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THE IMPACT OF AN INFORMATION SYSTEM ON PRODUCTIVE PROCESSES: A CASE STUDY IN A CLINICAL ANALYSIS LABORATORY OF A PRIVATE HIGHER EDUCATION INSTITUTION

Maycon da Silva Gerônimo
maycon.geronimo@hotmail.com
Ceuma University, São Luís, Maranhão, Brazil

Aureo Luan Gomes Mesquita
aureoluan@gmail.com
Ceuma University, São Luís, Maranhão, Brazil

Ricardo Daher Oliveira
ricardo.daher@hotmail.com
Ceuma University, São Luís, Maranhão, Brazil

Rialberth Matos Cutrim
rmcutrim@hotmail.com
Ceuma University, São Luís, Maranhão, Brazil

ABSTRACT

This project has as its main objective to verify how the use of information systems can contribute to the improvement of production processes, through a proposal for the implementation of a computerized system. The project is methodologically characterized as a qualitative and descriptive study. It was developed in two stages: in the first, a bibliographical research was carried out, through which it was possible to perform the structuring of a checklist for data collection; in the second stage, the case study method was adopted, based on the checklist, whose scenario was a clinical analysis laboratory of a private higher education institution, in São Luís, Maranhão, Brazil. Based on the general objective, it was possible to identify flaws in the monitoring of the flow of processes, activities carried out, input and output of materials in the laboratory, to determine that there is a need to implement an information system in order to improve organization and control of materials and streamline decision-making processes.

Keywords: Information system; Productive processes; Implementation.

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1. INTRODUCTION

The intense transformations that occur in the economic, political and social scenario are making them increasingly complex and competitive, requiring organizations to adopt new standards that allow them to adapt to changes, seeking constant quality in their processes, increased productivity, continuous improvement and optimization of costs, making information a key factor in this context. The processes that relate to information are part of the focus of economic groups and government, resulting in the valorization of information as a resource. This event can be understood by how the measurement parameters for competitiveness are correlated between people, groups, products, services and activities.

In this sense, information has become one of the most important assets used by organizations due to their ability to generate competitive advantages, innovate, anticipate opportunities, avoid threats and add value to products and services, requiring managers to use information in an efficient manner. With an increasing volume of information available in ever smaller time intervals, it is necessary to manage this resource, aiming at the systematization, organization of knowledge, available data and information.

The technological resources, together with the information, are necessary for the strategic, tactical and operational development of any company. You need to know where to look for information, how to get to know it, present it, and use it. Companies that do not take care of the information management go through a process of deterioration of performance, without even taking care of it. To ensure effective information management, it is imperative that the provision of information is relevant, of good quality and transmitted to the right people and places.

Information plays an essential role in the control of operations, in the elaboration of strategies and in the development of competitive advantages within the segments that act; thus, the management of this resource is determinant for the changes in the method of decision making, allowing the best allocation of these companies in the competitive sphere. It is important that institutions broaden the skills to break down available information and individual knowledge into interlinked actions. When information is selected and determined in a better way, it meets the needs of organizations; therefore, the faster the access to this information, the higher the organization will achieve its objectives.

It is noticed that the process of search for knowledge and information that individualizes the function of technological production tends to expand through the search for innovations and anticipated development of new products and services based on information. The dynamism and interaction of the available technological forms of information with society result in transformations, contributing to social relations. The information only fulfills what was proposed when integrated as an essential resource in the definition of strategies, in planning and in decision making.

Therefore, in order for organizations to remain competitive in a market that suffers great oscillations, it is clear that they follow the changes that are taking place around them, linking to these changes the management of information, which has been showing to be an increasingly innovative approach. The process of strategic use of information can generate the competitive differential, depending on how the information will be managed in the processes and services of the organization and in the business environment.

Considering the relevance of the topic addressed by this work, this article presents the following question as a research question: How can the use of information systems contribute to the improvement of productive processes? Such questioning must require both a bibliographical review and the use of observation or information gathering mechanisms, allowing the research topic to reach the general objective of the research, which is: to verify how information systems contribute to the improvement of productive processes.

2. THEORETICAL CONSTRUCTION OF THE THEME

In order for the present article to reach its objectives, it is necessary to contextualize the existing theories, whose purpose will be to give technical-scientific consistency to this work. In this sense, an approach to the following topics is required: information technology; information systems; and information systems in productive processes, which is understood as the way to analyze the problem raised in this article.

2.1. Information Technology

The replacement of people by machines occurs from the industrial revolution, when the small artisanal production enterprises had their reality totally changed and became mass production industries. This system seeks to improve the performance of activities and the automation of processes. It is appropriate to describe that the conception, planning, execution and control of activities had been exercised for a long time. With the evolution of the industrial activity, the processes started to be analyzed and new possibilities of increase of the productive ability and efficiency were idealized (Cortês, 2008).

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According to Tigre (2006), the technological transformation is not an automatic process, representing the substitution of existing procedures, causing some impact to the capital invested. According to the author, it is necessary to have a combination of aspects that stimulate and make possible such substitutions. Two factors are preponderant: opportunities for improvement and new economically compensatory methods. Only the union of such factors would lead managers to accept these changes in order to overcome workers' opposition to mechanization, otherwise their implementation would be impossible or, if it were to happen, the chances of the results being bad were very high.

According to Rossini *et* Palmisano (2014), technological advances dominate society and organizations, and become more evident in them because they seek constant changes in technology. Technology is defined as the knowledge of cause-and-effect relationships of the resources of transformation of products and services.

Information is a key factor for companies when they are exposed to the open and common market. Competitiveness, productivity and quality would not be likely without the existence of information. Through interaction with information technology in organizations, changes occur in the culture and behavior of the interlocutors. Information technology is a tool used to control, monitor and record many aspects of organizational performance and conduct.

The following are some dualities of information technology: it is used to create routines at work; connects information; and can reduce the companies' dependence on the capacity of people in certain positions (Rossini *et* Palmisano, 2014).

The diffusion of information technology, with its development in the twentieth century, is considered a technological revolution, because thanks to the positive results obtained with the improvement in the management and processing of data within companies, the active use of materials and energy has created a trend in terms of information and knowledge. Given the social, political and economic impacts, one can observe the growth of analyzes of institutionalist evidence that highlight the systemic view among the organizations and the internal and external environments, as a factor of conditioning technological and competitive performance (Tigre, 2006).

For Boghi *et* Shitsuka (2002), it is very important that people involved in the development of systems within organizations dominate three types of skills: problem analysis and problem solving, behavioral and communication skills, and technology skills. In the first skill, knowledge of systems development, mathematics, and behavioral science is required. The second involves the organizational strategy, structure, and the decision-making process. The third skill adds knowledge of information systems, database and the physical part of systems.

In the day-to-day of organizations, some sectors have the need for timely information, focusing on making immediate decisions, while others need support for long-term decisions to be made. In addition to the characteristics of the information, companies should consider information of different levels of preparation in order to support wider decisions and shorter deadlines. It is notorious that, even at levels where strategic decisions are developed, specific circumstances may require tactical or even operational decisions (Cortês, 2008).

Information technology plays a strategic role, contributing to knowledge and collective development and continuous learning, facilitating the sharing of ideas and solutions to problems in companies. The quality and consistency of the application of information technology are fundamental measures for competitiveness and business survival. Information planning is considered as a tactical resource, and information technology is a strategic resource (Rossini *et* Palmisano, 2014).

For a period of time, information technology was treated and operationalized by organizations with a basic rationale, by the distance that users maintained with that medium and by the cost of this technology. Information technology is any device that has the ability to treat and process data or information in a systemic manner and is contained in the product or process. Any information technology should provide the user with the effective domain of information, in addition to simplifying the steps of the activities (Cruz, 2011).

In order for information to be generated, it is necessary to obtain data, which can be worked and processed. The great tendency of the market is to increase the quality of data, in volume and complexity, as the business evolution occurs. Due to this trend, there is also the need to store data in organized collections, known as database. The transformation of data into information in a system follows these steps: activities generate data in the system; data are collected; data are stored; processing transforms the data; information is generated; with information decisions are made; and decisions affect the system (Boghi *et* Shitsuka, 2002).

The data when they go through evaluation, analysis or organization, generate the information and, from that moment, the decisions can be taken with greater reliability. It is important to emphasize that the quality of information depends on the quality and quantity of data that are processed by different systems. The information is acquired through the interaction of the data. When considering the types of

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information, it is verified that they act at all levels, transforming data into information (Cortês, 2008).

For Stair *et* Reynolds (2002), information is termed as a collection of events organized in a way that acquires a supplementary value beyond the value of the facts themselves. According to the authors, information is fundamental for making decisions when they add the following characteristics: accuracy, completeness, economy, flexibility, reliability, relevance, simplicity, punctuality, verifiability, accessibility and security. Accurate information contains no errors; when complete, it contains all the important facts; it is economical when feasible; flexible, when it can be used for various purposes; reliable, depending on factors such as the method of collection; relevant, if essential for decision-making; simple, when it generates facility in the interpretation of important points; punctual, if it is obtained when necessary; verifiable when making the decision; accessible, if available in agile time and to authorized users; and safe, if accessed only by authorized persons.

Information technology has two roles in any organization: to be used by people to carry out their activities; and tolerate the productive process. The first role is exercised by technologies that perform tasks proper to their activity. The second role involves lagging training for people to operate new devices. It is unimaginable that some activities carried out by human beings do not provide information technology, because, however simple it may be, there is always some device for the analysis of information (Cruz, 2011).

Therefore, business people need information for their businesses to function; and students need information about the subjects they are studying. In all activities and relationships there is a common point that is the need for information. Many managers believe that the simple act of using technology ensures the survival of organizations in the market. In the systems overview, information technology is considered capable of storing, collecting, transmitting, processing, retrieving and presenting data and information. Knowledge of systems implies knowledge not only of the technical part, but also of the organizational part with its rules, hierarchies, organization, methods and part of the people that make up the system (Boghi *et* Shitsuka, 2002).

2.2. Information Systems

According to Laudon *et* Laudon (2001), "an information system is an organizational and administrative solution, based on information technology, for an environmental challenge". The use of information systems requires a greater focus of the organization on how administration and information technologies form the system. Information systems are considered as solutions to the most varied adversities found in a work environment, such as idle time due to lack of communication between the company's sectors, lack of standard in the productive processes and the lack of correct information and quality.

The increasing volume of information within companies has resulted in a considerable increase in the need to deploy information systems within most of them. According to Oliveira (2012), although the executives and managers need a lot of relevant information, they end up being surprised with a huge amount of irrelevant information, because of the distorted view of reality that executives have or even their own scarcity of relevant information. Therefore, information systems are an effective way to improve management and decision-making.

Organizational managers are not required to have complete mastery of complex technologies or the most varied specialized applications of an information system; however, it is their responsibility to have extensive knowledge of active and responsible use and how systems should be successfully employed in a business environment. According to Turban *et al.* (2007), through the information systems the best results will be obtained and they will be transmitted to the right people in the appropriate format. For this to occur, there must be a collection of data relating to activities, transactions or any event that occurs within the organizational scope, then this data should be transformed into useful information and after into knowledge to be transmitted so that the understanding and learning about the current situation of the company is transmitted.

For Moraes *et* Oliveira (2015, p.25), a system can be understood as an aggregate of operationally interconnected elements, organizing and constituting as a whole. The authors evidence from their etymological root, that the word system means: "to form a set", "to group pieces", "to match". Systems are organized for a purpose, and can perform a specific activity or a specific group of tasks. In this context, the company or organization itself can be understood as a system, by incorporating in itself an aggregate of other systems (logistics, human resources, marketing, finance, quality, production, etc.), composing as an organized whole, with a view to acting in the market, in order to meet some need of society.

O'Brien (2004) states the following: "[...] the information systems are those that receive data resources as inputs and process them into information products, as output." According to Marçula *et* Filho (2013), information systems can be defined as "a series of interrelated elements that collect (input), manipulate and store (process), disseminate (output) the data, and provide a feedback mechanism". The input can be a manual or automated process whose function

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is to capture the data; processing stores the data manually or through computers and transforms them into useful output information; the feedback is used as a tool that analyzes the output information for decision making and input and processing adjustment, as shown in Figure 1:

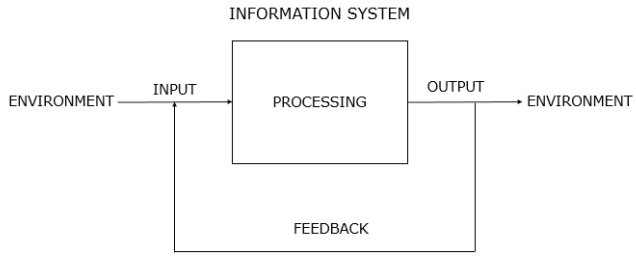

Figure 1. Theoretical scheme of an information system

Source: Adapted from Marçula *et* Filho (2013)

For O'Brien (2004), performance control is an important activity of the information system. The feedback produced by the system on input, processing and output activities should be monitored and evaluated to determine whether the system is meeting established performance standards. Therefore, any failure can be corrected and the activities adjusted so that the final product can be properly produced for the end users. According to the author, the end user of a company must be able to recognize the fundamental components of an information system, since this understanding will serve to be a better creator, manager and user of information systems.

Beal (2011, p.21) contributes by affirming that well-managed information can reduce uncertainties in decision-making, helping to reduce the risk of an inappropriate choice, and to ensure that they are taken at the right time. It is clear that the authenticity of decisions will depend both on the authenticity of the information provided and the competence of the person who will take it, since it is necessary to know how to interpret and use it in the best way. This makes clear the great importance that the access to information makes possible, besides allowing the increase of the probability of success of the final decision.

The Computer-Based Information System (CBIS) differs from hand-held pencil and paper systems because it does all of its processing and dissemination of information through hardware and software technology. According to Marçula *et* Filho (2013, page 203), in addition to these, the CBIS is also composed by:

- Telecommunications: which is a very important resource in the interconnection between computer systems in work networks;
- People: where these are considered the most important, as they are the ones responsible for the management, execution, programming and for maintaining the SIBC;
- Procedures: which are the methods, strategies, rules and policies adopted to operate SIBC, whether technical or operational professionals.

The use of information technologies in the processes results in the development of the information systems that, for the companies, ended up becoming an important strategic tool to obtain competitive advantage in the market. According to Turban *et al.* (2007), information technologies are capable of increasing the success of organizations by providing only the basic conditions for competitive advantage, such as cost reduction, quality customer service and superior supply chain management; therefore, any information system that provides competitive advantage or reduces disadvantages is considered a strategic information system.

Within an organization there are different levels of interest and specialties, for this, there are also different types of systems. The organization can be divided into several functional areas, such as production, sales, marketing, finance, accounting and human resources; therefore, to meet each area of interest, different types of systems should be implemented. Operational level systems provide support to transactions such as sales, payroll, and material flow; knowledge-level systems help in integrating new business sources and document control; management-level systems serve to control and make decisions at company events; strategic-level systems focus on strategic issues and long-term trends in both the internal and external environments of the company (Laudon *et* Laudon, 2001).

2.3. Information Systems in Productive Processes

According to Passarini (2014, p.89), the statistical use of data is essential for the smooth running of production, as it aims to provide methods for collecting, organizing, describing, analyzing and interpreting data. This contributes to the establishment of reliable conclusions in the face of some phenomena of study. At the stage of collecting the statistical data, information is collected and later processed, resulting in key information for a decision-making and/or process activity.

It is known that in the productive environment the absence of reliable information on the factory floor develops a perspective that does not portray the reality of the productive process, compromising the performance and agility of the company in the face of adverse conditions. In industries, the production process needs special attention, given that

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performance brings representative consequences for the organization in general. In this sense, the improvement of production processes depends on the quality of information about production, the ability to identify nonconformities and their possible causes and the ability to develop new improvements within the production function. The use of information systems in production contributes effectively, especially to more complex processes within organizations, allowing greater efficiency of all functions and factors involved in production (Meireles *et al*., 2003).

In general, information systems are composed of an organized set of people, hardware, software, communication networks, and data resources that collects, transforms, and disseminates information in an organization. Although information systems are considered as a modern concept, their origin is associated with the beginnings of mankind, since man started communicating. The resources of an information system have a broad scope of what is addressed by the concept of information technology. Within organizations, information systems play three basic roles: supporting their processes and operations, supporting decision-making, and supporting their strategies for competitive advantage (Lustosa *et al*., 2008).

Lustosa *et al.* (2008) argue that "the support of their processes and operations are systems that aim to streamline and ensure that internal routines and procedures are executed in a standardized, planned, controlled manner, interrelating with other systems". Decision support consists of systems that generally extract information from other transactional systems, operating at the operational level at which the collected information is handled and identified, and can be static (reports or files) and dynamic (allow for faster and interactive analysis). Finally, support in their strategies for competitive advantage after strategy development helps organizations determine which strategic objectives to focus on or differentiate in their markets, seeking competitive advantages over their competitors.

Information systems can be classified according to the different hierarchical levels whose decisions are taken to aid organizational processes. In addition to the three basic levels (operational, tactical and strategic), the level of knowledge between the operational and tactical levels is included. Engineers, scientists, administrators, marketing analysts, financial analysts and controllers, aiming to develop new information and knowledge, fit into this level of organization. Information systems are still divided according to the functional area they serve, including the areas of sales, marketing, production, human resources and accounting-finance. Figure 2, which follows, summarizes the information presented so far (Souza, 2000).

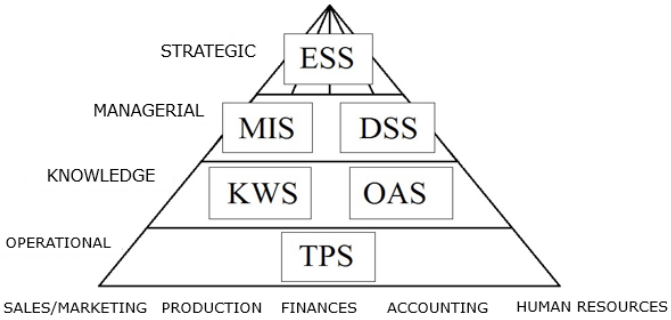

Figure 2. Distribution of information systems

Source: Adapted from Souza (2000)

According to Souza (2000), Figure 2 demonstrates how and which systems that meet operational needs are called:

- Transactional Processing Systems (TPS) are linked to day-to-day operations;
- Employee Support Systems at the knowledge level are divided into: Knowledge Work Systems (KWS) and Office Automation Systems (OAS); these systems have the objective of promoting the creation;
- The Management Information Systems (MIS) and Decision Support Systems (DSS) are present at the managerial level of the organizations, directed by the monitoring and control of the activities developed at the operational level;
- At the strategic level, Executive Support Systems (ESS) assists the managers and directors who make up this level. Such systems need to be well structured and flexible, interconnecting the different communication tools and systems that receive information from the external environment.

Decisions to invest in information systems will always depend on the production, quality and integration of information processed, whether structured or not. Therefore, depending on the stage in which a company is in relation to quantity, quality, integration, processing and availability of its information, it may need several systems, each of which presents a solution to specific problems. Once the existing needs or problems have been identified, the corresponding investment alternatives must be ordered, prioritizing the solutions that most provide the achievement of the strategic objectives. Prioritizing investments in information systems, supporting the objectives, aims to guide companies towards: reducing costs; improving customer service; increasing productivity or quality; improving decision making; increasing in profit margins; and increasing in the customer base (Lustosa *et al*., 2008).

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Production Planning and Control Systems (SPCP) are the most important components of the production process, keeping the various productive resources (people, equipment, storage space, among others) together, working as an integrated and cohesive system, with the basic purpose of planning and controlling the manufacturing process at all levels, including materials, equipment, people, suppliers and distributors. It is through production planning and control systems that organizations ensure that their operational decisions in terms of what they produce, how much and when they are compatible with their strategic needs, which, in turn, are dictated by their corporate strategic objectives and their market (Contador, 2010).

According to Contador (2010), production planning and control systems are systems that supply information that supports the efficient management of material flow, labor and equipment use, as well as the coordination of internal activities with activities of suppliers, distributors and the interface with customers, as regards operational needs. The author states that the key point is the managerial need to use the information to make assertive decisions. The type of system that has been deployed most by the companies is the Material Requirements Planning (MRP), whose main objectives are to calculate the needs and allow the fulfillment of the deadlines for making the orders available to customers with the minimum amount of inventories, planning purchase and production, in the quantities necessary.

For Meireles *et al.* (2003), the information systems in the production function aim to organize the processes within the organizations, and the ERP (Enterprise Resource Plannig or Integrated Systems of Business Management) is one of the tools that allows this paper. Factory floor information in ERP systems seeks to support all information needs for decision making, directly linked to: costs, billing, human resources, finance and accounting. Factory floor information defined in ERP systems is usually related to the times that make up the lead time, quantities and costs, considering the current planning and are directly linked to the planning and control of the production.

The ERP system can be summarized as an appropriate system to receive, control and process, in a structured and online way, the data inherent in most of the internal business processes carried out in an organization, integrating the functional areas into a single database. ERP enables the interaction and consistent exchange of information between specialized systems, which are part of its structure, such as accounting, finance, fiscal, commercial, production, supply, distribution, logistics and human resources. The adoption of these systems enables the improvement of the flow of information, with increased integrity, consistency, traffic agility and access to operational data (Lustosa *et al*., 2008).

One of the most important issues in production planning and control is management, due to the large volume of information generated by the activity. It is not just the production function that generates and receives this information, but also all other functions of a company. In this way, you can inform the planning and control decisions, and when and where they should occur and who should execute them, and this is what the ERP does. The ERP system is the latest and most significant development of the basic philosophy of MRP. ERP systems consist of modules with software support such as: marketing and sales, field service, product design and development, production and inventory control, purchasing, distribution, quality, human resources, among others (Slack *et al*., 2015).

3. RESEARCH METHODOLOGY

The technical procedures adopted for this survey were divided into two stages, the first being a literature search that, according Mascarenhas (2012), "is the analysis of books, articles, dictionaries and encyclopedias, since it has advantages in that it contains a lot of information about the topic explored, which helped in the relationship of the ideas of several authors with domain and knowledge of the area". Based on the bibliographic review addressed in the present study, it was possible to develop an observation checklist, with the purpose of examining the routine of the activities of a health laboratory in a higher education institution located in the city of São Luís, Maranhão, Brazil.

For the second step, the method of the case study was adopted, which, according to Mascarenhas (2012), "is formed through the reflection of a set of data describing the object of study". By means of the case study we acquired the information probed in this research.

The investigation arose during a supervised academic internship process, in which some problems and the lack of methods and processes for a better execution of the activities were verified, in such a way that they affect the income of the place where the research was carried out, making necessary a selection of matter to be treated. This same selection required hypotheses or presuppositions that served as a guide and, at the same time, delimited the subject to be investigated. From this point on it became possible to apply the appropriate research methods for project development and improvements.

3.1. The Case of the Laboratory of Clinical Analyzes

The research was developed in a private higher education institution, located in São Luís, state of Maranhão. The institution's school clinics comprise areas of medicine, phy-

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siotherapy, hydrotherapy, dentistry, psychology, occupational therapy, minor surgery and aesthetic procedures, reaching more than 300 daily appointments.

The study was restricted only to the laboratory of clinical analyzes, and an investigation into the processes that are performed was necessary. In order for the research to reach the objectives outlined, the period from August to November 2016 was delimited for the collection of data and analyzes. Data collection was restricted only to the unit of study, without the need for consultation in other sectors of the institution.

The laboratory activities are divided between sectors in which everyone operates sequentially and whose data and results are directed to the final destination that is the Management Sector, shown in Figure 3:

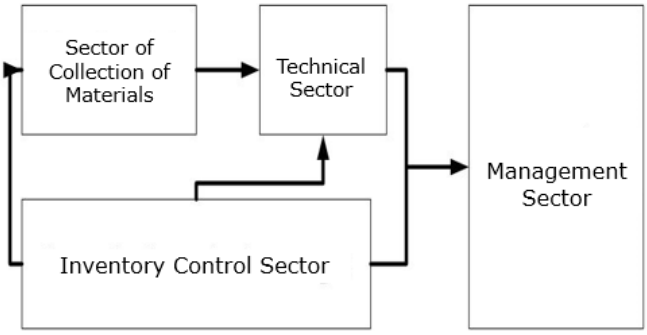

Figure 3. Flow of laboratory sectors
Source: Authors

According to Figure 3, it is possible to visualize how the flow of the laboratory sectors relates. The following shows how the steps and activities performed in each environment work:

- Collection Sector: activities are performed such as reception and identification of patients; discrimination of the type of material collected (blood, faeces or urine), examination and destination area in the laboratory; then the material is collected; and subsequently the packaging of the material, where they are identified and organized according to the norms determined by the Technical Supervision of Health;

- Technical Sector: in this sector occur: the recognition of the materials and the examinations that will be carried out; division and collection of serum from the samples collected; orientation and training of trainees who work in the area of clinical analysis; use of reagent kits for biochemical testing; issuance; and record of results;

- Management Sector: conference and confirmation of reports sent, with the records of the requested tests; daily statistical survey of the tests performed for the laboratory's billing; and issuing and submitting the evaluation report of the services provided;

- Inventory Control Sector: performs activities such as receipt and withdrawal of material; verification of materials received; control and maintenance of daily use of materials; control and maintenance of stock of materials; organization of the purchase order list for replenishment of stock; and forwarding of the materials to the other sectors of the laboratory.

4. RESULTS AND DISCUSSION

The laboratory works with a considerable amount of reagents, among other chemicals, that are directly related to its end activity, and other materials that are used in the activities of reception, collection and sanitation. Controlling the quantity of products in stock and their validity may not be such a simple goal, which can make product shortages and products and the identification of expired products a common problem. The distribution of the materials stored in the laboratory uses the First In First Out (FIFO) method, in which the first products that enter are the first ones to leave, keeping the movement control more organized.

After following the whole process that occurs in the laboratory, an analysis of the data collected through the checklist was performed, with the purpose of finding possible nonconformities between the activities of each sector. Some failures were identified in the inventory control sector, with poor utilization of the materials used due to inefficient control.

Purchase orders are only made when it is found that there are materials with expired expiration date or when the accounting are held. Those responsible for inventory control perform manual bookkeeping using the traditional method, pencil and paper, and only then the data is passed on to the computer to issue the purchase order note. There is no set date for stock accounting or an exact frequency, since it is only done once every month or when the responsible technician perceives the lack of some material.

The most used materials are always bought in large quantities so that there is no shortage, and only arrive in an average term of 15 days; however, the insufficiency of the materials of lesser use is constant. The lack of these materials results in the non-registration of patients who need to perform a specific type of examination that uses these materials. There was also an absence of effective control of material entry and exit. The manual record control requires

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more attention and is more susceptible to errors, in addition to being much more laborious, which can make the errors constant, once the control is performed without regularity.

Based on the inspections carried out, it was also verified that the clinical analysis laboratory does not have efficient and effective computerized techniques or systems, which allows the generation of reports to aid in the decision-making process, quantification of the products to be purchased and identification of the products in stock. Therefore, for this type of situation it is suggested to adopt a more operative systemic method in order to eliminate the problems, facilitating the work of the professionals responsible for the activities carried out in the laboratory.

4.1. Proposition of Improvements

The importance of adopting a system will bring several benefits to the laboratory that will help the productivity of each sector, reducing the need for manual controls and making the flow of information continuous. In addition, the detailed control of each item will generate reports that contribute to the decision-making process, as well as increase the performance of the entire team. From the use of a computerized technological system, control will become more precise, since the system will be constantly updated with real-time information (such as inputs and outputs) and the inventory will always be related to this information, thus reducing the chances of errors and nonconformities.

The system that will be implemented must carry out the preparation and issuance of inventory worksheets, demonstrating the entry, exit and remaining of materials in stock for the maintenance of daily use and materials purchased. In the current market, there are several software programs aimed at inventory management and laboratory activities; however, there is a low cost alternative to carry out this same process through Excel, which provides the necessary tools for simple and efficient control, and it is only necessary that the laboratory staff and trainees receive the appropriate training to conduct such software.

The stock consists of several types of materials, each of which has a specific shelf life and a specific form of storage; thus, standardizing the order of output and storage according to this information will result in more effective control over the laboratory stock. After standardization, it will be necessary to create a flow of each sector, where the consumption of materials will be analyzed, and then the planning of purchases will be formed. By performing the flow analysis, information such as the location of reagents and storage of basic materials, condition of use, prediction of maturity, yield of each material, quantity and correct date of purchase, will be available to the management of the laboratory. This prevents the lack of materials, in addition to providing an exact purchase of the quantity of materials and reagents.

The use of computerized systems for the management of input control is a great facilitator for the day to day, contributing to the optimization of the processes and reduction of the margin of error, avoiding that any type of disorder occurs. An integrated system that is used as a tool to help inventory management is essential, as it enables the registration of products and their respective shelf life, updating inventory records whenever there is a purchase or use transaction of a product; the calculation of the volume of inventory, generating purchase orders from the decisions of when and how much to buy; in addition to making it possible to determine the condition of the stock at all times.

5. FINAL CONSIDERATIONS

Starting from the initial premise of the research, this project aimed to verify how the information systems can contribute to the improvement of the productive processes in a laboratory of a higher education institution, a local without a computerized system, as demonstrated. After the studies and demonstration of results, it was verified that the implementation of a system is necessary since all the faults and negative occurrences that occur in the place can be easily facilitated through the use of one of these systems.

During the study, the entire operational process of the laboratory was observed, showing how important is the computerization, since it allows measuring how much can be gained in time, material and money use. The implementation of a new system may not be a very easy task, because it is possible that some failures occur until a positive operation is achieved, requiring a great deal of patience and determination, since the laboratory does not have someone with mastery in the use of a system of information, in addition to being familiar with methods that are more conventional, operationalized by manual processes.

The study was developed with a focus on inventory control of the laboratory; however, the project aims to highlight the impact of the information system on productive systems, for its development to benefit the entire institution, since it is a very broad project that is related to all sectors. This is because within its program there will be detailed reports, with all the information that is necessary to make decisions, such as the purchase of some material, identification of materials that use much less than the average of tests performed, and anticipated knowledge of the expiration period of materials.

From the realization of this research, it was noted how important the information system becomes, since a productive process is slow and incurs failures. In this study it was

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also possible to address quantitative and qualitative results regarding the application of observation and data collection tools, and how the application of other systems generate support to demonstrate the need for optimization in productive systems.

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APPENDIX A - Checklist Model

Observation Checklist
Phases of research

1 – Recognition of the place of study
Visit to the laboratory
Diagnosis for study opportunity
Conversation with responsible technical staff
2 – Definition of study opportunities
Analysis of the environment for the formulation of the study
Daily lab routine check
3 – Description of the activities carried out
Exposure of steps
Activity Score
Quantification of tasks in the laboratory
4 – Data collection accompanied by the technical head of the laboratory
Monitoring activities
Quantification of product ordering time
Verification of the method of counting materials
Verification of material control method
Verification of the Material checking period
5 – Data organization
Data analysis
Study for improvement proposal

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