7th European Conference on Industrial Engineering and Operations Management
Augsburg, Germany, July 16-18, 2024
Publisher: IEOM Society International, USA DOI: 10.46254/EU07.20240126
Published: July 16, 2024

Process Improvement at 2M Stands: Standardization of Modular Components to Reduce Total Cost

Filipe Mingorance Lombardi, Gustavo Araujo Garcia and Pedro Vieira Braga
Production Engineers
Graduate Program in Production Engineering
Engineering School Mackenzie Presbyterian University (MACKENZIE)
São Paulo, SP, Brazil
filipelombardi14@gmail.com, gustavoag01@gmail.com, pedrovbraga30@outlook.com,

Ana Maria Saut
Post-doctoral Researcher
Department of Production Engineer
Polytechnic School of the University of São Paulo University (USP)
São Paulo, SP, Brazil
ana.saut@usp.br

Orlando Yesid Esparza Albarracin and Silmara Alexandra da Silva Vicente
Researchers Professors
Graduate Program in Production Engineering
Engineering School Mackenzie Presbyterian University (MACKENZIE)
São Paulo, SP, Brazil
orlando.albarracin@mackenzie.br, silmaraalexandra.vicente@mackenzie.br

Abstract

This is a study on the assembly processes of wooden stands of the company 2M Stands. The main objective is to reduce both the costs and the total duration of setting up stands at fairs and events. Firstly, using a SWOT analysis, it was understood, in partnership with the company 2M Stands, the current situation regarding internal processes and how the fairs and events market is moving towards sustainable solutions, which reflect a competitive advantage in the product. Once this process was understood, the validation of the components was carried out, which within the assembly of wooden stands, had the potential to be standardized. All unit cost data of these components were collected, as well as the number of times they were used per project, over the period from September 2022 to September 2023. Based on the Pareto Analysis, it was possible to conclude that in addition to the potential financial gains, it is also possible to achieve a more uniform distribution of its resources, reducing the effects of market seasonality. Finally, it is highlighted that Lean mentality was applied, reflecting a continuous and comprehensive approach in decision-making aimed at the lean production system.

Keywords
Cost Reduction. Trade Fairs and Events. Wooden Stands

1. Introduction

In the contemporary business scenario, the incessant search for operational efficiency and the minimization of waste become fundamental for sustainable development and for the success of organizations in many sectors. This mentality is also applied in the market of fairs and events, a billionaire sector of the economy, which generates a great movement for tourism, restaurants and bars, local transport, and numerous job vacancies at the operations of assembly and disassembly, planning and the completion of the event (fair).

The company 2M Stands has stood out in terms of competitiveness with his exhibitor clients, especially in terms of setting up standss for fairs, which is the company's main activity. The main objective of companies operating in this sector is to build in a unique space, something that impacts consumers through imposing standss, and with increasingly larger areas. Barretto (2021) highlights that these events are crucial platforms on which companies not only exhibit and promote their products and services, but also establish strategic connections with investors, customers, and new partners.

2M Stands company was founded in 1986, marking its beginning in the dynamic events market. The company's trajectory has lasted for more than three decades. The company has consolidated itself in the construction of stands, becoming a reference in the assembly sector from aluminum profiles and glass plates, an assembly system created by the German company Octanorm in 1969 (Octanorm, 2020). Since then, its entire structure and workforce has been molded to perfect the assembly process of this type of stands, popularly called standard stands.

The events market is highly competitive and large companies, as of 2010, began to invest in built stands, which have wood as raw material. This type of construction began to shape the entire events industry, especially the automakers, which needed to prepare their office structure and warehouse to accommodate teams of carpenters and wood stocks. Although trade shows offer many benefits for businesses and help advance technology and innovation, they are also known for generating large amounts of waste. According to (Schueneman, 2012), studies claim that over 600,000 tons of garbage are produced annually at trade shows. For an event to occur sustainably, organized, and at low cost, there are several conditions that need to be considered and overcome. These include the short setup time for standss, planning and organizing the setup team, and primarily market trends, which were accentuated after the pandemic, saw an increase in demand for stands constructed using wood as their main raw material. Since then, numerous opportunities for studies and analyses have been identified that could enhance profits and increase the efficiency of setting up event stands, with a focus on wooden stands.

To mitigate all the variables mentioned above, this research seeks to use tools available in the market with the aim of achieving the general objective of analyzing and proposing the standardization of modular components at the company 2M Stands as a strategy for cost reduction and process improvement in setting up wooden stands. To accomplish this objective, it is necessary to analyze the main points of inefficiency within the process, identify which components have the greatest impact on costs, define the ideal structures for standardization, and present the potential gains from this action.

2. Literature Review

2.1 Lean Thinking

The Lean Thinking is based on the Toyota Production System. This thinking was developed in the manufacturing context, aiming to reduce resource usage to the minimum possible without compromising sector demand fulfillment. This thinking is grounded in the following paradigm:

> "[...] half the effort of factory workers, half the factory space, half the investment in tools, half the planning hours to develop new products in half the time. It also requires well less than half the current manufacturing inventory, in addition to resulting in far fewer defects and producing a greater and ever-growing variety of products" (Rodriguez, 1993).

The foundation of lean thinking is based on the evolution of Toyotism, which introduced a new perspective on production systems. Unlike Fordism, Toyotism prioritized on-demand production, known as just-in-time, and autonomation (Construído, 2003). Just-in-time involves production only when necessary, avoiding excessive stocks and idleness resulting from unresolved bottlenecks. Autonomation refers to automation with human intervention,

aiming to increase productivity by separating machine and operator activity times. This is possible with mechanisms like automatic machine stoppage, which prevents errors from being produced in series (Ohno, 1988).

Lean Thinking is based on five fundamental principles: (1) identification of what is value to the customer; (2) Mapping of the production flow and detection of waste; (3) establishment of continuous flow; (4) value generation for the customer; and (5) pursuit of perfection.

When these fundamentals are executed correctly, it becomes much simpler to achieve solutions for costs, losses, bottleneck resolution, and process replanning. The focus is always on the end customer, and achieving their expectations with the minimum possible resources indicates the success of lean thinking.

It is worth noting that this type of methodology is not on-time implementation, but rather a cyclical process. Once objectives are attained, the process of system reassessment and search for new improvement opportunities should begin anew. This is the principle of Kaizen, where the pursuit of improvement is constant and not limited to isolated points. Everything that is already good can become even better if the evaluation and analysis process continues.

2.2 SWOT Analysis

SWOT analysis, an acronym derived from the words Strengths, Weaknesses, Opportunities, and Threats, constitutes an approach to assess the internal strengths and weaknesses as well as the external opportunities and threats of an organization. The objective is to establish the SWOT analysis method as a comprehensive internal analysis tool, to process internal and external business information, capable of adding significant value to the company's strategic development (Bjorn, 2008).

When analyzing internal factors, the strengths of the SWOT analysis allow organizations to identify competitive advantages that can be leveraged. This includes not only tangible assets such as technology and efficient infrastructure but also intangibles such as brand reputation and employee expertise. On the other hand, when examining internal weaknesses, companies confront their challenges, such as process deficiencies, skill gaps, or management issues.

As mentioned, the analysis also encompasses external factors, including opportunities such as market changes, technological advancements, consumer trends, or untapped market gaps. This insight enables organizations to capitalize on gains such as product diversification, expanding horizons, and driving growth. Finally, anticipating threats such as fierce competition, regulatory changes, economic fluctuations, or technological advancements by competitors allows companies to proactively prepare, adjusting their strategies to mitigate possible negative impacts.

It is important to integrate SWOT analysis into a company's decision-making process. This allows for chosen paths to be outlined more clearly and all scenarios, both internal and external, to be analyzed to mitigate risks.

2.3 Standardization of Modular Components

Standardization of modular components is an effective strategy for enhancing processes in the assembly of wooden stands. This approach involves designing pieces that can be reused, simplifying assembly, reducing production costs, and the waste generated. Furniture, walls, and other modular structures can be designed to enable their reuse in different stands, promoting efficiency and sustainability in the construction process.

According to Devides (2006), during the production of rectilinear furniture, the most significant factors are the constraints, both material and the production process (including available machinery), as well as solutions that result in savings, benefiting exclusively the industry. Therefore, it is crucial to optimize the dimension of these pieces of furniture to maximize the utilization of the materials and thereby reduce associated costs.

Currently, there are software programs capable of planning the furniture to be built (see Figure 1), with the aim of minimizing waste and imperfections in the operator's cuts. According to Mansuri (2016), hardware and sheet suppliers indicate that 55% of carpentry shops use software for projects, contributing to the reduction of execution time and avoiding waste of sheets, resulting in up to 98% utilization, depending on the project and productivity.

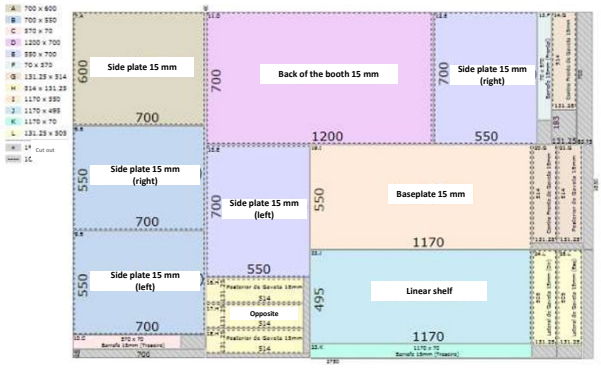


Figure 1. Example of a cutting plan. Search: 3Dcademy, 2016

3. Methodology

In this study, the methodology of applied research is adopted as a strategic approach to evaluate the improvement of assembly processes for wooden stands at the 2M Stands company. Applied research is an approach aimed at solving specific problems by identifying issues and proposing tangible solutions (Thiollent, 2009).

The primary objective of this study is to identify opportunities for standardizing modular components used in constructed stands. It is worth noting that the reduction of production costs directly impacts the increase in operational efficiency and long-term business sustainability. Figure 2 presents examples of constructed and standard stands. It is possible to observe that the complexity of the constructed stand is easily perceptible, but in technical terms, this complexity becomes more evident. On the other hand, the workforce needed to construct the wooden stands often lacks the necessary qualifications, leading to the demand for a more robust shed structure for its production. Finally, an important challenge arises from the frequent disposal of parts after use.

Figure 2. (a) Wooden stands design (b) Photo of a stand in standard assembly

Search: 2M Stands

During the period from September 2022 to September 2023, data were collected from projects executed by the company to understand the entire process involved in the production of stands. The following structures are highlighted:

- Sticks: Structures built for finishing, support, and routing power cables.
- Company name plate (forehead): The upper front part of the stand that highlights the company logo.
- Ceiling: Overhead structure for installing lights.
- Table: "U"-shaped structure used for product display or equipment support
- Nichos: Niches structures used for product support and vertical display.

- Tabletop: Used as finishing for the top part of countertops made of aluminum profiles.
- Bar: Fully constructed furniture used to support buffets, cabinets, product displays, among others.
- Panel: Structures usually 4.20m high and 1m wide, used to create the stands dividers.

The costs associated with each structure are given by Equation 1:

$$Cost = n \times Price_{unit} + \left(Hours_{production} \times Cost_{manufacturing\_time}\right) \times \left(1 + Percentage_{inputs\_used}\right) \quad (1)$$

where n is the number of items used. Inputs are essential elements in the construction of furniture, and it is crucial to allocate a percentage of the total cost to acquire these materials. To build a niche, for example, it is necessary to purchase glue and nails for fixing, as well as putty and paint for finishing. Thus, the total cost is given by Equation 2:

$$\text{Cost}_\text{T} = (C_c \times E_c + t_{mo} \times C_{mo})\left(1 + \text{P}_{inputs}\right) \quad (2)$$

Where C_c= Cost of panel; E_c= Panel thickness; t_{mo}=labor time; C_{mo}=Labor cost e P_{input}=Input Increase**.**

To highlight, identify, and guide the actions necessary for improving the assembly processes of wooden stands, a SWOT analysis was conducted, and Lean Thinking was adopted as a framework for best practices, particularly in standardizing carpentry processes. As suggested by De Oliveira (2023), Oliveira (2018) and Rocha(2020), the SWOT analysis identifies the main avenues for enhancing a company's development, pinpointing its strengths to leverage, weaknesses that may pose challenges, as well as external opportunities and threats that can impact productivity. This step was essential in guiding all actions and decisions made throughout the project's development. Finally, Pareto analysis was implemented as the quality tool to identify the structures with the greatest impact on costs, enabling a more targeted allocation of initial production efforts.

4. Results and Discussion

Initially, a SWOT analysis (see Figure 3) was conducted, which allowed to identify the main characteristics that need attention and revealed the context in which the company operates. This process enables us to recognize that 2M Stands, a well-established company, has been able to build a solid customer base and reputation in a prosperous and stable market. However, the woodworking project market has experienced significant changes, with the growing issue of unskilled labor standing out. This has resulted in pricing positioning below the current market rates and has prompted changes in the operational structure of the entire company.

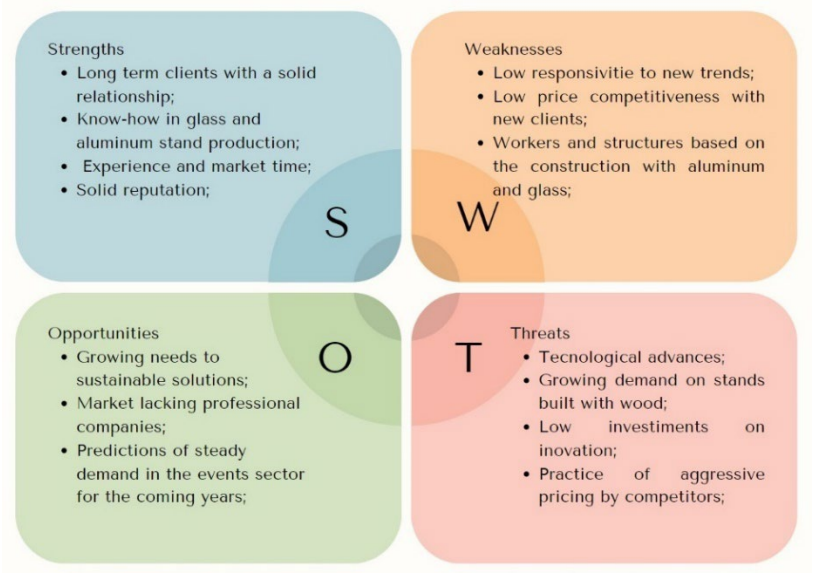
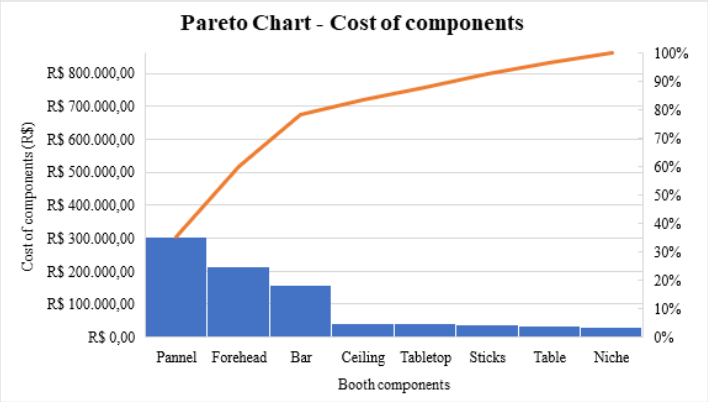


Figure 3. SWOT Matrix
Search: Authors.

Figure 4 shows the Pareto analysis, with values representing the unit costs of each structure multiplied by the quantity of times each one was built throughout the year. This analysis enabled us to understand the structures that had the greatest financial impact. It was identified that the structures having the most significant impact on the company's total costs during the period considered are walls, headers, and counters, respectively. The sum of the costs associated with these three structures totals R$ 675,527.36, corresponding to 78% of the total costs for this period. Given this scenario, the standardization of modular components for these structures is considered opportune, seeking to estimate the potential cost reduction during the period under analysis.



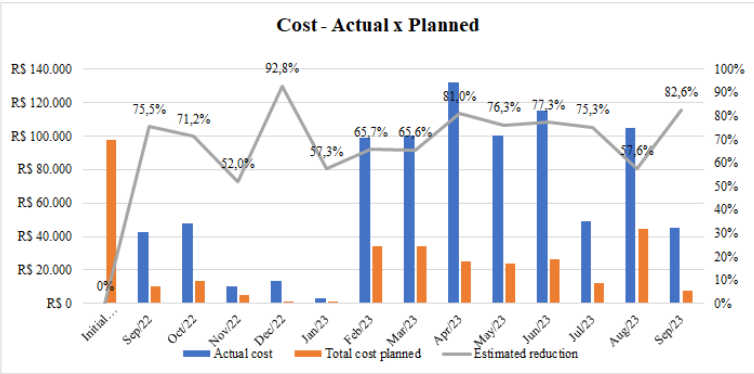
Component	Costs (R$)	Frequency	Frequency accumulated
Pannel	305,057.86	35.4%	35.4%
Forehead	213,833.51	24.8%	60.2%
Bar	156,636.00	18.2%	78.3%
Ceiling	42,961,86	4.9%	83.3%
Tabletop	39,924.50	4.6%	87.9%
Sticks	38,649.60	4.5%	92.4%
Table	35,423.60	4.1%	96.5%
Niche	30362.50	3.5%	100.0%
Total	**862,579.43**		

Figure 4. Pareto analysis of the costs of the structures used to assemble the booths.
Search: Authors.

To project these costs, practical experiments were utilized as a basis, indicating a reduction of 70%, 70%, and 60% in assembly time for each wall, counter, and header structure, respectively. These reductions are attributed to the ease of assembly of the structures, as the modules are pre-constructed and easily fit together.

The modular standardization strategy requires the manufacture of modular components at the beginning of the period for subsequent use in ongoing projects. The initial production volume was determined through project analysis, identifying the demand for these structures in close or even simultaneous periods. This planning resulted in an initial investment of R$97,523.93, allocated to the production of 76 walls, 26 counters, and 94 headers, the projected quantity to meet the demand of fairs with the highest utilization of these structures, considering a 15% margin for losses.

This analysis culminated in the development of a cost projection chart for the period from September 2022 to September 2023 (see Figure 5). This chart visualizes cost projections from the implementation of the modular component standardization strategy, reflecting expectations for cost reduction associated with the identified structures.

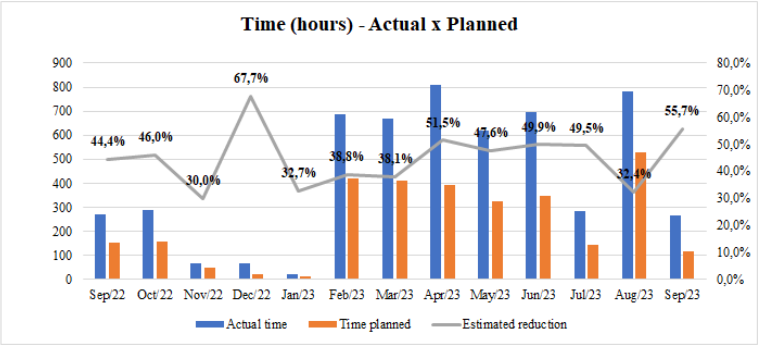


Month	Actual cost	Total cost planned	Estimated reduction (%)
Initial production	-	97,523.93	-
Sep/22	42,402.17	10,400.35	75.5
Oct/22	47,602.43	13,692.16	71.2
Nov/22	9,938.74	47,68.98	52.0
Dec/22	13,631.18	985.8	92.8
Jan/23	3,193.82	1,363.22	57.3
Feb/23	99,122.33	34,034.16	65.7
Mar/23	100,063.49	34,401.16	65.6
Apr/23	132,216.53	25,113.01	81.0
May/23	100,366.77	23,811.17	76.3
Jun/23	114,935.92	26,129.53	77.3
Jul/23	4,8945.24	12,103.06	75.3
Aug/23	104,939.77	44,538.13	57.6
Sep/23	45,221.04	7,875.61	82.6
Total	**862,579.43**	**336,740.27**	**61.0**

Figure 5. Analysis of costs reduction, Search: Authors

After the mentioned analyses, the company achieved an extremely satisfactory result. The implementation of the cost projection for modular structures resulted in a significant reduction of 61% in total project costs.

Furthermore, another study was conducted focusing on minimizing the effort required for the construction and assembly of structures, as shown in Figure 6. For this purpose, the estimated reductions in assembly time for the selected structures (70% for walls, 70% for headers, and 60% for counters) were considered, projecting from these data the time required for construction and assembly during the analyzed period.



Month	Actual time	Time planned	Estimated reduction (%)
Sep/22	273	152	44.4%
Oct/22	291	157	46.0%
Nov/22	68	48	30.0%
Dec/22	69	22	67.7%
Jan/23	22	15	32.7%
Feb/23	686	420	38.8%
Mar/23	667	413	38.0%
Apr/23	811	393	51.5%
May/23	620	325	47.6%
Jun/23	698	350	49.9%
Jul/23	284	144	49.5%
Aug/23	782	529	32.4%
Sep/23	265,5	118	55.7%
Total	**5.537**	**3.084**	**44.3%**

Figure 6. Analysis of effort reduction, Search: Authors.

According to the results (see Figure 6), there is a noticeable reduction in the time allocated for the construction of structures in projects during this period with the adoption of the modular structure solution. It was also possible to identify a significant 44% reduction in the required effort, decreasing from 5,537 hours to 3,084 hours for construction and assembly.

This reduction in required time is a promising indicator of the ability to expand market reach, grow the customer base, and maintain high service quality offered by the company. This improvement will allow for the completion of a higher volume of projects within the same time frame, boosting operational efficiency and the organization's competitiveness in the market.

It is important to mention that the company's consolidated structure, even when limiting the analysis to a one-year period, provided results consistent with its historical reality, as the stability of clients predicts demand with few fluctuations (see Figure 7).

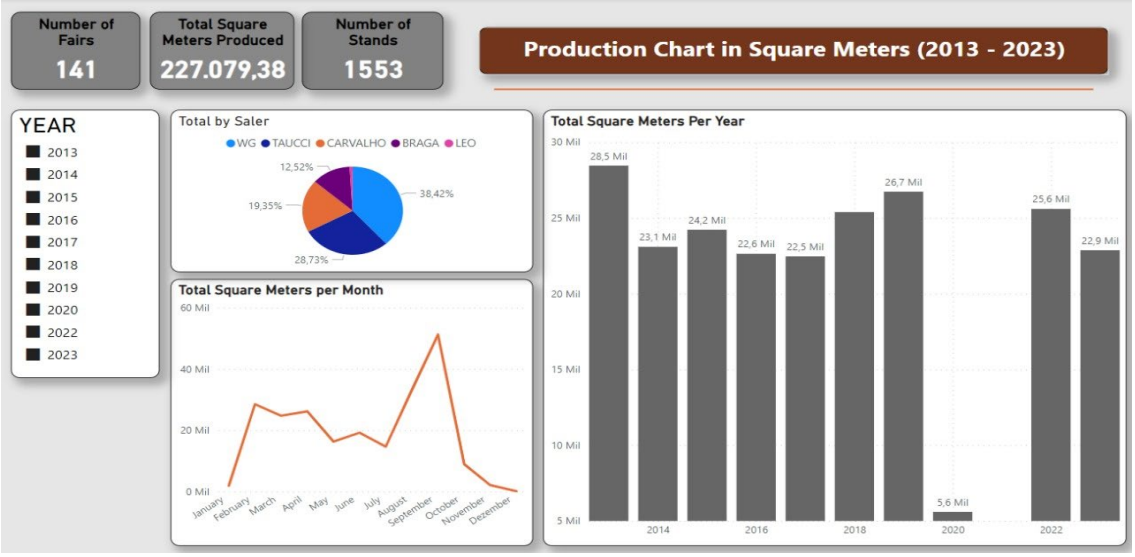


Figure 7. Production Chart 2M Stands (2013 – 2023) , Search: 2M Stands

5. Conclusions

Throughout this study, it was possible to achieve results consistent with the reality of the company, which were recognized and praised by the CEO. Furthermore, for the standardization of furniture, quantitative results were presented for the implementation of the model. However, for the construction of these units, the outsourcing model was chosen, with the inclusion of valuable ideas such as the use of solid planning software, aimed at increasing productivity and reducing production costs. Additionally, the company demonstrated awareness by analyzing the size of the sheets to establish standard measurements for the furniture.

Finally, it is suggested that the construction of these furniture pieces follow a triennial standardization. This calculation is based on wood wear due to excessive use, furniture breakage due to carelessness in transportation, and contamination of some pieces by termites, which end up rendering the entire inventory useless at the end of the three-year period.

This study contributed to the company adopting the replacement of existing structures with modular models, which generated extraordinary results. The projection indicated a 61% reduction in total construction and assembly costs, along with a significant 44% decrease in the effort required for these activities over a one-year period. Thus, the research purpose was successfully achieved, suggesting solutions that can bring a significant impact on the operational optimization of the investigated company. This research not only expanded knowledge on the subject but also stood out as a relevant contribution to the field, opening doors for future investigations and practical improvements in the field of modular structures. Finally, it is recommended that the company apply PDCA (cycle for continuous improvement: *Plan, Do Check and Act*) and SDCA (cycle for maintaining results: *Standardize, Do, Check, Act*) in its processes for the implementation of the suggested improvements.

References

Barreto, Kristen. Designing a Trade Booth System for the Circular Economy. 2021. School of Arts, Design and Architecture | Bachelor's thesis. Disponível em: <https://aaltodoc.aalto.fi/items/8cee3440-00df-41d9-b8c7-6744c5907259>. Acesso em: 25 nov. 2023.Bjorn, Anja. *The swot analysis*. Seminar paper – Berlin, 2008 – amazon kindle edition.

Construído, A.; Alegre, P.. Opportunities for the application of Lean Thinking in construction. vol. 3, no. 1, pp. 7–23, 2003.

De Oliveira, Vinícius Lima; Goes, Karoline Ferreira Kinoshita. *Análise swot-aplicação em uma empresa do setor varejista*. 2023.

Devides, Maria Tereza Carvalho. *Design, projeto e produto: o desenvolvimento de móveis nas indústrias do pólo moveleiro de arapongas*, pr. 2006. 120 f. Dissertação (mestrado) - Universidade Estadual Paulista, Faculdade

de Arquitetura, Artes e Comunicação, 2006.
Mansuri, D. N.. Optimization of Formwork Management Using Building Information Modeling (BIM) and Cascading Tool [Master's thesis, University of Cincinnati]. OhioLINK Electronic Theses and Dissertations Center. 2016. http://rave.ohiolink.edu/etdc/view?acc_num=ucin1470743739.
Oliveira, g.; Castro, v. G.; Nogueira, n. W.; Guimarães, P. P.; Bispo, D. *Mercado da madeira: estudo de caso sobre aplicação da ferramenta swot e desenvolvimento de estratégias*. Nativa, [s. L.], vol. 5, no. 7, pp. 601–605, 2018. Disponível em: https://periodicoscientificos.ufmt.br/ojs/index.php/nativa/article/view/5412. Acesso em: 03 nov. 2023.
Octanorm., Maxima, the maximum in exhibition systems. Disponível em: http://www.octanorm.com/us/downloads/itemid=8897&text=maxima&mgid=3&mgtext=product%20brochures, 2010
Ohno, t. Toyota production system beyond large-scale production. 1988.
Rocha, i. S.; Magalhães, a. M. C.; Mançu, j. De s.; Mançú, r. J. De s.; Sales, M. J. D. Rastreabilidade de resíduos da construção civil: uma visão conceitual entre o sistema de gestão ambiental e da qualidade. Brazilian Journal of Development, [s. L.], vol. 6, no. 9, pp. 66700–66712, 2020. Disponível em: <https://ojs.brazilianjournals.com.br/ojs/index.php/brjd/article/view/16368>. Acesso em: 25 out. 2023.
Rodriguez, M. Z. F. *La máquina que cambió el mundo.* Revista de Economía Aplicada, ISSN 1133-455x, vol. 1, no. 3, pp. 219-222. 1993
Schueneman, Thomas, *Green meetings: international sustainability standards for the convention and exhibition industry*. Disponível em: <https://www.triplepundit.com/story/2012/green-meetings-international-sustainability-standards-convention-and-exhibition-industry/60066>. Acesso em: 28 set. 2022.
Thiollent, M., *Metodologia de pesquisa-ação.* São Paulo: Saraiva , 2009.

Biographies

Filipe Mingorance Lombardi introduced himself as he began his career as a legal assistant at his father's law firm. Soon realizing it wasn't the right fit, he decided to pursue production engineering studies. Graduating from Mackenzie Presbyterian University with a specialization in production engineering, he focused on projects aimed at process optimization during his undergraduate studies, including integrative works focused on recycling companies and a thesis on cost reduction in an event stand manufacturing company called 2M Stands. He gained operational management experience during an internship in the logistics department at Shopping dos Lustres. Later, he joined the Israelite Hospital Albert Einstein, initially as an intern, and was eventually hired as a relationship analyst after 1 year and 8 months. Currently, he works as a Product Owner overseeing the implementation of the Salesforce CRM system. In this role, he leads the evolution of functionalities, ensures system quality and stability, interfaces with the technical team and developers, and delivers executive reports to the board of directors.

Gustavo Araujo Garcia production engineer graduated from Mackenzie Presbyterian University, currently working as an operational analyst since 2022 at REAQT, company whose operates in building and operation of water and effluent treatment. Taking part in leadership management at back-office team and field as well. Assisting in continuous improvement and operational excellence demands, control and governance of technical project calls and cost analysis. Previously at same company was involved in procurement materials, as well as hiring outsourced services for the department, which had about 25 active projects. Additionally, from March to September 2021, worked as a commercial estimator at Cultura CAD, taking part in budget preparation and commercial proposals. Furthermore, as an intern at Neopan do Brazil, from September 2021 until March 2022, focusing on quotations for industry-related services and materials, as well as office-related tasks and assisting on implementing new systems for the company.

Pedro Vieira Braga is a production engineer, graduated from Mackenzie Presbyterian University. During his education, he had the opportunity to work on four different occasions, at three different companies. The first opportunity was at 2M Stands, a fair and events assembly company, where he worked in the production resource planning area, applying lean methodology concepts. In the second opportunity, he directly managed as a managing partner of a gym called All Day Training, in Mooca, located in the eastern part of São Paulo. In the third opportunity, he joined a Dutch multinational in the chemical products distribution sector, currently Caldic, working in the commercial area of the agribusiness unit. Currently, he has returned to 2M Stands as operations manager and strategic planning.

Ana Maria Saut Ana Maria Saut is a post-doctoral researcher at the Polytechnic School of the University of São Paulo. With 18 years of industry experience, she has worked in various roles within operations, quality assurance, product development, procurement, planning, logistics, and project management. Ana holds a degree in Food Engineering from the Federal University of Santa Catarina and a Ph.D. and MSc degree in Production Engineering from the University of São Paulo. Her research areas include quality management, risk management, and strategic planning. She is a member of both the research groups Quality Management and Continuous Improvement (Mackenzie Presbyterian University) and Quality and Safety in Nursing and Health Services - GPQUALIS (University of São Paulo). ORCID: http://orcid.org/0000-0002-8775-7385

Orlando Yesid Esparza Albanacin is a professor at Mackenzie Presbyterian University's Production Department, is highly qualified. He holds a Ph.D, MSc and postdoctoral degree in Statistics from the University of São Paulo. He researches regression and prediction models and process control using control charts. He can be contacted at orlando.albarracin@mackenzie.br. Orcid: 0000-0001-6037-6518

Silmara Vicente holds a degree in Mathematics Education, a master's degree in Space Engineering and Technology, and a Ph.D. in Mechanical Engineering from the University of São Paulo. As a doctoral program student, she worked on projects involving Neural Networks, Artificial Intelligence and Fuzzy Logic. She has been a professor at the School of Engineering at Mackenzie Presbyterian University at since 2001, teaching in the Production Engineering course since its inception in 2003 until the present. She also teaches at Centro Universitário da FEI at the São Bernardo do Campo campus since 2008. Her multidisciplinary background allows her to teach basic engineering courses such as Differential and Integral Calculus, Analytical Geometry, and Linear Algebra. She has also taught Operations Research and currently is part of the Quality Engineering team in the Production Engineering course. She is a member of the research group [...] and has conducted research and supervised students in collaboration with TPF Engineering. Her area of expertise lies in Quality Engineering, Operations Research and Mathematical Education in Engineering.