STRATEGIC ALIGNMENT OF THE COMMODITY CHAINS OF SÃO PAULO INDUSTRY

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ABSTRACT

This article proposes to conduct a diagnosis of the strategic alignment of commodity chains of the São Paulo State industry. The diagnosis was carried out by using as the theoretical framework the concept of strategic alignment of a supply chain proposed originally by Marshall Fisher (1997), but applied to all the commodity chains not to a supply chain in particular. For each commodity chain, a responsiveness index and demand uncertainty index which allowed positioning each one of commodity chains in the responsiveness spectrum and verifying the existence of the strategic alignment. The calculation of the responsiveness index was made from secondary data coming from the Economic Activity Survey (PEAP) done by the SEADE Foundation. For the commodity chains that proved outside the area of strategic alignment in the responsiveness spectrum, a suggestion of guidelines in the range of operations strategy which could drive into the strategic alignment zone was done. A brief theoretical review on strategic alignment of supply chain completes the article.

Keywords: *Operations Strategy; Alignment Strategy; Supply Chain; Operations Management; Logistic.*

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1. INTRODUCTION

The incitement of the competition of the businesses in market economy nowadays is both public and notorious, and this incitement reached such an extent that the competition is not restricted only to the businesses which emboss their logo on the product, but rather involve all the other businesses which take part in the supply chain of the product at issue. Therefore, it is no exaggeration to state that in our days, competition does not happen any longer among the businesses, but rather among the supply chains.

From the advent that the competition takes place among supply chains, the studies about strategies, above all, in the operation strategy, area began to consider the phenomenon of supply chain in the design of competitive strategies which recognize that the organizations do not act in isolation, but rather as a part of supply chain.

In this perspective, the work by Marshall Fisher named *what is the Right Supply Chain for your Product* published in 1997 in *Harvard Business Review* is the one of greatest projection and defined the bases for the strategic alignment in a supply chain which are widely utilized up to now.

Nevertheless, although this concept of strategic alignment postulated by Fisher (1997) is well accepted to survey and define the strategy of a supply chain in particular, it would be possible to utilize it to survey the strategic alignment of all a commodity chain with the purpose of utilizing this survey to define public policies and guidelines for the enhancement of the competitiveness of all a sector?

Amazed by this question and believing that it is possible to expand the concept of strategic alignment of a supply chain to all a commodity chain, the present work proposes to survey how much the commodity chains of the state of São Paulo are aligned in order to obtain a diagnosis and suggest actions which increase the competition capacity of these commodity chains.

Utilizing the classification of the sectors which compose the São Paulo industries according to the criteria of the CNAE (National Economic Activity Classification - *Classificação Nacional de Atividade Econômica*) and according to the data obtained from the *Pesquisa da Atividade Econômica Paulista* (PAEP) (São Paulo Economic Activity Research) by SEADE Foundation (*Sistema Estadual de Análise de Dados* - State Data Analysis System), this paper is intended to identify the positioning of these sectors in the responsiveness spectrum and, from this point, to verify the strategic alignment of these commodity chains.

For this purpose, a brief theoretical review of what comes to be the responsiveness spectrum and the concept of strategic alignment adopted in this work as well as the presentation of the PAEP/SEADE and the methodology used to obtain complementary data. At last, the positioning of São Paulo industries in the responsiveness spectrum is presented and a survey in the light of the concepts of strategic alignment is done.

2. STRATEGIC ALIGNMENT

The authors Brodbeck and Hoppen (2000) having as a basis for the definition the authors Henderson and Venkatraman (1993) place that

> "Strategic alignment corresponds to the strategic adequacy and functional integration between the external factors (market, policy, suppliers, etc.) and internal factors (administrative structure and financial, technological and human resources) to develop the competencies and maximize the organizational performance"

Prieto *et al.* (2009, p. 319) stand out in their research in the literature on strategic alignment, the existence of two approaches to the subject, one the external strategic alignment, which is concerned with "the adjustments of the capacities, resources and strategies to the competitive environment of the organization", in that manner oriented to the design and to the preparation of the strategy and to its adjustment to the variations existing in the business environment of the business. The other, named internal strategic alignment, deals with the implantation of the strategy and its cohesion and consistency with the corporative issues, owning, consequently, focus on the implantation of the strategy and on the adjustment of that strategy with the different internal variables of the business.

Further for Prieto *et al.* (p. 319), after taking into consideration that "the key elements to be aligned include the strategy, the persons, structure and the process management", add that the strategy can present itself with the integrated model, which to those authors, discusses both the design and the implantation of the strategy, for, according to the study at issue, other authors discuss the idea that a part of the success of the implantation of the strategy lies in its design, in caring, for example, for the involvement of authors coming from de middle management in the team of strategists, considering their knowledge of the practices.

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In the sense of those latest statements by Prieto *et al.* (*op. cit.*), Patah and Carvalho (2009) stand out a question that reports well the idea of what comes to be strategic alignment, for after commenting on that according to the competitive scenario presented, it is up to the organization to conduct the changes in the strategy defined, as the sector de acting in which the business is inserted.

However, in the range of the management of supply chains, Fisher (1997) states that it is necessary to align the strategy of the businesses constituting the supply chain according to the characteristics of the product delivered to market. Fisher classified the products into two distinct categories: innovative and functional products; and also classified the supply chains into two categories: physically efficient and market-responsive. According to Fisher (1997), the meeting (He used the term: *matching*) occurs for innovative products and market-responsive chains and for functional products and physically efficient chains.

The idea of strategic alignment of the supply chain proposed by Fisher fast gained notoriety and spread in the current thinking of the realm of operations strategy, opening the way to the definition of the concepts of agile supply chains and lean supply chains presented by Lee (2002), Lee (2004), Christopher *et al.* (2006), Lyons *et al.* (2012), Qrunfleh and Tarafdar (2013) and many other authors. Other evidence of the impact that the concept of Fisher's strategic alignment is in the amount of typical text books of administration of the production, logistics and supply chain which in a short time published new editions to incorporate this concept, as is observed in Ballou (2006), Chase, *et al*. (2006), Slack *et al.* (2009) and Chopra and Meindl (2003) to cite some.

To explain the concept of strategic alignment, Fisher (1997) made use of a matrix built by two axes: type of supply chain (responsive and efficient) and type of product (innovative and functional), and then showed which the type of supply chain which matched the type of product as figure 1 on the left shows. However, Chopra e Meindl (2003) presented an evolution of this matrix, named responsiveness spectrum (figure 1 on the right). The responsiveness spectrum is also built through two axes which greatly resembles to Fisher's matrix, but, Chopra and Meindl (2003) expand the concept of innovative product and functional product to the concept of implicit demand uncertainty and define a alignment zone and also take over that the framework of the strategy of a supply chain can be continuous along this spectrum and not discrete as in Fisher's matrix.

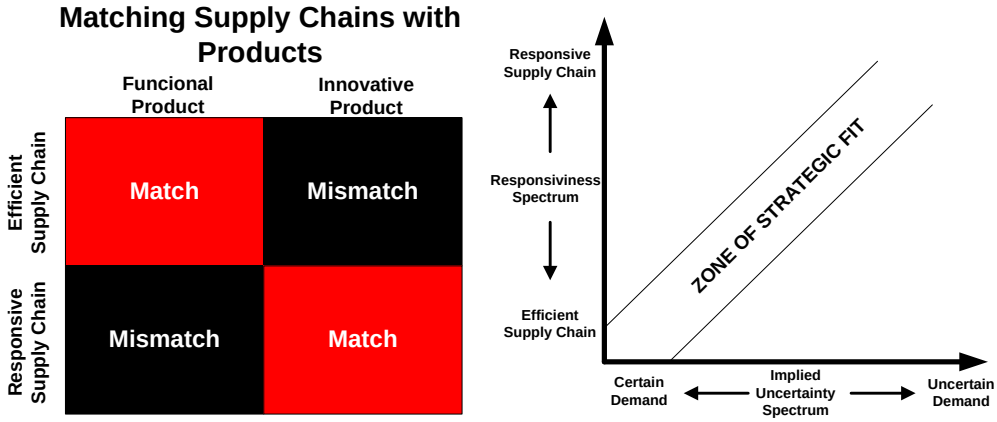

Figure 1 – Alignment Matrix (Fisher, 1997, pg. 109) and the Responsiveness Spectrum (Chopra & Meindl, 2003, page 35).

According Roh *et al*. (2014), Fisher (1997) and Lee (2002), the responsiveness stands for the ability to meet the market with a great responsive capacity, this means extreme variety of products, constant innovation, short deadlines, flexible service and all variations that denote a high level of service. While efficient supply chains are characterized by maximum efficiency in offering to the market low prices. Chopra and Meindl (2003) explain that implicit uncertainty of demand is concerned with undeclared preferences of the consumer, such as demands for price, time, variety, innovation, volume, and all the demands that may come to be required for a company to conquer consumers.

The competitiveness state will occur when the supply chain will be within the alignment zone. For a market with low implicit uncertainty of demand, the supply chain should be as efficient as possible; on the other hand, for a market with high implicit uncertainty implicit of demand, the supply chain should be as responsive as possible. Strategic alignment is the primary condition to achieve the competiveness status, for it defines the choices of operations management, particularly the management of transportation, inventory, production, location of facilities and information management, reflecting directly on the capacity and the level of service offered to the market (Georges, 2008).

For a supply chain that lies out of the alignment zone, for example: being effective for a market with high uncertainty, this will not achieve the competitiveness status for not having the capacity of meeting the requirements of this market (variety, innovation, service etc.), even offering a product at low price. Similarly, responsive supply chain supply will not be competitive in a market with low uncertainty due to the high cost of operation, for what a market with low uncertainty wants is low price (Lee, 2002).

It is from this concept of strategic alignment that the present paper develops, aiming to analyze how well aligned the commodity chains of São Paulo industry are and position them in a responsiveness spectrum and for commodities chains that are not aligned to suggest which movements should be taken to move into alignment zone in the responsiveness spectrum. The methodology used to reach these rates is presented below.

3. METHODOLOGY

It is applied research, with exploratory objectives, in which the concept of strategic alignment of a supply chain to produce a diagnosis of the strategic alignment of all commodity chains of the state of São Paulo is intended to use. This diagnosis will be made from the construction of the responsiveness spectrum of São Paulo industry, positioning commodity chain in terms of the degree of implicit uncertainty of its demand and the degree of responsiveness that this commodity chain presents and then position it in the responsiveness spectrum and verify if the supply chain is within the alignment zone.

To position a particular productive chain in the responsiveness spectrum, it will be necessary to prepare a responsiveness index of this commodity chain and an implicit uncertainty index of the demand for the market of this current commodity chain. These indices will be values ranging from "0" to "1", the value "0" being considered a fully efficient index and a market with very low implicit uncertainty demand, and the value "1" represents a fully responsive chain and a market with a very high implicit uncertainty demand.

To calculate the responsiveness index, secondary data was used from the Survey of Economic Activity Paulista - PEAP – done by the Foundation SEADE - State System of Data Analysis. The PEAP database aimed mainly at the furnishing of information of structural nature of the economic activity of the State of São Paulo and its regions. As one of the results of this result of this research, a database for the development of research and analysis about the technical-productive transformations underway is made available. This database makes available not only the measurement data of the economic activity –as, for example - number of units, value of the production, employed persons - but also indicators to assess the extent of the recent restructuring processes and their impact on the different sectors of São Paulo economy (SEADE, 2009). The information researched in the stratum of Strategy of Production Management, Automation and Technological Innovation, Informatics and Communications and customers and suppliers provided data utilized to calculate the responsiveness index, for such information reveals the management form of these segments investigated.

However, the information obtained to calculate the implied demand uncertainty index was obtained from the experts' consensus. The detailing of each of these indices, including formulas, data and the procedures used are detailed below.

4. DATA ANALYSIS

4.1. Variables that define the Responsiveness Index

The first task of this step was to specify the characteristics to be investigated that define the operating mode of a supply chain. These differences in the characteristics of the responsive and efficient supply chains are shown in Table 1 and they were obtained from several authors (Chopra & Meindl, 2003; Lee, 2002; Ballou, 2006; Fisher, 1997).

Table 1 – Differences of management in the different Supply Chains

Efficient Supply Chains	Responsive Supply Chains
Poor variety of products	High variety of products
High number of suppliers, based on better prices.	Poor number of suppliers based on quality and agility.
Poor index of product innovation	High index of product innovation
High level of resource utilization	Poor level of resource utilization
Large volume of production	Poor production volume
Stable production technology	Not so stable production technology
Poor outsourcing index	High outsourcing index
High volumes of stocks of finished product	Poor volume of stock of finished product
Production and delivery lead time	Short production and delivery Lead Time
Product with a long life cycle on market	Product with short life cycle on market

Product of poor earned value and small profit margin	Product with high earned value and high profit margin
Precise Sales prediction	Imprecise sales prediction

Once recognized the characteristics that define a responsive or efficient supply chain, a search in the PEAP/SEADE database as conducted in order to determine which items can be used to recognize the management form of this segment of the industry, framing it as either a responsive or an efficient supply chain.

Among the variables investigated in the PEAP / SEADE, some variables investigated that have closeness to the characteristics indicated in Table 1 were identified; these were the following variables:

- **Development of technologically new product;**
- **Broadening in the variety of products;**
- **Growth in the use of automation;**
- **Reduction in the number of suppliers;**
- **Close location from Customers;**
- **Outsourcing Logistics;**
- **Just-In-Time Manufacturing;**
- **Use of Computerized Systems.**

The **development of a technologically new product** is the variable of the PEAP/SEADE database denoting the characteristic of release of new products on market and an efficient supply chain is characterized by few releases of new products, while responsive supply chains are organized so as to offer constantly the release of new products on market.

The **broadening of the variety of products** is a characteristic that indicates whether the company used as a management strategy offering a wider range of products on market. The wide offer of products on market is a characteristic of responsive supply chains, as the demand for this type of market is very uncertain and companies see themselves obliged to offer a greater variety of products in the attempt of attracting the greatest possible number of buyers.

Growth of industrial automation is a variable that provides, although partially, evidence of the importance of reducing the production lead time. The need to provide production *lead times* shorter and shorter is a concern relevant to the responsive supply chains, because these have to adopt strategies that offer greater capacity for answers to the different requirements of demand, characteristic of a demand with a high implicit uncertainty.

The **reduction in the number of suppliers** is a characteristic of responsive supply chains because it is motivated by the need to seek greater involvement in activities such as joint development of new products, collaborative planning of materials, the need for quality assurance, the practice of providing with high frequency of delivery and low volume. They are demands that require a more careful selection of suppliers and a narrowing of intercompany relationship, different situation of efficient supply chains which seek to expand their suppliers as a means to increase competition and force price fall, since the lowest price is the main goal of efficient supply chains.

The **close location from customers** is a strategy to improve the delivery lead time, considered extremely important to products with high variety, low-volume, short life cycle and high added value, typical of responsive supply chains, as it is costly to maintaining high levels of stocks for quick service, the strategies aiming at the proximity to consumption centers being interesting.

Outsourcing of logistics occurs more frequently in responsive supply chains, as there is a need to carry small volumes and variety with large numbers of trips, making it difficult to maintain high levels of use. Efficient supply chains present better conditions to plan the logistics operation with high level of use because their shipments are of high-volume, low variety and shorter term requirements, allowing greater use of resources.

The adoption of **Just-in-Time manufacturing** strategy aims at greater flexibility in the productive system, capable of meeting a greater number of manufactured items with smaller produced volume, which are characteristics of a responsive supply chain. The Just-In-Time also reinforces the choice of responsive supply chains, as this type of productive system is much less susceptible to prediction errors, since its principle of production planning is pulled (on demand), while the pushed system is based on prediction. As responsive supply chains serve markets with little predictable demand, it is more convenient for such a supply chain to adopt the Just-In-Time production strategy.

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The **use of computerized systems** is motivated by the need for quick information exchange, allowing greater flexibility in the issue of orders of sales, purchasing, production order, delivery requests and many other benefits for businesses. However, it is the search in the agility of business processes and the resulting reduction in lead times of manufacturing and delivery that motivate adoption of information systems. It is the responsive supply chains the most interested in reducing the lead time for production and delivery due to the nature of the demand they serve.

4.2. The calculation of Responsiveness Index

For each of the variables presented above was generated an index ranging from 0 to 1, 0 being for the segment with the lowest number of companies that adopt such characteristic, showing a characteristic behavior of efficient supply chains; and 1 for the segment that presented the greatest number of companies that adopt such a strategy management, denoting a characteristic behavior of responsive supply chains.

For example, Table 2 below presents an example of calculation of the responsiveness index for the characteristic of broadening of the variety of product. In this particular case, among all segments of the São Paulo industry investigated, it was the electronic material and communication device and equipment industry that showed the highest number of businesses that intend to adopt this management strategy (the expansion of variety of product), giving characteristics of responsive chain to this segment of the São Paulo industry.

On the other hand, the segment of the Extractive Industry was the one which presented the lowest number of companies interested in adopting the expansion management strategy of the variety of products, giving the characteristic of efficient supply chain to this segment.

From the recognition of the industry segment that has the highest and the lowest percentage of companies interested in adopting a particular management strategy, 1 and 0 were set respectively for these segments and, from this point, the index for all other segments surveyed by the PEAP is calculated.

Table 2 illustrates the calculation of the responsiveness index for the particular case of the adoption of the expansion management strategy and reproduces this procedure for all variables selected for the calculation of the responsiveness index.

Table 2 – Calculation of the Responsiveness Index for the Broadening of Variety of Product

Broadening of the Variety of the Products\Services offered						
Classification of activity added for PAEP Analysis	**Without information**	**Yes**	**No**	**Total**	**% Yes**	**Index**
Making of clothing and fashion acessories	135	2.371	2.321	4.828	49,11%	0,4841
Editing, Printing, Picture Copying	86	1.279	1.377	2.742	46,64%	0,3860
Making of Foods and Beverages	74	2.470	1.623	4.168	59,26%	0,8880
Making of rubber and plastic products	61	1.714	1.187	2.962	57,87%	0,8325
Making of cellulose and paper	22	471	411	905	52,04%	0,6009
Making of office machines and informatics equipment	-	74	55	129	57,36%	0,8125
Making of electric machine, appliance and material	21	741	454	1.215	60,99%	0,9567
Making of machines and equipment	59	1.502	1.483	3.045	49,33%	0,4927
Making of chemicals	91	1.100	787	1.977	55,64%	0,7439
Making of textiles	43	939	859	1.841	51,00%	0,5595
Making and assembly of automotive vehicles, tow and bodywork	31	641	500	1.172	54,69%	0,7062
Making and refining of oil and alcohol	4	35	41	79	44,30%	0,2929
Industrial Making of medical equipment, optics and watches, precision instrument, industrial automation	13	347	215	575	60,35%	0,9312
Making of electronic material and communication appliances and equipment	31	275	137	443	62,08%	1,0000
Making of other transport equipment	15	119	89	223	53,36%	0,6533
Making of metallic products (excluding. machines and equipment)	142	2.382	2.510	5.035	47,31%	0,4125
Making of non-metal mineral products	26	1.498	1.370	2.894	51,76%	0,5896
Extractive industry	8	215	359	582	36,94%	0,0000
Basic metallurgy	24	551	652	1.226	44,94%	0,3183
Other industries	29	2.453	2.152	4.633	52,95%	0,6367
Preparation and making of leather artifacts	23	773	552	1.349	57,30%	0,8100
Total	939	21.950	19.133	42.023	52,23%	

Source: prepared by the authors

The calculation of index I of a segment of the São Paulo industry i in a characteristic, is obtained according to equation 1, where value is the percent obtained for a segment of the São Paulo industry i in the characteristic j, and min and max are the minimum and maximum values presented in the characteristic j.

$$I_{i,j} = \frac{value_{i,j} - \min_j}{\max_j - \min_j}$$

Equation 1 - Index Calculation for a j

Performing the calculation for all eight variables in the researched in the PEAP / SEADE, one has the specific indicators for each variable, as shown in Table 3 below.

Considering that each of the eight variables is equally capable of representing an important aspect in the form of management of the segments of São Paulo industries, the responsiveness index will be given by taking the simple arithmetic mean of the indices; one reaches an average responsiveness index, as shown in the last column of table 3.

Table 3 – Calculation of the Responsiveness Index

Calculation of the Responsiveness Index									
Classification of added activity for analysis of the PAEP	Development of new products	Broadening of variety of product	Growth of automation	Reduction of supplier	Closeness to the customer	Outsourcing Logistics	Making JIT	Use of information systems	Responsiveness index
Making of clothing and fashion acessories	0,0048	0,4841	0,0174	1,0000	0,1428	0,2312	0,3591	0,0268	0,2833
Editing, Printing, Picture Copying	0,0253	0,3860	0,0926	0,5174	0,1700	0,3161	0,3572	0,5648	0,3037
Making of Foods and Beverages	0,0635	0,8880	0,1894	0,5897	0,1313	0,1115	0,2465	0,0928	0,2891
Making of rubber and plastic products	0,0771	0,8325	0,3430	0,6231	0,1506	0,2669	0,3577	0,4746	0,3907
Making of cellulose and paper	0,0402	0,6009	0,2877	0,5669	0,1568	0,0242	0,4258	0,5011	0,3254
Making of office machines and informatics equipment	1,0000	0,8125	0,2035	0,3833	0,0000	0,0586	0,0000	0,9753	0,4292
Making of electric machine, appliance and material	0,2477	0,9567	0,3491	0,4131	0,5840	0,3432	0,6739	0,6995	0,5334
Making of machines and equipment	0,2607	0,4927	0,3450	0,4966	0,4527	0,5440	0,3796	0,7187	0,4613
Making of chemicals	0,3647	0,7439	0,4031	0,5966	0,3486	0,9314	0,4304	0,8525	0,5839
Making of textiles	0,1096	0,5595	0,2860	0,5169	0,3193	0,2615	0,1134	0,3000	0,3083
Making and assembly of automotive vehicles, tow and bodywork	0,1044	0,7062	0,2634	0,9029	0,2941	0,4136	1,0000	0,5819	0,5333
Making and refining of oil and alcohol	0,0000	0,2929	1,0000	0,0000	0,0000	0,6888	0,0000	1,0000	0,3727
Industrial Making of medical equipment, optics and watches, precision instrument, industrial automation	0,4429	0,9312	0,2272	0,2879	0,5289	0,4564	0,1954	0,5942	0,4580
Making of electronic material and communication appliances and equipment	0,5301	1,0000	0,4192	0,8616	0,8237	1,0000	0,7248	0,7029	0,7578
Making of other transport equipment	0,1780	0,6533	0,2733	0,1635	1,0000	0,2473	0,0000	0,7280	0,4054
Making of metallic products (excluding. machines and equipment)	0,0486	0,4125	0,1926	0,5542	0,2778	0,1216	0,3763	0,3683	0,2940
Making of non-metal mineral products	0,0297	0,5896	0,0500	0,3786	0,0420	0,2318	0,1442	0,0000	0,1833
Extractive industry	0,0227	0,0000	0,0000	0,0387	0,0000	0,0314	0,0000	0,0049	0,0122
Basic metallurgy	0,1079	0,3183	0,1339	0,5219	0,0661	0,1296	0,5500	0,3431	0,2714
Preparation and making of leather artifacts	0,0687	0,8100	0,0969	0,6629	0,0751	0,6033	0,2261	0,2424	0,3482

Source: prepared by the authors

4.3. Calculation of Implied Demand Uncertainty Index

For the calculation of the implied demand uncertainty index, it was not possible to reach it through the PEAP/ SEADE data analysis, because the variables investigated in the PEAP / SEADE intended to question aspects of demand were insufficient to characterize the degree of implied demand uncertainty. Therefore, to obtain the implied demand uncertainty index, the mini-Delphi methodology as presented by Pan *et al*. (1996) was utilized.

The questionnaire used to define the implicit demand uncertainty index of the segments was designed from elements capable of characterizing each segment with a high implicit uncertainty and low implied uncertainty. These elements are called demand characteristics and were surveyed from several authors (Chopra & Meindl, 2003; Fisher, 1997; Lee, 2002; Ballou, 2006; Chase *et al*, 2006) and are presented in table 4 below.

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Table 4 – Characteristic of the Demand

Characteristic of the Demand	High Implied Uncertainty	Low Implied Uncertainty
Required Variety of Products	Very High	Very Low
Innovative Products	Very High	Very Low
Volume of Purchase	Very Low	Very High
Requirements of Delivery Times	Very low	Very High
Demand Predictability	Very Low	Very High
Stability of the Production Process	Very Low	Very High
Life Cycle of the Product	Very Low	Very High
Variation of the Price at the End of the Season	Very High	Very High

Each of the segments of the São Paulo industry will be evaluated in each of the demand characteristics of table 4. This evaluation of each segment of economy in each demand characteristic will be done by a group of experts who will use a value scale (according to table 5 bellow) ascribing a concept to demand characteristic.

Table 5 – Criteria for quantification

Concept	Value
Very High	1,00
High	0,75
Mean	0,50
Low	0.25
Very Low	0,00

Four experts gathered together, who after detailed discussion of the questionnaire and goals of the work, each assigned the concept to each of the characteristics of the demand for each of the investigated segments of the São Paulo industry.

The questionnaires were collected and, if there were consensus among the experts in the judgment of the degree of implicit uncertainty of a given characteristic, it has remained so. There being no consensus, a new round of judging was made for the characteristic until they reached a consensus.

Based on the concept defined by the experts in each characteristic of demand, this was converted into a numerical value as shown in Table 5 and in the end, for each segment of the Sao Paulo industry, a mean among the values of each characteristic was extracted to reach an implicit uncertainty demand index for each segment according to the table 6 below shows.

Table 6 – Calculation of the Implied Demand Uncertainty Index

Calculation of the Implied Demand Uncertainty Index									
Classification of addeed activity for PAEP analysis - Business	Demanded Variety of products	Innovative Products	Volume of Purchase	Requirements of delivery time	Demand Unpredictability	Production Process Unstability	Product Life Cycle	Price Unstability	Uncertainty Index
Making of clothing and fashion accessories	1,00	1,00	0,75	1,00	1,00	0,75	1,00	1,00	0,94
Printing. Editing and Picture Copying	1,00	0,75	0,75	0,75	1,00	0,50	1,00	0,50	0,78
Making of Foods and Beverages	0,75	0,50	0,50	0,50	0,50	0,50	0,50	0,25	0,50
Making of rubber and plastic articles	0,50	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,28
Making of cellulose and paper	0,00	0,00	0,00	0,25	0,25	0,00	0,00	0,00	0,06
Making of office machines e informatics equipment	1,00	1,00	1,00	1,00	0,75	0,75	1,00	1,00	0,94
Making of electric machines. appliance and materials	0,50	0,50	0,50	0,75	0,50	0,50	0,50	0,50	0,53
Making of machines and equipment	1,00	0,75	1,00	0,75	0,50	1,00	1,00	1,00	0,88
Making of chemicals	0,75	0,75	0,25	0,50	0,50	0,75	0,50	0,50	0,56
Making of textiles	0,25	0,25	0,25	0,50	0,25	0,25	0,25	0,25	0,28
Making of automotive vehicles. tolls and bodywork	0,75	0,50	1,00	0,75	0,50	0,50	0,75	0,50	0,66
Making and refining of oil and alohol	0,00	0,00	0,00	0,25	0,25	0,00	0,00	0,00	0,06
Making of medical. optical equipament and watches. precision instrument and industrial automation	0,50	0,75	1,00	0,75	0,75	1,00	0,75	0,75	0,78
Making of electronic materials and communication appliances and equipment	0,75	0,75	1,00	1,00	0,75	0,75	1,00	1,00	0,88
Making of other transportation equipment	0,25	0,25	0,50	0,50	0,25	0,50	0,50	0,50	0,41
Making of metallic products (excepting machines and equipment)	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25
Making of non-metallic mineral products	0,00	0,00	0,25	0,25	0,25	0,00	0,25	0,25	0,16
Extractive industry	0,00	0,00	0,25	0,00	0,25	0,00	0,00	0,00	0,06
Basic Mettalurgy	0,00	0,00	0,25	0,50	0,25	0,00	0,00	0,00	0,13
Preparation and making of leather artifacts	0,25	0,00	0,75	0,25	0,50	0,25	0,25	0,25	0,31

Source: prepared by the authors

Experts chosen to do this analysis of the characteristics of the demand of each segment in order to obtain the implied demand uncertainty index were considered as having the required expertise, professional qualification, teaching experience or in research projects on related topics, as determined by the authors Hoffman *et al* (1995) and Green *et al.* (2011).

5. PRESENTATION OF RESULTS

Given the responsiveness index and the implied demand uncertainty index for each segment of the São Paulo industry, it was possible to draw up a chart positioning each segment in the responsiveness spectrum. In addition to the position of each segment in the responsiveness spectrum, an analysis based on the importance that each segment represents in relation to the percentage of the total revenue of the state of São Paulo.

The importance that an industry segment represents to the economy of the state of São Paulo in terms of percentage of the total revenue of the state is illustrated by the circle size in the responsiveness spectrum. Table 7 below shows how each industry segment contributes to the total revenue of the state.

Table 7 – Income of each segment of the São Paulo Industry

Classification of added activity	Income State of São Paulo	%
Making of clothing and fashion accessories	4.983.142.190	1,20%
Printing. Editing and Picture Copying	11.253.533.030	2,72%
Making of Foods and Beverages	67.437.837.607	16,30%
Making of rubber and plastic articles	17.791.824.493	4,30%
Making of cellulose and paper	14.253.303.506	3,45%
Making of office machines e informatics equipment	2.400.490.937	0,58%
Making of electric machines. appliance and materials	15.881.780.468	3,84%
Making of machines and equipment	24.505.019.980	5,92%
Making of chemicals	61.502.333.049	14,87%
Making of textiles	11.006.258.402	2,66%
Making of automotive vehicles. tolls and bodywork	50.086.073.468	12,11%
Making and refining of oil and alohol	52.584.169.916	12,71%
Making of medical. optical equipament and watches. precision instrument and industrial automation	3.400.031.698	0,82%
Making of electronic materials and communication appliances and equipment	15.724.110.804	3,80%
Making of other transportation equipment	10.546.846.474	2,55%
Making of metallic products (excepting machines and equipment)	14.342.360.703	3,47%
Making of non-metallic mineral products	9.332.847.472	2,26%
Extractive industry	930.323.604	0,22%
Basic Mettalurgy	22.698.088.000	5,49%
Preparation and making of leather artifacts	3.057.768.565	0,74%
TOTAL	413.718.144.366	100,00%

Source: prepared by the authors with PAEP/SEADE data

The immediate result of the calculation of the responsiveness indices and implicit demand uncertainty allied to the size that the industrial sector represents in the economy of the state of São Paulo is shown in Figure 2 below. The strategic alignment zone is defined in the responsiveness spectrum as being the range bounded by the lines in red. This alignment zone was defined through a margin of 15% in relation to the identity function (y = x), that is, the lines delimiting the strategic alignment zone is defined by the equations y = 0.85x and y = 1.15x.

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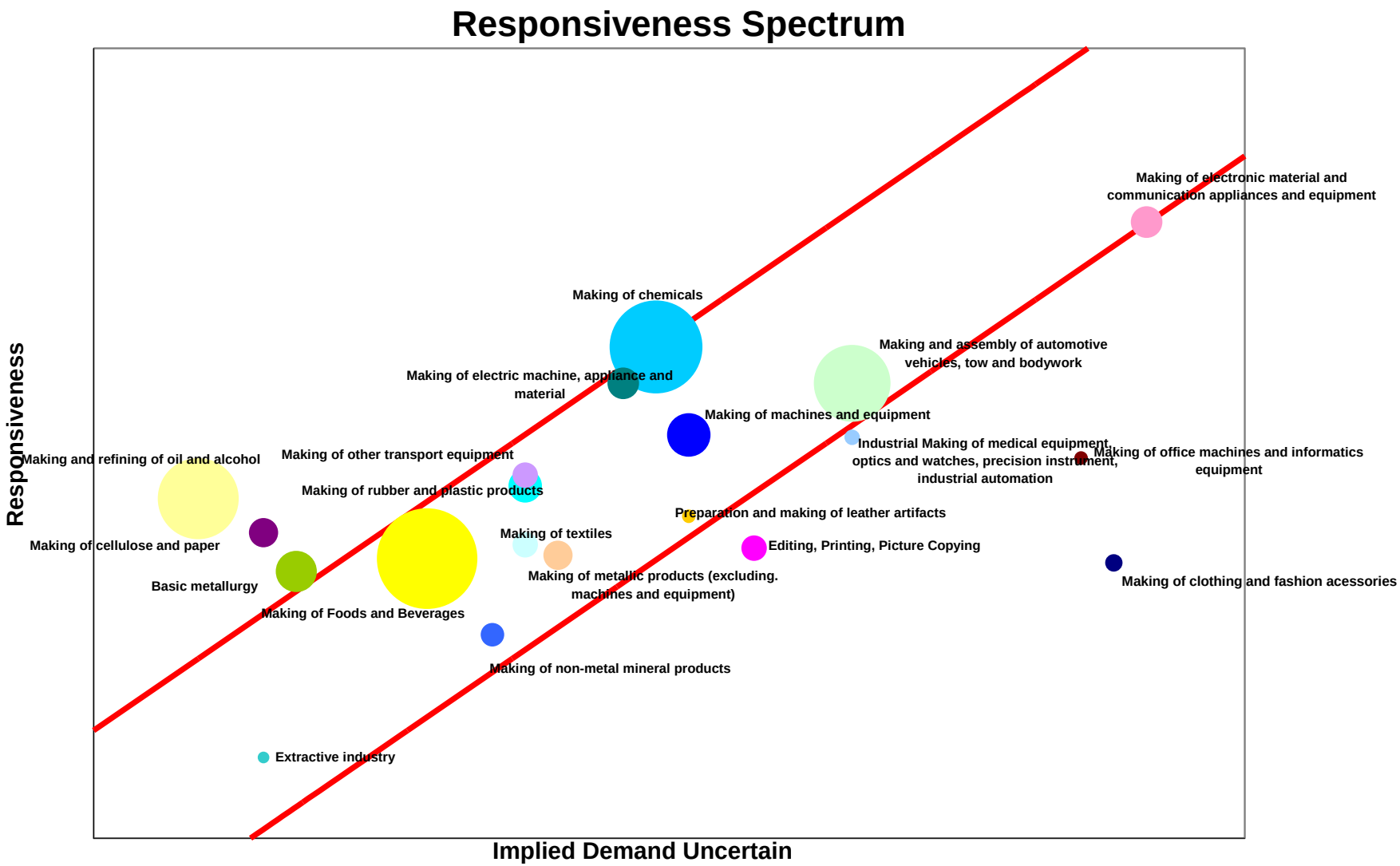

Figure 2 – Responsiveness spectrum of the São Paulo Industry
Source: prepared by the authors

From Figure 2, the following positioning of the segments of the industry of São Paulo regarding the strategic alignment zone is found.

5.1. Supply Chains within the Strategic Alignment Zone
The following commodities chains are inside the alignment zone are shown:

- Extractive Industry;
- Manufacturers of Non-Metallic Mineral;
- Manufacturers of Food and Beverage;
- Manufacturers of Metal Products;
- Manufacturers of Textile Products;
- Manufacturers of Rubber & Plastic Goods;
- Manufacturers of other Transport Equipment;
- Preparation and Making of Leather Goods;
- Manufacturer of Machinery and Equipment;
- Manufacturers of Electrical Machines, Devices and Equipment;
- Manufacturers of Chemicals;
- Manufacturers and Assembly of Motor Vehicles, Trailers and Bodyworks, and
- Manufacturers of Electronic Material, Devices and Communication Equipment.

These commodities chains of the industry of São Paulo lie strategically aligned, for they adopt management strategies that provide the product offered to the market the attributes that consumers want, whether low price whether high levels of service.

5.2. Supply Chains Outside the Strategic Alignment Zone
The following commodities chains are shown outside the strategic alignment zones:

More responsive supply chains that the market demands:
- Basic Metallurgy;
- Manufacturers of Pulp and Paper;
- Manufacturers and Refineries of Oil and Alcohol;

Less responsive supply chains that the market demands:
- Editing, Printing, Picture Copying;
- Manufacturers of Medical, Optical Equipment and Watches, Precision Instruments and Industrial Automation;
- Making of Clothing and Fashion Accessories;
- Manufacturers of Office Machine and Computer Equipment, and

These commodities chains of the industry of São Paulo lie strategically outside the alignment zone, requiring adjustments to be done so as to produce the strategic alignment.

6. SETTING THE STRATEGIC ALIGNMENT

From the identification of the position in the responsiveness spectrum, the company should carry out the adjustment of its strategy so that it moves the Strategic Alignment Zone. This movement is done by means of changes in the management of the Company's operations, through changes in five dimensions: Transportation Management, Inventory Management, Production Management, Location Management and Information Management (Georges, 2008).

Thus, for a given commodity chain which lies outside the strategic alignment zone and for it to align, it is necessary to move in these sense of gaining efficiency, as the type 1 industries in Figure 3 below, the decisions to be taken are intended to reduce operating costs. In this sense the direction of the business organization should do the necessary adjustments in each of the dimensions of operations management, as Table 8 shows, in order to bring the company to the strategic alignment zone with the objective of making the company competitive on its market.

For the commodities chains of type 2, figure 3, which lie outside the strategic alignment zone and need to move in the direction of gaining responsiveness, the decisions to be taken are intended to broaden the level of service, in addition to actions in the transportation modal in the variety and availability of stocks, the location and number of stores, the production volume and the number of new products, in the more efficient management of information system in order to make the company competitive.

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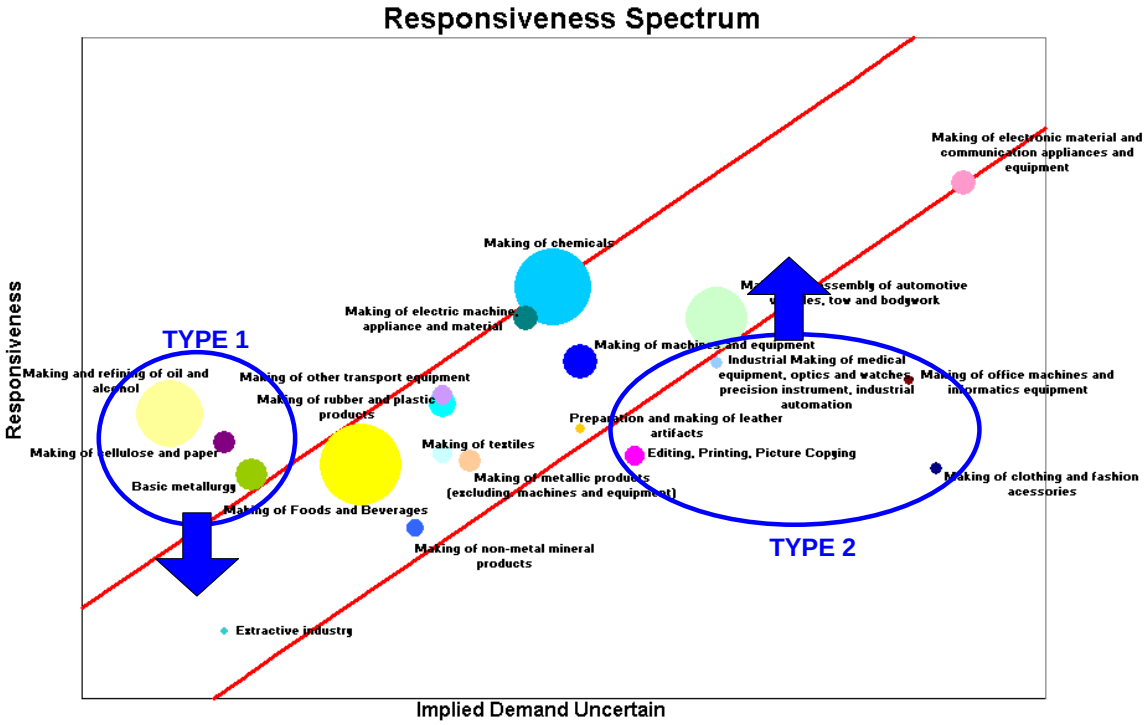

Figure 3 – Movement in the Responsiveness Spectrum
Source: prepared by the authors

Table 8 below shows some guidelines for each of the five dimensions depending on the type of chain (responsive or efficient).

Table 8 – Breakdown of the Operations Management due to the Type of Chain

	Type of Chain	
	Responsive	**Efficient**
Main Objective	High Service Level	Low Cost
Transportation Management	Faster Modal, Poorer Capacity and in greater number.	Preference for modals of greater capacity and as cheap as possible.
Stock Management	Great variety and high availability.	To minimize stocks (variety and low levels) to reduce costs.
Location management	Great number of stores and the as close as possible to the consumer centers	Low number (even none).
Production Management	High flexibility, low volume, great number of new products with short life cycle.	Low variety and high volume.
Information manager	Sharing and immediate availability of information along the chain so as to identify changes and plan reactions as soon as possible.	Sharing and immediate availability of information along the chain so as to plan the operation at the lowest cost possible.

Source: prepared by the authors

7. FINAL REMARKS

Strategically align the management of the company's operations with its supply network collaborates towards the competitive positioning of the company. Numerous business organizations for not knowing of this fact work not aligned strategically with their network, harming in the competitive aspect not only to themselves but to other companies participating in the relationship network.

It is worthwhile standing out the concept of strategic alignment adopted in this work is pertinent to supply chains and not to commodity chains. It is worthwhile remembering also, that the PEAP / SEADE research was done to obtain data from the industry as a whole and had no purpose of specifying a particular chain.

These limitations have imposed to research a broader analysis of how the industry segments have been organizing from the standpoint of strategic alignment, there being no conditions of specifying a particular supply chain. Thus, the analyses that were conducted are concerned with the general behavior of the companies that make up a commodity chain (which also makes up a Supply Chain).

As for the process of moving into the Alignment Area, there are still much to be investigated. The suggestions in Table 8 are still very incipient and very generalist. Developing a management model which points out with greater precision what management strategies within the realm of operations management which enables a move in the responsiveness spectrum is the great challenge which is put as a fruit of this investigation. One can, however, infer that they should be considered from the very strategic alignment of each of the companies participating in the supply chain and will involve people, the strategies, the design of the organizational structure and production processes of the organizations involved.

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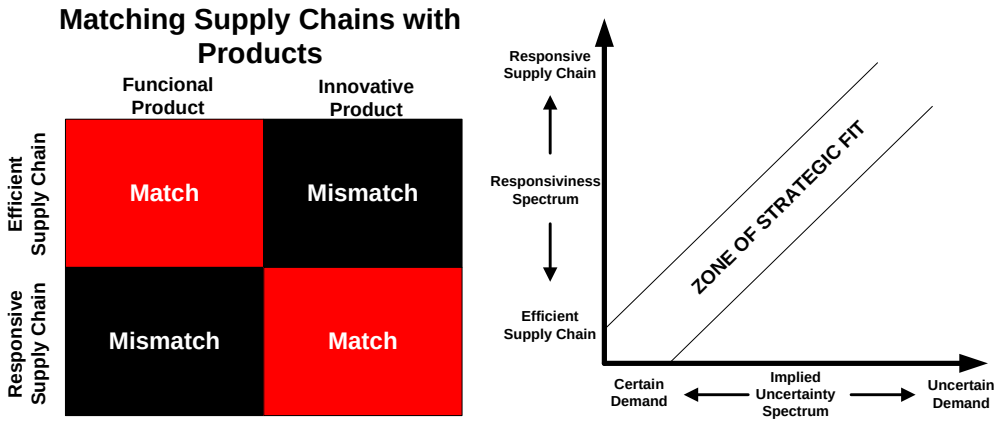

Figure 2 – Alignment Matrix (FISHER, 1997, pg. 109) and the Responsiveness Spectrum (CHOPRA e MEINDL, 2003, page 35).

Table 6 – Differences of management in the different Supply Chains

Efficient Supply Chains	Responsive Supply Chains
Poor variety of products	High variety of products
High number of suppliers, based on better prices.	Poor number of suppliers based on quality and agility.
Poor index of product innovation	High index of product innovation
High level of resource utilization	Poor level of resource utilization
Large volume of production	Poor production volume
Stable production technology	Not so stable production technology
Poor outsourcing index	High outsourcing index
High volumes of stocks of finished product	Poor volume of stock of finished product
Production and delivery lead time	Short production and delivery Lead Time
Product with a long life cycle on market	Product with short life cycle on market
Product of poor earned value and small profit margin	Product with high earned value and high profit margin
Precise Sales prediction	Imprecise sales prediction

Table 7 – Calculation of the Responsiveness Index for the Broadening of Variety of Product

Broadening of the Variety of the Products\Services offered						
Classification of activity added for PAEP Analysis	**Without information**	**Yes**	**No**	**Total**	**% Yes**	**Index**
Making of clothing and fashion acessories	135	2.371	2.321	4.828	49,11%	0,4841
Editing, Printing, Picture Copying	86	1.279	1.377	2.742	46,64%	0,3860
Making of Foods and Beverages	74	2.470	1.623	4.168	59,26%	0,8880
Making of rubber and plastic products	61	1.714	1.187	2.962	57,87%	0,8325
Making of cellulose and paper	22	471	411	905	52,04%	0,6009
Making of office machines and informatics equipment	-	74	55	129	57,36%	0,8125
Making of electric machine, appliance and material	21	741	454	1.215	60,99%	0,9567
Making of machines and equipment	59	1.502	1.483	3.045	49,33%	0,4927
Making of chemicals	91	1.100	787	1.977	55,64%	0,7439
Making of textiles	43	939	859	1.841	51,00%	0,5595
Making and assembly of automotive vehicles, tow and bodywork	31	641	500	1.172	54,69%	0,7062
Making and refining of oil and alcohol	4	35	41	79	44,30%	0,2929
Industrial Making of medical equipment, optics and watches, precision instrument, industrial automation	13	347	215	575	60,35%	0,9312
Making of electronic material and communication appliances and equipment	31	275	137	443	62,08%	1,0000
Making of other transport equipment	15	119	89	223	53,36%	0,6533
Making of metallic products (excluding. machines and equipment)	142	2.382	2.510	5.035	47,31%	0,4125
Making of non-metal mineral products	26	1.498	1.370	2.894	51,76%	0,5896
Extractive industry	8	215	359	582	36,94%	0,0000
Basic metallurgy	24	551	652	1.226	44,94%	0,3183
Other industries	29	2.453	2.152	4.633	52,95%	0,6367
Preparation and making of leather artifacts	23	773	552	1.349	57,30%	0,8100
Total	939	21.950	19.133	42.023	52,23%	

Source: prepared by the authors

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$$I_{i,j} = \frac{value_{i,j} - \min_j}{\max_j - \min_j}$$

Equation 1 - Index Calculation for a j

Table 8 – Calculation of the Responsiveness Index
Source: prepared by the authors

Calculation of the Responsiveness Index									
Classification of added activity for analysis of the PAEP	Develop-ment of new products	Broadening of variety of product	Growth of automation	Reduction of supplier	Closeness to the customer	Outsourcing Logistics	Making JIT	Use of information systems	Responsi-veness index
Making of clothing and fashion acessories	0,0048	0,4841	0,0174	1,0000	0,1428	0,2312	0,3591	0,0268	0,2833
Editing, Printing, Picture Copying	0,0253	0,3860	0,0926	0,5174	0,1700	0,3161	0,3572	0,5648	0,3037
Making of Foods and Beverages	0,0635	0,8880	0,1894	0,5897	0,1313	0,1115	0,2465	0,0928	0,2891
Making of rubber and plastic products	0,0771	0,8325	0,3430	0,6231	0,1506	0,2669	0,3577	0,4746	0,3907
Making of cellulose and paper	0,0402	0,6009	0,2877	0,5669	0,1568	0,0242	0,4258	0,5011	0,3254
Making of office machines and informatics equipment	1,0000	0,8125	0,2035	0,3833	0,0000	0,0586	0,0000	0,9753	0,4292
Making of electric machine, appliance and material	0,2477	0,9567	0,3491	0,4131	0,5840	0,3432	0,6739	0,6995	0,5334
Making of machines and equipment	0,2607	0,4927	0,3450	0,4966	0,4527	0,5440	0,3796	0,7187	0,4613
Making of chemicals	0,3647	0,7439	0,4031	0,5966	0,3486	0,9314	0,4304	0,8525	0,5839
Making of textiles	0,1096	0,5595	0,2860	0,5169	0,3193	0,2615	0,1134	0,3000	0,3083
Making and assembly of automotive vehicles, tow and bodywork	0,1044	0,7062	0,2634	0,9029	0,2941	0,4136	1,0000	0,5819	0,5333
Making and refining of oil and alcohol	0,0000	0,2929	1,0000	0,0000	0,0000	0,6888	0,0000	1,0000	0,3727
Industrial Making of medical equipment, optics and watches, precision instrument, industrial automation	0,4429	0,9312	0,2272	0,2879	0,5289	0,4564	0,1954	0,5942	0,4580
Making of electronic material and communication appliances and equipment	0,5301	1,0000	0,4192	0,8616	0,8237	1,0000	0,7248	0,7029	0,7578
Making of other transport equipment	0,1780	0,6533	0,2733	0,1635	1,0000	0,2473	0,0000	0,7280	0,4054
Making of metallic products (excluding. machines and equipment)	0,0486	0,4125	0,1926	0,5542	0,2778	0,1216	0,3763	0,3683	0,2940
Making of non-metal mineral products	0,0297	0,5896	0,0500	0,3786	0,0420	0,2318	0,1442	0,0000	0,1833
Extractive industry	0,0227	0,0000	0,0000	0,0387	0,0000	0,0314	0,0000	0,0049	0,0122
Basic metallurgy	0,1079	0,3183	0,1339	0,5219	0,0661	0,1296	0,5500	0,3431	0,2714
Preparation and making of leather artifacts	0,0687	0,8100	0,0969	0,6629	0,0751	0,6033	0,2261	0,2424	0,3482

Table 9 – Characteristic of the Demand

Characteristic of the Demand	High Implied Uncertainty	Low Implied Uncertainty
Required Variety of Products	Very High	Very Low
Innovative Products	Very High	Very Low
Volume of Purchase	Very Low	Very High
Requirements of Delivery Times	Very low	Very High
Demand Predictability	Very Low	Very High
Stability of the Production Process	Very Low	Very High
Life Cycle of the Product	Very Low	Very High
Variation of the Price at the End of the Season	Very High	Very High

Table 10 – Criteria for quantification

Concept	Value
Very High	1,00
High	0,75
Mean	0,50
Low	0.25
Very Low	0,00

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Calculation of the Implied Demand Uncertainty Index									
Classification of addeed activity for PAEP analysis - Business	Demanded Variety of products	Innovative Products	Volume of Purchase	Requirements of delivery time	Demand Unpredictability	Production Process Unstability	Product Life Cycle	Price Unstability	Uncertainty Index
Making of clothing and fashion accessories	1,00	1,00	0,75	1,00	1,00	0,75	1,00	1,00	0,94
Printing. Editing and Picture Copying	1,00	0,75	0,75	0,75	1,00	0,50	1,00	0,50	0,78
Making of Foods and Beverages	0,75	0,50	0,50	0,50	0,50	0,50	0,50	0,25	0,50
Making of rubber and plastic articles	0,50	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,28
Making of cellulose and paper	0,00	0,00	0,00	0,25	0,25	0,00	0,00	0,00	0,06
Making of office machines e informatics equipment	1,00	1,00	1,00	1,00	0,75	0,75	1,00	1,00	0,94
Making of electric machines. appliance and materials	0,50	0,50	0,50	0,75	0,50	0,50	0,50	0,50	0,53
Making of machines and equipment	1,00	0,75	1,00	0,75	0,50	1,00	1,00	1,00	0,88
Making of chemicals	0,75	0,75	0,25	0,50	0,50	0,75	0,50	0,50	0,56
Making of textiles	0,25	0,25	0,25	0,50	0,25	0,25	0,25	0,25	0,28
Making of automotive vehicles. tolls and bodywork	0,75	0,50	1,00	0,75	0,50	0,50	0,75	0,50	0,66
Making and refining of oil and alohol	0,00	0,00	0,00	0,25	0,25	0,00	0,00	0,00	0,06
Making of medical. optical equipament and watches. precision instrument and industrial automation	0,50	0,75	1,00	0,75	0,75	1,00	0,75	0,75	0,78
Making of electronic materials and communication appliances and equipment	0,75	0,75	1,00	1,00	0,75	0,75	1,00	1,00	0,88
Making of other transportation equipment	0,25	0,25	0,50	0,50	0,25	0,50	0,50	0,50	0,41
Making of metallic products (excepting machines and equipment)	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25
Making of non-metallic mineral products	0,00	0,00	0,25	0,25	0,25	0,00	0,25	0,25	0,16
Extractive industry	0,00	0,00	0,25	0,00	0,25	0,00	0,00	0,00	0,06
Basic Mettalurgy	0,00	0,00	0,25	0,50	0,25	0,00	0,00	0,00	0,13
Preparation and making of leather artifacts	0,25	0,00	0,75	0,25	0,50	0,25	0,25	0,25	0,31

Table 6 – Calculation of the Implied Demand Uncertainty Index
Source: prepared by the authors

Table 7 – Income of each segment of the São Paulo Industry

Classification of added activity	Income State of São Paulo	%
Making of clothing and fashion accessories	4.983.142.190	1,20%
Printing. Editing and Picture Copying	11.253.533.030	2,72%
Making of Foods and Beverages	67.437.837.607	16,30%
Making of rubber and plastic articles	17.791.824.493	4,30%
Making of cellulose and paper	14.253.303.506	3,45%
Making of office machines e informatics equipment	2.400.490.937	0,58%
Making of electric machines. appliance and materials	15.881.780.468	3,84%
Making of machines and equipment	24.505.019.980	5,92%
Making of chemicals	61.502.333.049	14,87%
Making of textiles	11.006.258.402	2,66%
Making of automotive vehicles. tolls and bodywork	50.086.073.468	12,11%
Making and refining of oil and alohol	52.584.169.916	12,71%
Making of medical. optical equipament and watches. precision instrument and industrial automation	3.400.031.698	0,82%
Making of electronic materials and communication appliances and equipment	15.724.110.804	3,80%
Making of other transportation equipment	10.546.846.474	2,55%
Making of metallic products (excepting machines and equipment)	14.342.360.703	3,47%
Making of non-metallic mineral products	9.332.847.472	2,26%
Extractive industry	930.323.604	0,22%
Basic Mettalurgy	22.698.088.000	5,49%
Preparation and making of leather artifacts	3.057.768.565	0,74%
TOTAL	413.718.144.366	100,00%

Source: prepared by the authors with PAEP/SEADE data

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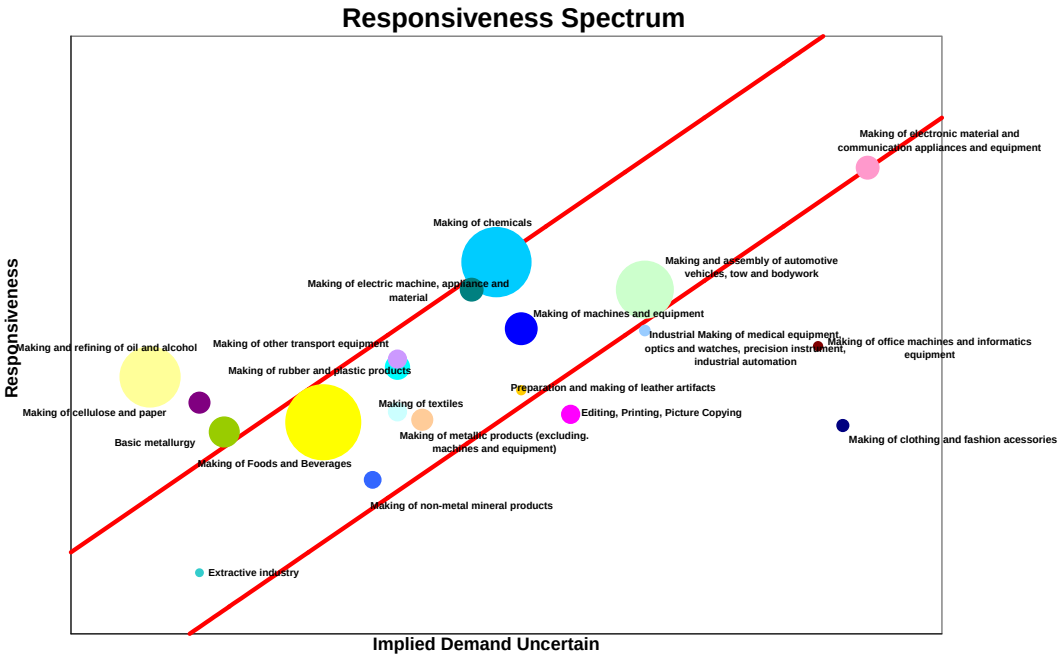

Figure 2 – Responsiveness spectrum of the São Paulo Industry
Source: prepared by the authors

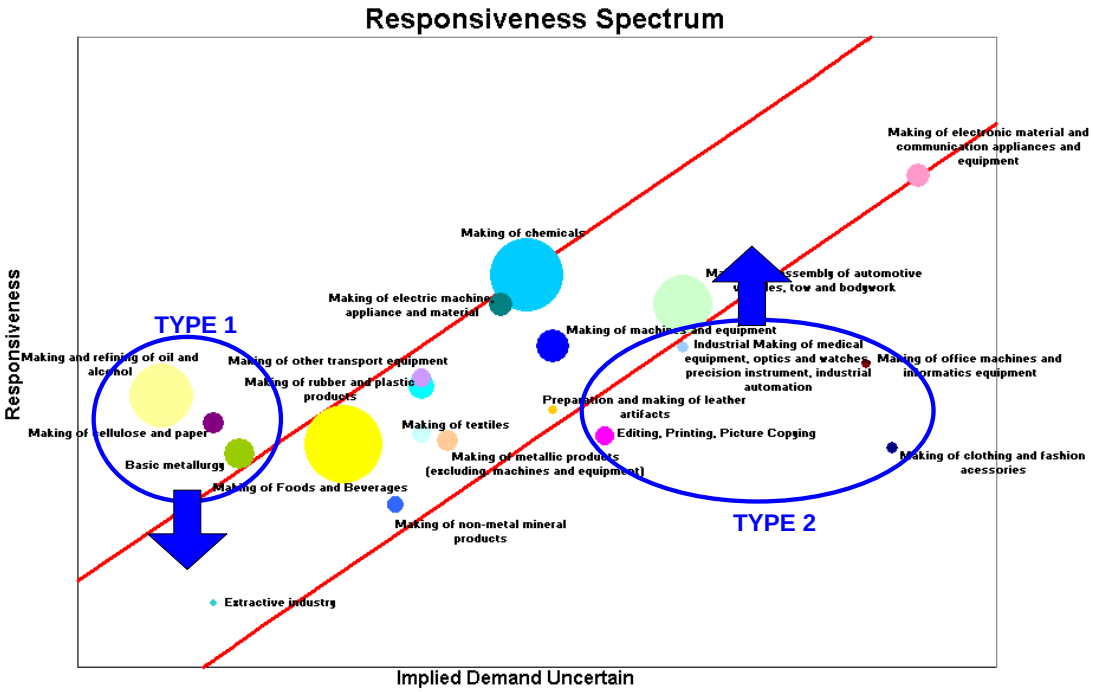

Figure 3 – Movement in the Responsiveness Spectrum
Source: prepared by the authors

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Table 8 – Breakdown of the Operations Management due to the Type of Chain

	Type of Chain	
	Responsive	**Efficient**
Main Objective	High Service Level	Low Cost
Transportation Management	Faster Modal, Poorer Capacity and in greater number.	Preference for modals of greater capacity and as cheap as possible.
Stock Management	Great variety and high availability.	To minimize stocks (variety and low levels) to reduce costs.
Location management	Great number of stores and the as close as possible to the consumer centers	Low number (even none).
Production Management	High flexibility, low volume, great number of new products with short life cycle.	Low variety and high volume.
Information manager	Sharing and immediate availability of information along the chain so as to identify changes and plan reactions as soon as possible.	Sharing and immediate availability of information along the chain so as to plan the operation at the lowest cost possible.

Source: prepared by the authors