

RELATIONSHIP UPSTREAM AND DOWNSTREAM EXISTING LINKS IN THE CHAIN OF SERRA GAÚCHA AUTOMOTIVE ACCORDING RASMUSSEN-HIRSCHMAN INDEX

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ABSTRACT

This study in the automotive supply chain of the Serra Gaúcha aimed to ascertain the central value given by this automotive supply chain upstream and downstream. For this we used the concepts of supply chain, automotive, among other theories. As an essential element for the delimitation of the study and in particular the chain of production data were used in the National Classification of Economic Activities - CNAE version 2.0. Regarding the type of research as the study was basically exploratory qualitative theme was followed the script for the case study, also help in solving this type of events and decision-making that occurred throughout the study and construction, yet to contribute to the line followed in the case study, in its twists and results presented. In addition we used several sources that contributed to the theoretical model used, such as books, journal articles, databases, reports on the subject matter drawn from the Internet and other available. After data collection and analysis of study materials, based on the Rasmussen-Hirschman index was reached that the identification of the automotive

industry generates downstream Serra Gaúcho, 1.08 times the value in its production, which values numerical represents R\$7.324 million for the year 2007 and \$ 8.953 million for 2008. Since the amount and rate based on the estimated value for the chain was estimated at 0.62, which representing the forward studied segment generates less value, in monetary terms presents U.S. \$ 4.57 million for the year 2007 and \$ 5.587 million for the year 2008. therefore, it is the recommendation that the automotive supply chain of the Serra Gaúcha is estimated at a value of 18.688 million to 22.847 million in 2007 and 2008, an increase of 22% in the years studied.

Keywords: *Automotive supply chain, Relationship upstream and downstream, Rasmussen-Hirschman index*

1. INTRODUCTION

The growing challenges of companies in the process of globalization and rapid technological change, means that new forms of management are incorporated in the business world. The establishment of inter-organizational relationships, where companies seek to focus on their core competencies, transferring to third parties other non-core activities, are increasingly gaining importance in the business scenario (STERNS, PETERSON, 2001). Changes in the global competitive landscape conditions difficult for businesses to survive (FORSMAN; PAANANEM, 2000), requiring the same to establish cooperative relationships in order to obtain the factors of production necessary for their maintenance and survival in the markets. In this context, it is a change of focus in terms of competitiveness, where new forms of competition emerge over the other. The isolated view of competitive productive unit loses ground to a broader group of competitive companies.

These new production arrangements can be analyzed on different denominations, such as chains, filière, Clusters, networks, alliances, virtual corporations, among others (HANSEN, 2004; PEDROZO; HANSEN, 2001; FLEURY; FLEURY, 2000; CASAROTO FILHO; PIRES, 1998; LAMBERT, 2001; COUTINHO; FERRAZ, 1995; PORTER, 1990).

Referring to the situation presented to justify the mesoanalíticas studies and interdisciplinary approaches, by allowing a more systemic, where all the isolated segments and / or connectors must fit together, and fit all the other variables in the general environment . The same changes that are driving companies to seek to establish the inter-relationships also predict the same trends. The supply chains need to build broader strategies that help them cope with these changes, looking at its future in a much broader context than that of its traditional markets and restricted. Knowing this can help future supply chains to adapt by choosing the most appropriate ways to seize opportunities and change strategies if threats to their environment glimpse of action. In this sense, the chains that strategically plan their future scenarios can anticipate situations that may influence the competitive potential of its agents. The scenario study rests on the premise of the complexity and the need to explore and understand the complex relationships, to establish possible alternative futures. This study aims to ascertain the value of upstream and downstream for the automotive industry in the city of Caxias do Sul it is necessary to define the concept of the automotive sector in this study. In order to assist in this task refers to the National Classification of Economic Activities, (NCEA) in its version 2.0.

The CNAE is the instrument of national standardization of codes of economic activity and a framework of criteria applied to all economic agents involved in the production of goods and services, including establishment of private and public companies, farms, public and private organizations, nonprofit institutions and individuals, this classification is the result of a joint effort of the three spheres of government, established under the coordination of the Internal Revenue Service and technical guidance from IBGE and was made official by publication in the Official Gazette - Resolutions IBGE / CONCLA N°. 01, September 4, 2006 and N°. 02, December 15, 2006 (IBGE, 2010).

2. LITERATURE REVIEW

2.1 Supply Chains

The articulation between the various progressive stages of the production process involving from the feedstocks, production, distribution, marketing and placement of the final product to consumers, forming links of a chain, can be understood by the production chain (MALAFAIA et al., 2006). The concept of supply chain originates from the filière concept of the French school of industrial economics. According Morvan (1984), considered to be a chain, some elements must be implicitly related to this vision.

Thus, the supply chain can be considered as a sequence of operations that determine the production of goods, whose interrelations are largely influenced by the technological possibilities, defined by the strategies of the links, and governed by the forces of the hierarchical chain.

According Batalha (1995), the sequence of operations is always a supply chain from downstream to upstream, in other words, the final product in the sense of the raw material base. In view of Ferreira (2003), analysis of supply chains can serve as a mechanism for technical and production description, in which the operations are described in the sequence in which they occur by analyzing the flow of technology. It can also be understood by this concept, the individual strategy of the firm, as well as their interrelationships with other links in the chain.

Neves, Jank (1994) consider a production chain as being made up by production segment: the segment of the processing of raw materials, and the distribution segment of products. According Zilbersztajn (2000), the chain of production may have a crop within a larger universe of a system. Thus, depending on the objectives of the study, may or may not include other segments on the amount of primary production, and it is important to study those who actually are the main determinants of the analysis. Thus, the concept of chains, the second Batalha (1995), can be located in the analytic space delimited by the contours of the external supply chain, seeking to identify any disorders that impair the efficient operation of the same and be located as a management tool in organizations. Figure 01 represents these situations.

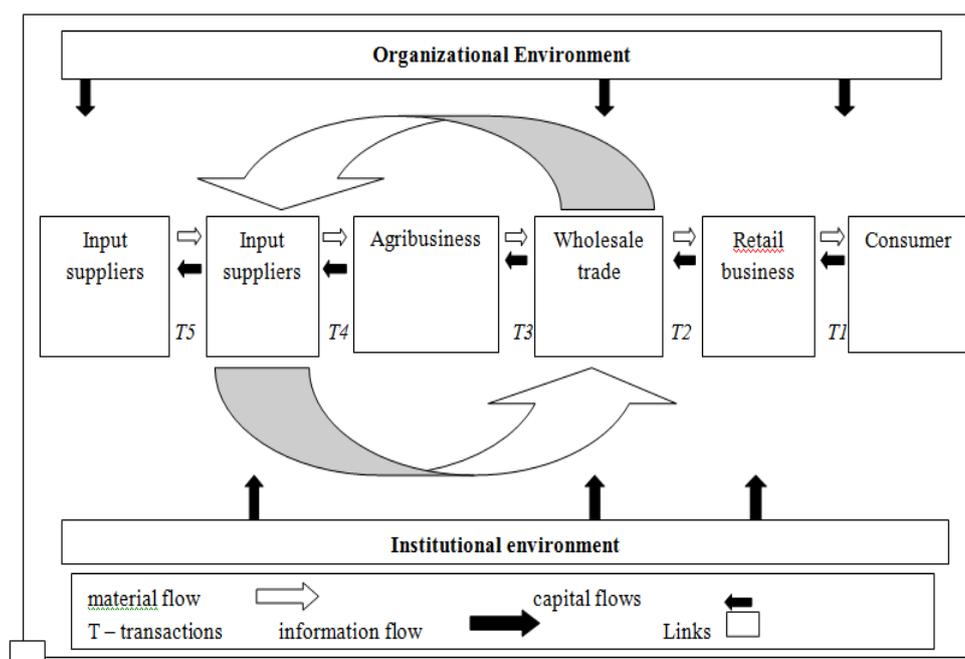


Figure 1: Layout of Theoretical Production Chain
Source: Castro *et al* (2002).

3. METHODOLOGY

3.1 Characterization of the Study

Since this study an exploratory function of a phenomenon that is not well known, the study characterized as exploratory. The exploratory study aims to "provide a framework that can facilitate the process of deduction of relevant issues in the investigation of a phenomenon" (Denzin, Lincoln, 2005). From that holding, it is possible for the researcher to formulate concepts and hypotheses to be further developed in subsequent studies. The study also has some characteristics of descriptive research, by describing the characteristics of the phenomenon here established in relations between the variables involved. This research used the case study, a procedure justified by the exploratory research. According to Yin (1984), the choice of case study as research strategy is justified when the study focuses on the scope of decisions, that is, trying to explain why decisions were made, they were implemented and what results found. It is also used a literature-based materials such as books, journal articles, databases, internet and other available.

3.2 Description of case

The case study concerns the automotive supply chain in the Serra Gaúcha, as shown in Figure 05. We chose this region because of its importance in the sector, due to be considered as one of the main productive centers in the country were involved agents representing all links of that chain to the diagnostic and prognostic analysis. Figure 02 presents the automotive division of the State of Rio Grande of Sul and number of businesses by the middle region.

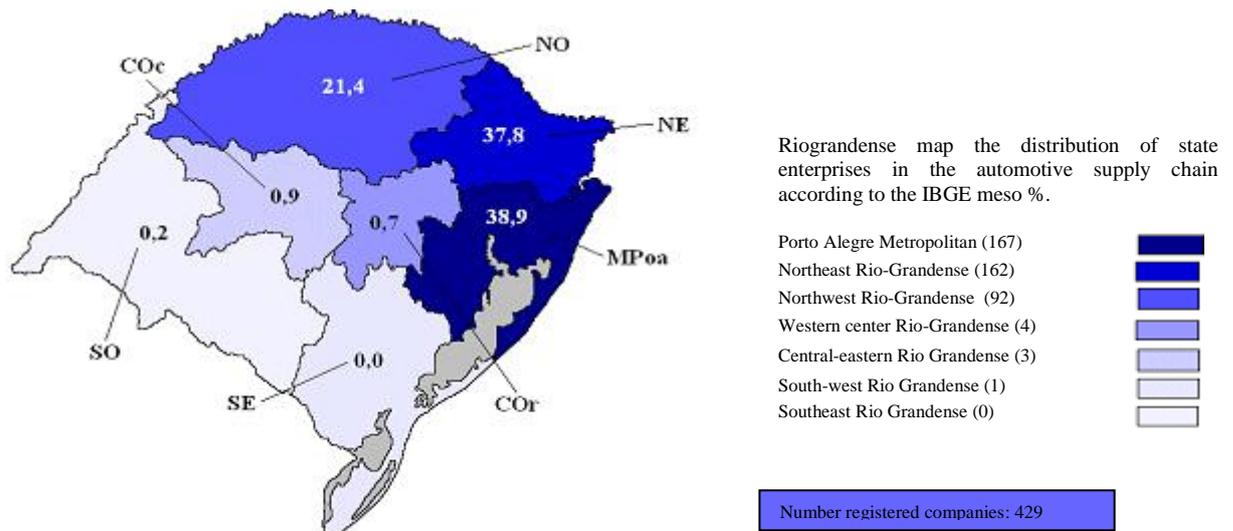


Figure 02: Chain and Metal Sector Automotive Sector of the Serra Gaúcha.
Source: Project GCD - IGEA (2010)

4. PRESENTATION AND ANALYSIS OF RESULTS

4.1 Índices de Hirschman-Rasmussen

To calculate the value of the Automotive Supply Chain of Serra Gaúcha was used indices Hirschman-Rasmussen. To calculate these indices b_j is defined as an element of Leontief inverse matrix and B ; B^* as the average of all elements of B e B^*_j , B_i^* , respectively, the sum of a column and of a typical line of B (FIGUEIREDO et al., 2005).

$$U_j = [B_{*j}/n] / B^* \quad \text{Defines the contents of link back (power dispersion) and}$$

$$U_j = [B_{i*}/n] / B^* \quad \text{Defines the forward binding rate (sensitivity of the dispersion).}$$

5. RESULTS AND DISCUSSION

5.1 Considerations of Automotive Sector

The automotive segment is formed by the manufacturing industry for light vehicles, vans and utility trucks and buses, agricultural and road machinery, auto parts and many other products and services that form the links in the automotive or automotive sector. This complex is present in about 40 countries and is one of the sectors that contribute to the development of world economy. Besides being one of the largest consumers of raw materials such as steel, aluminum, glass, plastic, among others, which directly contributes to the development of technological industries cited (CALANDRO; CAMPOS, 2000).

According Calandro and Campos (2000) in Brazil, it is highlighted and is considered one of the most important sectors of the economy. Has been developing over the past decades, where it reaches significant numbers of production and sales. Caxias do Sul in the automotive sector is established as a pillar of the economy. Currently, constitutes the entire segment with a metal mechanic of the main poles of the country. Caxias do Sul is the second considered the industrial center of the country.

In the automotive supply chain is possible to see that there are dynamic links that are devoted entirely to the chain, which provide only part of their production chain, as well as links that provide only a small portion of components to the automotive supply chain, but that run through all of it. The Federation of Industries of the State of Paraná - FIEPR (2010) describes the links as follows.

5.2 Links in the Chain Automotive

Suppliers of auto parts and systems, sale of parts and components (distribution and retail), Import / Export of auto parts, components and systems, Import / Export of vehicles, vehicle manufacturers, vehicle dealership / dealerships, Repair Services.

Besides the links mentioned above are part of this chain basic inputs such metal products, chemicals, rubber, glass, non-metallic timber. Compounds for the manufacture of electronics components used in electronics assembly of motor vehicles. Plastics used to manufacture components.

The complex is formed by the manufacturing of machines / tools for processing raw materials, manufacturing and assembly of parts and systems. They are included in this stage of the maintenance activities of machinery and equipment for the automotive industry. In addition to the logistics chain that supplies of raw materials, parts and components. Figure 03 presents the design of the automotive chain from the CNAE 2.0.

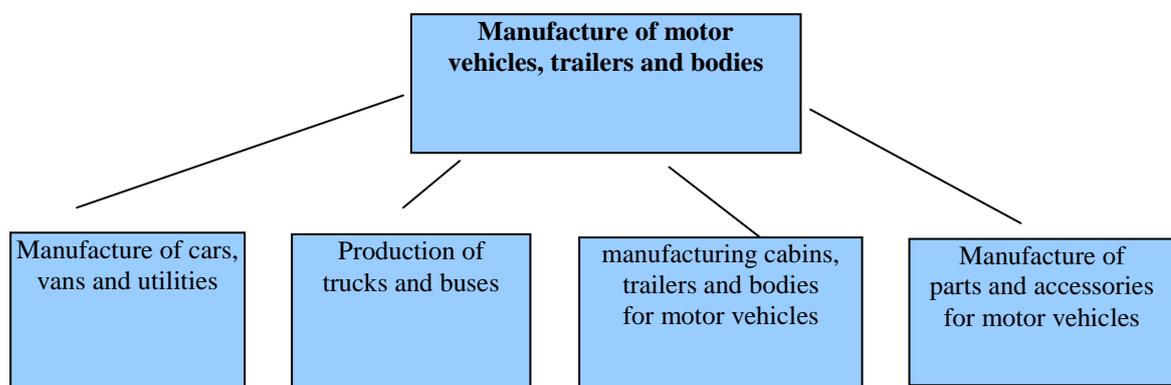


Figure 03 - Chain Automotive - 2.0 CNAE
Source: IBGE (2010)

Figure 04 represents the flowchart of the automotive chain of the Serra Gaúcha:

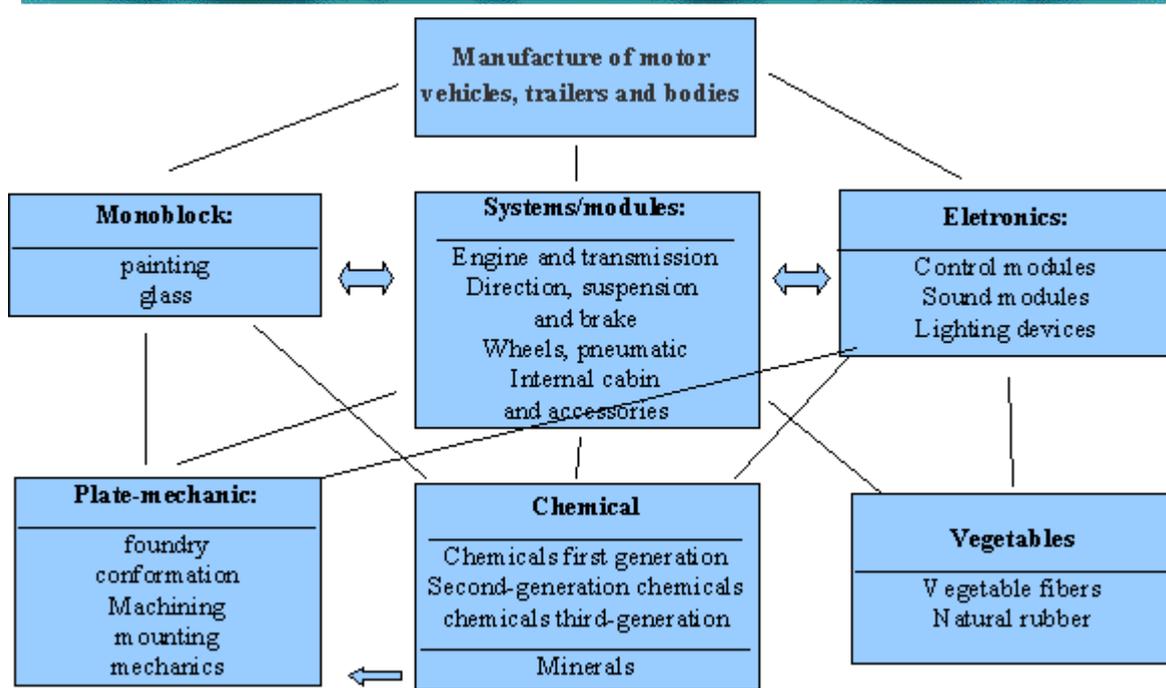


Figure 04 - Chain Saw Gaúcha automotive.
Source: Calandro, Campos (2000).

5.3 Economic importance of Automotive Sector

5.3.1 Sector Automotive in the Brasil

According to the Ministry of Development, Industry and Foreign Trade - MDIC (2010) The automotive sector is one of the most important in Brazil. Vehicles major automaker in the world are produced in the country are located in Brazil 19 companies automakers, with 40 plants located in Brazil, in 2007, was the 7th largest producer of vehicles, with production of 2.997 million units, the largest producer of buses and the largest producer of trucks in South America (MDIC, 2010). The importance of the automotive sector can be demonstrated by the figures in 2007:

- Participation of auto makers and the Gross Domestic Product - GDP in Brazil close to 5.4%.
- Generation of 120 300 direct jobs in the assembly of 217 000 jobs in the auto parts segment.
- Total direct and indirect jobs in the automotive supply chain is 1.3 million.

5.3.2 Automotive in the Rio Grande do Sul

According to the Gaucho Institute of Automotive Studies - IGEA (2010) the auto industry Rio Grande of Sul has 576 companies, 77,803 jobs, or 16% of industrial GDP, which represents \$ 13 billion in revenue and \$ 300 million investment year.

5.3.3 Automotive in the Serra Gaúcha

The automotive chain object of this prospective study of Serra Gaúcha is the main economic activity of the city. Caxias do Sul is the second largest city in the state, a position that remained in 2005, following significant investment in the expansion of production lines to meet the current and future demand (AUTODATA, 2010).

According to SIMECS (2010), the Union of Metallurgical, Mechanical and Electrical Material of Caxias do Sul and the Northeast Region which covers 17 municipalities, which includes 2,600 firms of which 2,200 are located in Caxias do Sul, totaling 46 thousand jobs

in this county. The Annual turnover of the segment in Caxias do Sul is \$ 11.7 billion the House Automotive R\$ 8,728,665,999 represents the industry sales of Caxias do Sul in 2009.

Figures 05, 06 and 07 present the economic and social data divided by the sectoral chamber of SIMECS related companies, and the number of employees by industry chamber. The information relates to the period accumulated and updated by the IGP-M January to December/2009 (SIMECS, 2010).

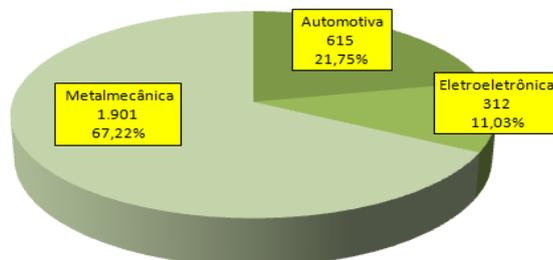


Figure 05 - Number of companies by industry chamber.
Source: SIMECS (2010).

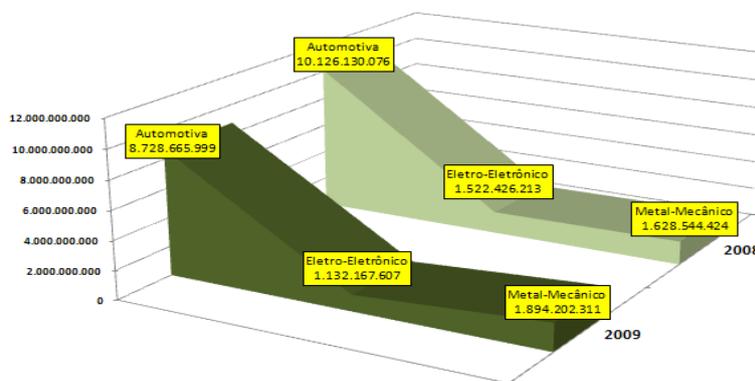


Figure 06 - Revenue by industry chamber.
Source: SIMECS (2010).

According to the National Classification of Economic Activities - CNAE 2.0, in the "C", which includes the processing industries and division "29" written for the manufacture of motor vehicles, trailers and bodies and more subdivisions are shown in Figure 07.

Hierarchy		
Section	C	Manufacturing industry
Division	29	Manufacture of Motor Vehicles, Trailers and Bodies
This division contains the following groups:		
291		Manufacture of cars, vans and Utilities
292		Manufacture of Trucks and Buses
293		Manufacture of cabins, Bodies and Trailers, Motor Vehicles
294		Manufacture of Parts and Accessories for Motor Vehicles
295		Reconditioning and Recovery for Motor Vehicles and Engines

Figure 07 - National Classification of Economic Activities - CNAE 2.0, section "C" division and "29".
Source: IBGE (2010).

Also according to the IBGE (2010), this division includes the manufacture of motor vehicles for transporting people and goods and the manufacture of cabins, trailers and semi-trailers for motor vehicles.

This division also includes the manufacture of parts and accessories, electrical and electronic banking and automotive upholstery for vehicles produced in this division and the manufacture of containers. She does not understand the maintenance and repair of motor vehicles (division 45).

Figure 08 shows the gross value of industrial production in the state of Rio Grande do Sul, as the Company's Annual Survey of IBGE, for the years 2007 and 2008 in thousand. These values are used to estimate the gross value of production for the city of Caxias do Sul.

Number Industry	2007	2008
C - Manufacturing industries	120.110.629,00	140.027.306,00
29 - Manufacture of motor vehicles, trailers and bodies.	119.666.729,00	139.447.759,00
	12.453.461,00	14.764.232,00

Figure 08 - Gross value of industrial production in the state of Rio Grande of Sul, in Thousand Dollars.

Source: IBGE - Annual Industrial Company / Table 1848 - General Data of the local industrial units with 5 or more persons employed by State, second division and group activities - Brazil, South and Southeast - except the Holy Spirit (SIC 2.0).

It can be seen in Figure 08, the gross value of production for total industry was 120 million in 2007, and 140 million in 2008. The CNAE 29 was 12 million in 2007 and 14 million in 2008. There is also the relative share of total CNAE 29 industries in the years studied.

Figure 09 shows the relative share of manufacturing industry for the total, as well as the participation of CNAE total of 29 industries for the years 2007 and 2008. These values are used as the relative size of each segment.

Number Industry		2007	2008
C - Manufacturing industries	C/number	100,00	100,00
29- Manufacture of motor vehicles, trailers and bodies	29/number	99,63	99,59
		10,41	10,59

Figura 09 – Relative share of the gross value of industrial production in the state of RS.

Source: IBGE, 2010.

It can be seen in Figure 10, the relative share of manufacturing industry goes from 99.63 in 2007 to 99.59 in 2008, showing a slight decline. When analyzing the CNAE 2, the movement is different. In 2007 was 10.41 and for 2008 is 10.59, an upward trend in the period.

5.4 Concept of Production Function

For Nicholson (1985) the production function is seen as a relationship that shows the maximum output that can be produced from any specified set of inputs given the existing technology or the state of the art.

Then the production function is used in economics to describe the relationship between quantity of inputs used in production and the quantity of products obtained. The savings are composed of a large number of companies using capital (K) and labor (L) to generate an

amount of production (Q). Thus, this function is defined as $Q = Q(K, L)$ (WONNACOTT, 1994).

The number of employees in Group CNAE 29 in the state of Rio Grande of Sul and in the city of Caxias of Sul, is shown in Figure 10.

	2007		2008
Rio Grande of Sul	41.758		44.767
Caxias of Sul	22.782		25.183
		2007	2008
29 - Manufacture of motor vehicles, trailers and bodies	VBP	R\$ 12.453.461,00	R\$ 14.764.232,00
Rio Grande of Sul	Workers	41.758	44.767
Coefficient	VBP/ Workers	R\$ 298,23	R\$ 329,80
Caxias of Sul	Workers	22.782	25.183
29- Estimation of VBP in Manufacturing		R\$ 6.794.260,94	R\$ 8.305.395,82

Figure 10 - Number of workers in CNAE 29 in the state of RS and the city of Caxias of Sul.

Source: MTE / PDET / RAIS (YEAR)

The Rasmussen-Hirschman indices indicate the degree of linkage sectors of the economy as far back as forward, ie, show the degree to which an industry demand or supply inputs to other sectors of the economy, as shown in Figure 11 .

	Downstream	CNAE 29	Upstream	Number chain
Hirschman-Index RASMUSSEN for 12 Cars, Trucks and Buses	1,08		0,62	
2007	7.324.213,30	6.794.260,94	4.570.309,10	18.688.783,34
2008	8.953.927,74	8.306.055,42	5.587.250,91	22.847.234,07

Figure 11 - Rasmussen-Hirschman Indices

Through this index can be defined upstream and downstream of the automotive chain. As can be seen from Table 08 the automotive industry generates downstream (in the link above) according to the Rasmussen-Hirschman index, 1.08 times the value. In monetary terms presents a result of \$ 7.324 million for the year 2007 and \$ 8.953 million for the year 2008. When analyzing the amount (in the link later) the Rasmussen-Hirschman index, is estimated at 0.62. Forward to say that the automotive industry generates less value. In monetary terms presents a result of \$ 4.57 million for the year 2007 and \$ 5.587 million for the year 2008. It should finally attract the attention of the chain is valued at 18.688 million to 22.847 million in 2007 and 2008. A 22% growth in the years studied.

6. CONCLUSION

The design used in this study for the automotive supply chain of the Serra Gaucha behaved the assembly and manufacture of trucks, tractors, agricultural machinery, road equipment, motor vehicles for transporting people and goods, manufacturing, cabins, trailers and semi-trailers automotive vehicles. They are part of the segment also parts and accessories for automotive vehicles, such as electrical, electronic, and upholstered seats. From the elaborate design for the automotive supply chain of the Sierra gaucha there was the need to map also the representation of different links that make up this segment of the

industry of the state and thus, this paper proposed from the Rasmussen-Hirschman Index of the discovery of the value that represents both the upstream and downstream in the degree of linkage sectors of the economy, this indicator shows the degree to which the segment demand or supply their products to other segments of the economic system. With the study and based on the Rasmussen-Hirschman index was reached that the definition of the automotive industry generates downstream Serra Gaúcho, 1.08 times more value in their production. Where, when dealing with numerical values, this represents U.S. \$ 7.324 million in 2007 and \$ 8.953 million in 2008. Since the index of the amount Hirschman-Rasmussen, was estimated at 0.62, which means that the automotive industry forward Serra Gaúcho generates less value. And in monetary terms this represents a value of \$ 4.57 million in 2007 and \$ 5.587 million in 2008.

Therefore it is recommended that the automotive industry of the Serra Gaúcho is estimated at a value of 18.688 million to 22.847 million in 2007 and 2008, an increase of 22% in the years studied.

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