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Abstract

The Manaus Industrial Pole follows the worldwide trend of engagement on the issue of continuous quality improvement, especially with regard to the organization of work and cleaning environments. From this perspective, the company G. Equipamentos sought to improve its production process with the application of the 5S program, making it a more competitive company against others. This article basically describes the fundamentals, concepts and benefits of the implementation of the 5S program in the company G. Equipamentos at Manaus Industrial Pole - PIM, in the field of gymnastics and body equipment manufacturing. It was used a case study based research to carry out this project, as the objectives, we searched for a qualitative research, seeking to elucidate the data and solutions pointed by the quality tools used in the project.

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Proposal to Implement 5S in a PIM Gym Equipment Company

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Abstract

The Manaus Industrial Pole follows the worldwide trend of engagement on the issue of continuous quality improvement, especially with regard to the organization of work and cleaning environments. From this perspective, the company G. Equipamentos sought to improve its production process with the application of the 5S program, making it a more competitive company against others. This article basically describes the fundamentals, concepts and benefits of the implementation of the 5S program in the company G. Equipamentos at Manaus Industrial Pole - PIM, in the field of gymnastics and body equipment manufacturing. It was used a case study based research to carry out this project, as the objectives, we searched for a qualitative research, seeking to elucidate the data and solutions pointed by the quality tools used in the project.

Keywords: 5S; Quality tools; Production process;

1. Introduction

Brazil, in order not to differentiate itself from words originating from the Japanese languages, used the word sense to describe the 5S, which in Brazil are the 5 senses, the words in Japanese to Portuguese are respectively: Seiri - Sense of use, Seiton - Sense of Ordination, Seisou - Sense of Cleanliness, Seiktsu - Sense of Health and Shitsuke - Sense of Self-discipline (COSTA, 2018).

According to Busa (2016), he also says that in essence, 5S generates a change of conduct that tends to mobilize the entire organization, thus the advantages of deploying 5S in one sector, and in the long run throughout the factory are numerous. It is possible to have immediate results, as is mainly the visibility of

the work you are doing when using the sense of use, and in the long run as the case of the sense of self discipline, for example the Japanese will teach the 5S culture to their and discipline them on these principles, consolidating and extending into adulthood, in society and in the professional

In order for the 5S program to be implemented in company G. Equipments, there was a need due to the excessive time wasted in searching for work tools, excess materials, not performing certain activities because the path was obstructed and so on. We need to develop a sense of urgency to make and maintain organized, lean and functional places (BOCK, 2015).

The overall objective of this article is to analyze cost reduction, reduce employee fatigue in looking for parts, things or equipment, and thereby improving employee quality of life, all through the 5S program, looking for the needs of the best possible needs. from all sectors of the company, encouraging employees to be able to implement the 5 steps of the 5S program and combat any lack of control, disorganization, cleanliness and health.

2. Theoretical Foundation

For the effective accomplishment of this research work, we tried to substantiate considerably the use of the 5S Program as a proposal for implementation in a company of the Manaus Industrial Pole - PIM, specialized in gym equipment.

2.1. What is the 5S Program?

Simply put, the 5S program is comprised of five Japanese words, namely: seiri, seiton, seiso, seiketsu and shitsuke, for each there is a respective representative for an associated sense, then we can better understand the description of each sense:

SEIRI - This first sense is associated with utilization, tidiness, organization and selection. It represents the action of leaving the work environment organized, eliminating the unnecessary and giving proper destination. avoid destination to what is considered unnecessary to the exercise of activities (COUTINHO; AQUINO, 2015).

SEITON - To this sense, it is closely linked to ordering, sorting, and / or how to better sort the area or work environment. Its main concern is associated with the constant search for the development of a better physical arrangement, which gives us a more functional experience in the workplace, without doubt in its implementation, this sense provides a significant increase in productivity, reducing costs and accidents. of work (FACHIN, 2017).

SEISO - It is associated with Zeal and Cleaning, its main association is to work in a preventive manner avoiding breakage of devices, deterioration of parts, machines, equipment, materials, among others, this through periodic maintenance with cleaning the environment. This sense does not need to be understood only in physical equipment, its scope can reach information that is also stored, such as the deletion of data and information that no longer interests us (MARTINS; MARTINS; FERREIRA, 2017).

Already the SEIKETSU - addresses a different approach, it is linked something related to cleanliness, integrity, hygiene and health. It is believed that with the practice of the first 3 senses, you will be guaranteed to get that sense. This sense will be related to the quality of life, because it includes the care with personal

hygiene, but not only taking care of personal hygiene, but taking care of the mind and image, he tries to work his self-esteem, emotional conflicts and empathy (DAUCH; DA SILVA ; BY SOUZA JABBOUR, 2016).

While SHITSUKE - brings us a sense of self-discipline, according to Nisiyama (2016), getting employees to have a vision of commitment to pre-established standards, moral, technical standards, focused on personal improvement associated with Company would be ideal. Where the pursuit of personal development, corroborating the improvements achieved, requires a very high level of maturity.

Figure 1 below is a copy of the 5S Japanese terms and their meaning in Portuguese.

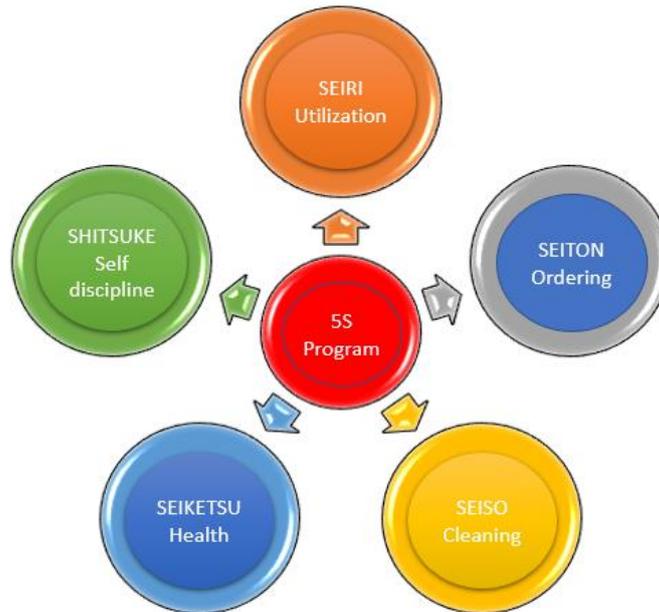


FIGURE 1 - 5S Program

Source: Prepared by the Author.

Table 1 - 5S Program

Description In Japanese	Description In English	Context
Seiri	Use	Organization, storage and selection
Seiton	Ordering	Classification, better way of ordering the work environment
Seiso	Cleaning	Covers general cleaning on both physical equipment and information and data
Seiketsu	Health of	Hygiene and cleanliness, personal care
Shitsuke	Self-discipline	Owner's vision, business commitment

Source: Author by Author.

In the table of figure 1, we have a list of the terms in Japanese and their respective Portuguese, bringing a brief context for a better and faster understanding of the senses of the 5S program.

For Rossato, Boligon and Medeiros (2016) there are consistent direct results with the implementation of the “5S”, mainly related to the improvement of the organizational and work environment, through standards,

procedures, with a more comfortable and cleaner environment. effort and especially time, thus eliminating unwanted papers and objects, improving the layout and use of spaces more and better, we have a clearer and more evident internal communication, with a greater participation of workers and thus obtain from the 5S program in company.

With the implementation of 5S in a company or sector, it is possible to verify that people will have changes in their lives, on the behavioral side, because the discipline of the acquired culture helps in this improvement (DE SOUZA et al., 2018).

2.2. *Quality Continuous Improvement Process*

Continuous improvement is based on a Japanese concept called Kaizen, which represents a crux of the philosophy of total quality, i.e. the main idea of the relentless pursuit of uninterrupted improvements in everything and every process the organization performs. This brief concept encompasses the emergence of a culture of constant learning any and all activities of the company, company and / or organization (DE ALMEIDA, 2015).

For Franco (2016) continuous improvement mainly values the elimination of waste originated by processes, but of course, this elimination with common sense, through more economical solutions, which are based on creativity, innovation, and motivation of workers contributing to the improvement of practice of their processes.

By applying continuous improvement to your processes, you can see the improvement of your processes gradually and continuously. At the same time, workers become more involved and committed to everyday tasks, and this brings significant results to the company, for example in prolonging the market. For continuous improvement to work as it is intended to improve processes, the involvement of the company's employees is fundamental, and we must not only restrict production or area of operation, but continuous improvement should involve the entire company (DE MACEDO; SCARIOT, 2019).).

2.3 *PDCA Concept*

To have a better understanding of the meaning of PDCA we must first understand the acronym of PDCA, where "P" means PLAN, "D" means DO, "C" means CHECK and "A" means ACTION when freely translated the words correspond. a: Plan, execute, verify and act, in a very simple way we can say that within a company it is very important to do the planning first defining the methods, conduct the training for employees, so that they can perform what was planned , with this check the results obtained, and compare with the planned, and act when necessary, to prevent the effects of errors (DE QUEIROZ ALBUQUERQUE, 2015).



FIGURE 2 - PDCA Cycle

Source: Adapted from Falconi, (2015)

P - Plan: Identify the problems analysis and elaboration of the action plan to reach the goals.

1 - Identification of the problem; 2 - Analysis of the phenomenon; 3 - Analysis of the process; 4 - Plan of action.

D - Do: Execute action plans, execute and enforce standards.

5 - Execution;

C - Verify: Control the effectiveness of action plans, always monitoring the work in order to follow the results obtained.

6 - Verification.

A - Take Action: Take corrective action when necessary, act with standardization, review activities and carry out new planning.

7 - Standardization; 8 - Conclusion.

2.4 Brainstorming

Brainstorming Free translation means rain or storm of ideas, it is a technique commonly used to recommend suggestions for improvements and / or troubleshooting. In this sense it arises to propose for a recognized species of disability (BUCHELE et al., 2017).

The term brainstorming is associated with a certain atmosphere, where it implies joining a group and making it spell out various solution proposals to solve the issue or problem. At first, the group is exposed to a problem or a certain concern, which is kind of relaxed and informal, not leaving the atmosphere heavy, making the employees feel more comfortable to expose their ideas. The main goal of brainstorming is to gather a very comprehensive list of opinions so that they can later go through a second analysis. In the brainstorm, everyone without exception is encouraged to participate, and all participants need to be aware that all contributions have their degree of importance and value (DAYCHOUM, 2018).

2.5 5WH2

Guinzelli et al (2017) in their work can state that the 5W2H tool originated in English language terms where: what, who, why, where (when), how, how much, and it's a checklist with a sequence of activities that needs to be done, and the information on that list needs to be as clear as possible from both the company,

As for the employees ARAUJO, 2018) shows more succinctly a comparison between the 5W and 2H methods giving us a more general view of the 5W2H methodology.

The 5W2H tool is commonly used mainly in the activity planning stage, because it is in this stage that all the activities to be developed will be organized, who will do a certain activity, where it will be performed, where it will be done, how it will be done and so on. This tool becomes essential in determining action plans (LUMBRERAS, 2018).

2.6 Ishikawa Diagram

The Ishikawa diagram can also be called cause-effect diagram or fishbone diagram, it is a widely used tool among organizations and mainly related to process quality management.

To Penna (2019) in his studies he states that the Ishikawa diagram was affirmed in 1953 with directed studies, establishing a careful analysis of what are the causes, with the aim of showing the relationship between a quality characteristic its various Determinant factors. Cause and effect diagram are a tool that brings us the information in a visual way, is widely applied in organizations.

Ishikawa diagram has several benefits for organizations where when well employed in production and / or other areas. It can be used in conjunction with other tools, a classic example and Brainstorming, which has an exponential effect on the root causes of problems (SOUZA, 2018).

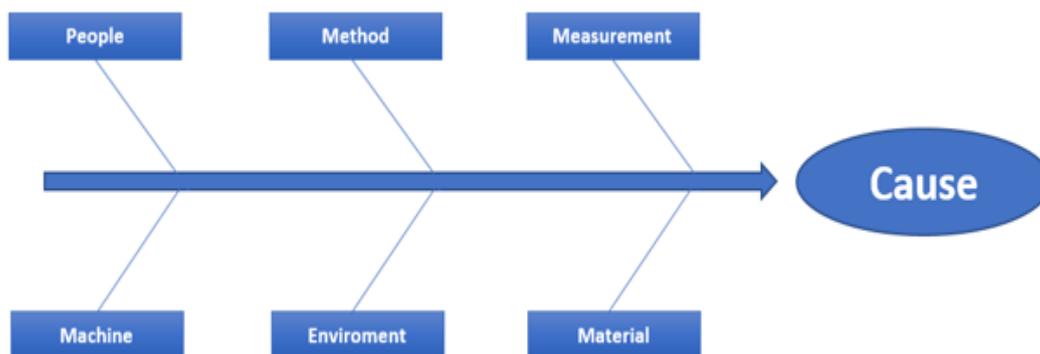


Figure 3 - Cause and effect plot or Ishikawa

Source: Liliana Adapter (2016)

This tool is very important in industrial processes, it is a user-friendly tool, especially for non-specialists to analyze and arrive at possible solutions to problems. The effects help us to diagnose the problems, and by attacking the root causes we will get the desirable improvements. The Ishikawa diagram can make the separation of the cause and effects of the problems, its possibility of use is very wide and can be applied in the most diverse contexts and in several possible ways.

The Diagram is characterized as a simple and easy graphical tool, easy to understand and understand and for senior management helps them in decision making, mainly by means of surveys of causes and effects.

3. Methodology

The tools used to compose the improvement actions were control spreadsheets in Excel, Presentations and Power point, periodic meetings during the implementation, at the end of the 5S deployment in the sector, an audit team was selected to be trained to perform correctly the verification of conformity and non -

compliance using the Checklist.

In the Analysis of Results, in the verification items considered problematic, the 5W2H tool was used, which consisted of analyzing the root cause of the problem, through the seven questions: What, Why, Where, When, Who, How, How Much.

3.1 Place of Study

G. Equipment's located at the Manaus Industrial Pole was founded in 2005, with specialized technical professionals capable of meeting market demands. Seeking to offer products, produced in Manaus Industrial Pole, that provide better quality of life and well-being for its customers, combining technology, quality and innovation with the best cost-benefit in the market.

G. Equipment's 'mission is to provide its customers with quality product and service solutions related to state-of-the-art fitness and body care equipment, comprehensive compliance with our customers' requirements, legal and associated requirements that aim for excellence in the form of act and offer continuous improvement to the quality management system.

Company Vision is the constant pursuit of excellence in its processes, with the purpose of bringing innovative solutions in products and services for gym equipment and body care, to our collaborating partners and shareholders with the focus on the development and contribution to the Industrial Pole. Manaus.

3.2 Type of Study

In this work we used a research based on a case study, where the main concern is in a proposal of implantation of 5s in a gym equipment company of Manaus industrial pole called G. Equipment's.

According to Matos (2016) shows us in his projects that any research that demonstrates a kind of investigation, where an established phenomenon has been occurring and there is a search for the understanding of this phenomenon that is occurring within a certain and daily scenario, and with the objective main reproducing it is called a concrete case study.

The case study uses a qualitative methodology that usually comes in such a way that it wants to deepen an individual unit, mainly serves to answer questions where the researcher does not have much control. It is a methodology that uses means and forms and especially the reasons for which such a decision was reached (DA SILVA TEIXEIRA; OLIVEIRA, 2017).

As for the literature review comes as a base subsidy for the whole case study, which was conducted a qualitative bibliographic and documentary research, and starting from the literature review and knowledge area documents, aims to analyze the implementation of 5S in the literature. G. Equipment's and the main quality tools were used to analyze the implementation of 5S in G. Equipment's in the Manaus Industrial Pole.

The quality tools helped us to diagnose the identification of nonconformities, and to evaluate the proposed efficiency and process improvements. With this, this work will show us through five tools for the analysis and solution of the nonconformities evidenced: Brainstorming, Ishikawa Diagram, PDCA 5W2H and 5S. The total of thesis articles, dissertations and documents consulted for the accomplishment of the objectives proposed in this research, to the review were made with 37 articles, 10 articles were discarded, and 27

published from 2012 to 2019 related to the theme were used. 5S implementation, and the use of the quality tools ”that are in this paper. These documents analyzed the conceptual, historical and technical aspects of the main theme.

4. Analysis of Results

4.1 Current Scenario

As the images below show, the scenario we could see through figure 4 before the implementation of the program, we can easily understand that this is a widespread disorganization, this is undoubtedly the first impression that passes to anyone passing by. by the location.

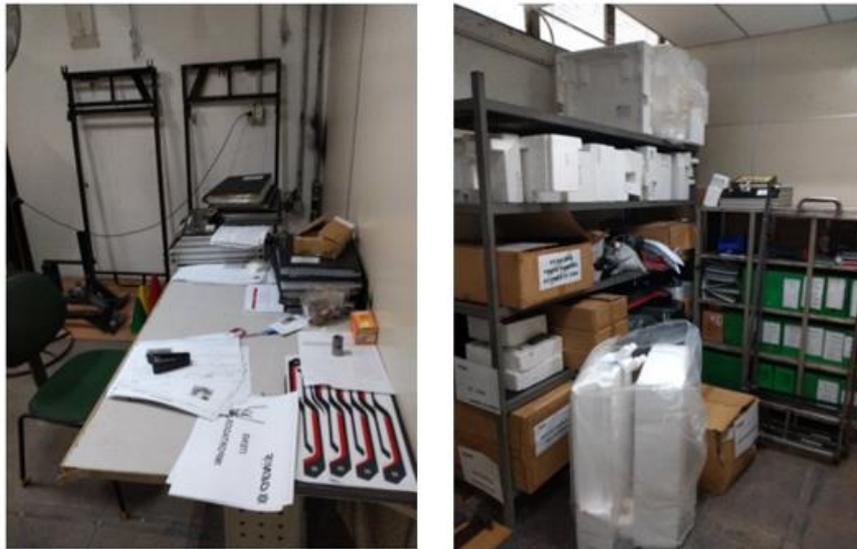


Figure 4: General scenario before deploying administrative inventory.

Source: Prepared by the Author.

Movement to pass people was completely compromised, had several obstacles, and could undoubtedly cause accidents, for example, cones, Styrofoam, equipment, cabling, fan, misplaced stairs, and this can be evidenced in figures 4 and 5.



Figure 5: General Scenario Before Deployment Inventory and Equipment Area

Source: Prepared by the Author.

There were also small spaces where they were used as deposits of various materials, where no one knew what it was due to lack of identification and the boxes were badly packed, not organized, so that handling is easier and a better environment, as shown in figure 6.



Figure 6: General scenario before deployment of parts inventory area

Source: Prepared by the Author.

4.2 Brainstorming

After analyzing the situation of the company, we had a field meeting with the employees and made use of the brainstorming tool in order to promote a shower of ideas in order to solve the problems in question. During the raising of ideas and analysis of the possible causes of the problems and their respective solutions, and concluding with the definition of the necessary actions at the appropriate time, executing and evaluating the actions.

Characteristic Brainstorming needs an early stage where many ideas are generated without criticizing them and then focuses on the ideas generated in the previous step to choose which ones are best, thus making it useful when needed to generate it. many short-term ideas (ORTIZ, 2013).

4.3 Ishikawa Diagram

From the brainstorming tool, brainstorming, we made a second analysis, eliminating those that did not make a significant reference to the problem, and then we put the information in the Ishikawa diagram, fishbone, where we find as the main causes for the problem. effect on people, method, measurements, and environment as shown in figure 7.

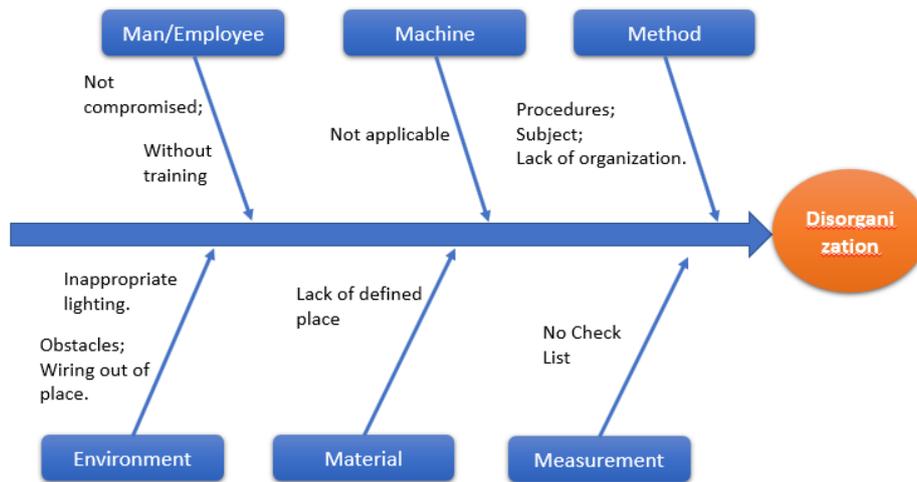


Figure 7: Ishikawa diagram with brainstorming
 Source: Prepared by the Author

4.4 Action Planning

4.4.1 5W2H

After all the analysis of the results we started to plan the actions started with a clarification meeting about the tool to be implemented. With the 5W2H tool was evidenced that to mitigate the main effects of failures that was disorganization, we can realize that the implementation of the 5S program was necessary. The results of the analysis were presented to the managers, they had the understanding and bought the idea of implementation of the program, soon after it was given instruction to the employees and the actual application of the 5S program.

5. 5 S Program Using PDCA - Implementation Steps

The first step consisted of making a presentation to the Test Engineering Supervisor Rogerio Pimentel, responsible for the team, requesting the appropriate authorizations for the implementation, and authorizations granted by the same. The research project was implemented through the case study that starts with a planning stage where an execution schedule was defined, identifying the action, the responsible and the execution time.

The PDCA Cycle, which has four steps, 1- Plan, 2- Do, 3- Verify, 4- Act, will be covered by explaining each task performed in the deployment.

Table 2 below shows us the senses of the 5S program and how they were used throughout the project implementation.

Table 2: Action Plan of 5S Implementation Activities

SENSE	DESCRIPTION
Seiri	In the first week of project execution the command was to separate what is useful from what is not, improve the use of what is useful, keep only what is needed in the workplace, combat waste. Before week of use, it was possible to find several empty boxes in the industry taking up shelf space, many unused equipment for the productive area. In figure 4, 5 and 6, an analysis of the equipment was made, and many of them were sent to the sector responsible for obsolete equipment.
Seiton	In the second week was the turn of the related Sense Ordinance, the organization, where we performed at the disposal of tools and equipment in a better order for the workflow. The process was done in order to eliminate unnecessary movements.
Seiso	In the third week, we began to utilize the sense of cleanliness. At this stage it was important not only to perform environment and workplace cleaning, but also to maintain it. Education has been provided so as not to get dirty, and to look after everything that is our responsibility.
Seiketsu	In the fourth week, the Health Sense was implemented, with it the challenge was to keep what was already clean and organized, favoring physical, mental and emotional health, based on hygiene practices. A meeting was also held for suggestions and compliments, reinforcing a Harmonious working environment.
Shitsuke	In the fifth week, the Sense of Self-discipline was already present, since in the other senses this practice had already been stimulated, because the fact that every week,

Source: Prepared by the Author

5.1 CHECK

To maintain the 5S Program, a group was set up to conduct audit training with the SGI (Person responsible for the Integrated Management System), so that there was control and monitoring of the development of the implementation. The audit took place seven days after the deployment results release meeting, through a Checklist, shown in Annex A and B, produced by the IMS, where all 5S items that had been implemented were reviewed. The results achieved were very rewarding, although we did not have the highest score, but the team was able to pass the Audit.

6. Final Considerations

Throughout the project was evidenced a lot of resistance from some collaborators, especially the older ones, they always used the following terms, old parrot will not learn to talk, that change to what always was that way and negative thoughts saying that it would not work and this happened at various times and at various times, however, with the help of the 5s task force, with all engaged, it was possible to overcome this barrier. The implementation of the 5S program was very significant for the company's top management and production and especially for all employees. Due to the actions of the program, several changes could be

noticed in the company, examples, reduced time to look for something, less fatigue, higher employee productivity, significant increase in the employee's quality of life, but better welfare for the employee. This also provided a better look of the desktop.

This work has given us the opportunity to show how important is the incessant search for the improvement of our processes, ensuring for the company a better placement in the market, and it is believed that this has greater share and competitiveness in the market. Thus, we leave here with this project an opening for further research such as program expansion, improving the audit process, implementing indicators and new quality tools to make G. Equipment's one more and more prominent.

7. Acknowledgments

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8. Bibliographical References

CAMPOS, V.F. TQC – Controle da Qualidade Total (no estilo japonês). 8 ed. Belo Horizonte: Editora de Desenvolvimento Gerencial, 1999.

ARAÚJO, André Luiz Santos de. Implantação das ferramentas 5S e 5W2H como plano de ação no setor de oficina em uma empresa de automóveis na cidade de João Pessoa-PB. 2018. Disponível em: <https://repositorio.ufpb.br/jspui/handle/123456789/13421> Acesso em: 15 jun. 2019.

BOCK, Claudia Patricia. Implantação do Programa 5s. In: O bem comum-Promoção da qualidade de vida. 2015. Acesso em: 11/11/2019. Disponível em: <https://www.metodista.br/congressos-cientificos/index.php/CM2015/BCPQV/paper/view/7240>

BUCHELE, Gustavo Tomaz et al. Métodos, técnicas e ferramentas para inovação: o uso do brainstorming no processo de design contribuindo para a inovação. *Pensamento & Realidade*, v. 32, n. 1, p. 61, 2017

BUSA, Jonatan. Implementação do programa 5s: estudo de caso da Penelo Indústria de Minerais Ltda. 2016. Acesso em: 11/11/2019. Disponível em: <http://repositorio.upf.br/handle/riupf/1095>

COSTA, DAVID VIEIRA. A segurança e saúde do trabalho e o programa 5S. 2018.

COUTINHO, Fagner Melo José; AQUINO, Joás Tomaz de. Os 5S como diferencial competitivo para o sistema de gestão da qualidade: estudo de caso de uma empresa de aços longos. *gestão. org–Revista Eletrônica de Gestão Organizacional*, v. 13, p. 176-186, 2015. Acesso em: 08/11/2019. Disponível em: https://scholar.google.com.br/scholar?cluster=6777654607349823498&hl=pt-BR&as_sdt=0,5&as_ylo=2015&as_yhi=2019

DA SILVA TEIXEIRA, Raphael Henrique Teixeira et al. Gestão da qualidade: um estudo de caso da melhoria organizacional e do processo produtivo por meio da ferramenta 5S. *ANAIS SIMPAC*, v. 8, n. 1, 2017. Acesso em: 10/11/2019. Disponível em: <https://academico.univcosa.com.br/revista/index.php/RevistaSimpac/article/view/682/833>

DAUCH, Karina Ahlemeyer; DA SILVA, João Eduardo Azevedo Ramos; DE SOUZA JABBOUR, Ana Beatriz Lopes. Avaliação da implantação da metodologia 5S em uma empresa manufatureira: análise de etapas, benefícios e barreiras. *Exacta*, v. 14, n. 2, p. 285-302, 2016. Acesso em: 08/11/2019. Disponível em: <https://www.redalyc.org/pdf/810/81046356010.pdf>

DAYCHOUM, Merhi. 40+ 20 Ferramentas e técnicas de gerenciamento. Brasport, 2018. Acesso em: 09/11/2019. Disponível em: <https://books.google.com.br/books?hl=pt-BR&lr=&id=VIRYDwAAQBAJ&oi=fnd&pg=PA1&dq=ferramenta+brainstorming&ots=oCETIA4d1V&sig=2kCxZ3U5vKgJ5DOu0R2Bz-JrDcw>

DE ALMEIDA, Daniela Alexandra Pinto. Aplicação de Técnicas de Melhoria contínua ao abastecimento de Linhas de Montagem. 2015.

DE MACEDO, ANA BEATRIZ CURY; SCARIOT, KAIQUE LIMA. Projeto Integrado Multidisciplinar-PIM. Revista de Ciências Sociais e Comunicação-UNIPLAN, v. 1, n. 1, p. 9-9, 2019. Acesso em: 09/11/2019. Disponível em: <http://www.revistauniplan.com.br/index.php/REV-SOCICOM/article/view/31>

DE QUEIROZ ALBUQUERQUE, Ananélia Cláudia Rodrigues. Avaliação Da aplicação do ciclo pdca na tomada de decisão em processos industriais. 2015. Tese de Doutorado. Universidade Federal do Pará. Acesso em: 08/11/2019. Disponível em: <http://ppgpep.propesp.ufpa.br/ARQUIVOS/dissertacoes/Dissertacao2015-PPGEP-MP-AnaneliaClaudiaRodriguesdeQueirozAlbuquerque.pdf>

DE SOUZA, Bruno Carvalho et al. Implantação do programa 5S através da metodologia DMAIC/Implementation of the 5S program through the DMAIC methodology. Brazilian Journal of Development, v. 4, n. 5, p. 2163-2179, 2018. Acesso em: 08/11/2019. Disponível em: <http://brazilianjournals.com/index.php/BRJD/article/view/245>

FACHIN, Angelo Felipe et al. O programa 5S como uma ferramenta de gestão da qualidade: um estudo de caso numa indústria de equipamentos odontológicos. 2017. Acesso em: 08/11/2019. Disponível em: https://facol.br/revista/pdf/5b732e008cc1c_v4_n1_2017_artigo.3.pdf

FRANCO, Ivan José da Silva. Investigação das possibilidades de melhoria contínua baseada na filosofia Kaizen: um estudo de caso numa empresa fabricante de motocicletas. 2016. Tese de Doutorado.

GONÇALVES, Mariane. O ciclo PDCA na gestão de energia e utilidades. 2018. Viridis Blog. Nova Lima-MG. Acesso em: 09/11/2019. Disponível em: <https://viridis.energy/pt/blog/o-ciclo-pdca-na-gestao-de-energia-e-utilidades>

GUINZELLI, Claimir Adolfo et al. APLICAÇÃO DAS FERRAMENTAS DA QUALIDADE. Anais da Engenharia Mecânica/ISSN 2594-4649, v. 1, n. 1, p. 1-10, 2017.

LILIANA, Luca. A new model of Ishikawa diagram for quality assessment. In: IOP Conference Series: Materials Science and Engineering. IOP Publishing, 2016. p. 012099.

LUMBRERAS, Lazáro da Silva Bailão et al. Gestão De Manutenção De Motores Elétricos Através De Ferramentas De Qualidade–Estudo De Caso. Disponível em: https://www.researchgate.net/profile/Marcio_Fortes/publication/328486502_GESTAO_DE_MANUTENCAO_DE_MOTORES_ELETRICOS_ATRAVES_DE_FERRAMENTAS_DE_QUALIDADE_-_ESTUDO_DE_CASO/links/5bd06f1c299bf14eac81b6e5/GESTAO-DE-MANUTENCAO-DE-MOTORES-ELETRICOS-ATRAVES-DE-FERRAMENTAS-DE-QUALIDADE-ESTUDO-DE-CASO.pdf, Acesso em: 15 nov. 2019.

MARTINS, Gleison Hidalgo; MARTINS, Sonia Ferreira; FERREIRA, Renata Lincy. Projeto 14: um estudo de caso sobre a implementação do programa 5s no setor de manutenção. Conhecimento Interativo, v. 10, n.

1, p. 84-101, 2017.

MATOS, Jânio et al. A gestão estratégica de vendas como ferramenta de sucesso ao processo de produção: um estudo de caso. In: XII Congresso Nacional de Excelência em Gestão. 2016.

NISYAMA, Edelcio Koitiro et al. O uso dos sistemas de controle gerencial e técnicas de gestão operacional. *Brazilian Business Review*, v. 13, n. 2, p. 57, 2016.

OLIVEIRA, Emanuelle. Estudo de caso. Acesso em, v. 18, 2017.

ORTIZ, Felipe Chibás. Métodos de criatividade para a gestão de projetos inovadores. In: VIII Workshop de Pós-graduação e Pesquisa do Centro Paula Souza, São Paulo. 2013.

PENNA, Everton et al. Aplicação dos diagramas de ishikawa e pareto para análise de não conformidades em uma empresa de processamento de aço e caldeiraria em campos dos Goytacazes. *Exatas & Engenharia*, v. 8, n. 22, 2018.

ROSSATO, Fernanda; BOLIGON, Juliana Andréia Rüdell; MEDEIROS, Flaviani Souto Bolzan. Estratégias para a implantação do programa 5S em uma cooperativa. *Latin American Journal of Business Management*, v. 7, n. 2, 2016.

SILVA, S. M. R. Importância da Utilização das Ferramentas de Gestão da Qualidade para a Produção de Alimentos Seguros - Análise de uma Unidade de Alimentação e Nutrição (UAN) na Cidade de Belém – PA. 2012. 103 f. Dissertação (Mestrado em Gestão de Empresas) – Universidade Lusófona de Humanidades e Tecnologias, Faculdade de Ciências Sociais e Humanas, Departamento de Economia e Gestão. Lisboa, 2012.

SOUZA, Maria Karoline Silva. Aplicação do brainstorming e diagrama de causa e efeito para o problema de pouco aluno em universidade pública: estudo de caso no CETENS/UFRB. 2018.