

Lean manufacturing in the north furniture polo of Santa Catarina from the perspective of strategic planning

A manufatura enxuta no polo moveleiro norte de Santa Catarina sob a ótica do planejamento estratégico

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Abstract

This article aims to investigate the process of implementation of Lean Manufacturing (LM) in companies in the North Furniture Center of Santa Catarina, seeking to identify its adherence to the concepts of strategic planning to ensure its success, within a long-term perspective. This article is based on a qualitative search with this furniture center to identify elements, through data analysis that allowed understanding the dynamics that were applied in this process of LM implementation and its interface with the strategic operations planning. Thus, as a result of this research, the study presented the main characteristics and behaviors related to the concepts of strategic planning aligned with this LM implementation process, which were found: staff training, communication, support for problem solving, monitoring of indicators, review and regular improvements. The study provided important guidance on the best practices for a consistent process for implementing the LM in order to obtain more robust and sustainable results for companies through the commitment of employees.

Keywords: Strategic management; lean thinking; lean production.

Resumo

Esse artigo analisou o processo de aplicação da Manufatura Enxuta (ME) em empresas no Polo Moveleiro Norte de Santa Catarina buscando identificar sua aderência em relação aos conceitos e definições do planejamento estratégico, dentro de uma perspectiva de longo prazo, para viabilizar o seu sucesso. Diversas empresas do Polo Moveleiro Norte de Santa Catarina tem, como objetivo melhorar a sua competitividade com a aplicação da ME. O presente artigo está baseado em uma pesquisa qualitativa junto a esse polo para identificar elementos, através de uma análise dos dados, que permitiram entender a dinâmica que foi aplicada nesse processo de implantação da ME e sua interface com o planejamento estratégico de operações. Assim, como resultados dessa pesquisa, o estudo apresentou as principais características e comportamentos relacionados aos conceitos do planejamento estratégico alinhados a esse processo de implantação, ou seja: o treinamento de pessoal, a comunicação, o suporte na solução de problemas, o monitoramento dos indicadores, e as revisões e melhorias regulares. O estudo forneceu as importantes indicações sobre as práticas mais adequadas a um processo consistente para a implantação da ME de modo a obter resultados mais robustos e sustentáveis através do comprometimento dos colaboradores.

Palavras-chave: Gestão estratégica; pensamento enxuto; produção enxuta.

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Introduction

The furniture industry is an important segment of the manufacturing industry in Brazil, due to significant value of its production and its capacity to generate jobs. In Brazil, this sector had export revenues of US\$691.35 million in the Jan/Dec 2020, (SINDUSMÓBIL, 2020) period being predominantly formed by small and medium businesses, according to the criteria defined by the National Bank for Economic and Social Development to classify the size of its customers to enable an analysis, consideration and performance appropriate to the characteristics of each segment, of family origin, with an operating dynamic determined by the equipment used in the production process. However, these companies are developing, reaching the production of serial goods and increasingly reaching the export market, especially the US and the European Community (ACR, 2019).

The furniture hub of the North of Santa Catarina presented the city of São Bento do Sul as the leader in the ranking of furniture exporting municipalities in the country, followed by the municipalities of Rio Negrinho and Campo Alegre respectively with revenues of US\$ 145,61 million in 2020. (SINDUSMÓBIL, 2020)

This industry is part of the so-called 'traditional sector of the economy', which has as common aspects its reduced technological dynamism; high use of labor; and the relatively high use of forest materials, which demonstrates its social, economic and environmental importance. These characteristics are particularly accentuated in the furniture industry (ACR, 2019).

Faced with this scenario and important challenges of how to meet volume demands, keep production processes stable and avoid additional costs that reduce the planned profit margin, these companies need to establish a better structured production system, capable of meeting the requirements in an integrated way.

The reaction to this context was the decision taken by the surveyed companies to implement Lean Manufacturing (LM) and thus respond to these challenges. However, LM as an advanced operating strategy requires adequate planning and organization to effectively achieve its goals. The question to be answered is: did the LM implementation process take place considering the aspects of strategic planning?

Thus, the main objective of this work was to investigate the implementation of LM in this pole, from the perspective of strategic planning, which should be seen as a dynamic management instrument, which con-

tains advance decisions about the line of action to be followed by organizations in the fulfillment of its missions, to ensure its success, within a long-term perspective based on the investigation of the practices effectively adopted.

Material and methods

This study was carried out through a structured questionnaire, with the aim of analyzing the application of the components of the chosen model, which relate to and contribute to generate results consistent with the strategic planning and its structuring (FNQ, 2010). According to the approach, the investigation is of a qualitative type, characterized by Berto and Nakano (2014), as a method of investigative conduct study, which allows the researcher to analyze and interpret the collected data.

The coverage region considered the municipalities of São Bento do Sul, Rio Negrinho and Campo Alegre in the northern region of the State of Santa Catarina, Brazil. The furniture industry in the North region of Santa Catarina, showing its strong export characteristics, presented São Bento do Sul with 14.6% of the production units, 34.5% of the people employed by the sector and 23.6% of the production in the State in the leadership of the ranking of furniture exporting municipalities in the country. (SINDUSMÓBIL, 2020).

The questionnaires were filled out online, via the Google Meet platform, with the managers of the researched furniture industries, between the months of March and April/2021 (due to the COVID19 pandemic). The units of analysis selected for the research were ten companies inserted in the industrial population of the furniture industry north pole of Santa Catarina and associated with the Union of Furniture Industries, in order to meet the criteria of representation of different realities in the production of the selected furniture pole.

Companies of different sizes were randomly selected to compose the sample in order to represent the breadth of the region. According to Chow, Shao and Wang (2008) the calculation of statistical power for 10 companies is 40% (10/27) considering a confidence level of 95%.

The grouping of companies was performed by cluster analysis and the grouping method used was that of Ward, using a non-standardized Euclidean metric distance. The result is presented in the form of dendrograms (CHOW; SHAO; WANG, 2008).

The analyzes are based on cluster centroids, which represent the mean values of the variables for all cases in the particular cluster (HAIR JUNIOR *et al.*, 2009), which allows analyzing the characteristics of the responses of each formed group.

Let the random vector $[X']_j = [X_{j1}, X_{j2}, X_{j3}, \dots, X_{jp}]$, with p variables for each j element of the n elements. The Euclidean distance will be given by equation (1):

$$d(X_l, X_k) = [(X_l - X_k)'(X_l - X_k)]^{1/2}, \quad (1)$$

with $j \neq l$.

By Ward's method, the distance between the clusters is given by equation (2):

$$d(C_l, C_i) = \left(\frac{n_l n_i}{n_l + n_i} \right) (X_l^- - X_i^-)'(X_l^- - X_i^-). \quad (2)$$

The questionnaire applied had 24 questions grouped into four main areas with six questions for each of the areas: Preparation, Planning, Implementation and Monitoring. The answers to each question were binary (yes or no) and the groupings performed provided the database for the analysis and considerations of the study carried out.

Below is the questionnaire applied with the division of the four main areas and their questions:

A- Preparation

A1- How was the beginning of the implementation of ME? How was it decided? What's the goal?

- 1- The Board decided to have Lean Manufacturing as its operations strategy.
- 2- The main objective is clear, the reason for implementing Lean Manufacturing.
- 3- There are performance goals for your operation, well defined, clear to everyone.

A2- How was the preparation to start the activities? What was done?

- 4- Has any manager or director held training (24h) on Lean Manufacturing?
- 5- An analysis/diagnosis of problems or difficulties in production was carried out.
- 6- The Board knows the critical points of the operation.

B- Planning

B1- How was the start of work planned?

- 7- There is information about the operational performance of competitors or others.

8- There is a detailed plan or schedule to implement Lean Manufacturing or its tools.

9- This work plan is consistent with the strengths and weaknesses of the factory.

B2- Is this plan detailed? How is it coordinated? How do people know what happens?

10- The plan details the actions, persons responsible and deadlines for execution.

11- This initiative is carried out and coordinated by a working group.

12- The initiative to implement Lean Manufacturing is communicated, disclosed to everyone in the factory.

C- Achievement

C1- How is this initiative happening? How is it working?

13- There is a defined person responsible for the Lean Manufacturing project and works on it for at least 2 h/day.

14- Teamwork in the implementation of Lean Manufacturing is normal and happens daily.

15- Activities are carried out and implementation actions take place as planned.

C2- Are employees and managers available, prepared and participating?

16- There is manpower available to work in the Lean Manufacturing initiative.

17- There is a trained workforce to work in the Lean Manufacturing initiative.

18- Employees participate and are involved in Lean Manufacturing implementation activities.

D- Monitoring

D1- How is this initiative being coordinated? Frequency?

19- The main performance indicators of the operation are regularly reviewed.

20- Regular meetings are held to discuss the progress of the project.

21- Managers are committed to, participate in and support the implementation of Lean Manufacturing.

D2- How is the problems and difficulties of the initiative handled? Are there production improvements?

22- In case of difficulty, actions are decided to solve the problem.

23- Improvements in production: process, machines and others happen regularly.

24- The plan to implement Lean Manufacturing has already been changed, corrected or improved.

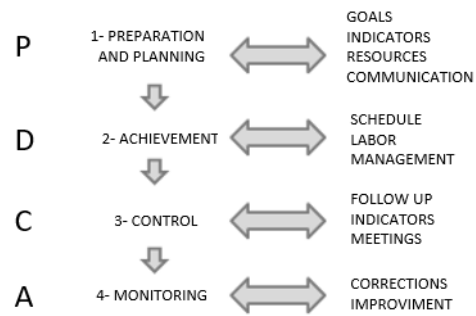
The questionnaire elaborated and applied followed the PDCA cycle which means Plan, Do, Check, Action (Plan, Execute, Verify, Action/Act) and this methodology is intended to ensure the organization of a company's processes, regardless of its nature. In this way, the areas of Preparation and Planning focused on the first step of the cycle (P = PLAN) were considered and, for this, the strategies should be formulated considering that the objectives were established with monitoring indicators and, equally, that the necessary resources as well as adequate communication for all involved actors were defined. For the second step of the cycle that considered the aspects related to the realization (D=DO) the schedules for the follow-up of actions should be established with the involvement and participation of the workforce present in addition to a responsible manager.

The execution and implementation of activities focused on increasing the added value to customers. The third step of the cycle considered the control aspects (C=CHECK) and the activities should be followed by the analysis of the results of the indicators and compared to the objectives defined for a specific period, through regular meetings, thus providing a track record of monitoring. Finally, completing the cycle in the fourth monitoring step (A=ACT), companies established the necessary corrections and improvements that fostered learning and knowledge at all levels of the organization (NORTH; VARVAKIS, 2016).

Figure 1 schematically and visually represents the interactions between the proposed model of the PDCA cycle and the activities that were observed in this study. The representation of the activity's mind map is a color visual diagram used to capture information and monitor / review the main topics of a topic in order to clarify the PDCA methodology used in the work, enabling a broader and more organized view of the study (BUZAN, 2019).

The choice of this strategic management model as a guidance tool is justified for this study because of its scope, its non-prescriptive nature and applicability in the context of small businesses (NORTH; VARVAKIS, 2016).

Figure 1 – Interactions between the proposed model of the PDCA cycle and the activities that were observed.



Source: The authors.

Conceptual theoretical framework

Strategic planning is carried out within the context of the organization. A company's organization consists of its structure, policies, and corporate culture, which can become dysfunctional in a rapidly changing business environment. While structure and policies can be changed (albeit with difficulty), company culture is nearly impossible to change. Often, however, changing the corporate culture is the key to implementing a successful strategy (KOTLER; KELLER, 2013).

Market-oriented strategic planning is the managerial process of developing and maintaining a workable fit between the organization's objectives, its skills and resources, and its evolving market opportunities. The objective of strategic planning is to shape the company's business and products, so that they generate the desired profits and growth (KOTLER; KELLER, 2013).

The use of strategies consists of maximizing resources and capabilities, and the studies already carried out by Ludwig *et al.* (2015) showed that strategic planning can be defined as a set of administrative actions, which managers need to perform to achieve their goals in the future, aiming to guide the companies' businesses and products in order to generate profits with actions focused on the present.

In addition, Lynch (2015) reports that monitoring and coordination is an important aspect of deployment, as this information is used to assess resource allocation decisions; monitor progress in deployment; evaluate the performance of managers in their implementation tasks; monitor the environment and provide a feedback mechanism and fine-tuning essential for strategy implementation.

Due to the growing need to increase productivity and reduce production costs and add value to products and processes, manufacturing models as well as competitive strategies must be reassessed and constantly improved in

order to improve performance, maximize positive results and with that to remain robust in the market (DANGAY-ACH; DESHMUKH, 2001).

According to Ferreira (2018), failures or difficulties in the practice of Lean Manufacturing are very common, as many companies and change agents focus on tools, without understanding that LM is a philosophy to merge in the organizational culture, whose involvement of managers and understanding of all employees is essential in the operations to be carried out.

Lynch (2015) understands that good communication is important to ensure that everyone understands what is happening, resolve any confusion, inform decisions and contingencies, and especially ensure that the organization is properly coordinated. In small organizations, this is simpler to resolve by involving the people responsible for implementation from development.

The important difficulty in making resources available in the implementation of systems, especially in small and medium-sized companies, such as the availability of engineering professionals or productive management consultants, continues to be a determining factor in the effective absorption of techniques, according to studies already presented by (ALVES *et al.*, 2013).

Thinking about small and medium companies, Matt and Rauch (2013) understand that the methods used in large production systems do not apply directly to small and medium companies, because in their studies a large number of them, interested in adopting LM techniques, not achieved the desired results. This is usually a consequence of lack of information, where copied concepts, which are valid for other companies, are incorrectly replicated.

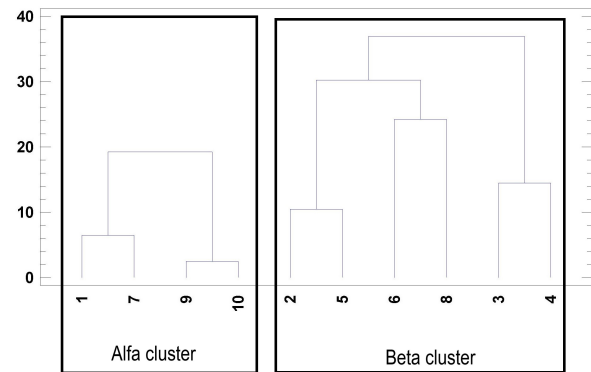
Results and discussion

Through statistical analysis of the data, the study identified two areas of coverage that were detailed: the first in relation to the behavior of companies and the second area in relation to the behavior of the issues, thus allowing to obtain evidence of the application of concepts related to the strategic planning of operations.

Behavior of companies

The data obtained after grouping the variables collected on the ten companies participating in the study were treated through an analysis of "clusters", applying Euclidean squared distance and the WARD method, resulting in the dendrogram illustrated in Figure 2.

Figure 2 – Denrogram: Ward's methods, squared Euclidean.



Source: The authors.

These results obtained for the companies in the Alfa cluster show a short-term view of the business, without an adequate management of performance indicators and action plans for improvement, combined with a low level of management qualification, characterizing a pre-industrial management model and without focus on long-term business strategies.

Thus, the Alfa cluster is characterized by companies with a limited organizational structure, typical of a business still in the process of professionalization, confirming that these companies do not have organized resources to implement LM and neither do they have a sense of strategic planning.

This analysis is corroborated by Lynch (2015), who states that implementing a strategy implies acting with four basic elements: 1 Identification of general strategic objectives, 2 Formulation of detailed plans, with deadlines and responsibilities, 3 Resource allocations and budget, and finally 4 Definition of monitoring and control procedures to guarantee that the objectives are met, respecting the foreseen budget.

The Beta cluster, on the other hand, is composed of the other companies: 2, 5, 6, 8, 3 and 4 and analyzing the centroids, it can be seen that this group has as its main characteristics high rates of YES in questions 1, 2, 12, 17, 19, 20, 22 and 23, that is, there is an operation strategy aimed at implementing the LM that includes communication and training activities (1, 2, 12, 17) and also the performance indicators of the operation and the process of implementation are regularly reviewed with necessary corrections and improvements in the process (19, 20, 22 and 23).

This demonstrates that the companies in the Beta cluster adopted LM with a long-term vision consistent with strategic planning, evidenced by a better structured orga-

nization, performance indicators implemented and monitored with regular actions for the necessary improvements. Ludwig *et al.* (2015), report that these aspects are present as fundamentals of strategic planning.

Still on the centroids, it is clear that in the Beta cluster there are companies that predominantly answered NO to questions 7 and 16, that is, they do not have information on the operational performance of their competitors and have unavailability of labor to implement Lean Manufacturing. Considering this decision to implement LM, these companies showed an inconsistency in not taking into account information from the external context, taking advantage of the opportunities in a more effective way and avoiding identified threats and, therefore, improving their strategic planning. Another important gap that this analysis presented was the unavailability of specific human resources to effectively act in this LM implementation strategy, which limits and hinders its effective process, as mentioned in the studies carried out by Alves *et al.* (2013). In this way, the companies in the Beta cluster have a relevant set of positive characteristics in relation to the four main areas of the questionnaire (preparation, planning, implementation and monitoring) and specific and positive actions in each of these main areas, bringing with it a vision in the clearer and longer-term business management, consistent with strategic planning as already presented in studies carried out by Lynch (2015).

Thus, the comparison between these two Alfa and Beta clusters showed a clear difference in organization and management between these two groups of companies, where the latter is more adapted to serial production and with more advanced practices in operation management and strategic planning. Which, with this, increases the possibility of success in the implantation of the LM?

Behavior of Questions

In this second analysis, the questions present in the questionnaire were grouped in order to understand which of them are multi-variably related, resulting in the dendrogram illustrated in Figure 3.

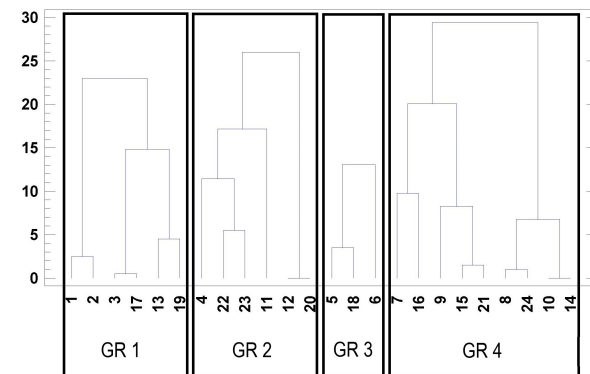
This analysis, Figure 3, showed four distinct groupings that will be presented below.

Results and Discussions of Group 1 (GR 1)

Observing Group 1 of grouped variables, a relationship between the questions can be seen: 1,2,3,17,13 and 19.

Regarding the analyzes of this Group 1, it can be said that when there is a decision to implement the LM in com-

Figure 3 – Dendrogram: Ward’s methods, squared Euclidean (second analysis).



Source: The authors.

panies and its objectives are defined, the actions for its implementation are effectively conducted by the availability of labor and with the formal definition of a responsible person for these activities with regular work to review the performance indicators that have been established for the operations.

Evidently, a board decision to implement an operation strategy focused on LM is a fundamental action that translates, in addition to the commitment of top management, a clear orientation to the entire team on the direction of the company to be pursued in the coming years.

This decision translates into the real need to adapt the workforce in order to provide a responsible person to support this process and that employees understand the purposes of this activity and are therefore able to understand and apply the appropriate tools on a case-by-case basis. This difficulty has already been considered critical to the LM implementation process in a research carried out by Alves *et al.* (2013).

The regular monitoring and review of indicators, in order to achieve the proposed objectives, ensure that the direction towards the strategic plan for the implementation of the LM advances consistently, overcoming any difficulties encountered.

In his work Lynch (2015) clarifies that the strategy coordination system must monitor its main elements and objectives. It is crucial to obtain information in time to act, it must be useful and available for the analysis of the implementation process. This coordination includes measures and indicators: financial, customer satisfaction; quality, market share and others.

The information in this Group 1 of questions shows the perception of a strategic vision of the LM implementation process with a focus on people and their results.

Results and Discussions of Group 2 (GR 2)

Observing Group 2 of grouped variables, a relationship between questions 4,22,23,11,12 and 20 can be seen.

This demonstrates that in the LM implementation process, the companies surveyed carried out formal training for a manager who supports the activities of a work group that, in turn, coordinates the process. There is a problem-solving approach, whether operational or to resolve any difficulties in the implementation project detected in regular review meetings.

Thus, the qualification of a high-level manager substantially reinforces the effort to implement the LM, not only by supporting the operational working group, but, above all, as a facilitator for obtaining adequate resources for the efficient and effective execution of activities.

This support adds the effort of the various interlocutors in the execution of production improvements, in the participation in regular follow-up meetings, also reinforcing the communication and credibility actions necessary for the project.

For Lynch (2015), when those responsible for the implementation process, usually managers, also participated in the development of the strategy, it is clear who will do what, its objectives and impacts. The greater the knowledge, than greater the commitment to the new strategy.

The information in this Group 2 of questions shows, at this stage, the perception of a strategic vision of the LM implementation process, which focuses on the manager's support for the work groups and on the systematic for following up on improvements.

Results and Discussions of Group 3 (GR 3)

Observing Group 3 of grouped variables, a relationship can be seen between the following questions: 5, 6 and 18.

This demonstrates that the companies attached importance to the identification of the problem, to the knowledge on the part of the board about the critical points of the operation, and also about the need for the engagement of employees in the implementation of LM.

Once the board is aware of the bottlenecks, it means that it is able to understand the importance of making a clear and accurate diagnosis of the causes of problems. In addition, if the board is familiar with the process, it is capable of assigning value judgments on the importance of each sector and the employees who work there. This culminates in a very clear orientation on where, what, how and why it is essential to implement the most appropriate tools for LM.

The appreciation of the human being and the knowledge of the cause on the part of the board is evident to the employees, which motivates and engages everyone involved.

These observations have already been presented in research carried out by Dangayach and Deshmukh (2001), which reinforced the need for mastering manufacturing processes, covering the problems and resources needed to ensure the competitiveness of companies in the market.

If the board does not know the production (bottlenecks, failures, difficulties, strengths, costs...), it will not be able to understand if the problems and difficulties of the identified process are really relevant. Also, their lack of knowledge of the details of the production process can lead to mismatched or superficial guidance on the actions necessary for the implementation of LM.

This type of situation can generate discontent among the teams involved, since any change can cause several reactions, as well as a lack of vision about how to do it and why to do it and what are the real gains for the company (time, money,...).

The information in this Group 3 of questions at this stage shows the perception of a strategic vision of the LM implementation process, which focuses on knowledge of the problems and their solutions that are relevant to the processes.

Results and Discussions of Group 4 (GR 4)

Observing Group 4 of grouped variables, a relationship between the questions can be seen: 7, 16, 9, 15, 21, 8, 24, 10 and 14.

This demonstrates that companies are interested in seeking information about competitors as well as in knowing the strengths and weaknesses internally in the company.

There is a detailed work plan, consistent with the company's needs and focused on implementing the LM, which evolves as expected. The follow-up of actions and their evolution are regularly monitored for the necessary corrections with the participation and support of managers.

The commitment of high-level leadership to a long-term activity plan is a key factor in ensuring its continuity.

Thus, the existence of an effective LM implementation strategy considering the company's internal and external scenario equally ensures that its objectives are achieved and its operation is sustainable in the long term. On the other hand, an adequate management of a work schedule that monitors the progress of necessary actions facilitates

decision-making at the right time in order to ensure the effective implementation of the LM project.

These observations were highlighted by Kotler and Keller (2013), who stated that the objective of strategic planning is to shape the company's businesses and products, so that they generate the desired profits and growth.

The information in this Group 4 of questions reinforces the perception of a strategic vision of the LM implementation process, which focuses on benchmarking to reinforce its internal processes.

Conclusions

The results showed that among the companies participating in this research, they were identified in two Alpha and Beta groups.

In the companies in the Alfa cluster, there was no consistent adherence to the concepts of the PDCA cycle of strategic planning, as these companies did not present systematic actions taken to deal with and monitor the problems, despite knowing them and reacting to resolve them. Formal structure of resources directed to the lean manufacturing implementation activities.

On the contrary, the companies in the Beta cluster showed greater adherence to these concepts since activities implemented in these companies were evidenced in the systematic follow-up of their performance indicators of their operations and their improvement processes, in addition to spending greater efforts on actions related to training of its personnel, in its communications and in support of these activities.

Regarding the behavior of the questions, this research detected four main focuses of alignment in relation to strategic planning, namely: focus on people and their results; focus on manager support to groups.

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