IOSR Journal of Business and Management (IOSR-JBM)
e-ISSN:2278-487X, p-ISSN: 2319-7668. Volume 26, Issue 2. Ser. 5 (February. 2024), PP 22-32
www.iosrjournals.org

Lean Logistics Applied To Distribution Centers A Case Study In A National Logistics Operator

Luiz Carlos Carmo Marialves [1], David Barbosa De Alencar[2],
José Roberto Lira Pinto Júnior[2], Antônio Estanislau Sanches[3]
[1](Academic, Of The Postgraduate Program In Engineering, Process Management, Systems And Environmental (Pgp.Epmse) - Institute Of Technology And Education Galileo Of The Amazon – Itegam).
[2](Professor, Of The Postgraduate Program In Engineering, Process Management, Systems And Environmental (Pgp.Epmse) - Institute Of Technology And Education Galileo Of The Amazon – Itegam).
3(Professor, Of The University Of The State Of Amazonas – Uea - Amazonas – Brazil).

Abstract:
Background*: The research focuses on the application of Lean logistics in the Distribution Center of a Logistics Operator, highlighting appropriate logistics methods and addressing challenges in this context. Furthermore, it seeks to analyze the Lean methodology employed by the Logistics Operator, contextualizing it in the domain of services enriched by concepts, approaches, and techniques derived from the Toyota Production System.*
Materials and Methods*: The study adopts a qualitative scientific approach, utilizing books and articles as a foundation for its development. Simultaneously, it employs a quantitative perspective through a case study. The successful application of Lean in services requires an understanding of principles, fundamentals, and mastery of specific tools such as VSM, SMED, Heijunka, and kanban.*
Results*: The research highlights Lean processes and showcases problem resolution, resulting in significant gains in Lead time, achieving a 63% improvement. The results also present the implemented control tools optimized within the organization, emphasizing the effectiveness of Lean in reducing waste in the production process.*
Conclusion: *The conclusion underscores the relevance of Lean in maintaining organizational gains, continuously promoting improvements, and reducing costs. The study reinforces the importance of developing teams capable of addressing exceptional challenges, emphasizing the applicability and effectiveness of Lean in the logistic context, with potential benefits for organizations.*
Key Word*: Lean Logistics; Distribution center; Logistic operator; Toyota Production System; Continuous improvement.*

Date of Submission: 03-01-2024 Date of Acceptance: 13-02-2024

I. Introduction

In the current business landscape, the survival of companies hinges on their ability to navigate a highly competitive market. Understanding and applying Lean philosophy is crucial for the logistics operations of large enterprises, as evidenced by the methodology employed by a Logistics Operator serving major automotive industry clients like Bosch, Volkswagen, Citroen, Honda, and Black & Decker in the São Paulo region.

To remain competitive, companies must embrace Lean initiatives with clearly defined purposes focused on creating value for the customer. This necessitates a profound analysis of the applied methodology, identifying necessary changes in processes and organizational workflow. As highlighted by the Logistics Operator's clientele, including industry giants, the adoption of Lean concepts such as Pull System, Milkrun, and Supply Routes has led to increased production efficiency, productivity, and cost reduction.

Lean, inspired by the Toyota Production System, has been a transformative management philosophy across various sectors. As organizations worldwide increasingly embrace Lean as a fundamental means of managerial transformation, the interest in and development of new techniques and experiences continue to grow. This study is particularly relevant for academics, serving as an excellent research source on the application of Lean in the Distribution Center of a National Logistics Operator. It contributes to the proper identification of Lean tools in distribution centers, adding valuable insights to the existing body of knowledge.

Logistics, a crucial area for any company, offers ample opportunities for optimization and cost reduction through the implementation of Lean philosophy. With the rise of globalization and rapidly evolving technologies, companies are compelled to focus on customer satisfaction, continuous improvement, waste elimination, and process optimization, aligning with the principles of Lean [1, 2].

The identification and elimination of various types of waste, such as warehouse inefficiencies, excessive inventory control, and unnecessary activities, are integral to Lean implementation. Lean Thinking, introduced by Womac and Jones, serves as the antidote to waste, emphasizing the systematic elimination of any human activity that does not add value [3, 4] .

To achieve continuous cost reduction, companies are advised to adopt the Kaizen philosophy, promoting constant improvement and cost reduction in all processes [5].

The Kanban system, originating from Japan, coordinates material and information flow, exemplifying the pull system. Today, electronic Kanban systems streamline production processes, allowing effective control of material quantities in process [6].

The 5'S program, originating in Japan in the 1950s, focuses on promoting behavioral change in individuals to achieve total organizational organization, cleanliness, a conducive working environment, waste reduction, and increased productivity [7].

Within this context, this paper presents a significant proposal reinforcing the use of Lean for process optimization, inventory management, and overall organizational efficiency. This approach aims to ensure market sustainability, increased results, cost reduction, and waste minimization while providing a comprehensive analysis of various resource aspects, including human and material resources.

II. Material And Methods

This study encompasses an exploratory and qualitative research approach, utilizing two sources. The first involves referencing theoretical frameworks through consultations with cited sources, utilizing books and articles for its development. The second source involves a case study within a Logistics Operator in the interior of São Paulo, providing services to major companies such as Bosch, Volkswagen, Citroen, Honda, and Black & Decker. The research focuses on a logistics company responsible for serving diverse supply chains of other factories. To maintain confidentiality, the company's name is preserved, and the data presented were gathered through meetings with responsible managers.

Application of Lean Concepts in the Warehouse:

The Lean method will be applied to assess and construct pillars outlined in this research. The application of Lean in the warehouse aims to achieve greater visibility, sustainable performance, and continuous improvement. Key elements during the technique's development include interactions and alignment with the organization, such as: sponsorship from top management, translating project results into financial language, projects associated with company priorities, high dedication from Lean specialists, short-term tangible project results, adaptation of Lean structure to the company's reality, specialists with suitable profiles and adequate training of the right individuals [8].

Mapping Material and Information Flow:

For managing this process, the research follows stages mentioned by cited authors: mapping material and information flows, implementing 5S, introducing visibility in processes, Time Takt and Continuous Flow in activities, standardized work, and Pull System (Kanban). The definition of methods was accomplished through meetings and interviews with logistics experts from the researched company, utilizing data organization analysis [9, 10].

Implementing 5S:

One theory integral to this research and essential in the Lean system is the application of 5S. As a working philosophy, 5S supports the maintenance of all applied improvements, including controls, cleanliness, and standardization. The goal is to generate value for the organization, encompassing aspects like workplace well-being, improved quality of goods and services, enhanced organizational image, accident and breakdown prevention, cost reduction, and elimination of rework. 5S functions as the nervous system in the company, enabling all employees to understand how their actions impact overall performance, aiming for waste elimination [11, 12, 13].

Standardization and Improvements:

This section outlines the types of visual controls to be applied as improvement tools, all based on authors researched here as Lean system tools. Visual instructions are emphasized, as the human brain responds significantly to visual cues (55%), compared to vocal (32%) and written instructions (13%) [14].

Time Takt and Continuous Flow in Activities:

Operational planning is another crucial factor to be applied to improvements in the center based on Lean production concepts [15].

$$Takt\ Time = \frac{Available\ time}{Demand} = \frac{420}{82} = 5{,}1min$$

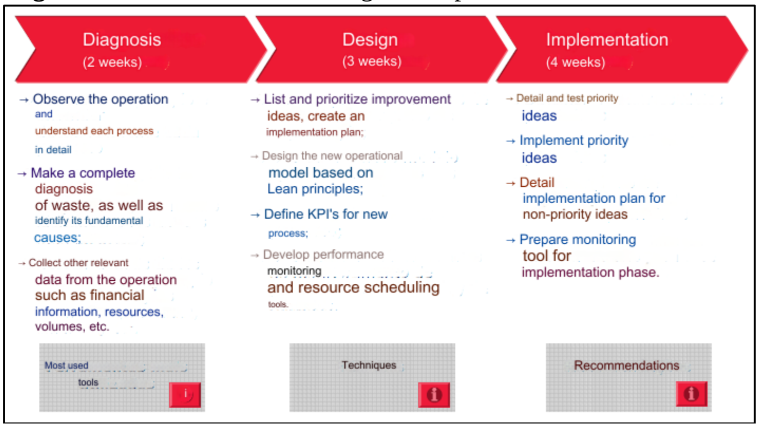
To measure the required capacity to meet sales, Time Takt formulas will be utilized, aligning production/processing pace with demand rhythm. The formula for Time Takt calculation is demonstrated to illustrate the calculations to be developed 16, 17, 18, 19.

III. Result

Warehouse analysis in a logistics operator

In the warehouse logistics operation, the concepts studied and demonstrated through the material and method were applied. In the following topics, the results obtained after implementation will be demonstrated. In this research we found, when analyzing its logistics flows, the program developed by the Head Office located in the Netherlands was initially identified, the LEAN Warehousing program of the logistics operator under study was inspired by the Toyota Production System. In Figure 1 are the data found after diagnosing a Wave when applying the Lean method.

Figure 1 - LEAN Warehouse Logistics Operator 3 Phases of a Wave



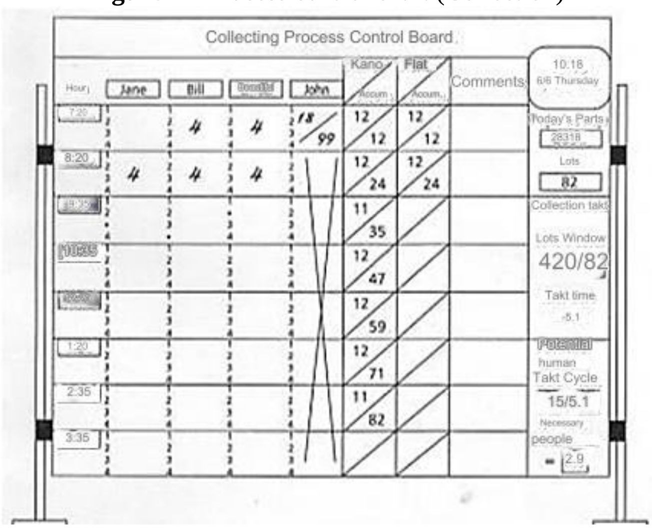
Source: Authors

The steps first go through diagnosis, then designs and finally implementation, which are returned as recommendations after a certain period of analysis.

Inventory data analysis

The data presented is a source of local research at the logistics operator and when analyzing the data it was verified that the items observed in Figure 2 are the collection data for application in the Takt time calculations presented in this scientific study:

Figure 2 - Process control chart (Collection)



Source: Authors

And to determine the pace and workforce for ideal reception, we will apply the following formulation:

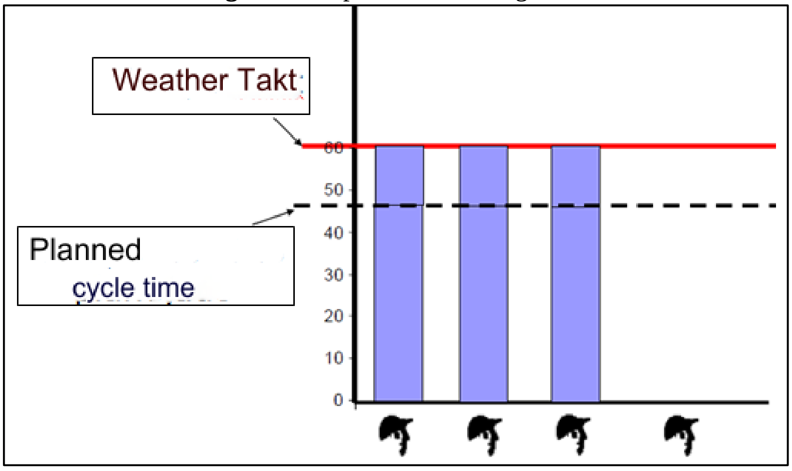
$$\frac{Takt\ time = 840\ min}{30\ trucks} = 28\ min/trucks$$

Average download time = 45 min

Total number of operators = 30 trucks x 45 min = 3.2 operators and 420min

Therefore, working faster than Takt Time, Figure 3 shows the operator's balancing after analyzing the calculations and adjusting the balance.

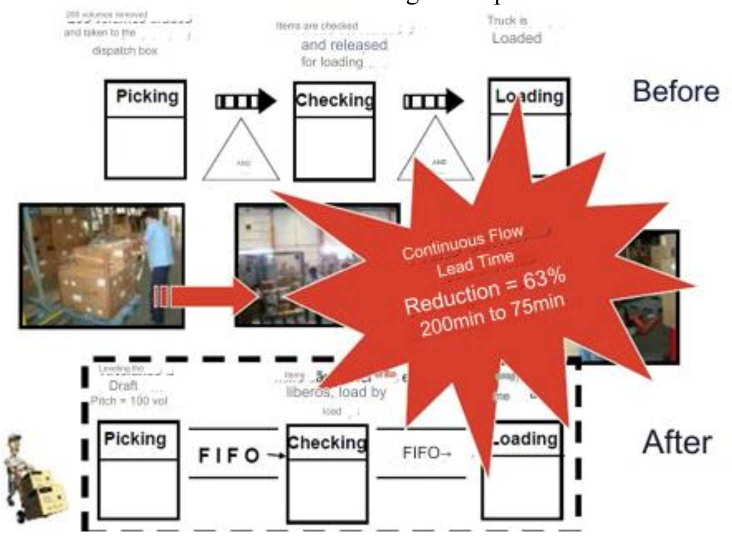
Figure 3 – Operator balancing chart



Source: Authors

After studying and applying the Lean concept, lead time can be reduced by 63% from entry to process exit. Figure 4 shows what the flow looked like.

Figure 4 - Reduction in lead time in the logistics operator's continuous flow



Source: Authors

Action plan

When raising the issues and finding some problems in the study process, three issues were analyzed and action plans were suggested based on the scientific studies raised.

Problem 01: Batch Process

In problem 1 we observed the points found for improvement where there was, Batch process – a lot of "Work in process"; Excessive movements and displacements; Disorganization and difficulty managing people and activities when tasks are not visible and clear. In figure 5 we see an employee with an overload and unbalanced positioning for the process.

Figure 5 - Problem 1

Source: Authors

As solutions based on the studies carried out, it was necessary to define workstations and cellular layout; establish a unitary and continuous flow "one piece flow" and make all materials available close to the operator. In Figure 6 you can see the workplace after the improvement.

Figure 6 - Solution 1

Source: Authors

Problem 02: Tray cart for pinching

In problem 2 we observed the points found for improvement where there was, the use of a tray cart for massive picking of several orders, forcing the operator to separate the orders after each mission. Figure 7 shows the cart used in the current process.

Figure 7 - Problem 2

Source: Authors

As solutions based on the studies carried out, it was necessary to use a modified cart, making it possible to increase the volume of each mission, and at the same time separate the material at the time of picking. In Figure 8 we can see the workplace after the improvement.

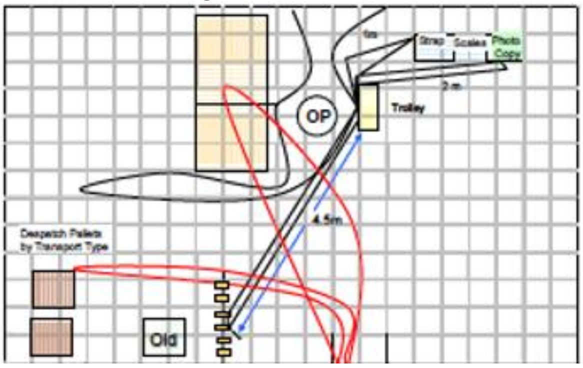
Figure 8 - Solution 2

Source: Authors

Problem 03: Space Optimization

In problem 3 we observed the points found for improvement where there was unnecessary movement in the process, thus generating a loss of movement. In figure 9 we identify the scenario before the improvement.

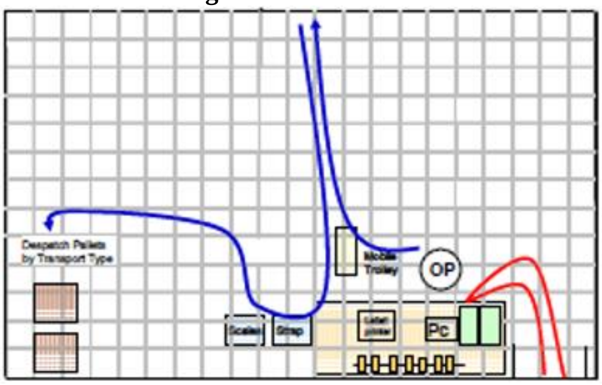
Figure 9 - Problem 3



Source: Authors

Based on the studies carried out, it was necessary to create a spaghetti diagram of the same process after the improvements: Re-layout of the process; optimization of space, thus generating shorter distances to be covered and more visibility of the process, in addition to increased productivity. In Figure 10 we can see the workplace after the improvement

Figure 10 - Solution 3



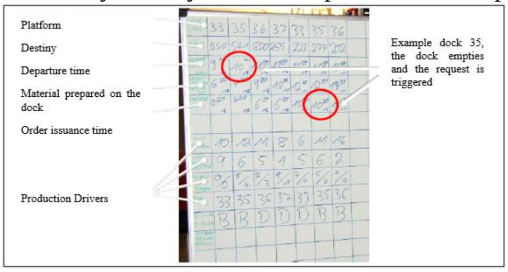
Source: Academic Research (2021)

All problems once identified need to be addressed, but for this to happen it is necessary to study and survey the current problems in the organization, therefore this study through scientific research has contributed to significant gains, both related to improving the work itself and as a result of gains in physical and financial space for the organization.

Flow Application, Kaizen, Kaban, Heijunka

In this session, continuous flows and the synchrony between separation and dispatch will be presented, raising through study, thus highlighting the concepts and practical use in Lean philosophy mirrored in its ramifications such as flow, kaizen, kanban, heijunka applied in this organization, which is currently an operated logistics of large organizations. In figure 11 we observe the control and synchrony between separation and dispatch.

Figure 11 - Synchrony between separation and dispatch



Source: Authors

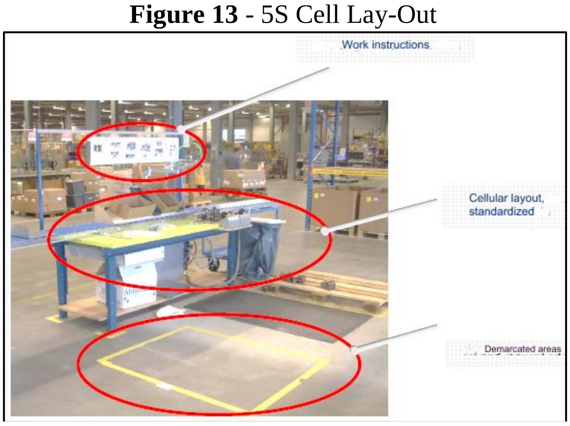
Heijunka box ½ is Kaizen performance management, in the organization we study we demonstrate commitment and participation to make improvements happen. In Figure 12 we have an example of the controls that are carried out, monitoring processes and productivity based on the ideal time already calculated for better optimization and customer service.

Figure 12 - Heijunka box ½

Source: Authors

The 5's must be part of the routine of a Lean factory, basing its routine on the five fundamental actions for achieving missions. Figure 13 identifies how the organization applies this tool, in a visual way so that everyone in stock can quickly be instructed about the work instructions.

Figure 13 - 5S Cell Lay-Out



Source: Authors

Figure 14 shows how the 5'S is applied in the routine of the warehouse under study.

Figure 14 - Visual systems and identifications

Source: Authors

And towards the end of the verification, the system of pulls (KANBAN) was seen in these examples, when a picking location is empty, the operator removes the card. In figure 15 we saw an example of picking when emptying.

Figure 15 - Picking empties

Source: Authors

When a picking location is empty, the operator responsible for picking informs via a flag that that location must be replenished. In Figure 16 we see the flag being signaled.

Figure 16 - Material must be replenished

Source: Authors

Establishment of standardization and controls

An extremely important part of Lean is standardization, all applied kaizens and other warehouse operations. In Figure 17 we see how this standardization effects.

Figure 17 - SOP (standard operational procedures)

Source: Authors

In this way, through this study we were able to highlight the forms of Lean controls that the Logistics Operator under study maintains to conduct its operations, and daily carrying out essential activities to optimize gains such as Kaizen, 5S and other theories presented in this research, reiterating the relevance in current context in which large companies are positioned.

Comparative results after implementing actions

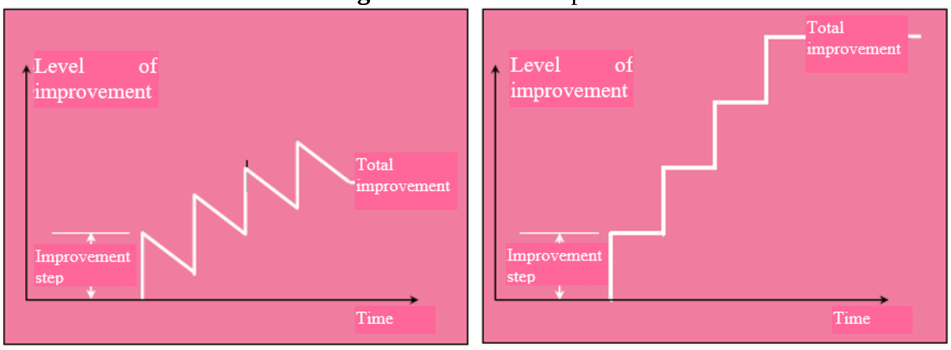
The online processing of data generated in the operation allows real-time monitoring of the operation, speeding up the decision-making process to correct deviations. In Figure 18, an important point is highlighted: due to the complexity of the parts and the large volume of items, performance must be done in real time.

Figure 18 - Real-time monitoring of the operation

Source: Authors

The following indicators were established: Receipt; Receipt of Return; Rework; Storage; Separation; Return Separation; Shipping and Return Shipping. With the use of Lean tools, the possibility of optimizing picking processes was verified through the use of voice commands, as seen in Figure 19 and Figure 40, demonstrating the actions and performance indicators implemented for control.

Figure 19- Avoid relapses



Source: Authors

It is very important for the operation to participate in the implementation of ideas, so that they can be maintained. Once implemented, each improvement must be standardized and audited regularly.

IV. Discussion

This article explored the application of the Lean philosophy in the Distribution Center of a National Logistics Operator, highlighting logistical methods, challenges faced, and an in-depth analysis of the Lean methodology adopted. By combining qualitative and quantitative approaches, the study used a scientific basis for its formulation, using books and articles, in addition to employing a case study to support the quantitative analyses.

Lean, inspired by the Toyota Production System, was applied as a domain rich in logistical concepts, involving tools such as VSM, SMED, Heijunka, and Kanban. Understanding fundamental principles, tools and methods has become crucial to effective implementation. The main focus of Lean is eliminating waste, and research has highlighted the importance of developing teams capable of solving exceptional problems.

The results of the study pointed to a notable improvement in Lead Time, with significant gains of 63%, demonstrating the effectiveness of Lean actions. The research also revealed the successful implementation of tools such as 5S, Kanban, Kaizen, and other continuous improvement strategies. Standardization, central to Lean, was visually represented, highlighting the importance of controls and standardized operating procedures (SOP).

Analysis of post-implementation processes demonstrated online data feedback, enabling real-time monitoring, which, in turn, facilitates rapid correction of deviations. Indicators were established for several processes, and the optimization of picking procedures through voice commands was explored, emphasizing agility in decision making.

The study identified specific problems in the logistics process, proposing solutions based on Lean principles. The successful implementation of corrective actions and continuous improvements was illustrated through three specific issues: batch process, use of tray cart, and space optimization. Each problem was addressed with the application of appropriate Lean tools, promoting efficiency and reducing waste.

When analyzing the historical context of logistics, the research highlighted that the application of the Lean philosophy is vital for business competitiveness, especially in highly challenging sectors. Renowned companies, such as Bosch, Volkswagen, Citroen, among others, were cited as examples of success in implementing Lean, highlighting the relevance of this approach in the global business scenario.

The study reinforces the importance of Lean Logistics in the efficient management of distribution centers. Proper application of Lean principles not only results in significant efficiency gains, cost reductions and process optimization, but also contributes to the long-term sustainability and competitiveness of logistics organizations. This article serves as a valuable resource for academics and professionals seeking to understand and effectively implement the Lean philosophy in logistics and distribution environments.

V. Conclusion

Through this study, it is possible to conclude that the logistics area presents several variables and opportunities for the organization to explore, aiming to increase profits and reduce costs. The implementation of the Lean philosophy in the company resulted in significant benefits, as observed in this work, where the results obtained indicate not only the constant implementation of Kaizen, but also continuous improvement in various operational aspects.

In Lean logistics, the functions of material supply and production are treated with distinction. In the Lean approach, the supply of materials plays the essential role, being the "pit crew" to the race car driver, who represents production. This perspective does not imply neglecting efficiency, but rather giving it due importance, so that it can be addressed after effectiveness has been established. Therefore, the objectives of Lean logistics focus on making the necessary materials available at the right time, in the exact quantity, and eliminating waste throughout the process.

We observe that many companies, not just those that follow Lean principles, exploit sales data. However, what differentiates Lean is the perception that the physical structure of distribution can act as a barrier to market information. Therefore, Lean proposes the development of creative approaches to remove or circumvent these barriers, highlighting the importance of flexibility and adaptation.

Thus, the research, based on concepts and literary references, combined with practice and cohesive identification, concludes that the application of Lean principles represents fundamental instruments for the organization to keep its processes aligned and coherent with market demands. The Lean approach aims to maintain the minimum quantity necessary to sustain production by closely monitoring, planning production to standardize the consumption rate of each item over time, organizing receiving logistics in a more predictable way and responding with corrective actions in the future. first sign of trouble.

VI. Acknowledgment

To Institute of Technology and Education Galileo of the Amazon (ITEGAM) for supporting this research and the Postgraduate. Program in Engineering, Process Management, Systems and Environmental (PGP.EPMSE).
To University of the State of Amazonas – UEA - Amazonas – Brazil

References

[1]. Arnold, J. R. Tony. Administração De Materiais. São Paulo: Atlas, 2009.
[2]. Maciel, Wilson Ravelli Elizeu Et Al. [Backup Moodle] Administração De Materiais E Logística. 2023.
[3]. Corrêa, H.L.; Gianesi, I.G.N.; Caon, M. Planejamento, Programação E Controle Da Produção. 5.Ed. São Paulo: Atlas, 2007.
[4]. Costa, Maria Alice Et Al. Planejamento, Programação E Controle Da Produção: Um Estudo De Caso Na Empresa Cottonbaby Em São José-Sc. Engenharia De Produção-Pedra Branca, 2019.
[5]. Guarnieri, Patrícia. Et Al. Sistema De Custo Kaizen. Encontro De Engenharia E Tecnologia Dos Campos Gerais, V. 2, 2008.
[6]. Gonçalves, Wilma Kf. Utilização De Técnicas Lean E Just In Time Na Gestão De Empreendimentos E Obras. 2009. 134 F. 2009. Tese De Doutorado. Dissertação (Mestrado)–Instituto Superior Técnico. Universidade Técnica De Lisboa. Lisboa, 2009. Doi: Https://Doi. Org/10.30970/Cma6. 0233. 2009.
[7]. Silva, Jackeline Stéfany Dos Santos. Aplicação Do Princípio 5s Na Organização De Documentos Do Sistema De Gestão Da Qualidade Em Uma Indústria De Alimentos. 2022.
[8]. Bashir, H. Et Al. Lean Warehousing: A Case Study In A Retail Hypermarket. Ieom Society International, P. 1599-1607, 2020.
[9]. Sehnem, Ezequiel Heinen Et Al. Utilização Dos Princípios Da Manufatura Enxuta E Ferramenta De Mapeamento De Fluxo De Valor Para A Identificação De Desperdícios No Estoque De Produto Acabado. Exacta, V. 18, N. 1, P. 165-184, 2020.
[10]. Slack, N. Chambers, S.; Johnston, R. Administração Da Produção. Tradução De Mara Teres A Corrêa De Oliveira; Fabio Alher; Revisão Técnica Henrique Luiz Corrêa. 2 Ed. São Paulo: Atlas, 2002.
[11]. Da Silva Lima, Aline Et Al. Aplicação Da Ferramenta De Qualidade 5s Em Uma Empresa De Médio Porte Do Ramo De Logística. Revista Ibero-Americana De Humanidades, Ciências E Educação, V. 8, N. 4, P. 205-222, 2022.
[12]. Felippes, M. Logística: Termos Técnicos. Ebook Amazon, V.1 São Paulo: Saraiva. 2020.
[13]. Leite, Paulo Roberto. Logística Reversa - Meio Ambiente E Competitividade. São Paulo, Pearson Prentice Hall, 2006.
[14]. Ingold, Tim. Pare, Olhe, Escute! Visão, Audição E Movimento Humano. Ponto Urbe. Revista Do Núcleo De Antropologia Urbana Da Usp, N. 3, 2008.
[15]. Mendes, Geângela Moreira; Fraga, Suellen Souto. Estudo Da Variabilidade No Tempo De Execução Com Mapa Fluxo De Valor. 2022.
[16]. Benetti, Vanderlei Giovani; Tolino Chaves, Bruna; Carlos Schmidt, Fabrício. Aplicação Dos Conceitos De Fluxo Contínuo E Balanceamento Em Uma Linha De Manufatura De Reservatórios De Ar Para Caminhões. Tecno-Lógica, V. 24, 2020.
[17]. Rebelo, Paula Malburg; Forno, Ana Julia Dal. Lean Manufacturing Na Indústria Têxtil: Um Recorte Teórico Da Ferramenta Takt Time. 2022.
[18]. Roldão, V. S., & Ribeiro, J. S. (2007). Gestão Das Operações - Uma Abordagem Integrada.
[19]. Womack, James P.; Krafcik, J. F. Vinte E Cinco Anos De "Lean". Lean Institute Brasil, São Paulo, [2013]. Disponível Em: Https://Www.Lean.Org.Br/Comunidade/Artigos/Pdf/ Artigo_248.Pdf.