

Design And Development Of A Second Generation BSC Focused On Eliminating Waste

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Abstract— The objective of this article is to design and develop a second-generation Balanced Scorecard (BSC) based on waste reduction. The company's mission and vision were defined based on a strategy to reduce the different types of waste. Strategic objectives were defined in each of the second-generation BSC perspectives aligned with the strategy of lean thinking. The links between the objectives of the four perspectives are shown graphically, with a list of activities to be carried out and targets and indicators for each. The main contribution of this research is the visual proposal of the second generation BSC, through a process mapping to identify the locations where the different types of waste are present in a value stream mapping (VSM) present and present improvement action using lean thinking tools in a VSM of the future. Through this visual integration, it is intended to achieve a better understanding and communication of the process, with the aim of achieving greater efficiency in activities and reduction in waste detected in a medium-sized commercial enterprise.

Keywords— *Balanced Scorecard; waste reduction; value stream maapping.*

I. INTRODUCTION (*Heading 1*)

Over the years, SMEs have faced disadvantages as most do not know about the usefulness of different business management tools that allow them to increase their efficiency and economic profitability [1] although various techniques have been developed and applied to improve processes in small businesses. [2] Planning in organizations does not ensure that the predefined methods, elements, and control mechanisms that contribute to monitoring performance, executing activities, and making decisions are aligned. Management models are increasingly used in a constantly evolving contemporary world where traditional measurement based only on financial indicators is no longer enough [3]. However, a balance must be struck between the company's vision and mission and its four financial perspectives on customers, processes and learning,

and growth [4], with the priority of maximizing production through the efficient use of available resources [5]. Considering the above aspects, it was decided to use the second-generation Balanced Scorecard tools based on lean thinking, which allows for visually identifying the locations where different types of waste are presented.

[6] Designed a strategic performance measurement tool called the BSC. It seeks to convert an organization's strategy into a set of comprehensive performance metrics in four key areas: financial, customer, internal processes, and learning/growth. Value stream mapping is a tool for lean thinking and maximizes productivity by eliminating activities without added value [7].

Both tools have favorable uses to apply in organizations that need to make improvements from simple to more complex and are eligible to apply in this study, which was carried out in a company dedicated to distributing sweets in the municipality of Uriangato Guanajuato. The company needs help identifying which activities can be practical in its process and achieving correct waste disposal. The organization has yet to have a system that allows it to measure its time in different activities, nor is it aware of the type of waste it has in each area. The objective to be achieved is the implementation of a second-generation BSC based on lean thinking focused on waste elimination and maximization of value-adding activities to improve the company's production process and make an Intervention to improve them by making the firm more competitive with firms with similar or similar developments. The paper is organized as follows. The following section shows two key concepts: the balanced scorecard and the Lean Thinking Tool Value Stream Mapping and some of their applications in different research. The materials and methods are then explained, with five essential steps and a brief description of each for tool development. Finally, the sections on results, discussion, and conclusions are presented.

This section presents the results of the search for the most relevant research on the BSC and VSM in different production fields.

Because of the potential of BSC in improving organizational performance and its universal applicability [8], there are multiple cases beyond traditional corporate domains where this can be used. As can be seen in [9] who conducted a BSC for prostate cancer treatment (PC) by evaluating performance in healthcare organizations in four dimensions: financial, patient and referrer, process and learning, and development, CP-specific KPIs were assigned for the four classical perspectives, as well as one more disease and specific outcomes. This facilitates value creation that aligns with the complete cycle of patient care. On the other hand, [10] developed a BSC focused on the evaluation of innovation and linking in the school (EPN) In order to align it with the school's vision and, in turn, analyze what external stimuli and internal dynamic tensions may be affecting it.

In other words, [11] implement the BSC to improve internal control in a company. It is identified as a weakness, the lack of knowledge among staff about indicators and meters to meet the company's objective. The aim is to determine how customers perceive the company's products and services. [12] main objective was to identify the different drivers of performance (key indicators) and measures of results (lagging indicators) investigated in the literature on the four perspectives of the balanced scorecard (BSC) in Operations Management (OM) contexts. About the recent research presented, a similarity was found when [1] developed a first and second-generation BSC in a manufacturing company to increase the speed of delivery of orders to generate reliability in customers; all this so that the tool allows the company to comply with the proposed strategy. Although, alone is of great help [13], the potential that can be added to one of the essential tools of lean thinking, which is the mapping of the value flow (VSM), is even more significant, as it identifies and reduces errors, losses, wait times and improves time to value addition, This leads to higher product quality through the empowerment of the production unit in terms of long-term production risk and cost reduction.

As [14] shows us, who focused on reducing the loss and waste of wheat and bread to ensure global food security and sustainability, the First step is to apply a VSM to map the WBL from a contextual modification. It identifies areas where materials are wasted or used inefficiently, allowing specific interventions to improve the circularity of a system [15]. Otherwise, [16] focused their research on the problem of low labor productivity in construction through lean construction and waste minimization and process optimization through a measurement approach to labor productivity, combined with VSM, increasing by 24.07%, with 11.54% contributing to resource efficiency and 88.46% contributing to flow efficiency. In the case of [17], they use lean tools, specifically VSM and complementary tools, to optimize the production process in the metal processing industry; thanks to this, it was possible to reduce

approximately 318 h (13 days), it VA increased at 23 h and process efficiency improved to 7.15%. [18] created a rational comparative alternative to overcome stress at work for the educational approach. The studies' applications have been mostly exclusive to one of the two tools and, in a few cases, complemented by other techniques. This is why the present investigation used both tools based on the company's requirements and took into account the advantages of both for better results.

II. METHODOLOGY

The methodology shown below is developed in five main steps, each of which is further described in the figure.

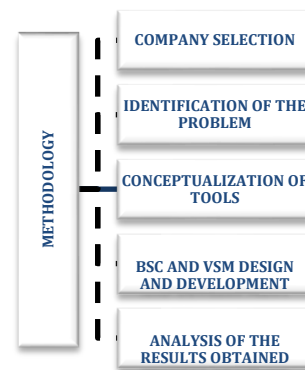


Fig. 1. Methodology

Table 1 gives a brief description of the steps in the methodology.

TABLE I. DESCRIPTION OF THE METHODOLOGY

1. Company Selection:	<ul style="list-style-type: none"> After a search within the options available in the region, the most appropriate one for the research was selected.
2. Identification of the problem:	<ul style="list-style-type: none"> Surveys were conducted among those in charge of the different areas and the lack of use of strategic planning and poor communication of company goals were identified.
3. Conceptualization of tools:	<ul style="list-style-type: none"> Once the problem was identified, a visual proposal was made for a second-generation BSC based on lean thinking.
4. Design and development of a second generation Visual Balanced Scorecard:	<ul style="list-style-type: none"> In order to achieve the visual proposal of the BSC, the VSM of the current state of the company was first developed to have a future comparison panorama taking into account the four perspectives of the BSC from this point of view. After that step, the objectives, indicators and strategies subject to the mission and vision of the company in a BSC were developed, as well as the relationship between them. Finally, a future VSM was created where the union of the most important objectives of the BSC and strategies was made and caizens were added to achieve them in each one of them. Once done, the comparison of the VSM of the present and future states can be made.
5. Analysis of the results obtained:	<ul style="list-style-type: none"> The tools were analyzed and comparisons were made between the present and future state.

III. RESULTS

As mentioned in the methodology presented above, the first step was selecting the firm to conduct the research. The company's philosophy was studied once the organization had been chosen, as shown below.

Mission: To offer innovative products to our customers, always taking care of quality and guaranteeing the punctual delivery of products with a firm commitment to sustainability.

Vision: To be the national leader in using available resources and offering high-quality products to the

market, always looking for alternatives for waste disposal in production and distribution.

Identifying the problems and based on the organization's philosophy, the tools were developed in accordance with the mission, vision, and strategy that the company intended to implement.

Strategy: "Eliminate waste and maximize value-adding activities."

Figure 2 shows the balanced scorecard drawn up for the firm, which contains seven specified sections.

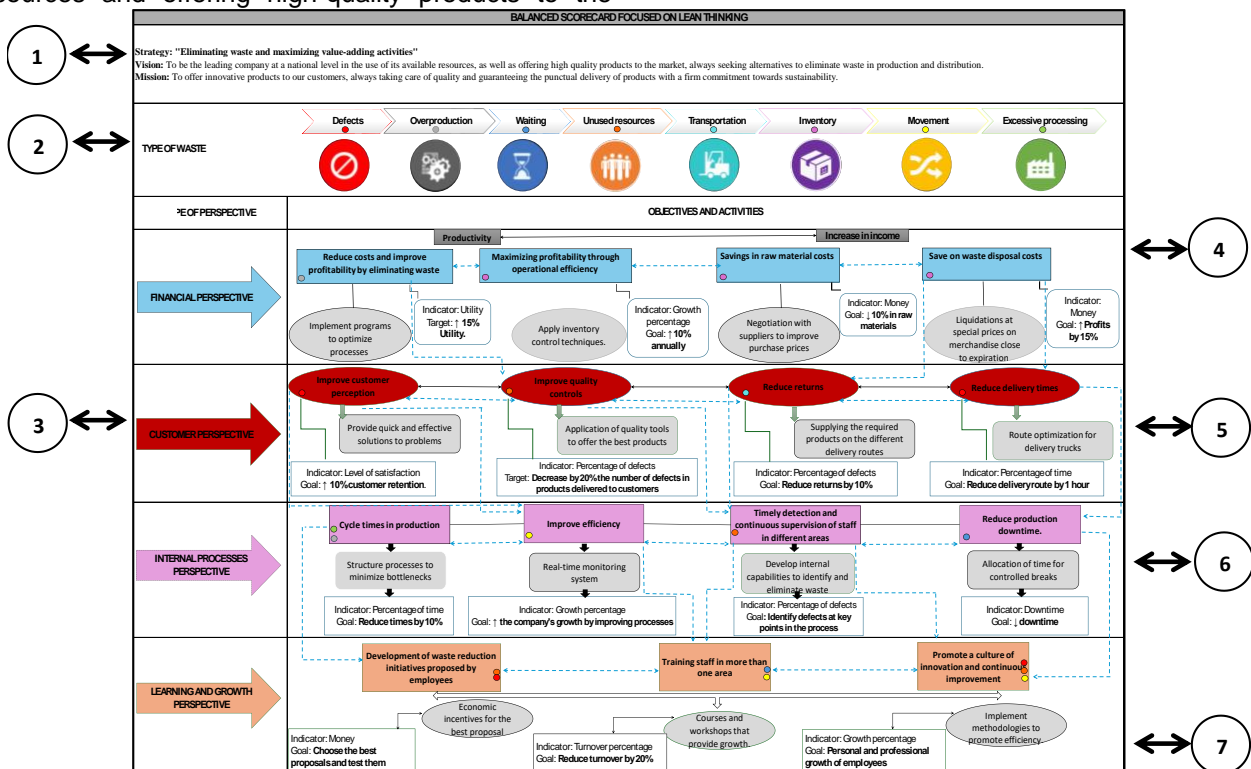


Fig. 2. Second-generation BSC

Section one shows us the strategy on which it was based and the company's vision and mission.

Section two contains the eight types of waste: defects, overproduction, waiting, unused talent, transport, inventory, movement, and extra processing, as well as the symbols for each. In addition, we made a color code on top for easy identification of the targets.

Section three: The four types of perspectives are identified by a different color code for the types of waste, which will be useful for identifying them in the value stream mapping.

Section four: The objectives proposed for each specific area are listed at the top of the "objectives and activities" section, followed by each type of perspective.

Section five: The activities to be carried out to achieve the proposed objectives are followed by the objectives from each perspective.

Section six: The relationship between the objectives of the different perspectives is shown by dotted lines.

Section seven is responsible for identifying the target and indicator in a concrete way for each of the objectives.

The following section shows illustration 3. It shows the value stream mapping of the current state, developed by the company under study, and its parts are marked by numbers, which are explained below.

Section one: In the balanced scored card tool, 15 objectives were obtained for the four types of perspectives. The most important objectives were selected and assigned to each area according to the color designated by the BSC. These can be seen distributed in the value stream mapping, resulting in one objective from the financial perspective, two from the customer perspective, two more from the process perspective, and one from the learning and growth perspective.

The symbols of the type of waste detected in these areas were placed within the objectives. Eleven types of waste were detected in the VSM. From a financial perspective, extra processing waste reduces costs and improves profitability. In the second customer perspective, two objectives were chosen: reducing delivery times and returns, where types of waste of waiting time and unnecessary transport movements were found, as well as the level of inventory respectively.

From the process perspective, two main objectives were designated: timely detection and continuous supervision of staff in the different areas with the type of waste defects. The other objective is Improving efficiency, in which four types of waste are presented since it covers several efficient areas: overproduction, waiting, transportation, inventory, and movement. From the perspective of learning and growth, the type of talent waste not used to develop a culture of innovation and continuous improvement was identified.

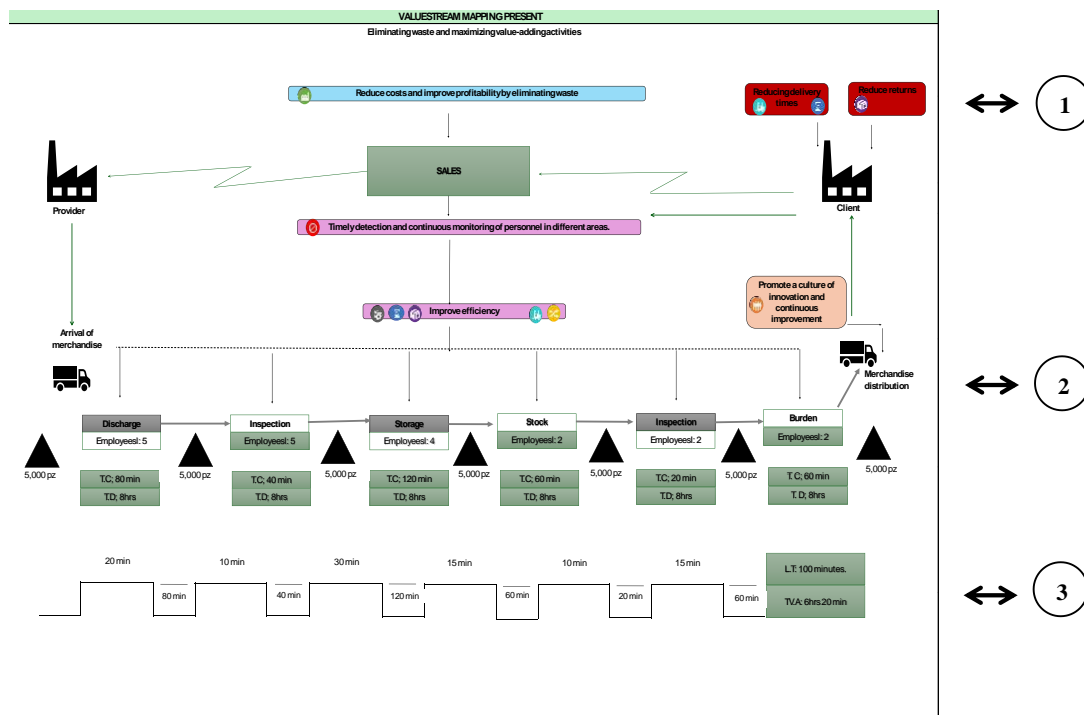


Fig. 3. Value stream mapping (VSM) present state

This research considers the most important objectives: reducing costs and improving profitability, promoting a culture of innovation and continuous improvement, and reducing waiting times. The various areas of the production process are covered, and if implemented, most of the problems encountered in the company will be solved.

Section two:

Here, we can see the process flow: "Unloading" with five workers, "Inspection" with five workers, "Storage" with four warehouse workers, "Supply" with two employees, the second "Inspection" with two people, and the last phase, "Cargo," with two workers in charge. The inventory level is 5,000 pieces. The important parameters in each process phase are cycle time and available time.

Section three:

At the end, a timeline is shown. At the top of the line, you can see the time that does not add value, and which is a priority to reduce. At the bottom is the cycle time for each phase of the process.

This record's purpose is to show the company's current status and the times it usually uses to make a comparison, which will be described in the following figure.

In illustration number four, we see the future state of the company.

As explained in illustration three, section one, the objectives were assigned to each area related to the perspectives in the VSM, and the types of waste present in each one was identified. In illustration four, we can see within section one the eleven wastes detected in the company, each one accompanied by kaizen events. The purpose of these is to eradicate waste through strategies.

Implementation of kaizen events.

Quality at Source is aimed at extra processing waste through a thorough review by the merchandise staff, verifying requested quantities or expiration dates.

Standardized Work aimed at waste defects: Two main strategies were established. 1.- Create a standardized guide for the different areas, follow the steps of the process, and avoid errors. 2.- Clear procedures for the proper use of the company's assets.

The aim of 5S is selection and ordering; its development takes place in two phases. 1.- Arrange all shelves where the goods are located so they can be easily identified. 2.- Establish teams to maintain order in the different areas and conduct weekly reviews.

Lot Size Reduction aims to reduce inventory waste. Request merchandise in batches according to what your route operators require.

Teams aim at movement waste. To achieve this, it is necessary to: 1. Hold weekly meetings to determine if there were problems in the process and take measures to solve them.

TMP is aimed at transporting waste. It will be developed by conducting reviews every two months to ensure that all the equipment involved is in optimal condition.

decrease without the need to add extra personnel or other requirements rather than making what is already available more efficient.

In section two, we can again see the number of pieces that pass between the different phases of the production process, the personnel involved, the times designated for each activity, and the time available on the workday.

Finally, in section three, where we can compare the current VSM with the future VSM and see the results of implementing kaizen events, we can see that thanks to the personalized strategies in each one, the scope of the objectives was achieved, and this can be verified by the decrease in times from 100 minutes to 42.

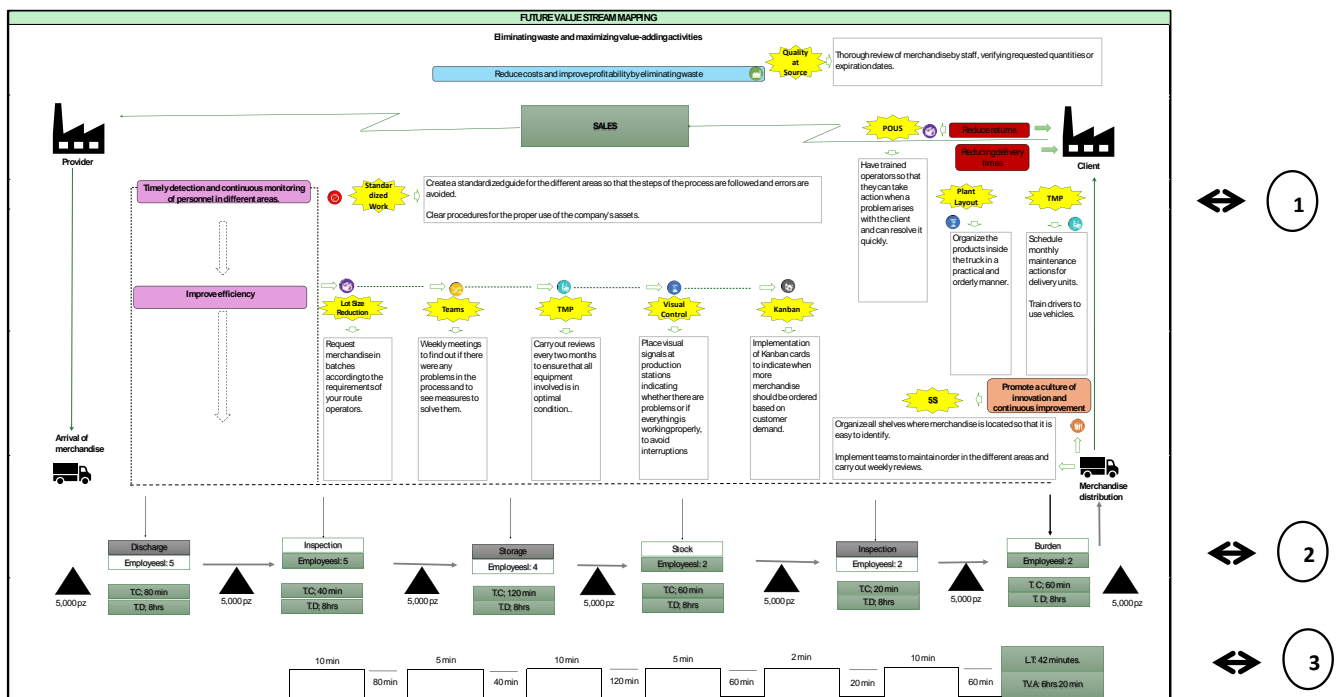


Fig. 4. Value stream mapping (VSM) future state

Visual Control aimed at reducing waste: It is implemented by placing visual signals at the production stations indicating problems or indicating that everything works well to avoid interruptions.

Kanban is aimed at reducing overproduction waste. It implements Kanban cards to indicate when more merchandise should be requested according to customer demand.

POUS is aimed at inventory waste. Operators should be trained to take action when a customer problem arises and resolve it quickly. The plant layout is oriented to better accommodate the material. The goods inside the truck must be arranged in a practical and orderly manner.

Waste management program for transport, a monthly schedule of delivery unit maintenance activities.

With this new intervention of strategies aimed at maximizing activities and eliminating waste, the company's production process time is expected to

CONCLUSIONS:

In this study, a second-generation Balanced Scorecard (BSC) was developed, combined with a lean thinking tool to help a medium-sized company improve its processes. This approach allowed us to identify waste in their current value stream and propose concrete strategies to eliminate it. The joint use of the BSC and Value Stream Mapping (VSM) not only facilitated a clearer view of the critical points in operations but also allowed the strategic objectives to be aligned with the company's mission and vision. The results were significant in the proposal since it was possible to reduce unproductive times and increase efficiency in key activities without having to resort to additional resources, making better use of what was already available.

With this proposal, work can be shown that combining these tools can be a practical and accessible solution for SMEs to be more competitive. For future research, it is intended to carry out a practical approach, as well

as serve as a reference and explore new research with this type of approach and be able to apply it in other sectors or companies and see how it can impact productivity and sustainability in the long term.

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