Process optimization of an emergency unit, using the quality tools, MASP and PDCA

Jordan Victor Trindade

jordanvic143@gmail.com

Centro Universitário FAMETRO – Amazonas - Brasil

David Barbosa de Alencar (Corresponding author)

david002870@hotmail.com

Coordenação de Engenharia de Produção do Centro Universitário FAMETRO – Brasil

Alexandra Priscilla Tregue Costa

ptreguep@yahoo.com.br

Coordenação de Engenharia de Produção do Centro Universitário FAMETRO – Brasil

Antônio Estanislau Sanches

novo.sanches@gmail.com

Universidade do Estado do Amazonas – UEA - Brasil

Abstract

Quality is one of the main points addressed in an organization, is a differential for its survival. In addition, it has a relevant importance when it comes to customer service and satisfaction. The present study started with the question of how to improve the quality of care provided to users in an emergency care unit. Through studies will be presented in this article internal processes related to hospital care, which will be used quality tools and through the MASP tool and through the PDCA cycle identified problems, through these tools will be suggested corrective and preventive actions.

Keywords: Quality Tools; Prompt Service; MASP; PDCA;

1. Introduction

The critical situation of public health organizations has reached delicate circumstances, generating huge queues and poor quality care. This has been one of the biggest contests according to users. All of this stems from a lack of good management, limited resources, high bureaucratic costs and political processes that further aggravate the current situation.

Due to the discontent of the population with the current conjuncture, measures need to be taken in order to increase the efficiency and quality of health service. These resources need to be studied for strategic decisions to be made thoroughly on each topic.

The Manchester protocol is a practical technique that, if well applied, greatly facilitates the care process. It is extremely visual, as if it were an Eye Management to handle care, helping to save more lives and streamline the patient screening process.

In order for improvements to be implemented in the Hospital, in the emergency care sector, the need was observed due to the waiting time for clinical care and a little objective screening that became the bottleneck of care, forming long lines, exceeding the limit of Expected time. It is necessary to develop a sense of urgency to perfect the flow making it more objective and without so much waiting.

The overarching goal of this case study was to improve performance in the emergency sector through quality tools that were used to support change at minimal cost, making it possible to make better decision-making in order to meet the need for excellence of the sector enabling improvements to internal processes, so that bottlenecks are managed quickly and efficiently, optimizing the flow in the hospital. Thus stimulating employees to be able to provide adequate care, combating eventual idleness.

For this it is essential that there is the appreciation of communication with the patient, this involves a lot of learning and changes in behavior on the part of the professional. This study generates a better understanding of how risk classification works in networks, providing clients with adequate service, without much waiting to avoid worsening the situation. However, this service is not always complete and reliable, and often end up affecting its efficiency and effectiveness leaving its users dissatisfied.

2. Literature Review

In this chapter through theoretical foundation will be presented some concepts that will lead to a better understanding of the project under study, PDCA, MASP, Brainstorming, 5 WHY, Failure Verification, Pareto Graph, Cause and Effect Diagram, 5W2H, Control Items, Verification, Stratification, Tracking Chart and Flowchart Items. Therefore, this understanding served as support for analysis of the results of this research.

2.1 MASP Concepts

MASP, a method based on the PDCA (Plan, Do, Check, Act), is composed of predefined steps to choose a problem, analyze its causes, define and plan the actions that establish a solution, verify the result and generate data learning from its application [1].

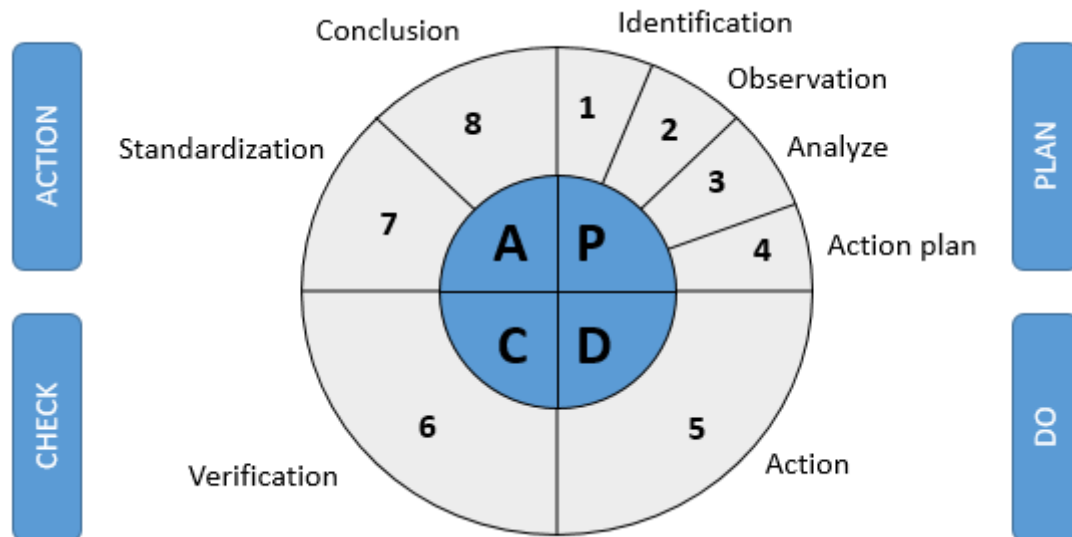Figure 1 adapted from [2] shows each of the PDCA steps, associated with the 8 (eight) MASP steps.

Figure 1 - Definition of MASP and PDCA steps.
Source: Adapted from [2]

According to [2], the MASP steps are defined as follows:

1- Identification of the problem: In the first step, the problem is clearly defined from a Pareto analysis, where the losses and visible gains are identified, as well as the frequency with which it has been occurring. At this stage the process controllers should also be appointed.

Note: This is the stage where the specific characteristics of the problem are investigated, with a broad view and from different perspectives. Through data collection and observation where the problem occurs, stratification is performed through Pareto graphs, thus obtaining the most important themes.

3- Analysis: From a brainstorming, the main causes of the problem are defined and the most probable are chosen. After an analysis is performed and if the causes are confirmed, one moves to the next step.

4- Action plan: In this stage, an action strategy is designed to block the root causes. But you have to make sure that the proposals do not cause any side effects.

5- Action: The action stage focuses on accomplishing what was planned in the previous phase. However, you must present the plan to everyone and perform the necessary training.

6- Verification: In this step the data collected before and after the action are compared, thus being able to verify the continuity or not of the problem. If the block was not effective, it returns to the observation step.

7- Standardization: The standardization stage is designed to elaborate or change the standard, in order to prevent the resurgence of the problem. Everyone needs to be communicated and trained, and follow-up should be done through periodic checks.

8- Conclusion: This is the stage in which the Problem Solving Method is reevaluated. What is right and wrong is identified, and even if the process did not go as planned, this step can serve as a learn- ing for future applications.

2.2 PDCA Concepts

The PDCA cycle is a tool whose main objective is to achieve control and effective results in the activities

of an organization. It is an efficient way to present an improvement in the production process. Using this tool, there is a standardization of the process and its information, thus contributing to quality control, avoiding logical errors and information that is easier to understand [3].

The PDCA cycle represents a very efficient cycle for solving problems throughout the process, thereby improving all steps several times [4]. According to [5], this method consists of four steps, which identify the expected results of a process. Being them:

Plan: This step consists of setting the goal or goal to be achieved, and how will be the path to reach the goal set.

Do: It is the work of detailing the goal and plan to achieve that goal in a way that everyone involved can understand what is being proposed and decided.

Check: During and shortly after execution there should be a comparison with the data obtained and the goal that was planned, so that you know if everything is going as planned.

Action: Transform the successful plan into a new way of doing things right.

Process control must be performed according to the method used in the PDCA cycle to achieve the goals necessary for the company's survival [6].

FIGURE 2 - PDCA CYCLE
Source: Adapted from [7]

2.3 Check Sheet

The Verification Sheet is a tool used to collect data, usually in real time. With it, it is possible to collect, organize and even present the results of various collections. Thus, it is simpler to analyze the variations of a process for example [7].

For its simplicity, it is considered the simplest of the 7 Quality Tools. It can be executed in table, table or spreadsheet format, which makes data collection more flexible. In addition, the Check Sheet also helps save time by eliminating the rework of collecting data from decentralized sources [8].

2.4 Paret Graph

The Pareto diagram, according to [8], uses the 80/20 principle. This quality tool is a vertical bar graphing

feature that, in addition to assisting in the most efficient visualization of existing problems, performs their ordering of importance.

In his paper [9] he further states that the Pareto diagram makes it much easier to identify which problems are really important. Most companies use the diagram to determine where their main efforts will be placed.

2.5 Cause and Effect Diagram

According to [10], also called Cause and Effect Diagram, the main functionality of this representation is to show the cause and effect relationship of quality, as well as its factors involved. In this way the main causes can be branched into secondary or tertiary causes, further facilitating problem identification.

Its structure is that all factors are involved in crafting a product or effect. According to [11], the Ishikawa Diagram is a very simple tool widely used in quality. Kaoru Ishikawa created the diagram in 1943 and used it in industrial environments to verify the dispersion of the quality of the products and processes involved. Also according [12], the tool presents the causes of a problem in the shape of fishbone: 4 M's method, labor, materials and machines. Using this diagram it is possible to identify the causes of the problems and solve them as best as possible.
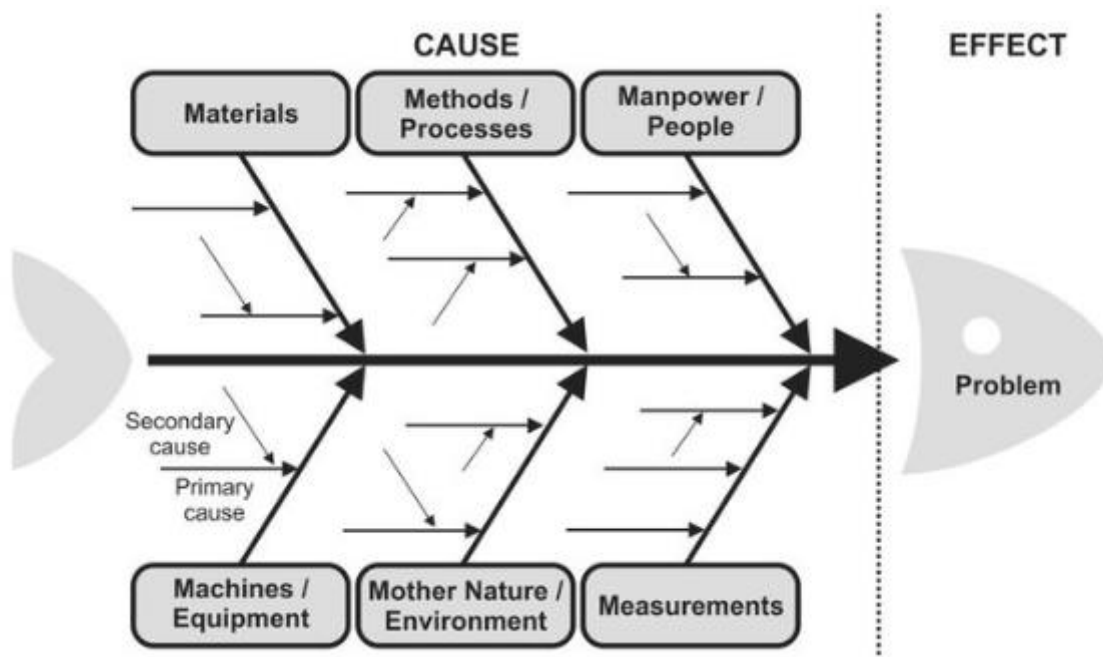

Figure 03 - ISHIKAWA DIAGRAM
Source: Adapted from [12] and [30]

2.6 Statistical Process Control

Control chart or statistical process control, according to [13], is the accompanying graphical representation, consisting of an upper line (upper control limit) and a lower line (lower control limit) on either side of the midline of the process. . It is noteworthy that these parameters are statistically determined.

This seeks to identify the sample averages on the chart to verify that the points are outside the control limits or form "undefined" patterns. If any of these cases occur, the process is considered unstable or out of control

[14].

In his work [15], he points out that the fluctuation of the points within the control limits results from the intrinsic variation of the process. This is due to common system causes and can only be changed by a change in the system itself. The points outside the control limits, on the other hand, reflect special causes, which are not original occurrences of the process and must be eliminated.

2.7 Second Check Sheet Concept

The second check sheet concept [16] is one of the quality tools that assists the administrator in presenting the history and pattern of process variations.

According to [17], the construction of the verification sheet involves the following steps: establishing exactly which event is being studied, everyone has to be observing the same thing; define about the period during which data will be collected; Build a clear and easy-to-handle form, making sure that there is sufficient space for data recording; and collect data consistently and honestly, making sure there is time for the data collection task.

From the above, it follows that, following the steps that make up the construction process of the verification sheet, the user will have an efficient tool that will assist him in the pursuit of quality.

[17] further states that the check sheet is widely used early in the process to gather as much information and data as possible and to identify problems that may occur.

2.8 Stratification

The stratification tool aims to fragment the source of a problem into factors. With this tool it is possible to take a problem such as the high waiting rate for care and fragment the possible origins of this problem, for example, the failure is occurring a specific shift, is always occurring with the same people, this always occurring with the same professional.

[18] mentions that stratification consists of dividing a large group into subgroups to facilitate the study and to provide further research into the cause of the problem. Thus the author reveals that several items may be influencing the production process and it is this tool that aims to evaluate each factor and see to what extent it can affect the process or problem in question.

2.9 Flowchart

The flowchart is used to describe the steps of a process, according to [19] this quality tool is defined as: The flowchart is for the description of processes. A process is a certain combination of people, methods, tools and raw materials that generates a product or service with certain characteristics. For example, the process of manufacturing furniture: Joiners and upholsters (people), using saws, planers, sandpaper (equipment and tools), work wood, leather and varnish (raw material), using certain sequence of operations (methods).

The flowchart describes the sequence of work involved in the process, step by step, and the key points that should be followed and the decisions that will be made, are nothing more than a graphical representation of the method or procedure in which the process is involved [19].

2.10 Brainstorming Concepts

According to [20] one of the most creative auxiliary tools used by managers, because it gives freedom to all actors who wish to contribute, without very stiff criteria, making room for stakeholders to participate actively, without pre-judgments, so that the process of creation flow lightly.

Also known as IDEAS STORM, its main purpose is to generate new ideas, discuss them, or even better, to make employees create a culture of giving suggestions, bringing solutions, instead of just being bystanders, watching from outside, often acting as ravenous critics, only leading to problems [21].

2.11 5W2H Concepts

The 5W 2H Action Plan, according to [22] is a tool used to establish a planning, execution or monitoring schedule for work or projects. Also according to the author, his name derives from seven (7) words, five with the initials "W" (What, Who, When, Where and Why), and two with the initials "H" (How and How much) [23].

In their work, [24] therefore conclude that from the use of this tool, the problem can be clearly presented by organizing the steps that help in the conclusion of the most accurate solutions.

It is noteworthy that, besides the described tools, others are also important and can be used in the application of the MASP method. However, as they were not applied to this study, its reference is irrelevant.

2.12 Manchester Protocol

The Manchester Protocol is a screening system that helps to organize the order of care of patients coming to the unit for help, facilitating their care by identifying them by color according to their degree of severity [25].

Each grading color determines a maximum time for patient care [26].

The technique is named after it because it first appeared in Manchester in 1997 and is quickly spread and applied in hospitals across the UK and Europe. Ten years later, in 2007, the method arrived in Brazil and was first implemented in the state of Minas Gerais [27].

TABLE 1 - MANCHESTER CLASSIFICATION TABLE

Number, name, colour, minutes

Number	Name	Minutes	Colour
1	immediate	0	red
2	very urgent	10	orange
3	urgent	60	yellow
4	standard	120	green
5	non-urgent	240	blue

Source: adapted from [31]

Emergency - There is immediate risk to the patient's life and needs to be addressed immediately.

Very urgent - There is a risk to the patient's life and needs to be addressed as soon as possible.

Urgent - It is not considered an emergency, but the patient needs to go through an evaluation right away.

Low urgent - It is considered a less serious case, the patient can wait for care or be referred to another health service.

Not urgent - this is the simplest case, the patient can wait for care or be referred to another health service.

MASP is an offshoot of PDCA. This unfolding is as follows.

TABLE - 2 PDCA Troubleshooting Analysis Method Table

PDCA	FLOW	STAGE	GOAL
P	1	Problem identification	Clearly defining the problem and understanding its importance.
	2	Observation	Investigating specific characteristics of the problem.
	3	Analysis	Discovering basic causes.
	4	Action Plan	Conceiving plan to block basic causes.
D	5	Action/Execution	Blocking basic causes.
C	6	Check	Checking if the block was effective, if not, return to step 2
A	7	Standardization	Preventing against recurrence of the problem.
	8	Conclusion	Recording the entire process of solving the problem for the future.

Source: Based on study by [32]

4. Application of Study

4.1 Planning Step (P)

Phase 1: Problem Identification

As discussed by [28] and [29] we must rely on facts and data so that we can be sure that the improvement goal and the corresponding problem that will be addressed are the most important at the moment for the company.

At this stage of the study, we identify the problem and clearly define and recognize its importance. To perform this step we used the Brainstorming tool, assuming that two heads are better than one. I gathered a multidisciplinary, multidisciplinary and multi-departmental team of some collaborators, in order to identify the problems and find a solution to the cause. It was defined that criticism or judgments could not be made to causes presented.

Phase 2: Observation

It consists in recognizing the characteristics of the problem. In this phase, an observation was made to specifically investigate the problems in question, through a detailed view of various points of view presented. Discovering the characteristics of problems through data collection and on-site observation.

First, we need to collect data: Obtaining the right data is essential for reliable process analysis, providing decision making through statistical tools.

For data collection it was necessary to: Define the purpose of data collection; Formulate the questions; Define the quantity and size of the data sample; Define the points for data collection; Prepare the statement and its instructions for recording data collection; Determine the frequency for data collection; Define responsibility for data collection and train those responsible; Conduct data collection.

Stratification: Stratify information from various points of view, such as: time, place, type, symptom, individual, etc.

Verification Sheet: All stratification factors of interest (Registration, Screening, Service Flow, etc.) should be included in the verification sheet that will be used for collecting and recording the data employed in observing the problem.

Pareto Chart: Visually disposes of information obtained from data stratification.

Phase 3: Analysis

It consists in discovering the root causes of the problem under consideration. The statistical tool presented below is widely used at this stage.

Task in problem analysis phase: Definition of influential causes; Choice of the most likely causes (hypotheses); Analysis of the most likely causes (verification of hypotheses); Root cause consistency test.

Cause and Effect Diagram: It was a tool used to present the relationship between the problem to be solved and the process factors that can cause the problem. In addition to summarizing the possible causes of the problem, it also acts as a guide for identifying the root cause and determining the actions that should be taken. Importantly, the causes listed in the diagram should be reduced by eliminating the less likely causes. This reduction can be made based on the results obtained from the use of statistical techniques in the previous phase (observation).

Phase 4: Action Plan

In this phase of elaboration of the action plan it consisted in the conception of a plan to block the main causes that were identified in the analysis phase, that is, the establishment of countermeasures to the main causes. The conclusions obtained through the use of statistical techniques to process the information involved in the fulfillment of the previous phases must always be kept in mind during the elaboration of the action strategy.

The Action Plan is presented as the product of every process related to the planning stage.

It contains, in detail, all the actions that must be taken to achieve the initially proposed goal.

4.2 Execution step (D)

Phase 5: Execution

It consists in the implementation of the action plan. In this phase, data should be collected that will be used in the next phase, to verify the effectiveness of the adopted block.

Tasks in the execution phase: Empowerment: Empowering people to perform the task.

Tools: Participatory meetings, training or orientation.

Action Execution: Perform tasks as agreed.

Tools: Inspection and audit.

Measurement: Measure the results obtained.

Tools: Indicators, control items, verification items and spot management.

The second step of MASP is to execute the established plan. Most companies fail to fail to perform their key tasks.

4.3 Verification Step C

Phase 6: Verification

It consists in confirming the effectiveness of the blocking action. This confirmation should be made by using the data collected before and after the blocking action, which will allow the comparison of results.

After the execution, compare the result obtained with the planned one and study the differences.

In this analysis it is necessary to investigate the causes of the differences that occurred.

If the result is worse than planned, you have to decide what to do to solve the problem and especially make sure that it does not recur!

If the result is better than planned, you need to investigate the causes to make sure they stick to it, so the plan gets better than it already is!

4.3.1 MASP Phases C

Comparison of results: Use data collected before and after action; Analyze the positive and negative effects.

Problem Continuity Check: Ensure that undesirable effects have actually been blocked and addressed. If not, restart MASP.

4.4 Verification Step A

Phase 7: Standardization

The PDCA standardization phase consists of the definitive elimination of the detected influential causes, ie prevention against reappearance of the problem. At this stage, the new operating procedure must be established or the old procedure reviewed. These measures mean that the new way of working should be adopted on a daily basis, with the objective of keeping the process at the new level of performance that has been achieved. In this sense, education and training at work and monitoring the use of the standard are fundamental.

Redo: Stick to the plan, fix something wrong, correct a measurement, or retrain or remotivate people.

Change: Modify the goal or correct the means, ie improve the resources or methods available.

Standardize: Equalize or standardize processes to ensure a desired outcome.

Tool: Flowchart and POP. This stage is characterized by the process of standardization of the actions

performed, whose efficiency was verified in the check stage, aiming at continuous improvement. Standardization should be based on positive results.

Tasks in the standardization phase: Elaboration or alteration of the standard; Communication; Education and training; Side dish.

4.4.1 How to standardize

Write a normative document; Establish the implementation date of the new system; Educate or train stakeholders; Broadly disseminate the new pattern to affected areas and follow up to prevent degeneration of the new system.

Phase 8: Conclusion

The completion phase consists of recapping the entire problem solving process and planning future work. In this phase, a list of remaining problems should be made and the solution planning for these problems should be elaborated. In addition, a reflection should be given on the problem solving activity itself.

Tasks at Completion Phase: List of remaining issues; Careful reflection on the solution's own activities.

5. Results and Discussions

The main difficulties pointed out in the study are related to the services provided by health professionals. It can be observed that poor management directly interferes with care, not identifying recurring difficulties in daily life, not offering adequate training to their professionals and working conditions, this somewhat interferes with other sectors, generated dissatisfaction and increased workload. .

Table 3- PDCA Cycle

P	**Indicator:** Appropriate number of classifications according to the Manchester Protocol.	
	Goal: Improve screening by 80% so that ratings are more accurate.	
	Features: Enhanced Equipment; Technical knowledge; Technical support; Appropriate work environment.	
	Method: Accurately perform the risk classification according to the data established in the Manchester protocol.	
D	**Train:** Qualified nurses with the Manchester Protocol course; Continuous updates; Nursing coordination and management meetings; Training with the SAE team	
	Execution: Satisfaction survey with patients periodically; Inspection of activities through Nursing Supervisors and Coordinators.	
	Measure: Through reports issued in the system.	
C	**Compare:** Rotating nurses in screening; Through graphs with the indicators and results obtained.	
A	**Act:** Define flow regarding the sectors involved; Equip one more screening room to treat patients when the flow is very intense.	

The work process in hospital care must be performed in an agile, effective and equal manner, bringing satisfaction to the patient. Through questions made by doctors and users, about patients being classified inappropriately with their clinical case and the delay to care. We identified that screening would need to improve evaluation for ratings to be more accurate. However, health professionals who performed this service had no training to apply the Manchester Protocol technique.

6. Final Considerations

The use of quality tools occurred in the emergency department, specifically where nursing staff provide the first patient care. From the data obtained in the previous analyzes, through the use of the MASP tool, some lines of actions that aim to solve the problems found were proposed.

The dissatisfaction level of health service users verified in this unit through satisfaction surveys is relatively high. In some satisfaction surveys conducted at the end of care, reports are seen that are common, long lines, delay in medical care, among other problems. It is essential that urgent changes are made.

The standardization of activities is a major advance in the process of seeking quality. However, before being standardized it is necessary to have firmness in purpose, delimitation of goals that can be achieved and commitment of the entire organization. Standardization tends to standardize the process implying better conditions to achieve the objectives.

Quality tools help you work safely, make it easy to understand the environment and data you need to solve problems.

It is concluded, therefore, that the organizational health system must offer the necessary support to qualify both the care procedures and the professionals in order to offer a humanized treatment, a satisfactory service to the clients, valuing the professionals and the quality of the services provided. .

7. Bibliographical References

[1] PIRES, José G. C. Aprendizagem Organizacional Através da Metodologia de Solução de Problemas – MASP. Revista de Administração da FATEA, v. 9 n. 9, p. 84-100, ago.-dez., 2014. Disponível em: . Acesso em: 26 set. 2017.

[2] CAMPOS, V. FALCONI, Gerenciamento da Rotina do Trabalho do Dia a Dia, 6ª ed., Belo Horizonte, Editora de Desenvolvimento Gerencial, 1994.

[3] TAVARES, GIEISON MARCOS. UTILIZAÇÃO DAS FERRAMENTAS BÁSICAS DA QUALIDADE COMO FORMA DE MINIMIZAR OS DESVIOS DE INSUMO NA EMPRESA JBS FOODS LAGES, SC 2015. **REPOSITÓRIOS DE RELATÓRIOS-Engenharia de Produção**, n. 2, 2015.

[4] SHIBA, Shoji; GRAHAM, Alan; WALDEN, David. **TQM: quatro revoluções na gestão da qualidade**. Bookman, 1997.

[5] DEMING, W. Edwards. **Sample design in business research**. John Wiley & Sons, 1990.

[6] QUANHONG, Li; CAILI, Fu. Application of response surface methodology for extraction optimization of germinant pumpkin seeds protein. **Food chemistry**, v. 92, n. 4, p. 701-706, 2005.

[7] AGUIAR, Silvio. **Integração das ferramentas da qualidade ao PDCA e ao programa seis sigma**. Belo Horizonte: Editora de Desenvolvimento Gerencial, 2002.

[8] MAICZUK, Jonas; JÚNIOR, Pedro Paulo Andrade. Aplicação de ferramentas de melhoria de qualidade e

produtividade nos processos produtivos: um estudo de caso. **Qualitas Revista Eletrônica**, v. 14, n. 1, 2013.

[8] BRASSARD, Michael. Qualidade – Ferramentas Para Melhoria Contínua. São Paulo: Qualitymark, 2002.

[9] SALES, Matías. Diagrama de pareto. **Recuperado el**, v. 15, 2009.

[10] KAMADA, Sergio. A cadeia de ajuda para manter a estabilidade produtiva. **Lean Institute Brasil–< ww. lean. org. br>–Acesso em**, v. 7, 2013.

[11] CHIROLI, DAIANE MARIA DE GENARO; GIROTO, ANDRÉ VITOR ORTEGA; PAPPA, MARCIA FERNANDA. UTILIZAÇÃO DO CICLO PDCA ASSOCIADO AO DIAGRAMA DE ISHIKAWA COMO FERRAMENTAS DE GESTÃO EM UMA ORGANIZAÇÃO NÃO GOVERNAMENTAL. **XVIII Simpósio de Engenharia de Produção: sustentabilidade na cadeia de suprimentos. São Paulo**, p. 3, 2011.

[12] CHIAVENATO, Idalberto. **Administração geral e pública**. Elsevier Brasil, 2006.

[13] MILAN, Marcos; FERNANDES, Ricardo Alves Thomaz. Qualidade das operações de preparo de solo por controle estatístico de processo. **Scientia Agrícola**, v. 59, n. 2, p. 261-266, 2002.

[14] SAMOHYL, Robert Wayne. **Controle estatístico de qualidade**. Elsevier, 2009.

[15] COSTA, Antonio Fernando Branco; EPPRECHT, Eugenio Kahn; CARPINETTI, Luiz Cesar Ribeiro. **Controle estatístico de qualidade**. São Paulo: Atlas, 2005.

[16] LINS, Bernardo FE. Ferramentas básicas da qualidade. **Ciência da Informação**, v. 22, n. 2, 1993.

[17] PEINADO, Jurandir; GRAEML, Alexandre Reis. Administração da produção. **Operações industriais e de serviços. Unicenp**, 2007.

[18] CARPINETTI, Luiz Cesar Ribeiro Gestão da qualidade: Conceitos e Técnicas. 2 ed. São Paulo: Atlas, 2012. (estratificação)

[19] LINS, Bernado Felipe Estellita. Ferramentas básicas da qualidade. Instituto Brasileiro de Informação em Ciência e Tecnologia (ibict), Brasília, p.153-161, 22 maio 1993.

[20] SILVA, Adelphino Teixeira da. Administração e controle. 10. ed. São Paulo: Atlas, 1997. 200 p.

[21] FILLMANN, Maria Carolina Frohlich. Inovação no processo de projeto do design de livro impresso: Insumos pelo design estratégico. 2013.

[22] FERREIRA, Beatrice Andrade. Proposta de Planejamento Estratégico de uma Biblioteca de uma Organização Semi-Estatal. **Estudos em Ciências da Educação e Informação**, v. 1, n. 1, p. 13-29, 2018.

[23] SANTOS, Anderson Salmo; MACÁRIO, Anderson Pereira. Melhoria de Processo no Tratamento de Zincagem a Quente.

[24] SILVA, Allan Krysthian Johnnier da et al. Ferramentas da qualidade aplicadas a gestão de estoque: estudo de caso em um centro universitário na cidade de Marechal Deodoro-AL. 2018.

[25] DE SOUZA, Cristiane Chaves et al. Classificação de risco em pronto-socorro: concordância entre um protocolo institucional brasileiro e Manchester. **Revista Latino-Americana de Enfermagem**, v. 19, n. 1, p. 1-8, 2011.

[26] PINTO JÚNIOR, Domingos; SALGADO, Patrícia de Oliveira; CHIANCA, Tânia Couto Machado. Predictive validity of the Manchester Triage System: evaluation of outcomes of patients admitted to an emergency department. **Revista latino-americana de enfermagem**, v. 20, n. 6, p. 1041-1047, 2012.

[27] DINIZ, Aline Santos et al. Demanda clínica de uma unidade de pronto atendimento, segundo o protocolo de Manchester. **Revista Eletrônica de Enfermagem**, v. 16, n. 2, p. 312-20, 2014.

[28] CAMPOS, Gastão Wagner de Souza. A saúde pública e a defesa da vida. In: **A saúde pública e a defesa da vida**. 1994.

[29] WERKEMA, Maria Cristina Catarino. As ferramentas da qualidade no gerenciamento de processos. In: **As ferramentas da qualidade no gerenciamento de processos**. 1995.

[30] HRISTOSKI, Ilija et al. Causality of Factors Reducing Competitiveness of e-Commerce Firms. **Cataloging-In-Publication Data**, p. 813, 2017.

[31] COOKE, Matthew W.; JINKS, Sarah. Does the Manchester triage system detect the critically ill?. **Emergency Medicine Journal**, v. 16, n. 3, p. 179-181, 1999.

[32] CAMPOS, Vicente Falconi. **TQC: Controle da Qualidade Total (no estilo japonês)**. Universidade Federal de Minas Gerais, Escola de Engenharia, 1992.