in parallel;
• The (“and / or”), when among the related activities only one or more than one occurs in parallel;

• X (“or”), when only one of the activities mentioned occurs;

• Go-to to direct the flow to an activity previously described.

The objective of this tool, as Santos and Varvakis (2002) tell us, is to identify the activities that come in contact with the consumer and that, therefore, may influence their perception of the service through quality parameters, as well as identify the interactions that occur between customer and supplier. Let's look at an example from Jorge (2013):

Figure 7 – SERVPRO for a customer at a self-service restaurant

Source: Jorge (2013, p. 77).

2.7. Activity Chart

The Activity Chart, according to Jorge and Miyakea (2016), is a tool used in the study of times and methods for planning and controlling operations, and is characterized by providing a detailed view of the interaction between production resources in the performing certain activities of a process. Jorge and Miyakea (2016) further clarify that this Activity Card can also be referred to as the Human Machine Diagram, when it is used to describe and analyze interactions between operators and machines, and to identify lost times and make them more efficient. Thus, the Activity Card allows to analyze the interactions between,
• Operator and customer;
• Operator and machine;
• Client and machine; or,
• Operator, customer and machine.

For its realization, each resource involved in the process is placed in a column of the Activity Chart, and in each column, the process activities allocated to the corresponding resource are listed in chronological order from top to bottom, allowing to verify the time spent by the resources in each activity. Briefly, this tool is applied in identifying and measuring the activities performed by consumers, indicating the time spent in a service process as well as the waiting time, for example, in the execution of an activity by an operator or a machine by the supplier. Let’s take an example from Jorge (2013),

Figure 8 – Activity Chart for the process of a customer service desk of a fast food restaurant chain

![Activity Chart](image)

Source: Jorge (2013, p. 75).
2.8. Comparison of tools

Each tool has its own distinctive features. In this way, different perspectives of the same process can be presented, each emphasizing certain aspects. Thus, Jorge (2013) presents two comparative tables of the different tools in relation to the visualization of consumer participation in a service process, highlighting the main characteristics.

Table 1 – Comparative analysis of the different tools (visualization of the customer participation)

<table>
<thead>
<tr>
<th>TOOL</th>
<th>TOOL DIFERENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIPOC</td>
<td>Visualization of the resources (inputs) spent by the customer to the execution of the activities under the customer responsibility</td>
</tr>
<tr>
<td>Blueprint</td>
<td>Visualization of the interaction of the parts involved in the process: actions of the customer, actions of the onstage, backstage, support</td>
</tr>
<tr>
<td>Consumption Map</td>
<td>Measurement of the time of the tasks made by the customer, stratifying the parts that contribute and the parts that do not contribute to aggregate value and defining the degree of satisfaction of the customer with the task</td>
</tr>
<tr>
<td>Activity Chart</td>
<td>Visualization of the time spent by the customer to the execution of the activities and the time that the customer remains on hold</td>
</tr>
<tr>
<td>SERVPRO</td>
<td>Describes the agent, customer or company, makes the action or the reaction in an iteration and defines parameters and measurements of performance to determine the quality of the service</td>
</tr>
</tbody>
</table>

Source: Jorge (2013, p. 79).
Table 2 – Comparative analysis of the different tools (visualization and measurement of the customer participation)

<table>
<thead>
<tr>
<th>Comparison terms</th>
<th>SIPOC</th>
<th>Blueprint</th>
<th>Consumption Map</th>
<th>Activity Chart</th>
<th>SERVPRO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of detail of the customer activities flow</td>
<td>Low</td>
<td>Average</td>
<td>Average</td>
<td>High</td>
<td>Average</td>
</tr>
<tr>
<td>Degree of detail of the alternative paths of the process</td>
<td>Low</td>
<td>Average</td>
<td>Average</td>
<td>Average</td>
<td>High</td>
</tr>
<tr>
<td>Characterization of the contact of the customer with the company</td>
<td>Only text description</td>
<td>Graphically indicates the moment and form of contact and counts physical evidences</td>
<td>Graphically indicates the moment and form of contact</td>
<td>Only text description</td>
<td>Only text description (in the diagram)</td>
</tr>
<tr>
<td>Degree of detail of the contact of the customer with the company</td>
<td>From nil to average</td>
<td>High</td>
<td>Average</td>
<td>Low</td>
<td>Average (at the description document)</td>
</tr>
<tr>
<td>Measurement of the time dedicated by the customer</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Measurement of the time spent by the customer with services</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Measurement of the satisfaction of the customer with the process</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Resources allocated to the customer</td>
<td>Yes</td>
<td>No</td>
<td>Partially indicates</td>
<td>Partially indicates</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: Jorge (2013, p. 81).

Analyzing the above information, Jorge (2013) used a color scale. Thus, dark gray indicates that the tool is highly related to its assumption, while light gray shows that this relationship is partial. Already white represents that the relationship is low, or even no relationship.

From the analysis of the respective tables, which make a comparison of the different tools, Jorge (2013) concludes that:

- With respect to the SIPOC tool, it allows us to present in detail the resources needed to accomplish each task in a process. The Blueprint tool deals with the form and the degree of contact between consumer and company. A Blueprint map also makes it possible to visually highlight the moments of interaction between consumer and company, as well as to detail physical evidence of the process.
The Consumption Map allows us not only to know the process execution time, but also the consumer's level of discomfort (or satisfaction) in relation to each task performed. These are the major differences of this tool compared to SIPOC and Blueprint.

The Activity Chart has the great advantage of expressing not only the time spent by the consumer in performing tasks, but also the time spent waiting for the company to complete their tasks. In this way a high degree of detail about the process is obtained.

Regarding SERVPRO, this tool shows when the steps of a process do not proceed sequentially. In addition, it also highlights the actions and reactions performed by both the customer and the company when they interact and defines performance measures to evaluate the quality of the service or product.
CONCLUSIONS

Being competitive is essential and crucial for companies to stay in business. Therefore, for companies to keep up with market developments and remain competitive, opportunities must be identified to optimize production costs and implement continuous improvement processes. Thus, process mapping is an indispensable management resource for identifying and optimizing company processes. In this sense, the aim of this article is to review the literature about the main process mapping tools.

The process map is a tool that allows the graphic representation of a process, describing the various steps, which may or may not add value. In short, a process map is essentially a planning tool. Note that the process flow map shows which processes are essential, and which ones add value, or not.

According to Jorge and Miyakea (2016), there are several tools used to prepare process maps, namely, SIPOC, Flowchart, Blueprint, PCN, Consumption Map, SERVPRO, and Activity Chart.

According to Gummesson (2008), the use of mapping tools is widely used to prepare process maps of organizations that provide products or services, as well as allowing to know the flow of activities performed by consumers.

Each tool has its own distinctive features. Thus, different perspectives of the same process can be presented, each emphasizing certain aspects. Thus, Jorge (2013) highlights the main differences between the different tools. Like this,

- With respect to the SIPOC tool, it allows to present in detail the resources needed to accomplish each task of a process. Already the Blueprint tool deals with in depth the form and the degree of contact between consumer and company. A Blueprint map also makes it possible to visually highlight the moments of interaction between consumer and company, as well as allowing to detail physical evidence of the process.

- A Consumption Map allows us not only to know the process execution time, but also the degree of consumer discomfort (or satisfaction) in relation to each task performed. These are the major differences of this tool compared to SIPOC and Blueprint.
• The Activity Chart has the great advantage of expressing not only the time spent by the consumer in performing tasks, but also the time spent waiting for the company to complete its tasks. In this way a high degree of detail about the process is obtained.

• Regarding SERVPRO, this tool shows when the steps of a process do not proceed sequentially. In addition, it also highlights the actions and reactions performed by both the customer and the company when they interact and defines performance measures to evaluate the quality of service.

For future research it would be interesting to cross-reference these tools with value stream mapping tools, namely Value Stream Mapping (VSM).
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How to cite this article: