

Application of Strategic Paradigm for Manufacturing Management in Brazilian Companies

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-----ABSTRACT-----

This study sought to apply and adapt the theoretical model of the Strategic Paradigm for Manufacturing Management (SPMM), proposed by Godinho Filho and Fernandes (2004), through multiple case studies in manufacturing companies, using as criterion the company size. This model encompasses five manufacturing management paradigms, which involve four key elements. To carry out these tests, it was applied mainly two questionnaires to identify which SPMMs are being used by the companies and whether they correspondents with the identified by the method studied. In addition, it was analyzed which reasons took the companies to choose or not the use of Strategic Paradigm for Manufacturing Management, being possible to show the behaviour of those companies, with regards to SPMMs. As main results, it is possible to assert that any studied company is using the most adequate SPMM in relation to the parameters encompassed by this method. Therefore, it is possible to observe the contribution in theoretical environment are related to the spreading and improvement of the method, to reach the causes that influence the enterprises to choose the SPMMs and practical environment is possible to make a behavioural analysis of the studies companies, offering to them a supporter tool for strategic planning.

Keywords - *Multiple case studies, Key elements, Strategic Paradigm for Manufacturing Management.*

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I. INTRODUCTION

The Strategic Paradigm for Manufacturing Management (SPMM) constitute the theoretical model proposed by Godinho Filho and Fernandes (2004) that aims to guide companies as to the most appropriate choice of paradigms treated by the model. The principle that guides this model establishes that each strategic paradigm must be adapted to the specific market conditions and characteristic of the companies, not having a single strategic paradigm that contemplates all the different variables and inconstant in the environment in which different companies are inserted (suppliers, competitors, consumers, legislation, objectives, etc.). Due to this each company presents different production systems, objectives and missions.

According to Kuhn (1991), the paradigm can be understood as being a widely recognized scientific concretion and that aggregate knowledge, through questioning and modelling of these, the scientific community and its practitioners.

In relation to strategy, Barney (2001) addresses this issue as being the way a company competes in the market, through satisfactory performance, to achieve success. Kroll, Partell and Wright (2000) argue that the strategy seeks to ensure that the company's goals and mission are met through previously determined and stipulated plans. Also, the activities that succeed in the company must have a differentiated character before the competitors or be carried out the same tasks, but in a more innovative way (Porter, 1996).

In this context, the SPMMs model is the focus of the present study, which encompasses five Strategic Manufacturing Paradigms: Current Mass Manufacturing, Lean Manufacturing, Responsive Manufacturing, Mass Customization and Agile Manufacturing. To make possible the contextualization of each strategic paradigm, parameters were created for the evaluation and identification of SPMMs, named as key elements, which are represented by the drivers, the principles, the enablers and performance objectives. Each key element has a certain function within the evaluative scenario of a company, seeking to provide guidelines for the formulations of its manufacturing strategies. The purpose of these key elements is to provide the reconciliation of the objectives of the company with the market requirements.

In view of these aspects and the importance of the SPM for the manufacturing management process, the purpose is to investigate the main strategic models of some manufacturing companies in the city of Três Lagoas - MS. Therefore, the reason of this study is to identify which paradigms are being used and if these paradigms are suitable for the companies evaluated here. In addition, it seeks to identify which paradigm would be ideal and to identify the intrinsic reasons that led companies to use or not certain strategic paradigms. The importance of this research is based in the need to promote data on the strategic paradigms that are being used to have a knowledge of its scope, especially in the city where the studies were carried out.

II. THEORETICAL REFERENCE

As a criterion for classification of the companies addressed in this study, the size of the companies was used. According to the Brazilian Micro and Small Business Support Service – SEBRAI (2018) and the National Development Bank - BNDS (2018), companies can be classified into micro, small, medium and large, whose criteria used for the business environment are made by means of the annual gross revenue and the number of employees. To this academic work, the classification by number of employees was used. In this way, it is classified as a microenterprise with up to 19 employees; small company between 20-99 employees; medium size between 100-499 employees; and large size over 500 employees. Thus, it is observed that the importance of classifying companies is motivated by studies (D'AMBOISE, MULDYNE, 1988; LEONE, 1991; MORAES, 2011) that consider this essential factor for the adequacy of management techniques and tools.

The SPMs (Strategic Paradigm for Manufacturing Management) refer to a theoretical analysis model proposed by Godinho Filho and Fernandes (2004). This model seeks to guide companies in choosing the best manufacturing strategy to be fostered. The purpose of this analysis is to reconcile the market requirements, in which the company is inserted, with the characteristics of its productive system. For this, four key elements were established, which are present in each of the paradigms that constitute the model, enabling a better structure of the paradigm adopted by the company.

The key elements used in this model are the drivers, the principles, the enablers and performance objectives. The drivers seek to identify the market niche in which the company is inserted as well as the conditions that the market and the decision makers impose on the company. The principles are related to the ideas that foment the way that the company must go to reach the measures of established performance. Enablers involve all the components necessary to achieve the principles. Finally, the performance objectives that according to Slack, Brandon-Jones and Johnston (2015), refer to a set of information provided by the clients, which refer to their needs and the understanding of the characteristics and attributes that add value to the product / process. This information is converted into performance measures that provide guidelines and goals for the company.

In this way, many authors (SLACK, BRANDON-JONES, JOHNSTON, 2015, CORRÊA, 2010, MEREDITH, SHAFER, 2002) have carried out studies in this area and proposed five production performance objectives: Quality, Speed, Reliability, Flexibility and Cost.

To provide a more systemic analysis of the performance objectives, and to facilitate the identification of the SPMs, Godinho Filho and Fernandes (2004) proposed their unfolding in seven performance objectives, providing a greater range of differences and similarities intrinsic to five strategic paradigms mentioned above. The seven proposed objectives are:

- Productivity: this objective is related to the volume of goods produced, being driven by demand. This is closely related to the cost of manufacturing, since the larger the quantity produced, the lower the cost of production and vice versa;
- Quality 1: it is the capacity of the production system to adapt the manufactured products to the specifications previously stipulated by the quality department, at a low cost, being perceptible to the consumers;
- Quality 2: this refers to the capillarity between the production system and the customers, based on the search and analysis of information from market research;
- Flexibility 1: conceptualized as the ease of the productive system in adapting to small variations of the product mix, in which efforts are directed towards the realization of low set up times;
- Flexibility 2: related to the adaptability of the productive system to large variations in the product mix, where efforts are directed at empowering the workforce, making it more flexible so that it can use universal equipment and perform set up more efficient and faster;
- Speed (velocity): this objective is related to the time that the productive system needs to adapt to the changes in production volume, that is, it is closely linked to the reduction of lead time;
- Punctuality: this refers to the delivery of the product to consumers within the time and place previously determined;

- Customization Ability: related to meeting the needs of individual consumers through differentiated products, where this differentiation is inserted in a mix of products initially established in the final stages of the production process;
- Adaptability: this objective addresses the facility provided by the productive system to accompany a niche market characterized by constant changes.

Therefore, it is possible to establish that the qualifying objective of the request can be understood as a product or service with fundamental characteristics that allow its insertion in a given market, thus enabling its commercialization. The order-winning objectives are the characteristics that enable the product / service to attract new customers (MEREDTH and SHAFER, 2002). Thus, they emphasize that the qualifying objectives, when achieved, provide the satisfaction of the clients and when they are not well explored they lead to their dissatisfaction. In relation to order-winning objectives is intended to surprise the client and it may even lead to the enchantment.

After understanding the performance objectives, it is necessary to establish which will be priority in terms of improvement. Thus, the Matrix of Importance - Performance is presented. According to Slack (1993), the Matrix of Importance is necessary in the identification of priorities in the process of improvement of each competitive factor, highlighted by its importance of performance. From this, the matrix is divided into two correlated axes, in which the Y axis represents the performance of the competitors against the current stage of the company studied, while the X axis refers to the perception of the improvement for the customers. Figure 1 shows the importance-performance matrix.

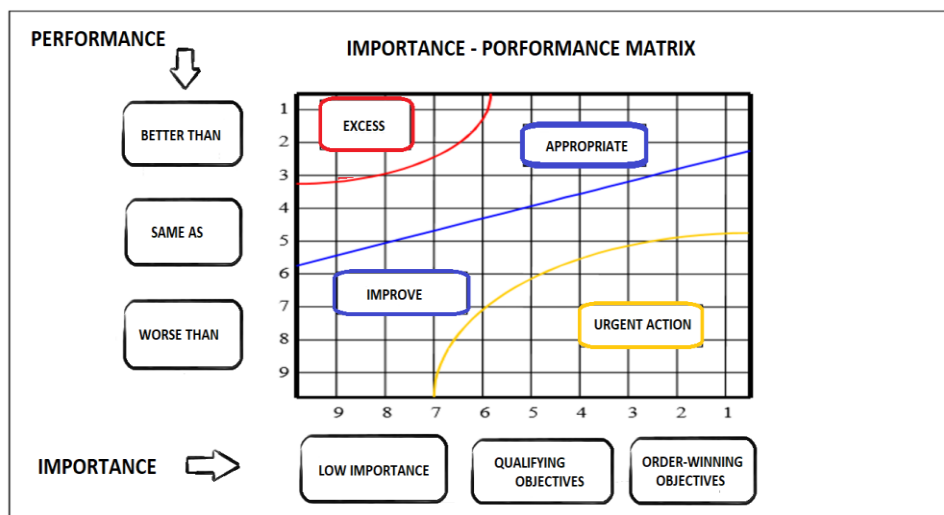


Figure 1 - Importance-performance Matrix.

Source: adapted from Slack (1993)

In this way the objectives are analyzed in four different areas. In the Excess area they place the performance targets of companies that perform better than their competitors, but are not important to consumers; The urgent Action zone addresses the objectives that customers evaluate as extremely important and that the company performs worse than its competitors and is considered a critical area; The Improvement spot refers to the potential to which the product has to be improved, in terms of performance objectives; The Appropriate zone is the ideal zone for a company to reach and establish.

Therefore, in view of the performance objectives analyzed, its positioning in relation to the X and Y axis are defined, allowing the analysis of the need for improvement to be established once the performance objectives have been identified.

2.1. SPMs

2.1.2. Mass Manufacturing x Current Mass Manufacturing

According to Corrêa and Corrêa (2010) the Mass Manufacturing was presented and applied by Henry Ford who used the concepts of the division of labour proposed by Adam Smith and the scientific management elaborated by Frederick Taylor on a large scale in the automobile industry. Meredith and Shafer (2002) find that Mass Manufacturing aims to reduce the unit cost of the product, using economies of scale and increased production capacity, from process standardization and interchange between parts. Zilbovicius (1999) points out

that mass production was consolidated due to the characteristics of the market at that time, which consisted of a predictable environment with stable products and low competitiveness.

Nowadays, changes in the market are perceptible when compared to the time in which the Mass Manufacture achieved its peak. However, Godinho Filho and Fernandes (2004) show evidence that Mass Manufacturing is still used. As an example, the researchers cite some Brazilian footwear companies that fall into this paradigm, being classified by these authors as Current Mass Manufacturing (CMM), since they do not present tools and concepts that can be related to any other paradigm addressed in the sections. Here, however, it is important to note that Mass Manufacturing has undergone some changes to adapt to the new demands of the market. Thus, the customers' demand for a certain degree of product differentiation (although there is no production environment with variety) stands out; the duration of the product on the market is not so long; and there is no longer a concern to delimit vertical integration;

In this way, it is possible to analyse the Current Mass Manufacturing through the order-winning and the qualifying performance objectives, as Table 1 suggests.

Table 1 - Performance objectives of the Current Mass Manufacturing.

Order-Winning Objectives	Qualifying Objectives
Quality 2 (approaches and value)	Quality I (user approaches, value and production) Flexibility I

Source: adapted from Godinho Filho (2004)

Table 1 shows that quality can be both an order-winning and qualifying objectives, modifying only its emphasis. In the first, the approach focuses on the user and added value. However, in the second, besides user and value, is also covered production. Still, the flexibility I is present in the qualifying objectives.

2.1.3. Lean Manufacturing

Lean Manufacturing came into existence in the mid-1970s and was established at the Toyota Motor Company in Japan. Its main goals are fostered in continuous improvement and maximum waste reduction (CORRÊA and CORRÊA, 2010). Still, according to Slack, Brandon-Jones and Johnston (2015), this paradigm seeks to align demand with production, in which customers dictate the pace of production. For this, the total participation of employees and work teams is explored. In this way, Lean Manufacturing concepts and tools seek to assist in the implementation of this strategic paradigm, facilitating internal communication among employees, reducing production time and costs. Thus, due to the various advantages proposed by Lean Manufacturing, this paradigm has been adopted by several companies in the world. Table 2 shows which objectives are used by this strategic paradigm.

Table 2 - Lean Manufacturing Performance Objectives

Order-Winning Objectives	Qualifying Objectives
Quality	Flexibility I Productivity

Source: adapted from Godinho Filho (2004).

From Table 2, quality can be highlighted as the main performance objective of this strategic paradigm, with the Flexibility (although small) and high productivity (referring to the cost of production) as qualifying objectives. Womack and Jones (2004) note that only with knowledge about Lean Manufacturing is not enough to deploy it; It is necessary to seek the full support of all members of the company, from the top management to the employees.

2.1.3. Responsive Manufacturing

Responsive Manufacturing emerged in the late 1990s and is a paradigm that has been deployed in several companies in the United States. In Brazil, this concept is recent, but there is already research work in this area (ANDRADE et al., 2011; SAES; GODINHO FILHO, 2010) that demonstrate that this paradigm can be applied in Brazilian companies providing many benefits, such as lead time reduction. According to Godinho Filho and Fernandes (2004), Responsive Manufacturing is applicable to the market in which customers consider as decisive buying factor the time and are willing to pay more for the faster consumption of the product.

For this work, the Responsive Manufacturing is treated as a synonym of QRM (Quick Response Manufacturing), since the concepts used here follow the same argumentative line. According to Suri (2010), QRM is a paradigm that approaches methods and tools that reduce lead time in all areas of the company, not only limited to production but also reaching office operations.

The Center for Quick Response Manufacturing at the University of Wisconsin - Madison (2016) points out that the occurrence of long lead times corresponds to high costs for the company whose values can reach four to five times the costs related to work. Suri (2010) notes that reducing lead time results in lower production costs and shorter lead times for the customer. Therefore, Godinho Filho and Fernandes (2004) highlight the performance objectives on which this strategic paradigm is based.

Table 3 - Performance Objectives of the Responsive Manufacturing.

Order-Winning Objectives	Qualifying Objectives
Flexibility 2 Punctuality Speed	Flexibility I Customization Ability Quality 2 Productivity

Source: adapted from Godinho Filho (2004).

Table 3 presents the responsiveness of the system (composed of flexibility, punctuality and speed) as the main factor of achievement of customers. Thus, responsiveness, as an order-winning objective, seeks to find the lowest possible lead time between the order made by the customer and the delivery of the product to the customer. Regarding the qualifying objectives, flexibility, customization ability, quality 2 and productivity are related to the existing market needs that this strategic paradigm can encompass in order to achieve the loyalty of its consumers.

2.1.1.4 Agile Manufacturing

The concept of Agile Manufacturing (YUSUF; SARHADI; GUNASEKARAN, 1999) emerged in 1991 in the United States, by a group of scholars from the Institute of Icocca at Lehigh University. According to Sharifi and Zhang (1999), this strategic paradigm stems from changes in market perspectives, which was previously dominated by economies of scale, whose main figure was Taylor, founded by the scientific administration, and now is instituted by the economy of scope driven by the continuous evolution of customer needs.

Thus, this strategic paradigm (GODINHO FILHO; FERNANDES, 2004) is characteristic of highly unpredictable and fickle markets, where customers demand different requirements and changeable in a short time. Thus, Agile Manufacturing's goal is to provide survival conditions for companies to succeed in environments of frequent and unexpected changes. Table 4 below summarizes the main performance objectives found in this strategic paradigm.

Table 4 - Performance Objectives of the Agile Manufacturing

Order-Winning Objectives	Qualifying Objectives
Agility	Speed Punctuality Quality 2 Productivity

Source: adapted from Godinho Filho (2004).

It can be noted from Table 4 that the Agile Manufacturing aims to gain agility. Slack, Brandon-Jones and Johnston (2015) address the concept of agility as the company's ability to meet market demands for its products, seeking to respond quickly and flexibly. Therefore, agility is related to the speed of adaptation presented by the company in relation to the high degree of changes and variations presented by the market where it is inserted and by the capacity to transform this situation into a competitive advantage. Regarding the qualifying objectives, Agile Manufacturing covers speed, punctuality, quality 2 and productivities as determining factors.

2.1.5. Customization in Mass

Mass customization was proposed in 1987 by Stanley Davis in his book "The Perfect Future". In this book the author proposes a new approach, in which companies offer highly customized products and services, with a high volume of production and low price. According to Godinho Filho and Fernandes (2005), this paradigm is applicable to markets in which customers request differentiation in products, being this differentiation exploited as a competitive advantage by companies. One of the approaches to identifying and attending to this "customization" is the insertion of the customer throughout the stages of the production system. Feitzinger and Lee (1996) note that the key to the success of this paradigm is to allocate customization as close as possible to the end of the production system, to standardize as many processes as possible.

Within the context of Mass customization, Royer (2007) points out some advantages such as greater degree of trust and loyalty; ease in determining the quantities and components of the product and reducing the inventory level; reducing the risk of product obsolescence; and the possibility of reducing the unit price of the product in the short time, since the knowledge about its manufacture is known.

Amato Neto (2001) presents the existence of companies that have reached a high level in the field of this strategic paradigm that have allowed them to produce a considerable quantity of products with prices compatible with those reached in the strategic paradigm of Mass Manufacturing. Table 5 shows the performance goals found in Mass Customization.

Table 5 - Mass customization performance goals

Order-Winning Objectives	Qualifying Objectives
Flexibility I Flexibility 2 Customization Ability	Speed Punctuality Quality 2 Productivity

Source: adapted from Godinho Filho (2004).

Godinho Filho and Fernandes (2004) emphasize customization ability as the main performance goal of this paradigm. This performance objective is to identify the requirements of the customers and to adapt them within a limited product mix, being composed of flexibility (short and long term) and adaptability. The qualifying objectives of this strategic paradigm are speed, punctuality, quality and productivity.

There are studies related to the implementation and use of Mass Customization in Brazilian companies (MACHADO; MORAES, 2009) to adapt products to the requirements of customers, while remaining competitive in the market.

III. METHODOLOGICAL APPROACH

The development of this work is based on the logical argument, involving the literature review regarding SPMMs, its key-elements and manufacturing strategies proposed by Godinho Filho and Fernandes (2004). Also, based on the methodological approach, it should be emphasized that the present work performs multiple case studies, encompassing four companies (GANGA, 2012; MARTINS; MELLO; TURRIONI, 2013). The purpose of the study was to identify the SPMMs used, the ideal for each company researched, as well as to identify the reasons that led to the choice of the current SPMM being used or the reason why some companies chose not to use any of them.

The methodology used to carry out this research is divided into three sets of actions. These actions are feasible through the application of two questionnaires. In relation to Questionnaire 1, proposed by Godinho Filho and Fernandes (2004), was divided in two parts. The first part sought to evaluate the degree of market turbulence in which the companies are, containing 23 questions, in which values were assigned between 1 and 10. The sum of the values will represent the degree of turbulence, as well as the corresponding strategic manufacturing paradigm, as shown in Table 6.

The second stage of Questionnaire 1 was aimed at identifying which performance objectives are required by the consumers, as well as the performance of the companies studied in this aspect through their competitors. Once these performance objectives are identified, the evaluation is performed to identify which of these should be prioritized, based on the importance-performance matrix (Figure 1). After performing the two steps of Questionnaire 1, the results are confronted to identify the ideal SPMM.

Table 6 - Relationship between strategic paradigms with performance objectives and market turbulence.

SPMMS	Performance Objectives	Market Turbulence				
		Low (0-45)	Low-Average (46-91)	Average (92-137)	High-Average (138-183)	High (184-230)
Current Mass Manufacturing	Cost	X				
Lean Manufacturing	Quality	X	X			
Responsive Manufacturing	Responsiveness		X	X		
Customization in Mass	Customability			X	X	
Agile Manufacturing	Agility				X	X

Source: Adapted Godinho Filho and Fernandes (2004)

With the information obtained by the first part of Questionnaire 1, it is possible to classify the degree of market turbulence into 5 categories (low, medium-low, medium, medium-high and high). As can be seen in

Table 6, each strategic paradigm stands out in two different categories. Thus, the second part of Questionnaire 1 provides a second result from the evaluation of performance objectives using the importance-performance matrix (Figure 1) as the basis for analysis. The degree of importance will be defined by means of the area in which the performance objectives are found, being considered more important the objectives located in the urgent action area and the less important ones in excess. In the end, the results obtained will be confronted and the ideal SPMM will be defined.

Pertaining for this purpose, during the development of this study, a second questionnaire was formulated containing 10 subjective questions, to explore and understand the reasons that led companies to use their current paradigms, and to identify the implementation phase and the degree of satisfaction of their strategic paradigms in their productive systems.

Regarding the reliability of the information, each company representative responsible for completing the questionnaires was required to hold a management position.

IV. PRESENTATION OF RESULTS

The determination was made through evidence presented by each company surveyed, benefiting from aspects such as number of employees, year of foundation, sector and so on.

From the data collected through the application of the first part of Questionnaire 1 it was possible to identify the drivers, that is, the degree of market turbulence in which this company operates. The second part of the Questionnaire had the purpose of classifying which performance objectives most influence consumers in relation to the purchasing decision process. In addition, this questionnaire sought to identify the position of the company in relation to its competitors, in accordance with the production performance goals.

4.1.1 Company A

Company A has as its main product refrigerators (white line), operating in Brazil and in three other countries. This was founded in 1966 and, the time of the research, it had 600 employees, being classified as a large company. The average annual production is 250,000 refrigerators. Based on the responses from questionnaire 1 the following results were obtained (Table 7):

Table 7 - Results of Questionnaire 1 regarding Company A

Company A	Questionnaire 1	SPMMs
Market Turbulence (Part 1)	Average	Responsive Manufacturing and Mass Customization
Performance Objectives (Part 2)	Customization ability e Quality	Mass Customization and Lean Manufacturing

In relation to the market turbulence (Table 6), Company A recorded 130 points, classified as medium turbulence, according to the parameters presented in Table 7.

Regarding production performance goals, and based on Figure 1, it was possible to identify the goals of punctuality, agility and cost in the appropriate zone. In relation to the objectives of quality and reliability, these are in the improvement zone, in which they were assigned a degree of importance 1 in relation to the evaluation of the clients and 3 in relation to the competitors for both.

Although the flexibility goal is also located in the improvement area, this was classified by the company as being less valued by its customers (grade 8 in the Likert scale) and this objective towards its competitors are approximately the same (grade 6 in the scale). For this reason, this performance goal was not prioritized. No performance targets were found in urgent action and excess.

The evaluation of the market turbulence presented a medium degree, in which the paradigms Responsive Manufacturing and Mass Customization fit better. However, about the performance objectives, quality and customization ability were identified as being of paramount importance, which are in improvement in the importance-performance matrix, whose strategic paradigms appropriate to these are Lean Manufacturing and Mass Customization respectively. Thus, the strategic paradigm identified as being ideal for Company A is Mass Customization, since this is the common classification of turbulence and performance objective.

In addition, this choice can be justified by the goal of Mass Customization, which includes customization ability as an order-winning objective and quality as a qualifying objective, in addition to being appropriate to the market that the company operates. Other reasons that led to the choice of SPMM as an ideal were the characteristics of the market pointed out by the interviewee, which highlighted the rapid change in customer needs and competition being based on product differentiation.

Moreover, the interviewee presented the differentiation of some characteristics of the product, such as painting, size and the insertion of adhesives, besides a reasonable degree of flexibility in relation to its customers as a key factor in the company's business.

The strategic paradigm that is being used by Company A is Lean Manufacturing. According to the interviewee, the reasons for this decision were the external pressures on its competitors, in which some of them were already using the strategic paradigm. Another external reason presented by the interviewee was consumer pressure in relation to the reduction of the price of the final product to a higher level of quality. Regarding the internal reasons pointed out by the company for the use of SPMMs, the possible benefits of reducing the cost of production and logistics, as well as increasing productivity and the level of product quality are presented.

Regarding the implementation of the strategic paradigm, in the period in which the research was carried out, the Company was in phase of execution of the tools, aiming the elimination of the wastes within the productive system and increase the efficiency of the factory. When questioned about the level of knowledge of the group of decision makers and who are applying the current strategic paradigm in relation to the SPMMs (on a scale of 10), 8 was assigned the level of knowledge about Lean Manufacturing. However, low values were attributed to the other four strategic manufacturing paradigms (between 1 and 3), which implies a superficial level of knowledge of the tools, concepts and strategies that compose them.

As for the compatibility of the stipulated results during the implementation of the Lean Manufacturing project with the hitherto achieved, the interviewee argued that there is still much progress to be made, however, the benefits obtained so far have been satisfactory.

4.1.2 Company B

Company B is medium-sized, being a consolidated company in the national market, having three production units in Brazil, working in the apparel sector. Company B has been presented in this city for more than 15 years, with 100 employees and an annual production of approximately 1,400,000 pieces.

From the sum of the 23 questions, a value of 154 points was recorded, being classified with a degree of medium-high turbulence. Regarding production performance objectives, it was possible to discriminate the variety and cost objectives in the appropriate zone.

The agility objective was pointed out as having little influence in the decision-making process of its clients (grade 8 on the scale) and this objective towards its competitors are approximately the same (grade 6 in the scale) since product diversification is directly linked to small changes in the product, not implying drastic changes in the production system.

Regarding the objectives of adaptability, speed and punctuality, these are in the improvement zone, in which they were assigned a higher degree of importance (1 in the Likert scale) before the clients' evaluation and 3 in what refers to their main competitors for both. No performance targets were found in urgent action and excess. The summary of results is given in Table 8.

Table 8 - Results of Questionnaire 1 regarding Company B

Company B	Questionnaire 1 -	SPMMs
Market Turbulence (Part 1)	High-Average	Agile Manufacturing and Mass Customization
Performance Objectives (Part 2)	Customization ability, Speed and Punctuality	Responsive manufacturing and Mass Customization

Through the evaluation of the drivers, it was possible to characterize the degree of market turbulence as being medium-high, in which the strategic paradigms that best respond to this market condition are Agile Manufacturing and Mass Customization. However, taking as a parameter the performance objectives, speed, punctuality and customization ability were characterized as being of paramount importance, whose strategic paradigms that include them are Responsive Manufacturing and Mass Customization. Thus, the SPMMs identified as being ideal from the two results achieved was Mass Customization, since it includes customization as an order winning objective, as well as speed, quality and punctuality as qualifying objectives, as well as being suitable for market that the company operates.

Other points identified through the application of the first part of Questionnaire 1 that would justify the choice of this strategic paradigm were the competition directed by means of the differentiation and the rapid change of the needs of the clients in relation to the characteristics of the product. Still, as a justification, the interviewee argued that quality is of paramount importance through its customers since products with a low level of quality could lead to dissatisfaction among customers.

The SPMMs used by Company B was identified as Lean Manufacturing. According to the interviewee, this strategic paradigm of manufacturing has been used since the plant's inauguration, being in the final phase, that is, the strategic paradigm is totally implanted in the factory. The reasons given by the interviewee that would justify this decision were the internal pressures (financial sector) for the reduction of production costs without there being a lag in the quality of the product.

Regarding the level of knowledge of the manager in relation to Lean Manufacturing, this was given a maximum grade, implying that he is a specialist in the interpretation and application of tools and concepts related to this strategic paradigm. In relation to the other SPMMs, the level of knowledge was considered as medium (4 to 6), implying knowledge of only some concepts and tools, but with some degree of lag in the application of these.

When asked if there would be a possibility of abandonment or change by another strategic paradigm, the interviewee argued that the improvement results presented by the project with those achieved so far were more than satisfactory and that the exchange for another SPMM would only occur if there was an extreme need, for market behaviour to which the company is embedded (competitors, consumers or legal aspects).

4.1.3 Company C

Company C is characterized as being small, located in this city. It operates in the food industry (producing cakes and ice cream). The company currently has a staff of 30 employees.

From the sum of the 23 questions, a value of 89 points was reached, being classified with a degree of medium-low turbulence. Regarding the production performance objectives, it was possible to point out the flexibility objectives in the appropriate zone and cost in the excess zone. Thus, the cost objective was pointed out as having less influence in the decision-making process of its clients (grade 6 in the scale) and this objective towards its competitors is much more superior to them (grade 1 in the scale). The objectives customization ability and velocity are in the improvement zone.

The quality and punctuality performance objectives are in the urgent action area, in which they were assigned a greater degree of importance (1 on the Likert scale) in relation to the evaluation of clients and 5 in relation to their main competitors. Table 9 shows the results obtained through the application of Questionnaire 1.

Table 9 - Results of Questionnaire 1 regarding Company C

Company C	Questionnaire 1	SPMMs
Market Turbulence (Part 1)	Low-Average	Lean Manufacturing and Responsive Manufacturing
Performance Objectives (Part 2)	Pontuality and Quality	Lean Manufacturing and Responsive Manufacturing

It is possible to conclude from Table 9 that the strategic paradigms that would fit best in this contextualisation of the market are Lean Manufacturing and Responsive Manufacturing. In addition, when considered the parameters obtained through the analysis of the performance objectives, quality and punctuality (since they belong to the urgent area of action) were characterized as of great importance, whose strategic paradigms that encompass them are Lean Manufacturing and Responsive Manufacturing.

As can be seen, when confronted with the two questionnaires, both presented the same results about possible strategic paradigms ideal for their productive system. However, when evaluating the answers obtained in determining the degree of market turbulence pointed out by the interviewee, it is possible to highlight as main characteristics the high degree of stability of demand; the ease in determining customer needs; the high price influence in relation to customers; as well as the high level of product quality required by customers. From this information, it is possible to conclude that the SPMMs that will fit best is Lean Manufacturing.

According to the interviewee, the SPMMs used by Company C is Current Mass Manufacturing. The implementation of this strategic manufacturing paradigm began in the first half of 2010 and the justifications presented by the same for the use of this SPMM were aimed at meeting the needs of consumers, as well as aiming for increased productivity. In the period in which the research was carried out, this strategic paradigm is in the execution phase.

Also, in relation to the level of compatibility between the project improvement perspectives previously defined with those achieved so far, the interviewee mentioned that most of the stipulated goals were achieved. Another justification presented for the use of the current SPMM is the lack of knowledge about other strategic paradigms of manufacturing, regarding the possible benefits that such paradigms can bring to the company.

When asked about the level of knowledge of the group in relation to the SPMM, the interviewee presented a great deal of knowledge about the Current Mass Manufacturing and the Agile Manufacturing (which were assigned grade 7 for both), intermediate knowledge regarding Lean Manufacturing and low knowledge about the other SPMMs. When questioned about a possible future exchange of the current SPMM, the interviewee argued that there are already projects for the implementation of the Lean Manufacturing in the company, in which it aims to reduce the stock levels of some products of the company.

4.1.4 Company D

Company D is a microenterprise manufacturer of food products, located in this city and active in the national market since 2001. This company currently has ten employees. No further information was provided about this company.

Based on the summation of the 23 questions, it was possible to count a value of 56, being classified in the degree of turbulence as being medium-low. Through the analysis of the performance objectives, it was possible to indicate punctuality, speed and flexibility in the appropriate zone. The agility and customization ability objectives were classified as having little influence in the decision-making process through their clients (grade 9 in the scale) and this objective towards their competitors are approximately the same (grade 5 and 6 respectively in the scale).

This can be justified in relation to the production system used, since the agility to adapt to the new requirements of the market is rarely required and, when demanded, do not have high degree of complexity. Still, the products do not have significant degree of customization in relation to their consumers. Regarding the quality and cost objectives, these are in the improvement zone, in which they were assigned a degree of importance 1 in relation to the clients' evaluation and 3 in what refers to the competitors for both. No performance targets were found in urgent action and excess. The results obtained from these analyses are shown in Table 10.

Table 10 - Results of Questionnaire 1 regarding Company D

Company D	Questionnaire 1 - Results	SPMMs
Market Turbulence (Part 1)	Low-Average	Lean Manufacturing and Responsive Manufacturing
Performance Objectives (Part 2)	Quality and Cost	Lean Manufacturing and Current Mass Manufacturing

The strategic paradigms that best respond to this market condition are the Lean Manufacturing and the Responsive Manufacturing. On the other hand, starting from the defined parameters of the performance objectives, cost and quality were found to be of paramount importance, whose strategic paradigms that more closely adhered to these goals are Lean Manufacturing and Current Mass Manufacturing.

Thus, the SPMM identified as ideal (from the two results obtained from the analyses of part one and two of Questionnaire 1) was Lean Manufacturing, since this was pointing in both questionnaires as being possible. Furthermore, this includes the quality objectives as the order-winning objective of the request and has a strong motivation to reduce costs (through the reduction of waste). According to the interviewee, quality is extremely important in relation to its customers, once it is a food product, in which products with a low level of quality could lead to possible damages to the client's health.

Other factors that would support this decision are the high influence of price and quality on the decisive buying process by the customer. Still, changing consumer needs is slow and the product life cycle is long, being characterized as basic need.

According to the interviewee, although there is no SPMMs in its specific production system, the production strategy used so far has brought satisfactory results. When questioned about the level of knowledge about the SPMMs addressed in this study, the interviewee reported having superficial knowledge about all manufacturing strategic paradigms, with values between 1 and 4 being assigned.

When approached the possibility of adopting some strategic paradigm, the interviewee argued that although they do not have a SPMM defined within their productive system, the company has already been applying some quality tools that have provided substantial improvements to the production process. Thus, the insertion of some strategic paradigm would only be justified by a possible drastic change in the market or the need of its clients.

V. ANALYSIS AND DISCUSSION OF RESULTS

Table 11 shows which SPMMs are being used by the companies studied, as well as which strategic paradigm has been identified as being most appropriate for the current conditions presented by the companies, through the identification of market conditions and established performance objectives.

Table 11 - Summary of results obtained

Company	Size	SPMM (Current)	SPMM (Ideal)
Company A	Large	Lean Manufacturing	Mass Customization
Company B	Medium	Lean Manufacturing	Mass Customization
Company C	Small	Current Mass Manufacturing	Lean Manufacturing
Company D	Micro	Undefined	Lean Manufacturing

As can be seen in Table 11, Company D chose not to use any SPMM, while Companies A, B and C opted for the use of one of the strategic paradigms. However, companies are using a strategic paradigm considered not ideal for the market conditions in which they are inserted.

According to the results obtained, it was possible to note that none of the four companies surveyed use the ideal SPMM defined by the model proposed by Godinho Filho and Fernandes (2004). Thus, possible justifications can be pointed out based on Company A, B, C and D.

Therefore, the reasons why small, medium and large companies are using the strategic paradigms may be due to the possible degree of complexity of their production systems, which in general demand a high level of management, both personnel and material. Thus, if a well-defined production planning and control model was not adopted, the chaos within the company could settle, since the production orders could be poorly defined and interpreted; the sequence of production would be based on the randomness of the operators; it would be more complicated to meet customer needs among other factors.

According to Iarozinski Neto and Cancigliieri Junior (2004), the complexity factors of a productive system can be classified into four groups: variety, unpredictability, uncertainty and interrelationships. Thus, the use of strategic manufacturing paradigms as well as the application of quality tools has been used to facilitate the interactions between individual, material, machinery and information, as well as to minimize the internal and external uncertainties that influence the productive system.

In the case of the companies A and B studied, several reasons could have influenced the choice of Lean Manufacturing. One of the reasons that can be highlighted is the high degree of knowledge, support and adherence that the Lean Manufacturing has in the Brazilian scenario, since there are several courses of specialization in this area. Since this SPMM is consecrated worldwide (considering the other SMMS(s)) and because it is a complete philosophy and its use can be extended beyond the company's production system (CORRÊA and CORRÊA, 2010). Other characteristics that would justify its use according to Holland (2014) would be the incessant search for the elimination of any waste inside the productive system, by quality tools and continuous improvement programs.

Regarding other possible factors that influenced the choice of this strategic paradigm would be the lack of deeper knowledge about the other SPMMs, as well as the environment that each of them responds better, since the managers interviewed generally have superficial knowledge about the concepts and tools encompassed by the other strategic paradigms, as well as the intrinsic benefits that each can offer. This can be justified because these strategic paradigms have been developed in foreign countries and are relatively new, what would require more time for the adaptation, application and collection of these results in the Brazilian scenario.

In relation to Company C, what may justify the use of Current Mass Manufacturing would be the focus on productivity, since among all the SPMMs addressed, this strategic paradigm is the one with the highest level of production of goods, providing a certain degree of quality in relation to value added by the user, also covering production. However, it is observed that the company presents some degree of flexibility in production (GODINHO FILHO; FERNANDES, 2004). Thus, this strategic paradigm stands out in environments in which competition prevails at cost and in which the market requires a certain level of quality and a stable market.

Among the companies addressed, the only one that did not adopt any strategic manufacturing paradigm was Company D. As previously shown, this is a microenterprise. As a result, the company presents peculiar characteristics in its productive system when compared to the small, medium and large companies, as shown in Table 12.

Table 12 - Characteristics of companies A, B, C and D.

Features	Company A	Company B	EMPRESA C	Company D
Size	Large	Medium	Small	Micro
Productive System (Complexity)	High	Intermediate	Intermediate	Simple
Estrategy	Just in Time	Just in Time	Just in case	undefined
Employees	600	100	30	10
Tools Used	According to SPMM used	According to SPMM used	According to SPMMS used	Quality Tools

Table 12 shows the characteristics found of each company, through the research carried out. From this information, it is possible to conclude that there are some characteristics in common between companies A, B and C, differently compared to Company D. An important characteristic that may explain the use of no PEGEM is the level of complexity of the productive system. The companies that presented the use of some strategic paradigm have a productive system that is more complex and difficult to manage.

Therefore, the choice of the use of a SPMM, together with its concepts and tools, helps in the aid and application of management in the production. Regarding microenterprise, it presents a less complex productive system, since it has few employees, machinery and tools to manage. Even though Company D does not have a defined SPMM, it makes use of quality tools in order to reduce waste and thus reduce the cost, also improving the level of quality in production, according to the interviewee.

As it was possible to identify through the research carried out, Companies A, B and C presented the use of non-ideals paradigms, according to the model proposed by Godinho Filho and Fernandes (2004). Regarding the companies A and B, the SPMM that these companies currently use are Lean Manufacturing, and the ideal

strategic paradigm identified for these companies was Mass Customization. In this way, it will be presented possible reasons that would justify the possible change of SPMM for the adoption of Mass Customization.

As mentioned by the respondents of Companies A and B, the product's suitability has been a differential through its consumers and competitors. Taking this into account and according to Gardner (2009), the main feature that makes Mass Customization stand out in the current scenario is to have configurable products (according to the needs of customers) at a relatively low price.

Another relevant point for the use of this strategic paradigm is presented by Royer (2007), who points out some advantages in the use of Mass customization as the predetermination of the products by the clients, which facilitates in the identification of the quantities of components in which the product must have the stock level. Moreover, this strategic paradigm allows for greater proximity and interaction with the customer, allowing the customer's needs to be easily identified and the customer more accessible in relation to the factory's production system, which would lead to greater confidence as a product. Other benefits provided by this SPMMs are the reduction of the risks of obsolescence of the products, due to these being made-to-order, and the reduction in a short time of the unit price of the product, since one already has the knowledge about its manufacture.

As can be seen, Company D was the only company not to use any strategic manufacturing paradigm. When applied to the methodology used in this study, it was possible to identify Lean Manufacturing as the ideal SPMM for companies C and D.

Despite the advantages already presented on Lean Manufacturing, as a reduction of waste and a cleaner and more organized work environment, this strategic paradigm allows the company to strengthen itself in the market to which it is inserted, providing reduction costs and raising the level of product quality.

At this point, it is observed that the fact that Company D has a small number of employees does not justify the use of any of the SPMM, since all companies have a well-structured planning and management system, being defined by means of theoretical models and scientific arguments, or even simple strategies that usually occur in the owner's head (Curran 2004, Leone 1998).

According to Pirasteh and Fox (2014) there are several factors that make companies give up implanting a strategic manufacturing paradigm as the initial high cost of training employees to execute the concepts and tools within production. Another factor mentioned by the authors is the companies' concern about the time needed to implement the strategic paradigms, as well as the return on invested capital.

According to the interviewees, cultural change is the most difficult and crucial factor to be achieved. According to them, this is due to cultural change within the company suffering resistance through their employees and, for this change to occur efficiently and durably, large amounts of effort, resources and time are required. Other factors such as training, adequacy of the productive system and limited quantity of resources were pointed out as factors that made it difficult to implement the current strategic paradigm.

This situation is accentuated in companies C and D, due to their size to the number of employees. This finding is supported by the studies by MORAES (ESCRIVÃO FILHO, 2006; SAFSTEN; WINOTH, 2002; BARNES, 2002) that affirm that issues related to the presence of family members in management positions, informal planning activities (face -to-face) among other characteristics, potentiate these challenges when compared to large and medium-sized companies.

With regard to the change of a strategic paradigm that is being applied within the company on the other, it is possible to reuse the knowledge, methodologies and tools that are derived from the current strategic paradigm and that have demonstrated benefits for the company and apply with the new concepts and techniques used by the new paradigm to be adopted, reducing the amount of money invested in training and making possible the faster and more effective application of the new SPMM, due to the experiences learned previously (SPROULL, 2009; PIRASTEH and FOX, 2014).

VI. CONCLUSION

To apply the theoretical model of Strategic Paradigm for Manufacturing Management, adaptations were inserted through changes / adequations in the questionnaires proposed by Godinho Filho and Fernandes (2004), aiming to point out the reasons that led the companies in this study to choose their SPMMs.

After the questionnaires were executed and analysed it was possible to find satisfactory answers regarding the questions that motivated the completion of this paper. Regarding the question about which strategic manufacturing paradigms are being used in the study city, it was possible to identify the predominance of Lean Manufacturing, found in companies A and B. It was also possible to point out that there are companies that do not use a defined strategic paradigm.

Although Company D does not use a SPMM, it does use some quality control and improvement tools, which may indicate a future trend towards the use of a strategic paradigm. Company C already enjoys Current Mass Manufacturing, which has some differences in relation to Fordist Mass Manufacturing, such as the degree

of differentiation of the product demanded by consumers, reduction of product longevity in the market and lack of concern about the vertical integration delimitation as enumerated by Godinho Filho and Fernandes (2004).

Regarding the questioning of whether the strategic manufacturing paradigms in which firms are using are in fact ideas for them, the model elaborated by Godinho Filho and Fernandes (2004) was applied, which considered the required performance objectives by the customers, as well as the positioning of the company on this through its competitors and the degree of market turmoil. In this way, it was possible to infer that no company is using the strategic paradigm identified by this methodology. This may be due to the cultural and economic characteristics of an emerging country in which the study was carried out, specifically in a region that recently started its industrial growth process (DE OLIVEIRA, 2008; IBGE, 2000), and that the paradigms may be influenced by a fad. This information is based on the number of articles published in Brazil in the last two years that present case studies on implantation and studies of such paradigms, in which eight articles are related to Lean Manufacturing, while the other paradigms added have half published articles in relation to Lean Manufacturing (PORTAL DE PERIÓDICO CAPES / MEC, 2018).

Finally, the last question raised in this study refers to the reasons presented by the companies that would justify the use of their strategic paradigm, and the reasons why companies chose not to use any SPMM. Thus, the main reasons presented by companies that are using some strategic paradigm were the need to reduce production costs and increase customer satisfaction by improving product quality. This may be a result of the economic instability that is occurring in the country of study, due to the economic recession and political instability (PERONDINI, 2017).

Regarding future work, there are some lines of research that can be explored. The first one refers whether there is any tendency to use specific paradigms according to the size of the company, that is, if the level of complexity of the productive system, the quantity of employees and materials have relevance in the choice of SPMM. Also, if there are any future trends for the insertion of the other strategic paradigms within the Brazilian competitive scenario not encompassed by the SPMM, as is the case of Theory of Constraints, and what benefits they can bring.

The second line to be explored would be studies aimed at identifying which SPMMs would be better suited to the most predominant production systems found in Brazil, considering that Brazil is one of the largest producers of commodities in the world, accounting for 66% of total exports of the country (CASTRO, 2016). Finally, a more in-depth analysis is proposed of the differences in firms with regards to the minimum number of employees, to exploit the particularities of small and micro-enterprises in relation to averages and big ones.

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