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Strategic Groups and Competitive Priorities in Lean Production Environments: Challenges of Production Management

Resumo

Este artigo tem como objetivo explorar como as escolhas e implantações das práticas de produção enxuta são influenciadas por prioridades competitivas priorizadas pelas empresas no contexto da estratégia de operações. Foi analisado um conjunto de cinquenta e seis empresas da indústria de autopeças na região de Campinas e Jundiaí, divididas em quatro grupos estratégicos. Esses grupos de empresas, que adotavam orientações estratégicas semelhantes, foram usados para investigar as relações entre implantação de práticas de produção enxuta e escolha das prioridades competitivas. Os resultados sugerem que a consideração de grupos estratégicos pode melhorar o entendimento sobre a competitividade em aplicar as prioridades competitivas e como estas podem definir as práticas de produção enxutas adotadas pelas empresas de manufatura.

Palavras chave: Grupos estratégicos, produção enxuta, objetivos de desempenho.

Abstract

This paper explores how the choices and implementation of lean production practices are influenced by performance goals prioritized by firms in the context of operations strategy. We analyzed a set of fifty-six companies in the auto parts industry in Campinas and Jundiai region, divided into four strategic groups. These groups of firms that adopt similar strategic orientations were used to investigate the relationship between implementation of lean manufacturing practices and choice of performance objectives. The results suggest that consideration of strategic groups can improve the understanding of how performance objectives can define lean manufacturing practices adopted by manufacturing companies.

Keywords: Strategic groups, lean manufacturing, performance objectives

1. Introduction

Slack and Lewis (2009) state that the operations strategy can have a major impact on the competitiveness of companies, not only in the short term but also the long term, the dilemma is that when it comes to resources distributed across the enterprise and identification difficult in its totality. This is the paradox of operations strategy, meaning it is at the center of management, the strategic intentions of the company, and practices is vitally important to the success of the organization, however, it is so comprehensive that it is easy to underestimate its importance.

The structure and competitive strategies of the auto parts industry underwent deep changes in recent years, mainly due to diffusion in the automotive complex of a production model (lean production), which brings together new forms of organization, new management practices and intensive use of equipment automated. The central pillars of determining changes include restructuring the practices of manufacturers and the relationship between the latter and their suppliers, the acceleration of product innovation process and the creation of trade blocs.

The adoption of the production model through the implementation of lean production practices have contributed to the improved operating performance of many companies, but it has also brought some frustrations (WOMACK, JONES and ROOS, 2004). The question that arises is considering lean production as an operations strategy in the auto industry because not always achieved the performance levels expected when the deployment of their practices? What is the relationship between the implementation of lean production practices and performance improvements?

In this paper, we analyze how the implementation of lean production practices can influence the operating performance in the auto parts industry companies. As the implementation of these practices is rarely quantified using cross-section data type (Cua, McKone and Schroeder, 2001) used a quantitative approach supported by nonparametric statistics linked to the concept of strategic groups. According Bozart and McDermott (1997), strategic groups have received more attention in operations strategy research since being treated by Porter (1991) in his book "Competitive Strategy". The usefulness of strategic groups is manifested where there are many competitors, since it facilitates draw conclusions in the analysis of industrial sectors. In these analyzes precision is lost, since when we focus on what companies must like to put them in strategic groups, lost in the level of detail on what makes each company is different. But the benefit is that we can better understand what happens in the industry by focusing only on strategic groups.

The paper is structured in six sections. After this introduction, section two presents the theoretical framework, which focuses on the role of lean production practices in the general framework of operations strategies. The third section describes the methodology used, including the sample and the measures. Subsequently, the fourth section describes the analyzes, the fifth section discusses the results and finally the sixth section provides the conclusions and suggestions for future research.

2. Literature Review

2.1 Operations Strategies

It is extensive literature on the operating strategies, and for this paper consider both as some recent publications that although prints are classical for analysis of operating strategies. Initially developed by Skinner (1969) and most recently worked for Hayes and Wheelwright (1984), Platts and Gregory (1990) and Slack and Lewis (2009) seeks to show that there is no single way great for the businesses to operate its resources as believed Henry Ford. The two central elements in the table are the competitive priorities and the categories of decision, which the pattern of decisions that make up the production strategy have to be made (HAYES and WHEELWRIGHT, 1984). This basic structure for the operational strategy presented in 1984 is still used in research work as, for example, in Boyer and Lewis (2002). There is a high degree of agreement that the strategy of focusing operations on competitiveness: cost, quality, delivery and flexibility conform Dangayach and Deshmukh (2001), and then there is a debate about additional constructs.

However, the operations strategy is changing from a vision "market-based" to "resource-based" vision. The first view sees the operation as a fully adjustable system and focused to follow successfully the rules dictated by the markets, while the second view suggests that it is more profitable to focus on the development, protection and leverage the company's operating resources in achieving competitive advantage.

This paradigm shift began with evidence that high performance is mainly explained by the strength of the resources of a company, and not by the strength of its market position (RUMELT, 1984; WERNERFELT, 1984). The resource-based view has gained more importance since Prahalad and Hamel (1990) emphasized the link between core competencies and competitiveness. Unfortunately, the application of these concepts in real business strategies may have been insufficient (HAYES and PISANO, 1994). Even today, it is difficult to find companies that use the function operations as a competitive weapon. One reason is the difficulty to "operationalize" the contents of the operations strategy (HILL, 2000).

Although the theory of resource-based view has a clear call, there have been studies on the advantage based on resource within a more general network context, such as, view of theory based on extended features. This extended view assumes that the strategic resources that are beyond the company's boundaries emphasize intercompany relationships; an example is the development of highly effective supply chain Toyota (SLACK and LEWIS, 2009).

The decision of operations strategy, according to Slack and Lewis (2009), consider a set of decision areas such as capacity, supply chain, including purchasing and logistics, process technology, development and organization as familiar to managers in a wide variety of operations. Researchers involved in the Manufacturing Futures Survey has suggested that actions rather than decisions are to be included within the operational strategy (KIM and FROHLICH, 1994).

The utilization of lean production practices in the operations strategy is the decisions and how the actions of both and therefore can be an important part of the standard, though lean production practice does not necessarily can cover all the aspects that make up areas decision suggested by Slack and Lewis (2009). For example, location on issues are not described extensively in the literature on lean production and not a part of the practices suggested later. Still, the strategic operating model is a means by which companies should be able to improve their internal and external processes, which should lead to improved performance (BOZARTH and MCDERMOTT, 1997). The model of Slack and Lewis (2009) decision and performance targets areas is an appropriate framework for analyzing the implementation of lean production.

2.2 Lean Production Practices and Performance Objectives

Many papers have been published since the 1990s on the relationships between lean production and performance practices (DANGAYACH and DESMUKH, 2001). Generally, it was believed that the practices just in time lead to shorter lead times and lower inventories, and that the total quality management practices improve quality. The empirical studies carried out show that this relationship is not always true, however, very little has been done in relation to lean production as a concept, in order to validate or refute assertions about lean production practices and performance targets. Cua *et al.* (2001) mention some studies that consider the main pillars of lean production as JIT(Just-In-Time), TQM (Total Quality Management) and TPM (Total Productive Maintenance) together.

While researchers recognize the value of investigating the interrelated practices simultaneously (JIT, TQM and TPM), there are few results to provide an empirical examination of the joint implementation of TQM, JIT and TPM practices (WAKCHAURE *et al.* 2011).

Based on a review of the literature are considered as practical the three pillars of lean manufacturing, TQM, JIT and TPM. It is worth noting that the TQM pillar is very wide, including the product design relationships, supplier and customer, while JIT and TPM pillars have specific characteristics. The performance objectives, therefore, reflect the traditional competitive priorities, such as quality, cost, delivery time and the flexibility to volume changes.

Furllerton & Wempe (2009) analyzed the practices that best explain the performance differences in companies. This was done on two levels: together (TQM, JIT, TPM and common practices) and with

individual practice. The results showed that the JIT pillars, TPM and TQM were significant to explain the relationship between lean production and performance objectives. At the level of single practice, not all practices contributed to explain this relationship there, the relevant conclusion for this work that is more appropriate to consider the pillars of lean production JIT, TPM and TQM together to better understand them are influenced by the objectives of performance defined as priorities.

2.3 Strategic Groups

A strategic group is the group of companies that work with similar strategies. The industry analysis with strategic group concept assumes that a given company is not in competition with all others in the same intensity. Generally, an industry consists of several strategic groups, which add a set of companies that have similarities along several strategic dimensions, such as degree of specialization, which refers to the extension of the product line, brand image, usually based advertising and sales force, the choice of distribution channels: own, specialized or generalist distributors, product quality: in terms of raw materials used, specifications, technological domain: leader in adopting new technologies or imitate, the degree of vertical integration, the position in terms of costs, the extent of the proposed ancillary services, such as technical assistance, price policy, relations with the public authorities, which may be reflected in obtaining grants or submit the firm the regulations.

The companies of different features and capabilities relate the constitution of strategic groups to the possession, which enables some of them to carry out certain investments in mobility barriers. Companies are likely to adopt different strategies, even holding the same features and capabilities, if they have different preferences for the investment to be made and their positions relative to risk (SHORT 1994). Another factor that explains the difference between the business strategy is the historical evolution of the industry, since the costs of adopting a strategy tend to be lower for the first industrial companies, since as this develops, mobility barriers are strengthened by means of exogenous causes or as a result of the investments made by companies already established (CAVES & PORTER, 1977).

3. Methodology

The conceptual framework used in this research can be represented by the figure below. It is a simplified version of the operations strategy where companies are grouped into strategic groups according to their competitive priorities.

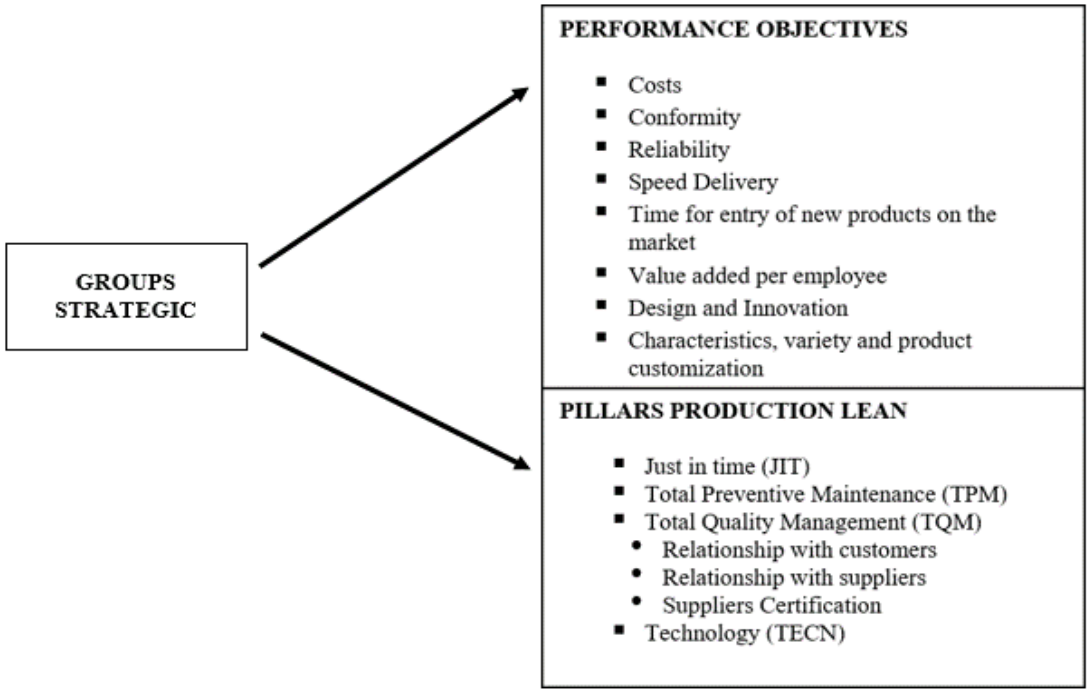

Figure 1 - Conceptual Framework

Two relationships are investigated, one being the relationship between strategic groups and operational performance, and other relations between strategic groups and degrees of implementation of the pillars of lean production (as summed scales). Due to space limitations for this paper, the link between the practices of lean manufacturing and operational performance are not investigated directly but by building relationships with strategic groups. The call is addressed indirectly.

3.1 Sample

A questionnaire was administered by the researchers in a group of fifty-six companies located in the region of Campinas and Jundiai in the months from March to October 2015. These companies are auto parts manufacturers and are grouped into six industries: metallurgical, mechanical processing, plastics, machinery and equipment, electrical and electronics and telecommunications.

The questionnaire consists of four categories of questions: contextual issues, questions about competing priorities, practical issues and issues related to the objectives performance, both current performance objectives and performance targets over the past five years. The performance objectives were considered: costs, quality, reliability, customer delivery speed, time to entry into the market of new products, value added per employee, design / innovation, product features, product variety and customization.

3.2 Measures

In this research was used Cronbach's alpha to estimate the reliability of the questionnaire used in this research. With it measured the correlation between the questionnaire responses by analyzing the answers given by the respondents, with an average correlation between questions.

The general rule used was that existing scales were exceed an alpha level of Cronbach 0.70. This is the case for the three pillars considered JIT, TPM and TQM. Compared to Cua *et al.* (2001), the JIT and TPM pillars have the same content as the TQM pillar was divided into TQM itself, Customer Relations (RCLI) Relations Provider (RFOR) and Supplier Certification (CFOR) for this search although the RCLI and RFOR have submitted Cronbach's alpha below 0.70. The "pillar"

technology (TECN) is not a pillar of lean production, but was included to check the influence of technology on lean production practices. These pillars and practices relating to each of them is shown in Table 1.

4. Data Analysis

Before describing the analysis of the data is necessary, introduce the results of another analysis that led to the formation of strategic groups. Four strategic groups have been identified, all significantly different in their most important competitive priorities. The companies received 100 points to distribute among a number of performance objectives, and this was the basis for the identification of groups. This process has been suggested a somewhat different way by Hill (2000) and used by Berry Hill and Klompmaker (1999). Strategic groups are named based on performance objectives considered important, as shown in Table 2.

This way, the strategic group A (GE-A) has a very high focus almost exclusively on cost. The strategic group B (GE-B) and strategic group C (GE-C) has an emphasis on quality and delivery reliability, but differ on the time to introduce new products on the market (strategic group B is dominant) and speed delivery (strategic group C is dominant). The strategic group D (GE-D) has an extra dimension to care: the aesthetics in their products. This is a new perspective, where customer and subjectivity of style and fashion changes can strongly influence the company's performance.

All tests for differences between strategic groups are not parametric. Parametric tests assume, among other things, the normality of the group populations and homogeneity of variance. In practice, these conditions are due to the central limit theorem, which generally requires the use of many cases (VIRGILLITO, 2006). Since this study was used a small amount of cases the assumptions for parametric tests are not necessarily true, which is why we used the nonparametric tests.

Table 1: Analysis Pillars and its lean production practices

LEAN PRODUCTION PILLAR	**LEAN PRODUCTION PRACTICES**	**CRONBACH'S ALPHA (α_C)**
J I T (α_C = 0,662)	1. Production Processes	0,610
	2. Cycle time reduction	0,571
	3. Agile Manufacturing	0,742
	4. Technical quick tool change	0,733
	5. Production systems focus on the factory	0,708
	6. Production flow JIT / Continuous	0,658
	7. System pulled / Kanban	0,754
	8. Bottleneck / Restriction Removal	0,523
TPM (α_C = 0,733)	1. Autonomous Maintenance	0,679
	2. Planning and scheduling maintenance	0,601
	3. Preventive maintenance or predictive	0,904
	4. Program security improvements	0,748
TQM (α_C = 0,707)	1. Formal programs of continuous improvement	0,570
	2. Quality Management Programs	0,794
	3. Total Quality Management	0,885
	4. Process capability Measures (CPK)	0,667
	5. Benchmarking	0,617
TECHNOLOGY (α_C = 0,720)	1. Systems of advanced planning and scheduling	0,630
	2. ERP Systems	0,741
	3. finite capacity scheduling	0,832
	4. Demand Management/Forecasting	0,678
RCLI	1. Continuous Replacement Program	0,771
	2. Customers participating in the product development	0,712

(α_C = 0,698)	3. Evaluation of the plant by the customer 4. Customer Satisfaction Survey	0,606 0,701
RFOR (α_C = 0,704)	1. Major suppliers make deliveries based on JIT 2. Stocks managed by the supplier 3. Suppliers take cost reduction commitment 4. Suppliers involved with development of new products	0,730 0,595 0,773 0,720
CFOR (α_C = 0,626)	1. Supplier certification program 2. Supplier evaluated based on total cost and not the unit price	0,680 0,572

One of the tests used was the Kruskal-Wallis test was used to compare three or more samples. It was used to test the null hypothesis that all populations have identical distribution functions against the alternative hypothesis that at least two populations have different distribution functions. This test was performed and revealed that the cost, quality, delivery reliability, speed of delivery, design and innovation and product characteristics differ significantly between the groups. The product time-to-market, product variety and customization of the product was not significantly different between groups.

Thus, the Kruskal-Wallis test showed that the strategic groups differ significantly from each other. Mann-Whitney tests, performed later, also showed that the groups differ in their performance objectives, that way, costs for strategic group A, quality and reliability for the strategic group B, reliability and speed of delivery to strategic group C and design and innovation for strategic group D.

Table 2 - Performance objectives rating in strategic groups

PRIORITY COMPETITIVE	**STRATEGIC GROUPS**			
	GE-A	**GE-B**	**GE-C**	**GE-D**
Cost				
Average	46,3	18,0	18,2	3,8
Classification	1	3	2	4
Quality				
Average	14,1	36,2	20,3	18,4
Classification	4	1	3	2
RELIABILITY				
Average	10,9	26,2	30,1	9,8
Classification	3	2	1	4
SPEED DELIVERY				
Average	11,4	7,3	20,1	3,2
Classification	2	3	1	4
PLACING TIME PRODUCT MARKETING				
Average	4,8	24,4	5,9	6,3
Classification	4	1	3	2
DESIGN & INNOVATION				
Average	8,8	12,8	5,1	41,9
Classification	3	2	4	1
PRODUCT CHARACTERISTICS				
Average	8,9	15,2	5,9	17,5
Classification	3	2	4	1
PRODUCT RANGE				
Average	10,9	15,1	6,2	20,1

Classification	3	2	4	1
PRODUCT CUSTOMIZATION				
Average	8,9	14,1	8,7	15,7
Classification	4	2	3	1

4.1. Strategic groups and performance

When we analyzed the role of strategic groups in the choice of priority performance goals a question appeared: Strategic groups alone can explain the choices of performance objectives?

To answer this question, it was necessary to show statistically significant differences between the groups and then back to attention to a more qualitative assessment. Table 3 shows the statistics.

The strategic group A has the lowest value added per employee than the other three groups. The strategic group D has the highest value added per employee among all groups. However, as revealed in Table 3, the D strategic group is in a vulnerable position because it the cost of the warranty, the customer the bounce rate and production costs increase significantly more than the other groups. Indeed, other groups experienced decreasing values of these three measures. One possible explanation for strategic group D to be very different from the others may be related to the fact that which increasingly customers are becoming more demanding with respect to the product design.

Table 3 - Significant differences in performance between strategic groups Mann-Whitney test. The letter in parentheses indicates the strategic group that has the highest value. Where there is no value there was no significant difference.

	GE-A x GE-B	**GE-A x GE-C**	**GE-A x GE-D**	**GE-B x GE-C**	**GE-B x GE-D**	**GE-C x GE-D**
Value added per employee in the year	0,056(B)	0,054(C)	0,164(D)	-	-	-
Warranty cost	-	-	0,011(D)	-	-	0,018(D)
Rate and rejection and customer	-	-	0,068(D)	-	-	0,153(D)
Production cost (without the cost of purchasing materials)	-	-	0,020(D)	-	0,043(D)	-
production cost (including the cost of purchasing materials)	-	-	0,091(D)	-	0,241(D)	0,072(D)

The fact that the strategic group A present an annual added value per employee very low indicates that it has a margin of contribution low, probably due to price competition, so this group has to focus on lower costs, then costs is a priority objective. Strategic Group A features a choice of well-defined performance targets compared with other strategic groups, as shown in Table 4. The group also gives a good degree of importance to the quality, but this importance is not as evident in other goals of performance.

The prioritization of cost performance and quality objectives, the strategic group A is as compensation against the speed of delivery and reliability. The strategic group B presents a greater degree of prioritization for quality, but in total, this group has the worst score. This group emphasizes quality and reliability, which is also, reflected in the choices of the chosen lean production practices. The strategic group C has its best prioritization distributed in the overall classification, but its emphasis is on speed of delivery and reliability. This strategic group shows a high degree of external adequation, so that he can deliver what the market wants quickly and reliably.

Finally, the strategic Group D features prioritization evidence in delivery speed, but in general, this group does not emphasize any of the performance objectives that are directly related to the lean

production practices, as shown in Table 4. The quality only seems to have a high degree of importance, but , it is the result of prioritization for design and innovation. Table 3 presents the strategic group D with significantly worse results than the other groups in terms of customer rejection rate. The data analysis shows that the rejection rate, instead other groups that have the quality its focus of action is due to the acceptance of the product design.

This can lead to the conclusion that is missing an adjustment in the choices of lean production practices by this group. However, this strategic group is new in the context of search configuration operations, has a strong emphasis on multifunctional performance objectives, and should therefore not be judged only because of degrees of priority of performance objectives. Still, the analysis of the performance objectives of this group indicates that it needs to improve its choices if you want the future to be able to sustain a high added value per employee.

Table 4 - Score for the classification of competitive priorities related to performance objectives. The points are based on the classification that each strategic group is the performance measure.

	GP-A	**GP-B**	**GP-C**	**GP-D**
COSTS				
1. Scrap and Rework	1	3	2	4
2. Warranty Cost	1	3	2	4
3. Quality Costs	1	3	2	4
4. Raw Material Inventory Turnover	1	3	2	4
5. Work in Process Inventory Turnover	2	3	4	1
6. Finished Goods Inventory Turnover	2	4	1	3
Average	**1,63**	**3,13**	**2,00**	**3,25**
QUALITY				
7. Finished Goods without rework	2	3	1	4
8. Defect Rate in the plant	3	1	4	2
9. Customer Rejection Ratio	2	1	3	4
Average	**2,33**	**1,67**	**2,67**	**3,33**
RELIABILITY				
10. Delivery Performance	4	2	1	3
Average	**4**	**2**	**1**	**3**
SPEED DELIVERY				
11. Purchase Lead-time	3	4	2	1
12. Production Lead-time	4	3	2	1
13. Sale Lead-time	4	3	2	1
Average	**3,67**	**3,33**	**2,00**	**1,00**

4.2. Strategic groups and Implementation of the Pillars of Lean Production

To analyze the implementation of lean production pillars of the strategic groups take based on the analysis of lean production pillars shown in Table 1, and the degree of implementation of these pillars in different groups. Various tests to measure the differences between the groups were performed. First a Kruskal-Wallis for differences between the groups, and then performed a Mann - Whitney test for differences between the pillars, seen individually, group by group. Finally, using Wilcoxon test was the deployment of lean manufacturing pillars is different in each group. The results are shown in Table 5.

The test Kruskal-Wallis showed no significance, which shows that all strategic groups should be considered as coming from the same population with respect to the lean production practices. This is a very different finding compared with the Kruskal - Wallis test the competing priorities of the strategic groups. The Mann-Whitney test for the different degrees of implementation of lean production pillars applied to the four strategic groups showed that strategic group A differs from strategic group C in their

degree of TPM implementation and differs from strategic group D the degree of implementation of TQM.

The Wilcoxon test for differences in the groups confirm that the groups have emphasized different pillars. For example, the strategic group A have a significantly higher degree of TPM deployment than most other pillars, while the strategic group B has a significantly lower degree of implementation of relations with the supplier (RFOR). Wilcoxon tests showing that the groups differ in who chose to apply, but it is not significant between the groups.

Table 5 - Implementation degree of lean production practices in strategic groups. The numbers in brackets refer to the lean production practices adopted, as shown in Table 1.

STRATEGIC GROUP	JIT	TPM	TQM	TECN	RCLI	RFOR	CFOR
GE-A	**-**	**(1, 2, 3,4)**	**(1,2)**	**(2,4)**	**(4)**	**(1,3)**	**(2)**
Average	**2,915**	**3,362**	**2,942**	**2,310**	**2,694**	**2,433**	**2,914**
Classification	**1**	**1**	**1**	**4**	**3**	**1**	**2**
GE-B	**(3, 5, 6,7)**	**(1)**	**(3,4,5)**	**(1,3)**	**(3,4)**		**(1)**
Average	**2,440**	**2,898**	**2,711**	**3,280**	**2,822**	**2,087**	**2,953**
Classification	**4**	**2**	**2**	**1**	**2**	**3**	**1**
GE-C	**(1, 2, 3,4)**	**-**	**-**	**-**	**-**	**(1,2)**	**-**
Average	**2,875**	**2,803**	**2,693**	**2,769**	**2,884**	**2,066**	**2,564**
Classification	**2**	**3**	**3**	**3**	**1**	**4**	**3**
GE-D	**(1,4)**	**(4)**	**(2)**	**(4)**	**(2,3)**	**(4)**	**-**
Average	**2,813**	**2,810**	**2,197**	**2,805**	**2,486**	**2,258**	**2,205**
Classification	**3**	**4**	**4**	**2**	**4**	**2**	**4**

Table 5 indicates that strategic group emphasized the JIT, TPM, TQM pillars and RFOR. Table 1 shows that the lean production practices, including those pillars, are generally favorable for low cost and shorter lead times, so this strategic group has a high degree of internal adjustment.

The emphasis on supplier certification (CFOR) is expected for the strategic group B because it focuses on quality rather than cost. On the other hand, the implementation of new technologies for this strategic group could be explained by its emphasis on delivery reliability.

Also, worth noting that the more oriented strategic group for the customer is the strategic group C, which have the highest score in customer relations (RCLI). This pillar is mainly the time aspects with respect to customers, therefore, consistent with the strategic focus of the strategic group C.

The strategic group B is the number 2 in TQM while the strategic group C is the number 2 in JIT, which is also in line with your goals; hence, these groups show a high degree of internal consistency.

The strategic group D choices are difficult to explain, in part because other practices beyond the lean production pillars can be very relevant for these companies, and does not have enough information about these practices. However, based on the data at hand, this group emphasizes the technology and the relationship with the supplier. The first must do with the use of technology development of new products and the second has to do with relations with suppliers with respect to the low cost and shorter delivery times. This seems to be valid when considering the delivery problems, but as Table 3 shows this group does not prioritize cost or quality. Looking at Table 2, this group does not emphasize the proper delivery performance; however, this group does not possess a high degree of internal adjustment.

The numbers in parentheses in Table 5 refer to lean production practices and include technology (TECN), which is not really a pillar of lean production, but it is a help in understanding the applications.

These data suggest that the strategic group A have made a more extensive application of lean production practices, followed by strategic group B, which for some reason are especially interested in the implementation of finite capacity scheduling technologies. The group has less implanted lean production practices is the strategic group D.

The analysis leads to the conclusion that the strategic groups three of them (A, B and C) has implemented lean production practices based on prioritized performance objectives and that the groups are selective about which pillars give greater emphasis. This is most clearly demonstrated by the strategic group A. The strategy group C shows that a good overall performance can be achieved without the implementation of a series of lean production practices. An analysis of the combination of the operating performance of the strategic group D with the deployment of lean practices can lead to two possible conclusions, that these companies are not good in the execution of their operations strategy or some of the companies considered in the analysis do not attribute an important role to operations strategies. Given these possibilities, we cannot get a more assertive conclusion to this group.

5. Discussion of results

Data analysis showed that the strategic groups differ both in respect to different sets of performance objectives and for the sets of lean production pillars that choose to implement. The analysis also indicated that there are links between the implementation of a pillar of lean production and prioritized performance goals, for example, the strategic group A showed that the implementation of TPM pillars, TQM and RFOR apparently go hand in hand with good performance at low cost. However, a high degree of deployment is not necessary to achieve a satisfactory performance in key areas such as strategic group C showed. This strategic group has a good performance in speed in delivery, but only uses lean production pillars (JIT and RFOR) at a moderate level.

This research provides evidence that more complex relationships between lean production pillars and performance objectives can be found. Not all pillars are equally important for all performance objectives. Moreover, there are elements to believe that there are relations between the members of each strategic group, the implementation of lean production pillars and performance objectives that have not been discovered or understood in depth.

This paper has shown that the use of strategic groups can help to explain how the choices of lean production pillars and their practices are influenced by performance goals prioritized by the company to achieve higher levels of competitiveness. The studies dealing with performance goals can gain from the inclusion of considerations on companies' operations strategies. Given the resource constraints, companies may not want to improve everything all the time, you need to focus. The strategic group can be a valuable tool for understanding the choices that companies must do to achieve high levels of excellence and assists them in the choices of lean production practices that are needed. Finally, the survey responded positively to the two questions raised in the introduction.

6. Final Considerationos

The research has established links between strategic groups, the lean production pillars and performance targets using cross-sectional data. Different groups have different strategic performance objectives and emphasize the application of different pillars and lean production practices. Especially strategic groups A and D demonstrates that are following different paths. The results are indicative only and the sample size is small for a high significance in statistical tests, however, the results summarized in Tables 2-5 indicate that evaluations of lean production practices with the use of strategic groups can bring results important in the context of operations strategy and that there are reasons to further investigate the lean production practices in this context.

This research has identified a new strategic group, in which aesthetics and industrial design is the priority. Several papers have recently been published demonstrating the importance of image, design and aesthetics for manufacturing companies and how design can influence operations strategies.

Within the limits and purpose of the study and the sample, the link between the lean production pillars and performance objectives have been well explored, as well as the role played by lean production practices.

In general, as Frohlich & Dixon (2001) argue, there is a need to replicate these results and, therefore, more research should be conducted in different sectors of the economy in different geographic regions so that we can have a general picture of how the operations strategies are handled by different strategic groups in their lean production practices and what results are obtained and how they are affected by the prioritized performance goals.

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