

The Influence of Automakers in

Industrial Organization of their

Suppliers: The Case of the Brazilian

Automotive Complex

AUTHORS:

João Amato Neto, PhD

Assistant Professor

Production Engineering Department

Politécnica School / University of São

Paulo/Brazil

Flávio D'Angelo, PhD

Associated Professor of Production

Engineering Department - Mauá

Engineering School/Brazil.

Abstract

This paper provides a multiple case study of the Brazilian automotive and auto parts industry and an analysis of trends on their organization and relationships. After a period following international standards in work organization and supply chain relationship, transnational automotive companies developed new models, like modular consortium and industrial condominium, to improve their production competitiveness. In these lean models, suppliers have an important role as mostly tier 1. In the past, product requirements were enough to guide the relationship between automakers and auto parts companies. Nowadays there are requirements of quality, logistic, product development, process control and cost. This global approach of automakers has as main line lean production principles and as target wastes elimination. The result is that auto parts companies became lean, even though most of the time it is not clear to suppliers and in some automakers' departments either.

key words: *supply chain; Brazilian automotive complex; globalization.*

The History of Brazilian Automotive Industry

Brazilian automotive industry was created during 50's through a planned action of government which target was developing the Brazilian industry and updating the way of life in the society according to standards of the United States and European countries.

The development of this industry has been made in steps. The first step was in 50's, when many international automotive companies (like Volkswagen and Mercedes Benz) built factories in Brazil. Others companies like General Motors and Ford, which had started their activities in Brazil in the beginning of the century, have enlarged their activities. These investments were based on official incentives and protection against foreigner competitors.

The second step was between 1958 and 1962, when a fast increase of production and sales. The next step is between 1963 and 1968, when a big recession was responsible for a very small annual increase in automotive production. After that, a new period of development (up to 1974) and a new stagnation period (from 1974 to 1980). This last period was called "the lost decade", because the production level in the end was almost the same of the beginning and there were almost no change in the models produced.

In the beginning of 90's, two important things have happened. On one hand, the creation of the concept of *popular cars*, with small tax for car which price was around US\$ 7,000.00¹. On the other hand, the Brazilian market was opened to foreigner vehicles and auto parts. This fact has finished the protection that Brazilians companies have had during almost thirty years and that has caused technological, organizational and quality backlog between these companies and their original units in United States, Japan and Europe. In a second moment (1994, with *Real Plan*), the end of high inflation levels has eliminated the financial profit of the companies. After that they have passed to look for profit in their core business.

The modernization Process

The opening to international markets has put Brazilian auto parts companies face to face with international players and costs. This situation has obligated these companies to make big efforts to attain international level of quality and productivity. Automotive companies have improved day by day the quality requirements of products that they were buying. Certifications according to quality standards like ISO 9000, QS 9000, EAQF 94, VDA 6.1, AVSQ 1994 and, more recently, ISO/TS 16949 have become essential for all suppliers. For some automakers to have a quality system certification is not enough any more. The target is zero defect and preventive and corrective actions have strict monitoring by automotive companies. Defective parts are not acceptable anymore and parts must be delivered directly in assembling line, without any inspections by automotive company.

With option to import auto parts and vehicles, automotive industry, which has established the principle to buy the world wide best price, has forced auto parts companies

to achieve international prices. This means that auto parts companies need to improve their productivity and most of them are making these through *lean production* principles.

Brazilian macroeconomics trends play an important role in this relationship. From 1994 up to 1998, with exchange rate of R\$1.00 to US\$1.00 automotive companies were importing a big quantity of auto parts. At the same time, it was very difficult to Brazilian auto parts companies to exports their products. After January 1999, with a new exchange rate², Brazilian auto parts are very competitive in internal and international markets. Besides that, this new exchange rate has made possible to sell Brazilian vehicles abroad.

This modernization process has happened with models produced in Brazil, as well. During the 80's only two new models were launched and almost all of others cars are old European models, projected in 60's and 70's except, of course, the Beetle which project was made in 30's. In this period, Brazilian exported cars were very different (in technological way) of their "similar" which were sold in internal market. During 90's a very strong replacement of models has taken place. Nowadays most of Brazilian cars are updated with international markets in design and technological aspects.

Due to the possibility of importation of cars from USA and Europe, big cars are not produced anymore in Brazil. This part of the market wants so many different models that it is not possible to any automaker achieves a profitable production level.

Brazilian automotive industry has achieved international cost and quality level. Some Brazilian units have become so competitive that workers in the original country of the company have made protests and strikes against Brazilian exportations of cars and trucks.

The Mercosul

Another international point which has influence over Brazilian automotive and auto parts industry is the relationship with partners of Mercosul³, mostly with Argentina. The other partnerships, Uruguay and Paraguay, have a secondary hole due to small size of their economy. With an industrialization process similar to Brazilian's one, Argentina's automotive and auto parts industries has passed by one big crisis in 80's (worse than Brazilian's crisis). This crisis has resulted in a technological backward. Besides that, the Argentinean population is smaller than Brazilian one, therefore the market is smaller, too. The last, but not the least point, is the exchange rate. Argentinean government has maintained the parity between Peso and Dollar. These conditions have made Argentina's automotive and auto parts industries a "satellite" of Brazilian complex. The original idea was to maintain equilibrium between two partners, with free circulation of auto parts and vehicles. Nevertheless, a lot of Argentina's auto parts companies have been bought for Brazilians ones. Most of Automotive companies have established their headquarters and main factories in Brazil. Some automotive companies defined that Brazilian factories produce small cars (low price, high volume) and Argentinean factories are in charge of medium size cars.

After the Argentinean bankrupt, in 2001 and 2002, the automotive industry almost stopped their activities, like almost all industrial sectors as well. The internal market almost disappeared and exportation to Brazil was the only one possible destination to Argentinean cars and auto parts. During 2003 the Argentinean internal market was revived, in a very low scale. This situation places the Argentinean automotive market in a secondary position to Brazilian automotive and auto parts companies.

Relationship between auto parts and automotive companies

Before discussing the new pattern of relationship amidst suppliers (auto parts) and their clients (automakers), we'll analyze the evolution of this kind of relationship, since of the beginning of the automobile industry. Already in the primes of the former industrial production principles, the big companies within the automobile sector called forth the emerging of a countless number of small companies, suppliers of auto parts, which started to produce many kinds of parts and components for the large car manufacturers of that time (first half of this century). Even though companies such as Ford and General Motors showed high standards of vertical integration, while Chrysler and the European companies tended to buy greater part of the components from independent firms, the fact is that subcontracting has been present since the very birth of the automobile industry.

However, although a great number of parts and components had been bought from "captive subsidiaries", such companies developed their own projects independent from the final product (automobile) on which these parts were to be used. Thus, a number of problems arose in the relationship between the contracting firms (manufacturers) and suppliers of auto-parts, such as:

1. Irregularity in delivery times, in many cases due to their own informality in contracting individual items.
2. High rate of faulty or defective pieces, incompatible with the parts with which they were to be assembled. (Not assured quality).
3. Conflictive relationship between suppliers and vehicle manufacturers, mainly during the frequent strikes occurred in the 1960-ties and 70-ties, in the North-American industry, which aggravated the delivery problems. This whole situation forced the large manufacturing companies of the time to seek schemes of *double supply* in order to prevent eventual gaps in delivery (and consequent lack of parts).

After 1950, the Japanese automobile industry has developed a new production strategy, latter called lean production (that will be analyzed following), with, besides other very important new ideas, a very different system of relationship between suppliers and manufacturers. The basic idea of this subcontracting system consists in narrow links between the small auto-parts supplying companies and the large car manufacturers. Such links include cooperative development of new projects and/or improvement of already existing parts/products by means of technical assistance, mutual use of laboratories, personnel, test equipment, etc., as well as the possibility of financial support from the large manufacturer (usually tied to huge conglomerates) to the small and medium size industries.

Some of the main benefits gained through this scheme by the large manufacturers should be emphasized:

1. Within the logic of the "just-in-time production system", the intention to eliminate or at least minimize the maintenance of stock is amply favored by the possibility of transferring to the suppliers the onus of high stock of parts and components. This means very little demand of high rate rolling capital on the part of the manufacturers. It should be further pointed out that the physical proximity between supplier and manufacturer represents the "key" to success of the "just-in-time" system.
2. In times of uncertainties and instabilities of the market, the risk, associated to high investments in a very vertical plant, becomes significantly smaller, when the manufacturers transfer the task of producing their different types of components and sub-products to smaller size companies.
3. The managerial decentralization accomplished by this subcontracting arrangement, makes the productive system (manufacturer and suppliers) much more

efficient as a whole. In special, the search for "total assured quality" production or for "zero error" becomes more and more facilitated at smaller size industrial units.

Nowadays, in order to be able to compete better, automotive companies have started a new kind of relationship with their suppliers. A new concept: the modular system has appeared and a lot of new obligations were passed from automakers to the supplier. The responsibility over development and production of one or more systems has made necessary that the auto parts companies have a high level engineer team. This team is very expensive and the companies need to have high production level (in worldwide scale) in order to share costs. It is not the condition of Brazilian companies, which are, most of them, local player.

The international competition has created the concept *follow sourcing*, which means that a supplier will work together with an automotive companies any country which the last one has factories. It makes necessary that the supplier has several factories (most of them very small) and far from each other. There are few Brazilian companies that are able to attend this condition.

Finally, the Brazilian market as a whole is very attractive for international auto parts companies and they can buy Brazilian companies very cheap (according to international prices).

Considering these facts it is easy to understand why most of Brazilian companies were sold during the last ten years. Even companies which were considered with international level of performance were sold. The number of Brazilian independent companies has become smaller day by day. According to Sindipeças⁴, in 1994 the share market of Brazilian auto parts industries was around 50% according criteria like value of capital, auto parts sales or value of investments. In 1999, using same criteria, the share market of Brazilian companies is around 30%. Ten years ago Brazil had 38,000 auto parts companies, today it has 8,000 but up to 2010 they will be only 2,000. Brazilian auto parts companies do not participate in new developments anymore because they are not able to attend new requirements of automotive companies as a worldwide player. They do not have capital and production level to develop new products and new production process. Beside that, with new automotive companies have arrived several international auto parts companies. These companies need to achieve high production scale and are fighting over market share with Brazilian companies. Therefore, in a few years, they will probably be working only in aftermarket. Brazilian aftermarket is very profitable, so profitable that automotive companies are working very hard to establish themselves into it. With so powerful competitors, the future of Brazilian independent companies is not clear.

There is an international process of concentration of auto parts companies. Big companies have bought others in order to have high production level and to be able to make big investments in product development. In fact, the automotive components and production process have become so sophisticated that to be a global player to have adequate return of the investment. Just to illustrate this tendency it could be mentioned the following companies: Delphi, Visteon, TRW (that bought an important Brazilian auto part company-Freios Varga, in the recent years), Magnetti-Marelli (that, in the recent years too, bought another global Brazilian auto part company-Cofap), Valeo, Meritor, Mahle (that is another company which bought an important Brazilian auto part company-Metal Leve- in the recent years) , Eaton , in the midst of others.

After 20 years with only eight companies (Ford, Fiat, General Motors, Mercedes Benz, Toyota, Scania, Volkswagen and Volvo) assembling cars, busses and trucks, Brazil has received investments of new automotive companies (Honda, Renault, Peugeot, Kia, Audi, Chrysler, Navi Star, Nissan, Rover, Iveco, etc). Besides, older players have opened new factories (Ford, General Motors, Mercedes Benz, Volkswagen and Toyota) and some of them have changed their core business (Volkswagen has started operations with busses

and trucks; Mercedes Benz is assembling cars, Toyota has started assembling cars after thirty years assembling a kind of Jeep). So many new factories and companies make sure that Brazil is a very interesting place for transnational automotive companies both due to internal potential market and to be an exportation base. On one hand Brazil is against the international trend because there is a superabundance of automakers plants and many of them have been (like Navistar one) or will be closed.. On the other hand, Brazilian automotive industry is following the international trend of productive alliances. While PSA and Renault are producing together vehicles and engines in Europe, in Brazil PSA is a supplier of 1.6 engines to Renault and receive 1.0 engines of this company. Chrysler and BMW have a joint venture to produce engines (exported to be used in Neon, PT Cruise and Mini) in Brazil. New factories are been built out of the traditional industrial center (São Paulo State) and most of them have received tax incentives. Sometimes local governments have made investments and are owner of a part of new companies. Besides, official banks have made loans with reduced interest tax for some automotive companies. There are official benefits for auto parts companies to establish themselves in these new areas too, but most of times this benefits are not so good than those received by automakers. Governments have justified these benefits with the generation of a lot of jobs. In fact, the industrial job in these places has improved, but the amount of workers in automotive and auto parts industries is very smaller than that one which has been announced. In these areas of later industrial development salaries are smaller than in São Paulo, where unions are stronger and have more effective actions. The payment of a worker in Curitiba - Paraná State is one third of the one with similar job in São Paulo. Therefore, logistics costs due to be far from São Paulo (which is the most important market for cars) are compensated by smaller salaries and tax incentives. Nevertheless, nowadays workers are protesting against this policy and there are doubts about how long this difference should be maintained.

A new concept has been used in new plants of automotive companies: “*systemist supplier*” or “modular supplier”. A *systemist* is a company which is responsible to assembly a big and important system (engine, suspension, people control, vehicle control for instance) of vehicle and sell it to automotive companies. The parts that form the system can be produced or bought by the *systemist*. This concept was not only in use in Brazil.

This concept share responsibilities between supplier and automotive companies. A lot of work is passed to the supplier and it causes a cost reduction for the vehicle producer. This reduction is due to smaller salary that suppliers use to pay for their workers. In addition that, this kind of organization transfers the stock (and its cost) to the supplier

The concept of systems was based on three points:

1.) suppliers must to be close to assembling factory.

There are two usual ways to manage this point. First, the supplier is established into the automotive factory and its workers are responsible for assembling and test a part of vehicle (one or more systems). This system (Modular Consortium) is being applied in Volkswagen trucks factory in Resende - Brazil. The other option is the Industrial Condominium, where suppliers are established in the automotives plant but they maintain their independent factories.

2.) makes assembling operation simple.

Vehicle must be design to be easily assembling. The assembling operation must be to put twelve (or less) systems together. It means that only 10% of operations are realized in automotive factory.

3.) integrated logistic

With small distance between factories, the shipment can be just in time and batches can be very small. In this system, the automotive industry is responsible by the project, the management of production and quality control. Several activities of vehicle assembling are

transferred to suppliers. Automotive companies concentrate their efforts to car conception and marketing activities.

According to this model, suppliers are responsible for design of each system. The automotive companies define performance, lay out, interfaces, quality aspects and costs. Sub suppliers development is a task for suppliers. If the supplier cause any problem (like an assembling line stopped), it will receive a penalty, most of the time paying for all costs that automotive company have. In this kind of production organization, the relationship among automotive company and its suppliers have changed a lot. In traditional model, there was little commitment between two suppliers. In *Modular Consortium*, for instance, the payment for all suppliers is making only after the quality control approval. If a vehicle was rejected, no supplier would receive the payment (it does not matter who is responsible for the rejection). On the other hand, in *Industrial Condominium* the supplier must have just in time production and delivery. Automotive industry does not allow finished products stock, because it means high final costs to vehicle.

The Lean Production Model

This production model has been first developed in Toyota in 50's. Initially it was not a theorist model, but a group of practical actions developed around the idea to eliminate wastes in industrial activities. In fact, the Lean Production can be defined as *a permanent work to find and eliminate wastes in all process into the organizations*. After some years of application and improvement of these practices, they were organized as a production model. This model is an evolution of Mass Production Model, applied by Henry Ford in 20's. The success of Toyota and other Japanese companies that used this model has validated it and has made occidental industry to pay attention in these ideas. Now a day Lean Production Model is the industrial paradigm, applied in almost all industrial areas.

The main idea is to remove all waste in all activities. Sources of wastes can be: defective products; excess production; unnecessary production; stocks of raw material, in process items and products; unnecessary work; unnecessary movements of people and materials; waits and projects and services that do not attend client desire.

In order to avoid wastes, some principle must be applied. They are:

- define the product value;
- define the value stream;
- make sure that activities into value stream go on in fast and continuous way;
- implement the pulled production, that means, the product will be done just after a requirement of the customer;
- continuous improvement of product quality, process performance, project activities and all other activities into the company.

The Lean Production Principles remove all safety buffers in the process. Therefore, every problem in quality, project, workmanship, logistic and so on would mean a production break. Therefore, all these aspects must be well developed and must improve continuously.

The development of case study of four auto parts companies

The purpose of this study is to analyze the relationship of four different companies with their automotive clients. The target is to answer the question: *does the relationship with automotive parts help auto parts companies to adequate themselves to lean production principles?* It has been done through a multiple case study because the phenomenon that is studied is very complex and can not be taken of its context without

loosing its consistence. Information was collected directly from each company, through a questioner, followed by a personal visit in each site.

The selection of companies has made according to some criteria:

- 1) Tier 1 automotive suppliers, but with different customers;
- 2) Different customer port folium;
- 3) Different origin, size and time of work
- 4) Different types and levels of technological dominium;
- 5) Different sizes

In order to guarantee the confidentiality of companies' names, they were called X,W, Y and Z.

In order to make this evaluation it was necessary to establish a standard and a metric to compare practical results themselves and against reference points. The reference adopted was two complementary standards: *SAE J4000 – Identification and measurement of best practices in implementation of lean operation* and *SAE J4001 – Implementation of lean operation user manual*.

These standards has been chosen because where defined by an independent and recognized institution. Other reason for this choice was the structure of these standards allows defining numerical metrics to evaluate companies. Since it was not expected that all companies would have some no conform points, a pass/non pass criteria would not be helpful for result analysis. In this case study, a points scale were defined, showed below in italic letter. This scale allows making numerical analysis since one specific item up to all the organization.

The SAE J 4001 is divided in elements. Six of them are used to evaluate organizations. They are:

Element 4: Management and Commitment

Element 5: Human Resources

Element 6: Information

Element 7: Supplier / Organization / Customer

Element 8: Product

Element 9: Process / Flow.

Each element is formed by specific requirements. In this research, these requirements were transformed in questions to be answered by each company. This transformation had the target to guarantee a good and the same comprehension of each item.

These standards establish key points in all organizational activities and define how each one must be satisfied. The evaluator must indicate how each item is. There are four options (called levels):

- Level 1: item is not implemented (*0 point*);
- Level 2: item implemented, but information is not used to continuous improvement (*1 point*);
- Level 3: item implemented and information is used to continuous improvement (*2 points*);
- Level 4: item implemented, information is not used to continuous improvement with important progress in last year (*3 points*).

Each company received a questionnaire, where an executive of Quality Department evaluated the achievement for each requirement of the standard. Moreover, it was asked to them to indicate which requirement of SAE J 4001 was a customer requirement as well.

The analysis was made taking in consideration the global satisfaction of lean principles and the satisfaction of customers' requirements. A comparison between quality

system standards requirements (ISO 9000, for instance) and results of each company have been done because in some cases, certification of quality system is a requirement of automotive companies.

The Results

These results are concerning the research moment and, of course, can be other nowadays.

The W company was 55 years old. It was supplier to automotive companies and sold in aftermarket. It was Brazilian and had 250 workers. Its quality system was certified according QS 9000 due to customer ask. Executive and technical people did not know about lean production principles and standards SAE J 4000 and SAE J 4001 either. This company satisfied 69% of SAE J 4001 requirements. A deep analysis of results showed that this high level of achievement was strongly affected by customer and QS 9000 requirements. This influence was expected, since principle of lean production was not known by technical and executive people.

The X company was 43 years old. It was just a supplier to automotive companies. It was transnational company and had 850 workers. Its quality system was certified according QS 9000 due to own initiative. Executive people knew about lean production principles and standards SAE J 4000 and SAE J 4001 as well. This company satisfied 70% of SAE J 4001 requirements. A deep analysis of results showed that this high level of achievement was strongly affected by QS 9000 requirements, but weakly influenced by customers' requirements. Even though technical and executive people had knowledge about lean production principles and standards SAE J 4000 and SAE J 4001, there were not an effort to satisfy the all standards' requirements.

The Y company was 8 years old. It was just a supplier to automotive companies and sold in aftermarket. It was transnational company and had 130 workers. Its quality system was certified according QS 9000 due to own initiative. Executive and technical people knew about lean production principles but did not know about standards SAE J 4000 and SAE J 4001 as well. This company satisfied 67% of SAE J 4001 requirements. A deep analysis of results showed that this high level of achievement was strongly affected by customers' requirements. Even though technical and executive people had knowledge about lean production principles, it is not the reason of improvements.

The Z company was 2 years old. It was just a supplier to automotive companies. It was transnational company and had 60 workers. Its quality system was certified according ISO/TS 16949 due to customers' ask. Executive and technical people knew about lean production principles but did not know about standards SAE J 4000 and SAE J 4001. Important improvement vectors are customer and ISO/TS 16949 requirements. This

company had many requirements classified as level 4 (significant improvements in last year) and has many requirements classified as level 0 (requirement not attended). Probably it was due to be a new factory, where some things were recently implemented and had good progress, in spite of other things that were not implemented.

Results of this research allowed different kinds of analysis. In this way, it was possible to analyze the performance of one company by each specific requirement, by elements or concerning the global standard. On the other hand, it is possible to analyze the performance of many companies concerning one requirement or element. A global approach (all companies together) was possible as well.

Conclusion

In few words we can tell that, in Brazil, the relationship with automotive companies makes auto parts companies look for achieving lean production principles in productive and administrative areas. Almost all requirements of automotive companies are in line with these principles, even though there are some requirements that are against lean principles.

Some examples of requirements in line with lean principles are: product development by suppliers; high quality level of products; high level of process control; standardization of logistic operations; quality system certification; product quality assurance; cost reduction and human resources development.

Requirements of automotive companies against lean principles are: safety stocks that supplier must have near to customers' factory; technical people of supplier that work into automotive factory to solve problems that eventually could happen. These two needs are the result of believe that problems will occur at an undefined moment. Lean production principles say that if you had a problem, you should eliminate the root cause and must not put something (people or stocks) to minimize the effect of the problem. Nevertheless, a car is formed by thousands parts and the lack of one is enough to block the commercialization of a unit. Therefore, these requirements of automotive companies could be wrong in theoretical way, but in the practical approach they are very understandable.

The influence of automotive companies over auto parts companies to be lean is very positive, even though some time it is not realized by auto parts companies. Each automotive company has specific strategies to improve the productivity in its production chain, even though some times with some previously defined waste. Usually these strategies are deployed in quality, logistical, financial, technological and other requirements. Auto parts companies receive these requirements from different people of automotive companies in different moments and with different approaches (since a "suggestion" up to a "mandatory requirement"). This process of communication makes difficult to supplier to understand the philosophy behind some many requirements. To make things worst, some times automotive workers that have contact with suppliers do not have this complete vision of the strategy, and it makes more confused the suppliers' perception.

One point that makes more difficult a complete satisfaction of SAE J 4001 requirements is that there is no evaluation and certification according this standard by

customers or independent auditor society. In a quality system certification, all elements must be ready to have a good result. So, there is a uniform work in all aspects of the company. In the case of lean production principles standards, there is no evaluation and a death line to have all activities done. Therefore, even in companies that know this standard, it is not used to evaluate the production and administrative system, and most of time, activities that result in progress in lean direction are result of a different desire, not to improve this activity.

Since the priority in almost all auto parts companies is to attend customers demands, this requirements are the more important vector to auto parts companies adequate themselves to lean production principles. Another important reason for this movement is a quality system certification, which sometimes is another demand of automotive companies.

Efforts to be lean caused by a desire to have significant improvements are not usual in companies in Brazil (Brazilian or transnational companies). But, companies that have decided to go in this direction normally have results more significant and faster than companies that are focused in attending customers demand.

References

ADDIS, C. Cooperação e desenvolvimento no setor de autopeças. In: ARBIX, G.; ZILBOVICIUS, M. (org). *De JK a FHC: a reinvenção dos carros*. São Paulo, Scritta, 1997.

ADLER, P. S., *The "Learning Bureaucracy"*. New United Motor Manufacturing, Inc., School of Business Administration, University of Southern California, 1991.

AMATO NETO, J. - *"Desintegração vertical/"terceirização" e o novo padrão de relacionamento entre empresas: o caso do complexo automobilístico brasileiro"*. São Paulo, 1993 - Thesis (doctorate). Polytechnic, University of São Paulo (Brazil).

AMATO NETO, J.; D'ANGELO, F. - ***"Supply chain and new industrial organization forms: the case of Brazilian automobile complex."***

in 1st World Conference on Production and Operations Management, Sevilla, Spain, 2000.

ARBIX, G.; ZILBOVICIUS, M. Consórcio Modular da VW: um novo modelo de produção? In: ARBIX, G.; ZILBOVICIUS, M. (org). *De JK a FHC: a reinvenção dos carros*. São Paulo, Scritta, 1997.

AUTOMOTIVE INDUSTRIES. Modular mania, november 1998. pag. 34.

BEST, M. H. , *Institutions of industrial restructuring*. U. K., Polity Press, 1990.

- BUTERA, F., *"Dalle occupazioni industriali alle nuove professioni"*. Milano, RSO/Organizzazione Tecnologia e Società, Franco Angeli Libri S.R.L., 1987.
- CHANARON, J. J. et all , *"Constructeurs/fournisseurs: spécifités et dynamique d'évolution des modes relationnels"*. Journées Internationales du GERPISA-RI, Paris, juin 1993.
- D'ANGELO, F. *"Padrões Normativos para Sistemas da Qualidade."* in Amato Neto, J. (org). *Manufatura Classe Mundial* . - São Paulo - Editora Atlas 2001.
- DIAS, A. V. C. *Consórcio Modular e Condomínio Industrial: elementos para análise de novas configurações produtivas na indústria automobilística*. Dissertação (Mestrado) – Departamento de Engenharia de Produção, Escola Politécnica, Universidade de São Paulo, 1998.
- DIAS, A. V. C.; GALINA, S.V.R.; D'ANGELO, F. Análise contemporânea da cadeia produtiva do setor automobilístico: aspectos relativos à capacitação tecnológica. In INTERNATIONAL CONGRESS OF INDUSTRIAL ENGINEERING, 5., Rio de Janeiro, 1999. Anais (CD-Rom)
- EISENSTEIN, P.A. Dancing the Automotive Samba in Brazil. **Automotive Industries**. v.176, n.9. p. 94,101. Sep. 1996.
- FERDOWS, K. *Making the Most os Foreign Factories*. Harvard Business Review, p. 73-88, mar/abr 1997.
- FERRAN, L.. *Fornecedores do Complexo Industrial Ford de Guaíba*. Porto Alegre, 16 set. 1998 (Apresentado à Federação das Indústrias do Rio Grande do Sul – FIERGS).
- FLEURY, A. *Estratégias, organização e gestão de empresas em mercados globalizados: a experiência recente do Brasil*. Gestão e Produção, v.4, n.3, p. 264-277, dez. 1997.
- FREYSSENET, M.; LUNG, Y. *Between globalization and regionalization: what future for the automobile industry?* Actes du GERPISA, n. 18, novembre 1996.
- POSTHUMA, A. C. Autopeças na encruzilhada: modernização desarticulada e desnacionalização. In: ARBIX, G.; ZILBOVICIUS, M. (org). *De JK a FHC: a reinvenção dos carros*. São Paulo, Scritta, 1997.
- SALERNO, M. S.; ZILBOVICIUS, M.; ARBIX, G.; DIAS, A.V.C. *Mudanças e persistências no padrão de relações entre montadoras e autopeças no Brasil: proximidade, global e follow sourcing, parcerias e co-design revisitados*. Research Report, Escola Politécnica, Universidade de São Paulo, 1998.
- SCHULZ, H. *Globalization of Markets Compels Changes in the Value Addition Chain of the Automotive Industry*. Produção, vol. 7. nº 1, jul. 1997, p.69-73.
- SILVA, F.A.P. *Avaliação da implementação e manutenção de um sistema da qualidade certificado: estudo de caso de uma empresa de autopeças*. São Paulo, 1998. 184p. Dissertação (Mestrado) - Escola Politécnica, Universidade de São Paulo.
- SILVA, F.A.P. - *"Análise da influência das montadoras de automóveis sobre as empresas de autopeças sob o paradigma da produção enxuta – um estudo de caso de empresas brasileiras*. São Paulo, 2002 - Thesis (doctorate). Polytechnic, University of São Paulo (Brazil).
- SINDICATO DOS METALÚRGICOS DO ABC. *Sem peças o Brasil não anda*. São Bernardo do Campo, s.d.
- SINDICATO DOS METALÚRGICOS DO ABC. *A globalização e o setor automotivo*. São Bernardo do Campo, 1996.

SOCIETY OF AUTOMOTIVE ENGINEERS. Identification and measurement of best practices in implementation of lean operation. SAE J 4000. Warrendale, 1999.
SOCIETY OF AUTOMOTIVE ENGINEERS. Implementation and lean operation user manual. SAE J 4001. Warrendale, 1999.
WOMACK, J.P.; JONES, D.T.; ROOS, D. *A máquina que mudou o mundo*. Rio de Janeiro, Campus, 1992. 337 p.

¹ Today this kind of cars are responsible for almost 60% of Brazilian market.

² Nowadays the exchange rate is around R\$1.80 to US\$ 1,00.

³ Mercosul is economical community formed by Argentina, Brazil, Paraguay and Uruguay

⁴ Sindipecas is the Brazilian Auto parts Industries Confederation

AUTHORS:

João Amato Neto, PhD
Assistant Professor
Production Engineering Department
Politécnica School / University of São Paulo/Brazil
F. 0055 11 8185363 -r.409
FAX: 0055 11 8185399
e-mail: jomaprod@usp.com.br

Flávio D'Angelo, PhD
Associated Professor of Production Engineering
Department - Mauá Engineering School/Brazil.
620, Heitor Villa Lobos Avenue, – apto 164
Zip code 12243-260 - São José dos Campos – SP –
Brazil
Phone 55 12 3913 4899
e-mail: dangelo@directnet.com.br

Regras de apresentação do trabalho tiradas do site do POMS

Full length papers are not required for presentation at the conference. Nevertheless full length papers of accepted abstracts may be submitted for publication on a CD as part of the conference proceedings.

Full-length papers can be submitted online at this website beginning January 27, 2004 and ending February 22, 2004.

Manuscripts should be submitted on web as a word document or pdf file, preferably a pdf file. Manuscripts should be typed on 8½" x 11" paper, double-spaced, including references, footnotes, and abstract. Papers should not exceed 32 pages, including all references, tables, graphs and appendices 12-point font with 1-inch margins on all four sides. Papers should have double-spacing throughout, including abstract, references, and footnotes.

The first page should include the following:

Abstract Number

Title of the Paper:

Name of the Conference: Second World Conference on POM and 15th Annual POM Conference, Cancun, Mexico, April 30 - May 3, 2004.

For each author provide the following information:

Name

Institution

Address

E-mail Phone Fax

While submitting the paper you will also be asked whether to consider the paper for special issues of IJOPM and IJPE.

Click the link below to start the Paper Submission process.