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Lean Office: The Lean methodology applied to the improvement of administrative processes in a Higher Education Institution

Carvalho Cleginaldo Pereira de ^{1,*} and Martins Itúrbides Vicente de Paiva ²

¹ *University of the State of São Paulo – Faculty of Engineering of Guaratinguetá, Industrial Engineering Department, Avenida Dr. Ariberto Pereira da Cunha 333, Pedregulho, Guaratinguetá, São Paulo, Brazil, Zip Code:12.516-410.*

² *Paula Souza Center, Faculty of Technology of the São Paulo State, São Paulo, Brazil.*

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Abstract

With the advent of globalization, provided in part by the advancement of information and communication technologies (ICT), has allowed companies in different segments and on different continents to have a significant increase in their visibility on the world market, thus requiring them to be more competitive with other companies. The specific objectives are the following phases: to carry out a survey of the current conditions of the administrative procedures related to the sector of the Directorate of Administrative Services, as well as their demands and results; to verify at which stages of the processes there is a waste of time in the execution of these administrative procedures, that is, to identify opportunities in the procedures practiced by the IES; to propose improvements based on LO thinking for each of the opportunities found; and finally to identify to what extent the results, or the deliveries made, have had a significant improvement from the proposition of applying LO concepts. As a research method, it will use the following tools: bibliographic research, documentary research, statistical treatments, Quality Management, Value Flow Map, using the 5S tools, Standardized Work, SIPOC, Visual Management and Business Process Model and Notation (BPMN). To this end, LO concepts will be used for the organization, the survey, analysis and proposals for improvements in the identified processes. As a result, there is an alignment among its employees and compliance with all mapped activities, without rework and with significant results.

Keywords: Administrative Processes; Higher Education Institution; Lean Office; Opportunities for improvement

1. Introduction

The advancement of technologies, especially those related to Information and Communication, allowed companies from different segments and from different continents to participate in the globalization process quickly and significantly, uniting the markets of these countries, reducing or even eliminating the existing borders between them. With the advent of globalization we can also see an increase in competitiveness among companies, because, with its increased visibility in the world market, there was a need to review the internal processes that involve production, products and their customers [1].

Developing more efficient processes and products that take into account the profile and preferences of the consumer has become essential for the maintenance of the company's operation. When the company is a public Institution of Higher Education in the State of São Paulo, the considerations pointed out above are also, to some extent, applied as well, because, despite the different branches of activities, they have similarity in how to treat their processes.

* Corresponding author: Carvalho Cleginaldo Pereira de

University of the State of São Paulo – Faculty of Engineering of Guaratinguetá, Industrial Engineering Department, Avenida Dr. Ariberto Pereira da Cunha 333, Pedregulho, Guaratinguetá, São Paulo, Brazil, Zip Code:12.516-410.

Public Institutions of Higher Education, regardless of administrative category (Federal, State or Municipal) have distinct characteristics, that is, they are maintained by the public power and do not charge tuition [2].

The procedures practiced by these Higher Education Institutions, which involve financial, accounting, budgetary and patrimonial resources, are inspected by the legislative and by the State Audit Court. Thus, their accountability needs to be up to date, always characterizing a correct application of public resources employed in the HEI (Higher Education Institution). Thus, the administrative processes involving HEIs must be under constant review, because they are sensitive to changes arising from the economic, financial, or even public health situation, which was recently affected by the COVID19 Pandemic.

Moreover, there is the issue of the conservative organizational culture (resistant to change) that still permeates public administration, thus making it impossible to implement and/or improve procedures, thus enabling the success of a change in organizational posture.

2. Contextualization and justification

The implementation of the Toyota Production System since its emergence, presents the progress and improvement achieved in the industrial sector, especially in the automotive industry. According to [3], the author cites in his work that the introduction of the Lean philosophy can be adapted to the administrative processes. Consequently, when focusing on production, many times the administrative processes do not receive the importance deserved with regard to the waste pointed out in the Lean philosophy, however, one should remember that every process of execution of a certain activity there is a bureaucratic process inserted and also a communication tool between the areas, departments and between the companies of the same corporation. According to [4], the Toyota Production System is a global trend in the production of goods and services, and studies point to the expansion of the use of the Lean philosophy in service companies and administrative sectors. Lean Office is an adaptive evolution of Lean Manufacturing, with a particular difference: while in Lean Manufacturing the work scenarios are clearly visible, because they are processes with physical flows, in Lean Office the work scenarios are often difficult to visualize because they are processes involving non-physical flows. In other words, Lean Office is a management tool aimed at processes in which the flow of value is not linked to materials, but to information and knowledge [5].

Thus, the introduction of the Lean philosophy in the administrative sector is not an easy task. It requires a level of commitment and engagement from all employees at all levels of the company. [6], cites in his work a study in the United Kingdom on the performance of Lean in small, medium and large companies, which revealed that the gain in the balanced scorecard was representative in the larger ones, due to the incorporation of Lean thinking in the top management of the organization. [7] cite that the benefits provided by Lean philosophy in the administrative sectors are: Produces high quality - zero defect; Meets quality, cost and delivery requirements; Eliminates waste from the flow that adds value to the customer. However, by achieving the goal of implementing the Lean philosophy, many benefits are obtained, bringing to the organization expressive results in increasing employee productivity and eliminating or reducing waste according to the particularity of each company. It also brings improvement in the work environment generating greater satisfaction, a fair division of tasks avoiding fatigue and demotivation of employees. Another important consequence is that it brings more autonomy to employees in solving problems. [7] argue that the success of the application of the Lean philosophy depends on the commitment of the team members, and describes the benefits obtained between the short and long term: Lean systems allow the business to become more competitive, having more chances of survival in the market. The system provides for quick adaptations to sudden changes; There is great potential for using Lean in the office, a system that originated in the production sector and currently covers other sectors such as administration and services; By eliminating waste Lean improves worker performance. An environment with correct and precise information circulation facilitates work, eliminates rework and contributes to the professional satisfaction of the individual; The tools of the Lean Office - LO are developed by the team itself generating the personal commitment of each employee The LO works with the current state value map, the elaboration of the map is initiated by the customer where the steps followed are those in which the customer recognizes the importance because it is the product or service that he receives. In this format, it is possible to identify the waste and thus take the necessary actions for its elimination or reduction. According to [8] process improvement occurs through activities that identify the problem and waste where actions are taken for its elimination. After these actions the process is measured and the result and benefits of the change are evaluated. The process is customized for each company; there is no formula in which the insertion of variables gives an exact result. For this reason it is necessary to make a brief study of the current state value map in order to identify the wasteful areas and modify them.

3. Theoretical background

3.1. The lean manufacturing

To understand the Lean philosophy, we need to understand how it was born, we highlight that the development of Lean Production is based on the Toyota Production System (STP). Its history is linked to the process and the need for the growth of the automobile production system started in the 1940s by the Toyota automaker with the goal of changing models in the form of process management, seeking higher productivity and as a consequence the reduction of corporate costs.

After the Second World War, Japan faced a very difficult scenario due to the lack of production resources and financial capital for mass production. To remain active in the market, Toyota's president at the time Eiji Toyoda went to Ford in the United States to learn about the production process of the automobile industry. The objective was to learn about the concept of mass production, considered at the time to be the world reference in automobile production.

After this experience in the United States, they returned to Japan together with production engineer Taiichi Ohno and concluded that the mass production model practiced in the United States did not meet Japan's needs and expectations in terms of economic development. Given this conclusion, it was necessary to think a new production system more efficient and especially in accordance with the reality of the country at that time [8].

During the development of this new production system, the discussions and observations made by managers and engineers at Toyota Motor Company on how to improve productivity and increase the corporation's financial return, always pointed to the existence of waste in the production lines of vehicles. Therefore, [9], one of those responsible for the creation of STP, described that the preliminary step for the application of a new production system was to completely identify the waste in the production process. According to [9], STP is defined as a work management philosophy to meet the needs and expectations of customers in the shortest possible time, with high quality products and services at the lowest possible cost. To achieve this goal, it is necessary to implement actions to eliminate waste and optimize the companies' processes, by standardizing tasks and eliminating or minimizing activities that do not add value to the product and services. In summary, the search for waste elimination results in the company following the concepts of lean thinking. The understanding of lean thinking can be compared to learning a new culture, where it is about changing behaviors, thoughts, and understanding the work environment system. Given this, companies that are able to develop an organizational culture that supports continuous improvement in building products and providing services will certainly be able to reduce costs and increase productivity in their production processes.

"It is increasingly evident that Lean is a business system that can be applied in any sector, including services, because it allows to serve customers with high quality, low costs and adequate delivery times [10]". The expression Lean Manufacturing, defined by John [11], researcher at the International Motor Vehicle Program (IMVP) and translated into our language as Lean Manufacturing, is the representation of a revolutionary oriental system that has in its essence a fundamental dimension: the use of smaller amounts of resources, maximization of efficiency and productivity and, mainly, maximization of flexibility, because it is more agile, innovative and able to better face structural and market changes.

3.2. From mass production to lean manufacturing

Lean production, an expression defined by IMVP - International Motor Vehicle Program researcher [11], is "lean" because it uses less of everything in comparison with mass production. According to [12], the system became popular through the book "The machine that changed the world" in which the authors report in detail the emergence of lean production. Another factor that drove the adherence to the new philosophy was the change in consumption; the consumer started to demand differentiated products with quality and competitive prices.

In addition Toyota's flexible production system and its ability to reduce production engineering costs allowed the company to supply the variety of products demanded by buyers without high costs. By 1990, Toyota offered consumers around the world as many products as General Motors, even though it was half the size of General Motors. Changing its production and specifications still costs mass production firms a fortune.

In contrast, a prominent lean producer like Toyota can offer twice as many vehicles with the same budget to develop them [12]. According to [13], process and operation have distinct concepts in modernity. For the former refers to a set of operations formulated for the transformation of raw material into finished product. The operation, on the other hand,

refers to isolated procedures that contribute to a production stage of a given product. All production, whether performed in the factory or in the office, should be understood as a functional network of processes and operations. Processes transform raw materials into products. Operations are the actions that carry out these transformations. These fundamental concepts and their relationship must be understood to achieve effective improvements in production [14]. [3], cites in his work that Ohno's quest was for production optimization, producing diversified products with the least amount of waste, lowest cost, and zero inventory. Thus he breaks with Taylor's first principle where he advocates "one man, one task", so the same man could perform several tasks, obtain a higher level of knowledge of the activities the process and less physical effort. It also breaks with the idea of producing large batches, replacing it by small batches with higher added value. And finally, it breaks with the specialization of the management task. With the break of the paradigm of the continuous improvement of the operation emerges the new paradigm of the improvement of the productive systems based on the improvement of the manufacturing processes.

3.3. The lean thinking principles

[15], define lean thinking as a way to produce more with fewer resources, whether physical, human, or financial, while providing customers with exactly what they want. These authors present the five basic principles that can be used as an ideal framework for an organization to implement lean methodology, being:

- Value: specifying value accurately is the starting point for lean thinking. Value is defined only by the end customer. However, it is the organization that must identify what generates that value for the customer. Having determined the value and defined the product, the next step is to specify the target cost based on the resources needed to manufacture the product with the specific characteristics;
- Value Stream: The value stream or value chain is the path taken from the start of production to delivery to the end customer. Each step involved in the process is mapped following the premise that activities that cannot be measured cannot be managed, and those that are not precisely identified cannot be analyzed and improved. With the value stream mapping it is possible to identify and eliminate the activities that contain waste through waste elimination techniques;
- Continuous flow: After the analysis and mapping of the value stream, it is necessary to make the activities that generate value flow through the process without interruptions. The best way to make the products flow is to put them in continuous flow whenever possible, reorganizing the sequence and the equipment so that there is no waiting and no stock between activities;
- Pulled manufacturing: Pulled manufacturing has the objective of decreasing the lead time to the customer. Implementing the pull system means producing a good or service only when the customer requests it, and not pushing the product to the consumer;
- Perfection: When the four principles are clearly followed, that is, when the organization accurately states the value, maps the value stream so that the products flow continuously, or when the customers pull the products, it is possible to achieve process perfection by eliminating losses and waste. One must always seek continuous improvement to achieve this perfection.

For the lean mindset, the most important drive to perfection is to maintain transparency between everyone involved in the system so that it is easier to identify ways to create value.

3.4. The seven wastes

According to [15], although it may not be simple to apply Lean thinking, working with this concept makes us see a critical factor in any situation, whether in products or services. We can cite some examples of waste present in companies in various sectors:

- Labor that absorbs resources but does not create value;
- Errors that require rectification;
- Production of items that nobody wants;
- Accumulation of goods in inventory;
- Unnecessary processing steps;
- Movement of employees or goods without purpose;
- Groups of people in a follow-up activity waiting because a previous activity was not performed on time;
- Products and services that do not meet the customer's needs.

The fact is that regardless of the classification of the type of process that we are analyzing, if analyzed according to the concepts of lean thinking we will certainly be able to identify some type of waste. [15] state that lean thinking is a powerful antidote against waste. According to [16], waste is a completely unnecessary activity that generates costs and does not add value to the product or process. [17] classify activities into three groups:

- Value-adding activities: activities that customers are willing to pay for because, from their perspective, they add value to the product or service and are therefore necessary. These activities represent about 5% of the activities performed in manufacturing environments and about 1% in administrative environments;
- Activities that do not add value, but are necessary: in this group, we concentrate the activities that do not add value from the customer's perspective, i.e., they are not willing to pay for them; however, they are necessary at least in the short and medium term, for technical or economic reasons. One should seek to eliminate them as soon as possible. These activities represent, on average, 35% of the activities in manufacturing environments and, on average, 50% in administrative environments;
- Activities that do not add value and that are unnecessary: these are the activities that do not contribute to the delivery of value to the customer. That is, they are unnecessary under any circumstances and the customer is not willing to pay for them. They are pure waste, which should be eliminated in the short term (immediately). These activities comprise, on average, 60% of the efforts of a company in the manufacturing sector and, on average, 49% in administrative environments.

[15] define that the purpose of lean thinking is to find a way to specify value, identify the best sequence to execute actions, perform activities in a continuous, standardized and increasingly efficient way. Value can only be defined by the final customer. It is only meaningful when expressed in terms of a specific product or service that meets the customer's needs at a specific price at a specific time. Therefore, lean thinking is a way to do more with less, in other words, it seeks greater efficiency in its processes by performing them with greater safety, higher quality, greater productivity, exceeding customer expectations, and at the same time performing tasks with less effort or human resources, optimized structures, shorter task execution time, optimized layout, and lower cost. Lean thinking is the search for the waste that can constantly occur in a product and service process in any company. Finding them is the first step to plan and develop robust actions so that waste can be eliminated or, depending on the company's characteristics, minimized.

There are two factors that we can cite as more significant that make it difficult to identify the waste in a company:

- First, we can mention the process itself, when there is the presence of confusing processes, waste, and mixed activities that add value to the product or service;
- Another important factor that we can cite is the conceptual and or behavioral part of the employees who understand that they are always busy and start to consider normal or acceptable ways of working extremely inefficient for the execution of tasks.

According to [9], it is important to understand the waste that can be identified both in the manufacturing process and in administrative environments. Thus, they are classified into seven types:

- Superproduction: this is classified as the most damaging loss, since it has the ability to trigger and mask the other wastes and is the most difficult to combat. The loss due to overproduction can be by quantity, when more is produced than necessary, or by anticipation, when it is produced before the correct time. Overproduction is mainly a consequence of the misalignment of production in relation to demand and, therefore, the organization must always produce what is needed, in the quantity needed, and at the time needed;
- Waiting: this waste represents the material or service that does not undergo any process that adds value immediately, but that remains stationary, waiting to be processed. Waiting is caused mainly by stocks resulting from overproduction;
- Transportation: transportation represents on average 45% of the total production time of a material and, therefore, should also be treated as a priority in the cost reduction effort. One of the measures for its elimination is the readjustment of the layout to a model that minimizes the distances covered by the items;
- Over-processing: this can be understood as the amount of unnecessary processing that can be eliminated in order to maintain the final result of the process and the characteristics of the product;
- Inventory: represents the stock of raw material, work in process or finished product. The costs associated with this waste range from unnecessary floor space to the cost of maintaining these inventories;

- Movement: unnecessary movements made by the operator during the operation of the item. The study of times and methods is recommended to combat this waste, which aims to apply correct handling methods, adequate ergonomic aspects, and efficient layout;
- Defects: the product presents one or more quality characteristics out of the standard, which implies rework or scrap. The consequence of this scenario is the waste of practically all resources that were applied to the production of the damaged item.

3.5. Lean office (LO)

The LO emerged through the concepts of lean thinking initially practiced in productive processes in factories and began to be practiced in administrative environments. For [18], applying the principles of lean mindset allows organizations to achieve success and effectiveness in their activities. Although started in manufacturing industries, the lean concept can also be deployed in various service areas.

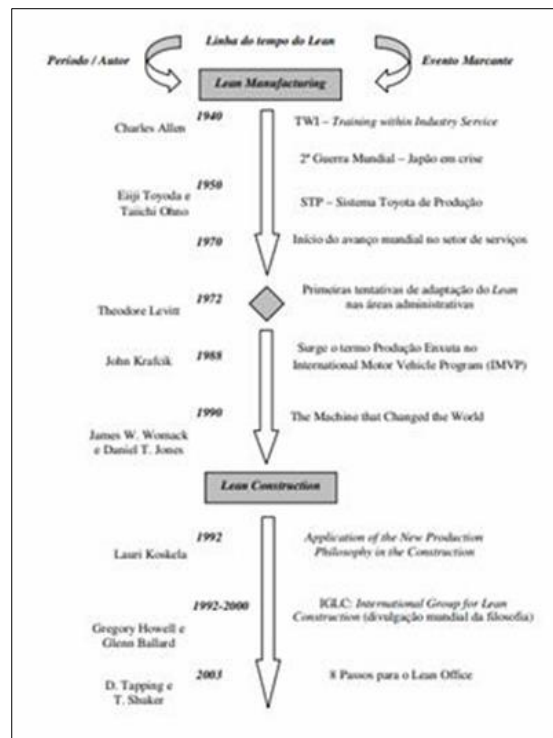


Figure 1 LO Evolution. Source: [21]

The success of the application of lean thinking concepts in industrial production formed a solid base for administrative environments to adapt the use of the tools in their work environments and processes. The application of these concepts and the use of the tools brought positive results, making the information management more productive and assertive, generating more value to the information flow and the administrative processes. For [7], the application of Lean concepts in administrative areas is of great importance, since 60% to 80% of the costs involved in meeting a customer's demand is administrative in nature. Thus, the LO is born, where its objective is to reduce these high administrative costs, making processes more agile and efficient, meeting the needs and expectations of customers.

The authors [8] point out that the LO was the concept created to integrate the already existing management tools and techniques with those incorporated from Lean Thinking or lean thinking. Such application made it possible to attribute importance to information activities, stock control, and movements inserted in offices. It made the provision of expected services more effective, meeting the needs of customers, consequently providing them with satisfaction.

According to [19] the LO if applied correctly enables the reduction of wasteful overproduction of printed documents, the reduction of service delivery time, the restriction of excessive movement of people between offices, the improved use of underutilized human resources, the reduction of hierarchical levels, and the minimization of document storage costs.

Lean Office is an adaptive evolution of Lean Manufacturing, but with one particular difference. While in Lean Manufacturing, one has very visible work scenarios, since it deals with processes with physical flows, in Lean Office the work scenarios are often difficult to visualize, since it deals with processes involving non-physical flows [20].

[8] state that since its conception, the lean concept has been the target of study by managers concerned with the use of new tools to increase the efficiency of production processes. Based on these studies, the ideas of the lean mentality quickly reached other industries such as construction, thus generating Lean Construction, and offices, generating LO. The evolution of this derivation of Lean will be shown in the Figure 1.

3.6. Eight steps for the application of lean office (LO)

[7], mention in their work that conceptually the implementation of Lean philosophy is considered simple, but its implementation can be challenging and if there is no commitment and engagement of all employees, the maintenance of this work can be compromised. A successful implementation of LO requires a very detailed planning, the deliveries of the sector where the tools are being applied cannot be compromised, so the customer, be it internal or external, will not be affected as to their demands and commitments.

[8], state that LO is a concept that varies according to each area of work and each office objective in adding value to their activities. Standards for implementing this concept emerge as its application occurs and are mostly the responsibility of the offices themselves. Therefore, each one can and should identify its specific way of structuring the implementation process of the LO tools. [22] mention that the lean mentality, especially the proposed LO concepts, can present good results for the public administrative sector. According to [7], the adoption of the Lean system in administrative areas represents a great potential for improvement in its structure, seeking to eliminate all the waste present in the company's value flow. In this way, the authors cite eight steps to be implemented during the application of the LO concepts:

- Commitment to Lean: Teamwork must be stimulated so that there is a commitment from everyone involved in the application of lean concepts;
- Choice of the value stream: the most representative product/service or process value stream in the organization should be chosen. Besides that, there must be an immediate concern with the consumer;
- Learning about lean: everyone should have a good understanding about lean concepts and terms;
- Mapping the current state: provides a clear view of waste and shows the current status of the analyzed process
- Identification of lean performance measures: choose which metrics will help achieve the lean state;
- Mapping the future state: improvement proposals should be incorporated to the map, considering the customer demand, the search for continuous flow and the establishment of a workload leveling;
- Creation of kaizen plans: establish the processes and deadlines for improvement implementation;
- Implementation of kaizen plans: execute the proposals obtained in the future map.

In the LO, information management is extremely critical for successful execution. The differentiation between a data, the record about the current state of the world, an information, data gathered and provided with relevance, and a knowledge, product of the reflection of information performed by the human mind, has extreme importance in delegating tasks or structuring processes.

Therefore, according to [8], it is up to managers and operators to understand in which situation the information is generated.

And to facilitate the transformation into knowledge, the authors suggest asking the following questions being: What? Why? How? When? Who? Where? Which/what? How much?

According to [5] there must be a commitment from all parties involved with Lean. Top management must involve employees in the planning and execution, thus creating a bond of responsibility in the success of the implementation. The philosophy contradicts the pushed production system where the demands arrive from top to bottom, because it organizes the execution in order to grant autonomy to the worker to pull the demand.

This way the role of the pilot arises, an employee with the behavior of a facilitator between the work units, considering the focus on the value stream. Figure 2 shows the desired production model in the LO concept, that is, the production being pulled by the employee.

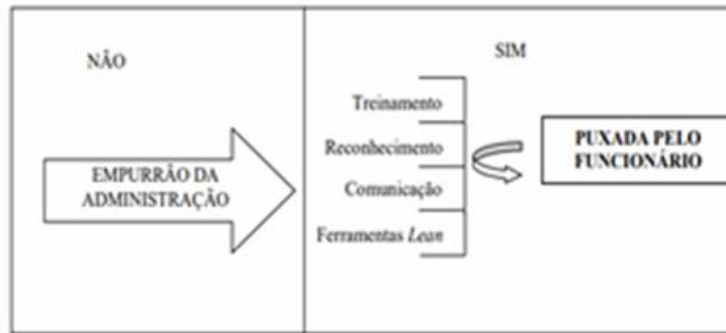


Figure 2 Employee-pulled production in LO. Source: [7]

Just as top management chose the pilot, it must also designate other members to the core deployment team that will perform the tasks of identifying roles on the overall team, establishing procedures, and coordinating communication among the overall members. [7] mention that “the primary goal is to make the entire organization faster, smarter, and leaner than the competition”.

[23] reports three important conditions to achieve success in the implementation of LO, these are: clear and efficient communication, the possibility of conducting experiments with new tools and flexibility in the application of the concepts. [24] emphasizes that the Lean change does not occur suddenly, but it is a process of evolution of the methodology application with the interaction and maturation of the team.

mention in their work that in the implementation phase of LO it is necessary to be clear about concepts such as work unit, flow, value, historical panel, and value stream management. Below we will provide more information about these concepts:

- Unit of work: refers to a specific amount of work, well-delimited with the functionality of transforming the process into smaller parts, facilitating management. For example: opening of claims, opening of accounts, service order write-offs, engineering requests, and completion of reports.
- Flow: [25], define flow as a necessary path to be taken in order to deliver what the customer expects, it is a sequence of activities that will transform the raw material into product, or the basic information into knowledge.
- Value: The importance given by the customer to the characteristic of the product or the service, for which he is willing to pay.
- Historical panel: [7], systematized the implementation in eight stages, each with specific goals. The historical dashboard, shown in figure 5, is a graphical way for the team to understand where they are and what direction they need to take.
- Value Stream Management: [26] mention that Value Stream Mapping (VSM) is a simple tool that allows the vision of the process only with added value, without stressful tasks that consume resources, but the customer does not see value.

What is meant by value stream mapping is simple: one should just follow the production path of a product, from the consumer to the supplier and carefully draw a visual representation of each process in the flow of material and information [27].

For [7], they understand that "value stream management is just a process for planning and linking Lean initiatives through systematic value capture and analysis." The authors developed a value stream management method that consists of 8 steps: Commit to Lean; Choose the value stream; Learn about Lean; Map the current state; Identify Lean metrics; Map the future state; Create Kaizen Plans; Implement the Kaizen Plans.

3.7. Recognizing the value stream

[28], report that the administrative and service sector has characteristics that directly influence its processes, such as the level of employee and customer participation.

That the attributes of intangibility, not being tangible; of timeliness, being consumed at the time of production; and heterogeneity, being adapted to each individual; makes the service value map more complete than the manufacturing map [29]. Table 1, presents the differences in value flow between manufacturing and office.

Table 1 Value stream differences between manufacturing and office. Source: [30]

	Manufatura	Escritório
VALOR	Visível a cada passo objetivo definido	Difícil de enxergar, objetivos mutantes
FLUXO DE VALOR	Itens, materiais, componentes	Informação e conhecimento
FLUXO CONTINUO	Interações são desperdícios	Interações planejadas deverão ser eficientes
"PUXAR" A PRODUÇÃO	Guiado pelo <i>takt time</i>	Guiado pelas necessidades da empresa
PERFEIÇÃO	Possibilita a repetição de processos sem erros	O processo possibilita a melhoria organizacional

[23], mentions the importance of identifying the correct flow of value to the customer, because it will be the basis of the future state process. To have a preparation with quality it is necessary to listen carefully to the customer's needs, know their means of production, as well as the team of employees, and establish bonds of commitment with managers of the sectors involved.

For [24], the path to be followed in the elaboration of the value stream is from back to front, i.e., it starts not by the production input, but by the customer at the end of the chain. So the first link will be the customer, then the necessary processes, and finally the supplier.

3.8. Process

The literature presents numerous definitions for process, one of them is presented by [31], where he defines process as a group of logically interconnected tasks that use the organization's resources to generate the defined results in order to support its objectives. The authors [32]; [33]; [34] and [35] define process as a set of activities that from an input, adds value to it and produces an output for a given customer.

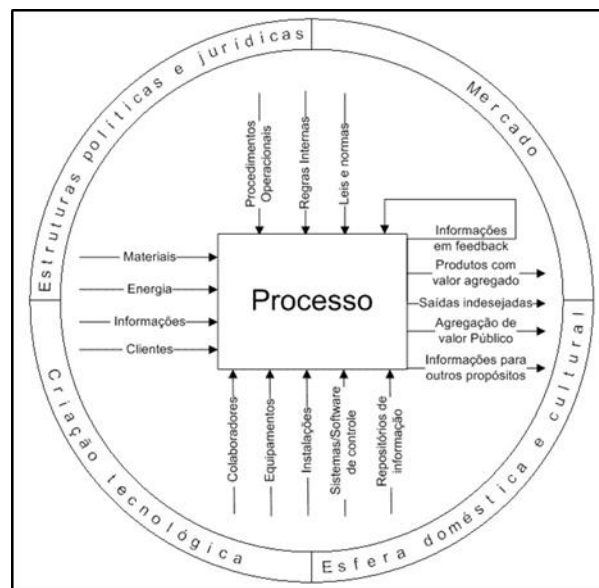


Figure 3 Process diagram in the organization. Source: [38]

For [36] process is simply a set of structured and measured activities intended to result in a specific output for a particular customer or market. The author also defines it as “a specific ordering of work activities in time and space, with a clearly identified beginning, end, and inputs: a framework for action.

For [37] process is a coordinated and standardized flow of activities performed by people or machines, which may cross functional or departmental boundaries to achieve a business goal that creates value for an internal or external customer.

Figure 3 shows what is directly involved in a process such as inputs, outputs, resources, and controls.

The organizational processes are classified by several authors, among the different classifications we present the definition of the authors [39], who group the business processes into four distinct categories:

- Operational processes: responsible for the work of producing goods and services.
- Support processes: responsible for providing support to operational processes.
- Driving processes: related to the establishment of the organization's strategy.
- Managerial processes: involve decision making and communication activities in the company.

[40] groups organizational processes into three categories:

- Operational processes: processes of creation, production and supply of goods or services, i.e., they relate to the end-activities.
- Decision processes: processes that result in decisions related to operational processes, with the objective of controlling them.
- Administrative processes: processes that support operational and decision processes.

These process categories involve sequences of mutually dependent activities, which transform the inputs into outputs within the timeframe and quality defined so that they can meet the satisfaction and needs of the internal or external customer, regardless of the product or service that was requested.

For [41], processes are the basis of analysis for an organization to diagnose all kinds of problems, and if organizations have a process-focused mindset, they can manage their work more efficiently.

3.9. Lean tools

The concepts of lean thinking, seen in the previous section, go beyond the realm of theory and expose practical tools to help companies and managers become lean. This section summarizes the main techniques and tools that can be used to achieve a lean and more organized work environment. Lean Manufacturing and LO have practical tools that help companies and managers implement the concepts. Among the main Lean tools are 5S, Standardized Work, Work Cells, Visual Management, Value Stream Mapping, SIPOC (SUPPLIERS, INPUTS, PROCESSES, OUTPUTS, CLIENTS), FIFO Method (First in - First out), Just In Time, Continuous Flow, Pulled Flow, Kanban; Takt Time, Jidoka, Heijunka, Kaizen, The Five Whys, A3, Source Quality, and Leveling.

According to [7], the Lean tools of greatest application in these environments are 5S, Value Stream Mapping, Continuous Flow, Standardized Work, and Leveling.

For this work, we will apply the tools that we understand to be the most appropriate and assertive for this phase of implementation of the LO in the chosen sector of the institution. The tools that will be applied are: 5S, Standardized Work, SIPOC, Visual Management and Business Process Model and Notation (BPMN).

3.10. 5S

[42] mentions that 5S is a widely used tool in the process of implementing lean thinking. The 5S tool is based on the initials of five Japanese words that begin with the letter "S": SEIRI (classification, selection), SEITON (order, organization), SEISO (cleanliness, inspection), SEIKETSU (standardization, improvement), SHITSUKE (discipline, self-control) as shown in Figure 4.

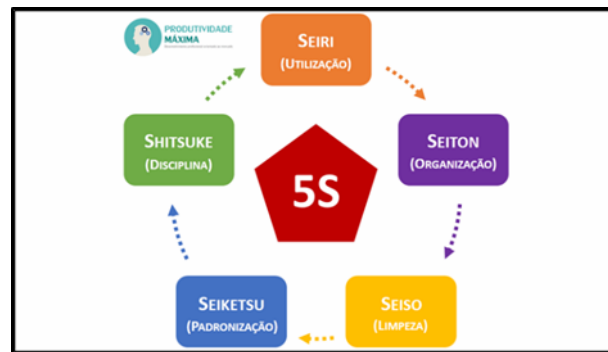


Figure 4 Definition of 5S. Source: [43]

Each of the words becomes a prerequisite for the next, and these are the definitions of each:

- SEIRI: separating the useful, useless materials at work and eliminating the unnecessary. It can be interpreted as a sense of use, tidiness, organization, and selection. Identify how materials, equipment, tools, utensils can be classified based on their use;
- SEITON: tidy up, identify and define the appropriate place for materials needed for work;
- SEISO: clean the work environment, cooperating to the smooth running of processes;
- SEIKETSU: standardize and create rules and procedures to maintain the first 3 (three) S in succession;
- SHITSUKE: discipline that makes the previous attitudes a habit, transforming the five steps into a pattern.

The first three senses are directed to practices, orienting action, and the last two senses are directed to people's behavior. [44] characterize 5S as the creation of a clean, orderly, and safe work environment that eliminates losses and makes anomalies immediately visible.

In the view of [45], 5S is visual management and is an essential tool for improving lean behavior among office workers. Being very useful in achieving cost reduction, waste elimination, zero defects, safety improvements, and accident reduction. In addition, it is considered as the basis of Lean tools in developing continuous improvement in the office environment.

According to [8], the application of the tool depends on the participation of each employee. Thus, it is necessary that each one:

Identify the materials used at work, for later separation and organization according to usefulness, between useful and unnecessary things;

Clean their workplace, determining the level of polish they want to achieve, maintain, and subsequently establish pre-assembly measures to align the efforts of team members to produce the cleanliness;

Standardize how all workplaces are organized, involving developing a routine or process for keeping the target area clean, clutter-free, and optimized to a standard level.

3.11. Standardized work

Standardized Work (TP) is a basic lean tool that specifically seeks to present the operator's activities and movement in the work environment. It is generally applied in repetitive process situations to standardize the process and eliminate waste. As a result of kaizen, the standardized work is the basis for future improvements to be made in the company.

[46] cites in his work that Standardized Work at Toyota does not mean forcing workers to work hard, but to work efficiently without any wasted motion. A standardized sequence of various operations to be performed, called a "standard operations sheet", facilitates the achievement of this first objective.

The authors [47] and [22] mention that Standardized Work is a concept that means establishing and documenting the procedure that provides the best result, with the best method and the best sequence of activities.

3.12. SIPOC

SIPOC (Suppliers, Inputs, Process, Outputs, Customers) is a tool that seeks to identify all relevant elements of a project before it begins.

According to [48], this tool allows the vision of all interrelationships within the process, highlighting its interfaces and the impact of these interfaces on the quality of the Output, thus contributing to develop a process-oriented vision of the organization.

It is a versatile tool, whose application is widely explored in planning process improvements based on methodologies such as Lean and Six Sigma, both in the manufacturing and service areas [49, 50]. [51] describes the SIPOC diagram as a tool used to identify all the pertinent elements of a process improvement project before work begins. The author points out some steps to apply the SIPOC diagram in an easy way, such as:

- Create an area that will allow the team to post additions to the SIPOC diagram;
- Start with the process;
- Identify the outputs of this process;
- Identify the customers who will receive the product of this process;
- Identify the contributions required for the process to work properly;
- Identify the providers of the contributions that are required by the process;
- Optional: Identify preliminary customer requirements;
- Discuss with project owners and others involved for verification;

[52] mentions SIPOC as one of the most appropriate tools to be used to adequately define the problem, which aims to identify the project boundaries, that is, which suppliers and customers of the process under study, and also which are the main “inputs” to be processed and the relationship of the most critical characteristics to customers regarding the “outputs” generated. In Chart 1, we have an example of a SIPOC model.

Fornecedores Suppliers	Entradas Inputs	Processo Process	Saídas Outputs	Clientes Customers
		Requerimentos Requirements		Requerimentos Requirements
S ₁ Fornecedores de matéria-prima	I ₁ Matéria-prima	R ₁ Parâmetros de qualidade definidos no contrato	O ₁ Produtos	C ₁ Cliente
S ₂ Empresa de RH	I ₂ Recursos humanos	R ₂ Habilidades curriculares pré-definidas	O ₂ Resíduos	C ₂ Departamento Municipal de Meio Ambiente
S ₃ Distribuidora de energia	I ₃ Energia	R ₃ Distribuição sem interrupção e sem oscilações	O ₃ Lucro	C ₃ Acionistas
S ₄ Cliente	I ₄ Pedidos de compra	R ₄ Pedidos compatíveis em tipo, quantidade e prazo	O ₄ Benefitorias	C ₄ Município

Chart 1 Example of SIPOC. Source: [53]

3.13. Visual management

A visual system gives employees a broad view of the processes, helping them to perform their tasks and keeping them more engaged in production activities.

[8], for the control and management of the activities of an office, based on a visual structure, simple tools can be used as the detailing of activities in process, the flowchart and its detailing among the benefits that can be identified with this technique.

3.14. Business process model and notation - BPMN

The Business Process Model and Notation (BPMN) was developed by the Business Process Management Initiative (BPMI), integrated with the Object Management Group (OMG).

According to [54], BPMN has been consolidated as an international standard language for process mapping, aiming to provide a notation that was easy to read and understand by all business users, from business analysts to those who will manage and monitor these processes.

[55] reports that a major advantage of BPMN is that it is an open standard notation, although maintained by OMG, it is not owned by any company. Therefore, any individual who wants to contribute to the evolution of the notation can send their contributions to the OMG group and any vendor can access and develop tools, which makes many available their tools, often for free.

According to OMG, a Business Process Model and Notation (BPMN) provides companies with the ability to understand their internal business procedures in a graphical notation and gives organizations the ability to communicate those procedures in a standard way. In addition, the graphical notation will make it easier to understand performance collaborations and business transactions between organizations. This will ensure that companies understand themselves and the participants in their business and allow organizations to adapt to new internal business circumstances quickly.

3.15. Elements of the notation

BPMN is a graphical notation that aims to provide a grammar of symbols to map, in a standard way, all business processes of an organization.

[56] cites in his work that one of the challenges of BPMN is the creation of simple mechanisms for building business process models, but maintaining the ability to map and understand complex business processes of higher complexity.

According to [57], since its formal availability in 2004, BPMN has been widely used in organizations worldwide. Currently there is a large supply of process mapping tools that support the notation. Due to its wide acceptance it is helping to spread concepts related to business processes and is considered today a key feature of any decision making initiative.

Through BPMN, the business process is represented through a chain of events and activities, connected through connectors that show the sequence in which they are performed. In addition to events and activities, other flow control elements can be used in the modeling to allow the creation or unification of parallel flows that occur during the same business process.

3.16. Graphical notation

[58], reports that flow objects are the main graphical elements to define the behavior of the work process.

[57] mentions that the great potential of BPMN for process representation lies in the fact that it proposes a simplified set of elements (events, activities, connectors, gateways, connectors, and swimlanes). The following will present the symbologies and definitions currently used in the representation of a business process.

- Events are elements used to represent the occurrence of facts in a process. Events may represent waiting for a fact to happen to start/follow the process execution or they may signal that the process will produce the occurrence of a fact during or at the end of its execution. Events are signaled in the process by a circle, and depending on the point in the process where they occur they can be signaled differently. Start events mark the starting point of the process and are represented by a single-line circle. Intermediate events mark the occurrence of events in the course of the process and are represented by a double-line circle.

End events mark the end point of the process and are represented by a thick line circle.



Figure 5 The symbology of events. Source: [57]

Activities: Activities represent work performed in a step of the business process. Activities can be classified into tasks where it represents an action in the process that can be performed by a person or a system. Visually it is represented as a rectangle with rounded edges, containing its description within the box area as shown in Figure 6.

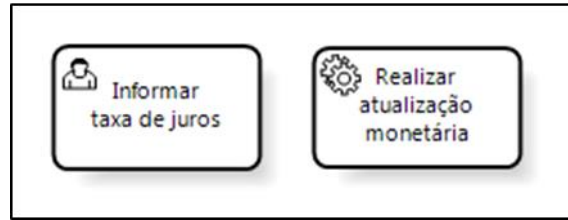


Figure 6 BPMN activity representation. Source: [57]

0 BPMN suggests some symbols that can be added to the task to visually represent its use and thus obtain a better detailing and visualization of the activity performed according to Figure 7.

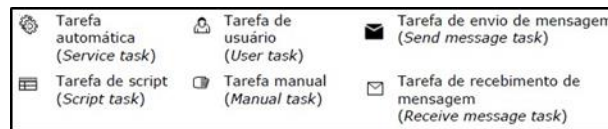


Figure 7 Representation of the internal symbology of the activities. Source: [57]

Flow Sequence Connector: the main purpose in mapping a process with BPMN is to represent the sequence in which activities happen from their start to their completion. In BPMN METHOD & STYLE (2ED), [59] clarifies that the purpose of BPMN is to represent the logic of the process.

The flow sequence connector is represented using a solid line with a filled arrow pointing to the destination. In a business process, all flow elements need to be connected to each other through a sequence connector according to the order in which they should be performed.

It is important to understand that in interpreting a BPMN process, the sequence connector implies that there is a dependency between the connected activities, of the end-start type. The connection means that after the completion of the activity, the next activity can be started. The process logic is visually demonstrated through the flow created by the sequence connectors according to Figure 8.

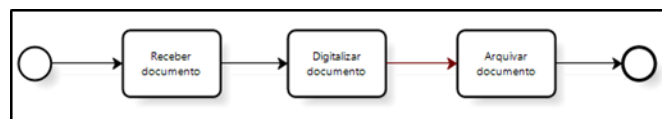


Figure 8 BPMN flow sequence connector representation. Source: [57]

Gateways are key elements in business process modeling, because they allow you to describe the activities that always happen in the same way or in the same sequence, but the activities of possible exceptions known to the business. This gateway can be represented visually as the empty rhombus or with an "X" marker according to Figure 9.

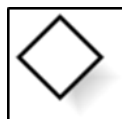


Figure 9 BPMN gateway representation. Source: [57]

When the running process reaches this gateway, the process must check the indicated condition, only one of the gateway's outputs will follow. This gateway acts as an "or", since one or the other path may be followed. The output sequence connectors of this gateway can have descriptions that help identify which condition is required for the flow to follow that path. In Figure 10 we have an example of the application of a gateway in a process map.

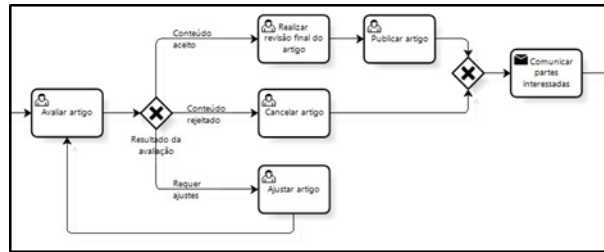


Figure 10 Example of the application of a gateway. Source: [57]

Swimlanes are the BPMN elements used to organize the processes in a diagram, defining the scope of each process and enabling the identification of the roles responsible for the execution of each process activity.

These elements are defined in a structure similar to a pool and its lanes. A pool can contain only one business process. Different business processes must each be contained in a specific pool.

A pool can contain as many lanes as necessary to characterize the participants involved in the execution of the process activities. The common practice is to draw the pools and their lanes horizontally, but the notation allows for vertical representation.

The pools are named with the Process Identification - ID when the modeled process is at the operational level of detail, or with the Participant ID, such as an external entity that is involved in some way with the business process modeled in another pool. In Figure 11, we have a representation of Swimlanes.

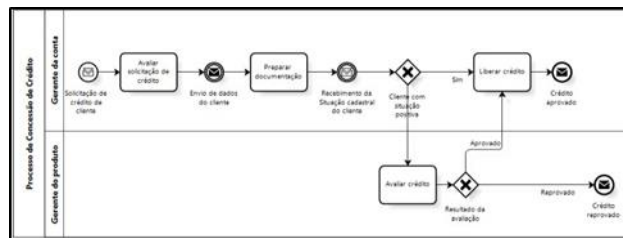


Figure 11 BPMN Swimlanes representation. Source: [57]

Artifacts: In addition to flow elements (activities, gateways, and events), connector elements (sequence flow and signaling of the process but which do not influence the process flow. These are annotation elements, which can be used to add supplementary information to the process.

The data object is an element that represents a set of information in the context of the process, an activity or an exchange of hands. It is represented by a page with a folded end.

The text annotation artifact is an element that can be used to add comments to the process or to an element. It is represented by a text area marked with the side border and may or may not be connected to diagram elements.

The group artifact is a visual annotation element that can be used to flag groups of activities for emphasis. The group is a simple annotation and does not influence the process flow, and can even be drawn across lanes and pools. It is represented by a rectangle with rounded edges and a dashed line.

The association connector is a specific connector to connect the artifact elements to the diagram being represented by a dotted line, and may or may not present “v” arrows, it is distinct from the message flow, which has a dashed line and a triangle tip. In Figure 12, we have a representation of artifact usage.

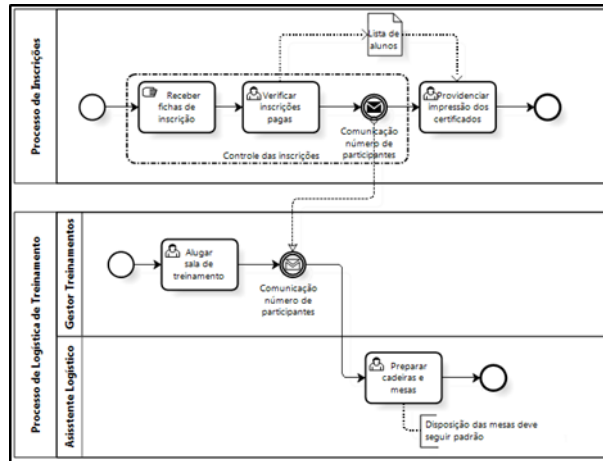


Figure 12 BPMN artifacts representation. Source: [57]

4. Material and methods

The research was developed in the Administrative Services Directory Sector. This sector is responsible for the direction and coordination of the administrative and operational support activities of the Educational Institution and its organizational structure is composed of 4 collaborators divided into 74 attributions. To understand the attributions, activities, and functions of the collaborators of this sector we tried to apply Lean tools such as 5S, Standardized Work, SIPOC, Visual Management, and Value Flow Mapping presented in the BPMN tool.

The first tool applied was 5S, the practices of the concepts of this tool create a satisfactory work environment and a reduction in the time spent on the execution of activities. It can be considered a lean tool that has as its basic objective to promote a systemic order of the functioning of a process in a work environment. 5S ranges from office layouts, organization and maintenance of the environment, and even the availability of electronic data and information on a computer. Focused on continuous improvement, it is a participative program and a tool to educate people in an easy, simple, and effective way inside and outside the workplace.

5. Results and discussion

Tipo de Desperício	Identificado		Descrição
	Sim	Não	
Super Produção		X	
Espera	X		Não atendimento aos prazos de fechamento das atividades causando atraso no fechamento do processo não somente na Instituição mas também no Governo do Estado.
Transporte	X		Telefones e troca de e-mails para entendimento, troca de informações e correção do documento ou processo enviado com algum tipo de erro.
Processo Deturpado	X		Aquisição de Materiais e Serviços não permitidos pelo procedimento Regime de Alimentação / Falta de entendimento e prioridade na Gestão do Recurso Público.
Inventário	X		Deficiência na Gestão do Patrimônio.
Movimentação	X		Troca de informações entre os colaboradores do mesmo setor sobre a mesma atribuição.
Defeitos	X		Erros frequentes na elaboração e envio da documentação causando devoluções e solicitações de correções pelo Departamento de Finanças.
Subutilização de Pessoas	X		Pessoas ociosas dividindo tarefas que poderiam estar centralizadas e assim otimizar o tempo em outras atividades pertencentes a sua função.

Chart 2 Waste identified after the application of the BPMN tool. Source: Authors

As a result of this mapping, it was possible to observe the sequence of activities and obtain a better understanding of the waste suffered by the Institution regarding the use and management of the Advance Payment System. We can cite the main wastes so that they can be identified when compared to the sequence of current activities. As shown in Chart 2, we present the wastes identified in this work compared to the 8 wastes reported by the authors.

5.1. Mapping the current process

Based on the information gathered after the understanding of the current process mapping, it was observed the need for a review in the process of using the Advance Payment. As mentioned in the table above, all the waste identified in this process had a main negative consequence for the Institution regarding the Management of Public Resources. In this way, new work procedures were defined in order to allow the Administrative Services Directory sector the condition of planning, monitoring, control of the use and guarantee a Public Resource Management with the objective of maintaining the Institution serving the students, teachers and employees with a quality structure.

In this way it was developed according to the new guidelines based on concepts and procedures already in place a new map of the process to represent the management of the Directorate of Administrative Services as the budget of the Advance Scheme.

5.2. Implementation of the actions

To carry out the planning of the purchasing and service provision process, the unit was divided into groups and subgroups to better understand the direction of the Public Resources and thus offer the unit's Manager a clear vision of where and how this resource is being used. The groups are divided as follows:

- Building maintenance: includes masonry maintenance, plumbing, electrical, painting, locksmith, locksmith, glasswork, among others;
- Equipment maintenance: includes computers, note books, printers, projectors, air conditioners, and computer devices, among others;
- Office materials;
- IT materials;
- Cleaning materials

A schedule of activities was created to guide the Director of the Institution and the Director of Administrative Services in the decision making process regarding the use of the funds from the Advance Payment System. For the control and management of the DMPP, it was necessary to create a database to generate information about the amount spent, where it was spent, what kind of material or service was purchased, and to whom the payment was made.

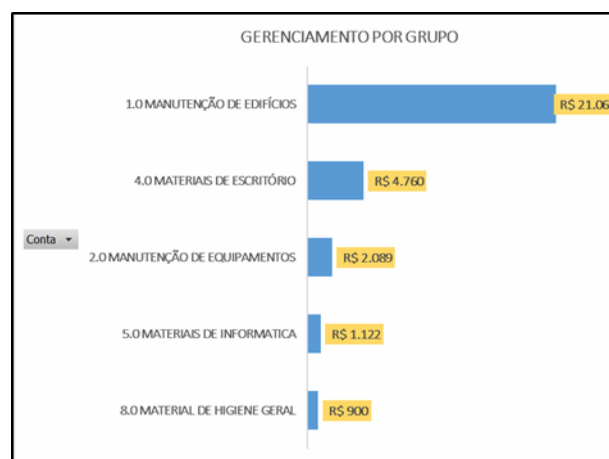


Figure 13 Group management. Source: Authors

Based on this information, it was possible to identify where and what are the problems that are most impacting the functioning of the institution and to direct actions with the State Government regarding a bidding process for maintenance and conservation of the building and acquisition of new equipment. It is important to mention that for ethical and confidentiality reasons and to preserve the names of suppliers and service providers, we will only present

the information from Groups and Subgroups extracted from the database. In Figure 13 is represented the expenses related to the groups of the Advance Payment Scheme.

In Figure 14 are represented the expenses related to the subgroups of the Advance Payment Scheme.

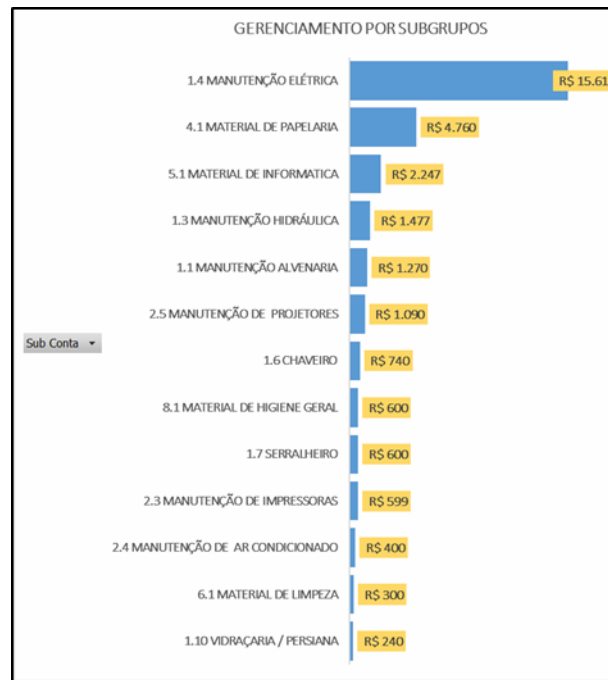


Figure 14 Subgroups Management. Source: Authors

The next phase of the project is in progress, given the positive results obtained with the implementation of Lean tools and LO concepts in the sector.

It was observed that it was necessary to develop a Management System responsible for uniting various sectors in order to ensure the functionality of the institution. Thus, together with teachers and students, a project was started to create a Facilities Management software that will provide a new concept of administration and management of the Educational Institution. As the software is still under construction, Figure 15 shows a projection of what this system will look like.



Figure 15 Facilities Management Software. Source: [60]

6. Conclusion

The purpose of this work was to evaluate the application of the LO concept to the Advance Payment Plan Process (DMPP) of the HEI where it is understood the fulfillment of the main objective and the achievement of all specific objectives of the research.

With the application of the BPMN of the current state it was possible to understand how the activities are performed and also to identify the existing waste culminating in the analysis of the value flow of the DMPP process.

It is concluded that it is extremely feasible to use this management concept in HEI administrative environments because it is understood that it will bring benefits to the manager and to the unit, such as improvement in the level of performance of activities, simplification of processes, debureaucratization of processes, elimination of waste, cost reduction, improvement in the flow of information, increased responsiveness in changing documents and processes, reduction of cycle time in the execution of processes, greater organization and management of public resources.

Other positive results were observed, such as the standardization of activities, the optimization of the existing labor resources in the sector, the significant improvement in terms of planning, execution and accountability of public resources, and the definition of a management model for these financial resources with the State Government.

A limitation present in this research was the fact that the current literature does not contemplate different discussions regarding the application of LO in an administrative environment of a State Public Teaching Institution. This is due to the complexity of mapping the value stream chain of such a context, which involves, in this case, the movement of information and even knowledge among the processes performed, differently from what is found in an environment that involves the manufacturing of products, much discussed in studies and research in the area of Lean Production or even Lean Manufacturing.

As a result of the Bibliometrics results it is possible to state that, despite the existence of several literatures dealing with LO, it can be noticed that few of them approach tools or methods to analyze the processes that involve the flow of information in an administrative sector of an HEI. One hypothesis may be due to the dynamics of the interrelationships that occur in this context, thus interfering in the execution of its processes and, in this way, hindering its implementation.

However, it is understood that there are limitations in this Lean philosophy implementation process, where a critical analysis is necessary, observing the characteristics of the sector and the activities that are developed. The HEI has manuals for the execution of its activities and because it has this tool in hand many understand that it is not necessary to apply the Lean concepts and tools. However, it is important to highlight some difficulties encountered during the implementation of LO in the proposed context.

According to the literature presented, and it was no different in the context of this research, the workers involved presented, to a greater or lesser extent, resistance to the proposed activities, since the execution of such activities would require employees to leave, in some way, their comfort zone. Even though they were aware of the complexity of the paths that the flow of information took, these were already familiar to those involved.

Among several reasons, one that stood out was the fact that a single activity was fragmented into several stages and involving different collaborators, resulting in interactions, work and rework.

Because there was not a systematization in the way these employees worked, issues of cultural nature (variations in task execution procedures and those involved in the tasks) stood out over the technical ones, thus generating discomfort when the adoption of new processes involving the large flow of information within that department was proposed.

It is perceived that future projects can be conducted by expanding the study done in the process of procurement and payment of goods and services to other administrative processes of the HEI, thus contributing to identify and eliminate waste existing in other activities and contribute to the change of management of administrative activities based on the Lean concept.

This study theme can also be carried out in other Educational Institutions in different locations, which would allow to draw comparisons and evaluate if there are similarities in the administrative processes, contributing to the expansion of knowledge and dissemination of this subject.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors of the article claims that he has no conflict of interest. Acknowledgement section may be presented after the conclusion, if desired.

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