
Performance Measurement in Supply Chains: A Study in the Automotive Industry

Mário Sacomano Neto and Sílvio R. I. Pires

Additional information is available at the end of the chapter

<http://dx.doi.org/10.5772/46850>

1. Introduction

Transformation and growth on the automobile sector has opened a vast research field involving supply chain performance measurement. The change on the pattern in the relationship of the automakers with suppliers and dealers is accompanied by a need for modifications on the supply chain performance measurement systems.

In the last years, several and new productive arrangements were implanted in the Brazilian automobile industry, among them the modular consortium and the industrial condominiums. Those new arrangements are characterized by a high degree of outsourcing, long-term contracts, co-production of components, transfer of information and support to the suppliers. These new arrangements have also modified the relationship of the automakers with the suppliers (Helper, 1991; Lamming, 1993; Lambert, Cooper & Pagh, 1998; Croxton *et al.*, 2001; Pires e Sacomano Neto, 2008).

There are two basic consequences of those changes to auto parts suppliers: (1) significant increase on the demands of the automakers for quality, just-in-time delivery, global sourcing, follow sourcing, research and development of products, supply of complete functions (systems, sub-systems or modules), financial and technological training; (2) concentration of auto part suppliers in the hands of large international companies groups (Carvalho *et al.*, 2000).

The intense change in the relationship with auto part suppliers opens a vast field of studies regarding the stage and characteristics of supply chain performance measurement. The need for low levels of stocks and the high complexity of the logistic flow management made the automaker outsource important parts of those processes to logistic service integrators. Consequently, the base of the suppliers' consolidation and the outsourcing of internal processes made automakers establish new mechanisms of supply chain performance measurement.

In order to understand this set of modifications, this article aims verify the current stage of the performance measurement system within a relevant supply chain of the Brazilian automotive industry. The study characterizes the main changes of automaker relationship with the auto part suppliers and dealer influenced the supply chain performance measurement.

In order to accomplish the objective of this research, interview were realized with managers of the automaker (industrial condominium), with one systemist supplier (installed inside the automaker's condominium) and other three auto parts suppliers and one dealer. Besides studying four relationships of the automotive chain, that group of companies allowed to understand the performance measurement in highly cooperative relationships (as in the systemist supplier), "more traditional" relationships in the chain (other suppliers) and commercial relationships (dealers).

2. Performance measurement systems

The measurement mechanisms and performance evaluation were incorporate to the business atmosphere since the beginning of the mass production. The need for measuring the performance has intensified since the establishment and growth of large companies. The first type of established measure system was created by Taylor in the work rationalization process, presenting the first scales of "evaluation of merit" (Brandão & Guimarães, 2001). That period was the beginning of the establishment, in several ways and systems, of performance measurement in companies.

After that, the accounting administration, which was composed by measures that had as objective to measure the financial return, turned up. That type of measure turned up in response to the change of the market nature and to the perspective of larger profits through centralized production (Waggoner et al., 1999).

However, the measurement system revolution began when managers felt the need for instruments or systems to assure the maintenance of organization strategies (Eccles, 2000). From 1980 to1990, the performance measures appeared related to quality and customer's satisfaction, respectively (Eccles, 2000). The necessity to control the strategy, the quality and the customers' satisfaction performance turned up because of external factors, such as customers and competitors, interfered significantly on the strategic position of the organizations. The picture 1 illustrate the supply chain indicators. The picture presupposes the existence of an individual group of indicators (represented by ind. 1, ind. 2 and ind. 3), used in each one of the business units. Besides, there are some common indicators to the whole productive chain and these common indicators will determine the supply chain performance.

There is a significant set of concepts on the performance measurement systems. For the FPNQ (1996), a measurement system and evaluation on business performance should be guided according to the aspirations of all the interested parts (stakeholders), including customers, employees, shareholders, suppliers, partners, society and community.

According to Neely et al. (1995) the performance measurement process involves three central concepts: (1) performance measurement: it can be defined as the process of

quantifying the efficiency and the effectiveness of the actions; (2) performance measured: metric used to quantify the efficiency and/or the effectiveness of the action and (3) system of performance measurement: it is the unity of metric used to quantify the efficiency and the effectiveness of the actions simultaneously.

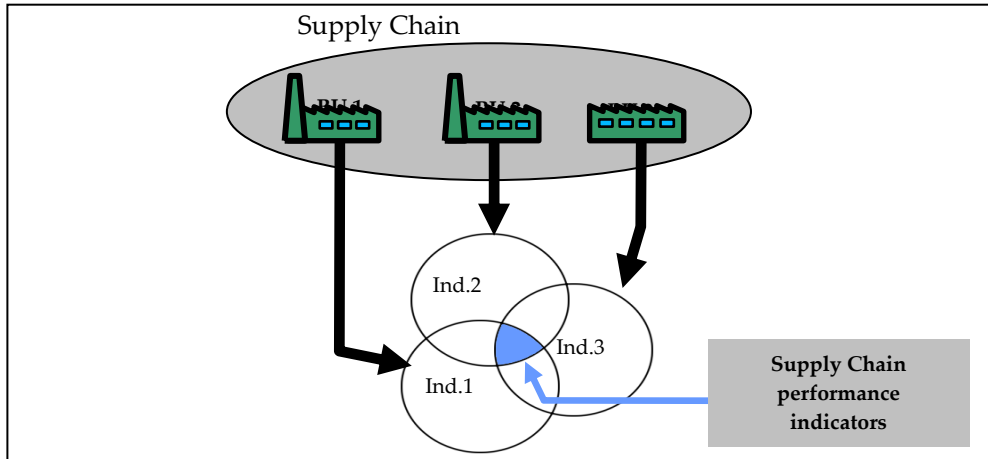


Figure 1. Illustrate the supply chain indicators (Source: Pires e Aravechia, 2001)

The performance measurement is one of the central elements in the management systems, and the performance consists on the result of decisions taken. Such decisions are made through proportional information by the system (Kaydos, 1991). Therefore, the level of performance has direct influence on quality and amount of information.

The objective of a performance measurement system is to establish the level of evolution, stagnation or decadence in certain processes. Performance measurement system also supply refined information to the decision taken process on preventive and/or corrective actions (Nauri, 1998). The performance measurement is essential to maintain high levels of quality and productivity, not only to provide a good control and administration, but also to develop and motivate the organization (Kaydos, 1991).

With high levels of outsourcing in the automakers activities, systems and metrics to supply chain performance should be developed. A great amount of costs in a vehicle is about materials, parts and systems from suppliers. Considering that, the need to control is fundamental for the systems optimization. Due to competition within the supply chain, it is important to think over a way to built knowledge, as well as to, incorporate a new performance measurement system considering the supply chain.

3. Supply chain performance measurement

The Supply Chain Management - SCM is an original term in logistics literature, specifically in purchases and stocks management (Trienekens, 1999). However, the Council of Logistics Management itself defines logistics as "a part of supply chain management that drifts,

implements and controls the flows efficiently, storage of products, services and information correlated, starting from the origin to the consumption point, aiming to assist the customers' needs" (Lambert, Cooper & Pagh, 1998 p.3). The authors point out that logistics has a functional role to deal with the information and matter flows in supply chain.

The Supply Chain Management is a strategic model that goes beyond logistics when integrating business operations and the administration of key processes in the supply chain from the development of products to the marketing. Therefore, it can be said that the Supply Chain Management is multifunctional, involving production management areas, marketing, purchases and logistics (Saucer, 2004).

According to Lambert and Pohlen (2001), many measures used in the supply chain are internal and it does not measure the chain performance as a whole. Several authors point out that there are a few studies about performance measure in the supply chain (Beamon, 1999; Gunasekaram et al., 2001; Holmberg, 2000).

There are few performance measurement systems focused exclusively on the supply chain. According to Lambert & Pohlen (2001), lack of suitable measures to the supply chain can result in flaws to get the customer's expectations, sub-optimizations in the chain, barriers to get competitive advantages and generate conflicts among participant companies. According to Beamon (1999), the choice for performance measures in the chain is complex because it depends on many factors, such as size, culture, needs, location, etc.

There are some relevant characteristics that should be considered to analyze the chain performance measurement system: inclusion (measure of all pertinent aspects); universality (to allow comparison among different levels); measurement (the necessary data can be measured) and consistence (solid measures with strategic goals). Those characteristics guarantee consistence and reliability to the measurement system (Beamon, 1999).

The performance measurement integration in the whole supply chain allows the global performance to be evaluated and to identify the internal improvements that should be accomplished in order to have a great impact in competitiveness (Croxtton et al., 2001).

There is a tendency to use specific performance measures in the chain, because they are more attractive to the implementation and monitoring point of view (Beamon, 1999). Functionality and effectiveness in this type of measure is considered very limited because they show the chain performance in just one aspect, and serious problems can be hidden. The type of measure most used in this context is related to costs because it is a basic measure used in any measure system, even when it takes into consideration a unit of business in an isolated way. However, the problem is that only this type of measure does not translate the real performance in the chain. It is necessary to include other types of measures to guarantee the effectiveness of the system for the whole chain.

The supply chain performance measures can also be classified in qualitative and quantitative measures. The quantitative measures are easier to measure than the qualitative ones, because they are more subjective, and, therefore, more complex to measure. The measures that can be classified as qualitative are: customer's satisfaction, flexibility,

integration of material and information flow, effective risk management and the supplier's performance. The measures that are framed as quantitative are the ones related to cost and the customer's satisfaction (Beamon, 1998).

According to Stewart (1995), there are four areas that should be developed to guarantee the improvement of the chain performance measurement system. These areas are: (1) performance of delivery, (2) flexibility and customer's feedback, (3) logistics costs and (4) performance of assets.

The performance measures provide a great amount of information inside to enlarge the integration of the company and alongside the supply chain. The performance measures have, as objective, not only to monitor the performance system but also to accomplish diagnoses, to propose improvement of performances, to stimulate performances along the chain and customers' service.

One aspect to be considered as the performance measurement system limitation is the lack of connection between the elaboration of the performance measures and the final satisfaction of the customers. That fact is extremely relevant because the performance measures, in a business unit or even in a supply chain, should be unfolded starting from their strategic objectives. Considering that the strategic objectives should be directly linked to the factors that determine the customer's satisfaction, the focal company (or that one which represents the chain strongest relationship) should direct actions which reflect an efficient management and service of demand.

Because of this, the research has incorporated the analysis from second tier suppliers to car dealers, delimiting a richer and not common to research area.

4. The research methodology

This case study has involved one automaker (assembler) using an industrial condominium (focal company), two first tier suppliers (companies A and B), two second tier suppliers (companies C and D) and a vehicle dealer. Figure 2 delimits the supply chain studied, including upstream and downstream companies.

The research was exploratory and descriptive. The collection of data was accomplished through interviews (followed by a semi-structured questionnaire developed previously) with the responsible for the production areas and logistics in the automaker and in the auto part suppliers, always also visiting the productive, operations and logistics areas. At the dealer, the commercial director was interviewed.

An interesting aspect of the studied chain, is that, the supplier A is a "systemist" supplier installed inside the automaker plant. One aspect that was verified and explored in this study is the difference between the relationship (connections) of the automaker with a systemist and the automaker with traditional suppliers. That fact has generated different types of connections and measures performance in the same supply chain. That aspect will be explored later, when analyzing the research results.

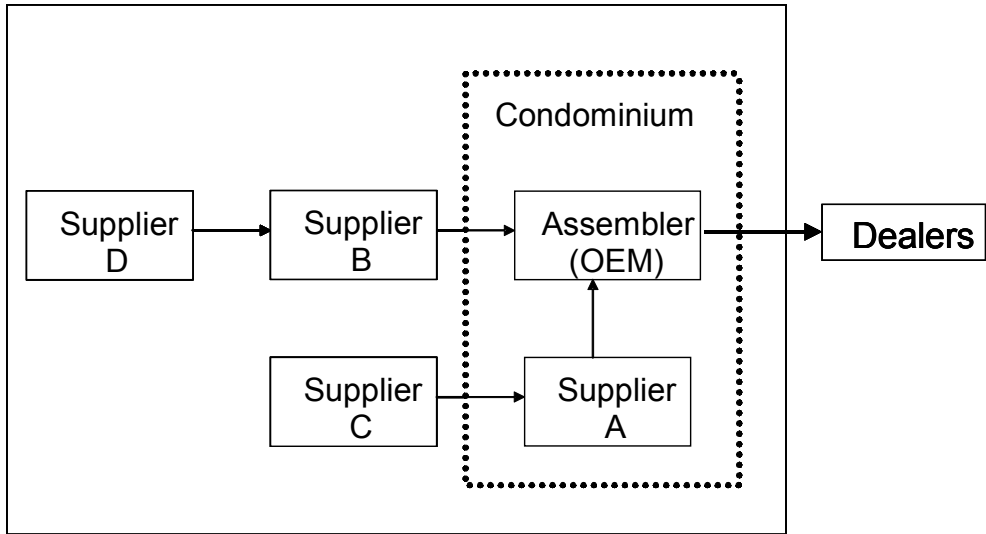


Figure 2. Delimitation of the supply chain studied

5. Study cases

That item presents in a descriptive way data about the automaker, the suppliers and the vehicle dealer.

5.1. Automaker and the industrial condominium (focal company)

Its original manufacturer was inaugurated in 1957 in São Paulo metropolitan area and it represents one of the automotive industry icons and Brazilian industrialization. In the beginning of 2008 it would hire 20.545 employees (automaker: 15.000; outsourced: 5.545) and more than a thousand engineers in the engineering center. Its production capacity was of 1.600 vehicles a day. The figure 3 illustrate an industrial condominium plant, were the suppliers are beside the car manufacture installation.

In 2002 the plant was refurbished to become an industrial condominium. As it is explained by Pires (2004), in the industrial condominium the key suppliers are installed physically beside the automaker in order to supply the productive system. According to the Automotive Business Data (2005), the company invested R\$ 2 billion in a structure with high level of automation and modernity. Laser welds, robot islands in the frame, automation in the painting line, use of palm tops to control the production in real time, modular system assembly and truck transporters adapted to the employee's height were some improvements and innovations accomplished in the new plant.

The systemist suppliers are physically located inside the automaker condominium and they have a close and collaborative relationship with the automaker on the product development

and the production plan. The levels of trust in this type of relationship are intense, involving high investment from both.

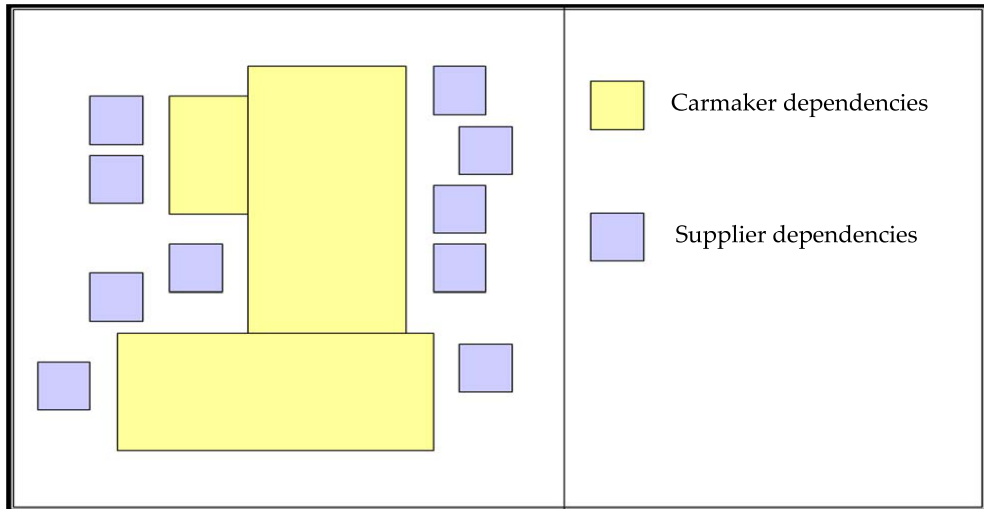


Figure 3. Illustrate an industrial condominium plant

The company logistic has been of high complexity. There are different kinds of suppliers: those responsible for supplying the line in the point of use, being, therefore, responsible for affairs involving transport and storage, and those not responsible for the transport because the automaker takes charge of this activity through a logistics consolidator.

Another responsible factor which makes the complexity of the system worse is the number of components, around 4.000 by platform. This number can vary because the automobile design suffers constant changes. Considering all the platforms present in the plant, the total of components to be managed by the automaker is around 25.000. If there are no systemists, that number would be approximately 40.000 components as mentioned by one of the directors of the automakers.

To work with low levels of stock and high flexibility on the production system, the automaker uses logistics practices to guarantee the production synchronization and the logistics efficiency. Examples of practices that contribute to a better result are the milk run, the cross docking and the just in sequence activities.

The milk run is a provisioning system with pre-defined itinerary and schedules to collect materials in the suppliers, whose main objective is to reduce the provisioning logistics costs via scale savings and rationalization of the routes.

The cross-docking can be defined as a practice that seeks to avoid unnecessary storages (that represent great sources of waste) in distribution centers or in places that work as such. That practices is accomplished by the automaker during the delivery of the components.

The just in sequence is a contemporary logistics practice involving the provisioning process. Its objective is to place the item according to automaker production sequence. That allows stocks and the provisioning time to be optimized. That practice can be considered an evolution within the provisioning process inside the just in time logistics, which points out that the customer should be given the right thing, the right amount and at the right moment (PIRES, 2004).

5.2. Suppliers and customers

- **Supplier A** - is a systemist installed inside the automaker plant which hires 40 employees. The supplier belongs to a German group that deals with the automobile branch, supplying auto parts and systems to trucks, chassis and motors (powertrain systems). In Brazil the group has 22 subsidiaries and it hires around 9.000 people.
- **Supplier B:** supplier B belongs to a German group, developing and producing mechanical and electronic locks to the automotive industry. More than 200 designers work in Germany, USA and Korea developing components to access the cars and immobilization systems known as "passive entrance". In Brazil the plant is settled in the state of São Paulo and supplies directly to the automaker.
- **Supplier C:** supplier C also belongs to a German group that deals with the automobile segment, manufacture of tubes, mechanical engineering and distribution. At the automotive branch the company develops and produces complete modules, components for trucks, chassis and motors. This auto part supplier came to Brazil in 1999 in order to established a flow sourcing with two automakers.
- **Supplier D:** supplier D is a national company that provides printings and cut tools to supplier B. It also supplies to other companies; in its great majority, to the automobile industry suppliers. The company was founded in 1983 in the state of São Paulo and today it hires 19 people.
- **Dealer:** the dealer studied belongs to a business group that operates in São Paulo and Minas Gerais states. The group has, as a whole, 6 dealers.

6. Results

In this item it is shown how the automaker deals with the evaluation of suppliers and dealer. It is also shown the company internal performance system and its deployment in the supply chain.

6.1. Evaluation of suppliers

The evaluation of suppliers is considered to be a relevant issue to the automaker, according to several reports taken along the research. This evaluation is accomplished in a multifunctional form, having different weighs of measurement in the following areas: logistics, engineering, quality, finance and commercial.

Logistics is responsible for evaluating the operational aspects of the suppliers, such as: easiness on the information flow, kinds of packing, ways of transport and storage and service level related to the execution of the scheduling and on-time deliveries. Logistics is also responsible for the placement of the product at the use point as well as for the service of the master program in production. Logistics, operating in a very efficient way, guarantees both a synchronized production and an appropriated level of stock.

The engineering area verifies the development potential in products and processes, quality of the process and it makes possible ways to control the analysis and to select the suppliers. The most technical processes related to the evaluation of suppliers are found in this area.

The quality area takes care of the system making possible the quality process (internal process, means of control, checking of tools and maintenance). This area has got the veto power to evaluate the suppliers because this requirement is considered to be a request qualifier. A qualifier competitive priority of request means that the requested characteristic should be intrinsic to the product or component. The two more relevant aspects in this area are: the product conformity and the specification service of the automaker.

The Finance area also participates in the evaluation of the suppliers analyzing whether the latter has the necessary profitability and "financial health" to be kept in the business. This is an important issue because if the suppliers do not have financial balance, aspects, such as, the quality of the product or the delivery performance can be compromised.

The last area to participate in this process is the commercial one, which studies and monitors the intensity and relationship forms between the suppliers and the company. This also analyzes the contribution of the supplier productivity to reduce the end product prices.

If an area vetoes a supplier, yet it is verified that the supplier has a supply potential, plans for actions are taken to help it.

The five areas that compose the performance evaluation centralize the information in weekly meetings called "the supplier definition forums". These meetings happen twice a week, with the representations of each area and it isq held by the director of the area of Purchasing.

In order to define new suppliers for a new project, two meetings are held inside "the supplier definition forums". The purchasing sector indicates the capable suppliers and in the first meeting, they raise up the quotations of prices on the Internet, which pre-define the suppliers taking part in the process. In the second meeting, the suppliers are appraised for each area and one and only one decision is made to choose the best supplier.

Subjects, such as, quality and delivery performance are important characteristics to evaluate the suppliers. The cost is very often the competitive priority that assumes the position of requested winner.

Suppliers also have internal performance measurement systems that are deployed in external measures. Supplier A has several performance indicators, such as: physics of sales, the customers' complaints, field flaws, stop of the customer's line, medium time of flaws, waste control and refuse, raw material blocked by the suppliers, the product auditing and maintenance control. The criteria directly related to the automaker supply chain are the customer's complaints and stop of the customer's line. Supplier A considers that it has an internal performance measurement system more rigorous than used by the automaker to measure the supplier performance. It considers that the automaker measures, in fact, are the quality and an eventual and unwilling stop at the end of the assembly line

Supplier B also uses several internal performance indicators, such as: delivery performance, number of faults, relationship with the customer, revenue, cost of labor, volume of sales, turn of inventories, percentage of purchases on invoicing, cost of the non conformity, quality, punctuality and the deliver performance, productivity, matter loss excels and industrial efficiency. Those criteria generate information regarding the logistics performance, quality and finances. However, the company considers that the automaker controls, mainly, the quality and the delivery performance (punctuality, flexibility, transport, package, service and accuracy).

Similarly, supplier C is evaluated in quality matters and the delivery performance by the automaker. Every six months, supplier C receives an evaluation from the automaker informing its delivery performance and monthly an evaluation of its quality. The performance measures are more intense in areas, such as, quality and logistics because the engineering was evaluated in begin of the project.

Quality and delivery are the two main appraised criteria (for supplier B) in supplier D. Types of exchanged information limit issues involving the project and programming (types of parts, quantities and dates). A key problem for supplier D is the production reprogramming, which generates problems with planning, generating, very often, delivery delays and harming the upstream companies.

The demands from supplier B to supplier D involve: specification of the invoice request number, quantity and types of parts.

In the chain studied, the relationship with supplier D is considered to be of less intensity among companies because it supplies a commodity with little aggregated value that reflects significantly in the relationship among the companies. Figure 4 tries to characterize the relationship between the aggregated value and the need for integration on the processes and performance measures verified in the chain.

It is noticed that the larger the aggregated value of the supplied parts is, the larger the need for integration of processes and performance evaluation will be, as it happens in the relationship with supplier A, where there has been not only close partnership but also high performance criteria.

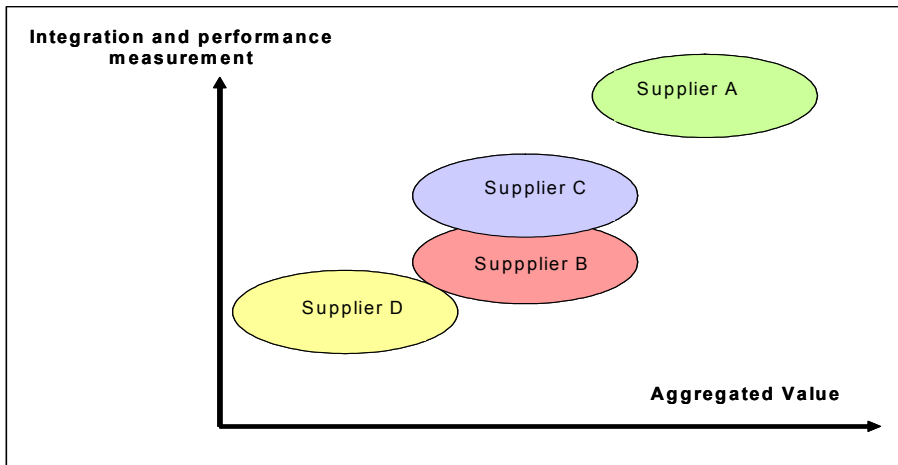


Figure 4. Relationship of the joined value and the integration

6.2. Evaluation of dealers

The automaker's commercial area makes the connection between the automaker and the dealers objecting to assist the final customer's demand regarding the conformity performance and of the delivery performance. The commercial area that has been analyzed is responsible for the region that includes São Paulo city, and it is represented by 40 dealers. Inside the state of São Paulo the automaker studied includes more than 100 dealers. In the whole, the company is represented by 6 regional that involve all its commercial areas (sales) in the country. The interviews done with the automaker commercial area tried to answer questions regarding the relationship among the commercial, manufacturing, logistics areas and dealers.

According to the Brazilian law, the automaker cannot sell to the final consumer. Considering that the final customer is the most important element of the entire chain, dealers are the distribution channels to assist that demand. Therefore, the automaker has great interest in monitoring and evaluating the dealer performance because it checks how the customers are being assisted and how the trademark (brand) is worked.

The relationship between the commercial and the manufacturing areas defines the models to be produced. In the past, the relationship between the commercial and manufacturing areas was represented by the duality of goals. While the manufacturing area wanted to simplify production, the commercial area tried to sell "what the customer wanted". That caused critical cross-sector problems. Nowadays, that relationship is more integrated, effective and with resolution of problems taking together.

The automaker imposes to the dealers a minimum batch of purchase of basic vehicles and another batch of vehicles "ordered" by the dealer. The objective of the commercial area is both to intermedate the management on requests and to intermedate the connection between a viable production and the demand.

There is an integrating exchange and sharing information among the automaker, commercial area and dealers. The dealer can access the information on the automaker production programs in the following five weeks, and the automaker can get information about the cars that are available at the dealer through this same information system. That integration of information permits to optimize stocks and to elevate the level of service at the dealers.

Integration between the automaker commercial area and the dealers is necessary and evident. Monthly meetings are held between the commercial area and big dealers to define the market policies and strategies. Each dealer has a different strategy because it is located in a specific area with different target customer.

In order to improve the service to the customer (demand) several initiatives were implemented by the automaker in the last few years. One of the main measures was the restructuring of the dealer base. As consequence, the relationship between the automaker (performed by the commercial area) and dealers are increasing. The automaker's commercial area does not only measure the dealer performance but also interferes in management policies. The automaker has nominate consultants to dealers both to analyze and to propose changes, since administrative activities, until the customer's loyalty.

There are two ways in which the automaker gives technical and administrative support to dealers: back-office and front-office. The back-office is characterized by consultants that analyze and propose plans of actions that go from the subjects related to the service level to the dealer management. Consultants can be classified in three types: market, distribution and business. São Paulo regional front-office is composed by four managers who run and monitor 40 dealers under the regional responsibility. And they can be considered an element *in loco* to support the back-office at the dealers.

There are several indicators to measure the dealer performance. The three main indicators analyzed by the commercial area are: sales performance, service performance (customers) and monthly business profitability.

The sales performance indicates the potential growth and development of the dealer. That indicator is usually linked with the service indicators to the customer and profitability.

The commercial area spends strong efforts to keep the service levels in order to please the dealer customers. Currently, it is not interesting to the automaker that only the dealer commercializes high quantities of cars. This also interests the automaker, as the customer is being assisted and so are the business levels of profitability. Dealers with short life cycles can harm the vehicle brand. The automaker commercial area force to be bought by larger groups.

Several studies are showing that the automaker should control and give more attention to the after-sale. The automaker measures the customer's satisfaction through a so called QIS (Quality Information System). This system is responsible for measuring aspects related to customer's satisfaction in terms of sales and services at dealers.

The customer's satisfaction is measured by QIS through a questionnaire sent directly to the customer's home. Through QIS the dealer and the automaker identify whether the customer is satisfied. If he/she is not, diagnoses are accomplished and performance plans are elaborated to improve this indicator. The indicators considered in the QIS are: the customer's general satisfaction, satisfaction with sales and services, characteristics of the show-room, the salesperson's evaluation, price evaluation given to second hand cars, attendance after purchase, repair quality, treatment given to the customer, repair price, period of delivery and offers. Through that after-sale monitor the automaker makes a diagnosis to verify the critical points to be improved at the dealers.

6.3. Performance measurement of the supply chain studied

A single systematic way was not verified to measure the supply chain studied. The focal company has internal performance measure systems, which are deployed to the supply chain, both downstream (suppliers) and upstream (dealers) directions.

The suppliers also have internal performance measures. Logistics supplier performance measures are strongly influenced by the automaker demands. In the studied chain, the chain measurement system is in development. Most of the characteristics on the automaker measurement system maintain the characteristics of the traditional systems, that is, of the systems practiced internally in the companies.

The automaker does not have an exclusive measurement system, but it addresses the whole measurement process to the chain, exercising the governance (coordination) of the performance measurement criteria. Despite that characteristic, the automaker internal system permits to consolidate several pieces of information in order to measure the performance along the chain. That group of measures comes from the automaker internal indicators and also the suppliers' definition forums.

The automaker measures and evaluates the internal performance through a solid group of KPIs (Key Performance Indicators) and it includes all the areas and internal collaborators. Criteria and goals are set starting from corporate strategies, for specific areas, such as departments, sectors, etc. The performance criteria are signaled by colors green, yellow and red with very defined limits of control. The area that has consolidated those numbers is the finances (controller), which is responsible for shooting the results of the indicators, both financial and performance of other areas.

The automaker logistics area also makes use of a key group of 10 blocks of indicators which are: percentage of lost production, bill of material, scrap, cripple (number of missing units / incomplete vehicles), levels of inventories, deliveries of replacement parts, overtime, logistics costs (purchase of inputs), overhead, volume and fidelity of the inventory. Similarly, other functional areas in the company have that same backup through the same procedures of the system and each one of their employees has his/her KPI sheet and criteria that add value to the area.

Some logistics performance measures are copied from the automaker to the suppliers. One of the typical performance measures is the *cripple*, which indicates that when the car is being assembled some parts are lacking and, consequently, measures flaws along the supply chain. Therefore, even indirectly, KPIs end up reflecting in the suppliers. The reflections of KPIs in the suppliers systemists are discussed daily at the automaker premises through meetings where preventive and corrective actions are solved.

The automaker performance measure system is similar to Balanced Scorecard model, mainly, regarding the definition of the measures, starting from the strategic unfolding. The corporation draws the strategy and, from this, the objectives that should be reached are delimited. The strategic objectives of the corporation are transferred to the functional areas. According to the results of the research, Hronec (1994) points out that the performance measures should be developed on the corporate level and be related to the strategy. That happens with the automaker studied, although the alignment of the strategy and the chain performance measures involves great complexity.

According to Pires (2004) there exist some difficulties to implement a strategy along the chain: (1) in each relationship what really prevails is the company strategy, which is derived from its performance in the market and internal competence, and it is not necessarily linked to a strategy that belongs to the chain; (2) the strongest company's strategy in the chain can influence all the other strategies linked to the company; (3) the participation of several links in several chains hinders the implementation of a single strategy along the chain. Those aspects hinder both the alignment of the strategies and also the performance measurement development among companies in the chain.

Dealers working close to the final customer can identify either new needs or strategic issues along the chain. For this reason it is possible to explain the constant attendance of the operational design and service to the customers in the dealers. The customer's satisfaction is a multidimensional measure that evaluates several aspects, for example, quality (under several perspectives), cost, flexibility and even, intangible factors, such as trust.

Measures related to the final customer's satisfaction were thoroughly seen at dealers. Dealers can inform the levels of demand and stocks and transmit it to the automaker that can inform the other relationships in the chain, trying to reduce impacts on the variation of the demand.

Through the interviews done at the automaker, the concern was to verify just measuring companies which were considered strategic to the automaker. The second tier suppliers participate to the performance evaluation just when some serious problems with the product are detected either by the automaker or the first tier supplier. What motivates the evaluation of the second tier supplier is usually the lack of quality regarding conformity and specifications. The Table 1 illustrates the downstream and upstream performance measures in the focal company.

UPSTREAM PERFORMANCE MEASURES	DOWNSTREAM PERFORMANCE MEASURES
<p>Logistics areas, engineering, quality, finances and commercial compose the supplier selection forum. The automaker has got other criteria to choose the systemists supplier: such as: quality, co-design and worldwide performance. The upstream performance measures involve operational and technical criteria.</p>	<p>sales performance; customer service; business profitability; satisfaction with the services, show-room characteristics, salesperson's evaluation, price evaluation on second-hand cars, vehicle delivery, attendance after purchase, repair quality, treatment given to the customer, repair price, period of delivery and car offering. The downstream performance measures seek to measure the dealer performance through the customers' satisfaction.</p>

Table 1. Downstream and upstream performance measures in the focal company.

The group of criteria downstream and upstream is intense, mainly for the companies on the immediate chain. The results of the research show qualitative and quantitative measures, as pointed out by Beamon (1998). Although there is not a unique system for the chain, the measures have shown good inclusion, universality and measuring capacity.

According to Slack (1993), in order to gain in effectiveness, in every supply chain it is mostly necessary to measure only the companies that are part of the immediate chain. Therefore, academically as well as in practice, it was verified that the measure tendency in the chain is to happen in the immediate chain. For Gasparetto (2003) if all the companies are involved in the same efforts, even if it is just with their partners from the immediate chain, the whole chain will be involved in dyadic relationships and the improvement in competitiveness in many companies will be permitted, although the relationship composed by the systemist presents both larger process integration and larger specificity on the performance measures.

Regarding the performance measure selection, Beamon (1999) describes that some companies use just one indicator of performance to evaluate the chains. But, the same author criticizes that position because she believes that a single indicator does not translate, under the operational and strategic perspectives, the total chain performance. The studied supply chain has shown a reasonable level of evolution in this sense because besides having indicators regarding costs, it also has indicators that express the logistics performance, the suppliers' evaluation, the customers' satisfaction and other factors related to the chain.

An important characteristic for the performance measure system is its flexibility. This fact can also be proven in this study because besides measuring the performance of the immediate chain, the automaker determines new performance plans. A fact seen in the case studied, which proves the dynamic character of the system, is the automaker capacity to set certain behaviors. The focal company offers a consultancy service to the dealers seeking to improve the dealer performance in terms of profitability and service to the customer. In

doing that, the company improves the supply chain performance using downstream information, such as the demand and stock performance.

The capacity to stimulate performances, according to Neely et al. (1995), consists on one of the greatest benefits in a measurement system. In this case, the measurement system plays an important role to reach certain strategic goals proposed by the automaker. These roles may come from an individual contribution for the system and it should not be faced as a control. However, the characteristics of control are still much stronger in these performance measure systems than in most traditional relationships. This can be explained by the strong influence that the automaker imposes on the chain governance.

The automaker coordinates and controls the provisioning and distribution channels. That role influences the automaker capacity to exercise governance in the chain. For Suzigan, Garcia and Furtado (2002) governance refers to the hierarchy degree and command (or, alternatively, collaboration and cooperation) among the actors. Storper and Harrison (1990, p.408) understand governance as the "actor that has the power to affect the system development". Those relationships can be ruled either by market mechanisms or by cooperation processes supported by mechanism of control and performance.

The automaker has two ways to exercise governance and coordination in the chain: one is accomplished by traditional market relationships (where price and quality are the basic criteria) and another is got through high cooperation (ruled relationships in trust and high change of resources), mainly with the systemists and large dealers. The automaker uses both forms to guarantee the relationships with suppliers. For the commodities suppliers the selection is accomplished by "suppliers' auctions" registered through the internet, where the basic criteria are the price and the quality (examining criteria). Yet, with the systemists suppliers there is an intense cooperation in the activities to improve the levels of productivity in both plants. In that relationship, it has to be taken into consideration the inter-business high interdependence and costs.

Even with more cooperative relationships in the chain, the automaker governance can be classified as core-ring with the leader firm according to Storper and Harrison (1990). In that system the leader companies can be completely independent from the suppliers. The negotiation power is asymmetrical and there is considerable hierarchy. In this system, the leader company is dominant, that is, the participants depend on the leader's strategy. That part of the research is important, because the governance structure involving the relationships of authority and power among the firms and it determines the financial resource allocation, materials and labor along the chain (Gereffi, 1999).

It can be said that the automaker governance, for some suppliers, is based strongly on imposition, because it exercises a great economical power on the other suppliers in the chain. Yet, in other relationships with systemists, the governance is strongly based on cooperation, but with intense performance measurement system. The relationship with the systemists supplier is soft and with cooperation routines. Therefore, the governance legitimacy is accomplished through a combination of coercion and cooperation systems.

7. Final considerations

The necessity of controlling the strategy performance and the customers' satisfaction interferes significantly in the strategic positioning of the organizations and the way it measures the performance.

As mention previously, it was not found a single performance measurement system in the supply chain studied. The automaker internal performance measures deployed to both the suppliers and to dealers. The automaker internal systems, added to the suppliers and dealers evaluation and the suppliers' definition forum are enough to generate several performance indicators to increase the immediate chain. The automaker is responsible for the whole coordination of the chain measure process.

Starting from the performance indicators used by the companies and from the focal company perspective (automaker) in the studied supply chain, it can be seen that the downstream measures are addressed strongly to quality, production and delivery performance. On the other hand, the upstream measures present a strategic and market characteristics and also receiving special attention from the automaker although the downstream processes tend to be more complex and are subjected of unpredictable events.

It is also noticed that the performance indicators related the chain space besides the traditional indicators regarding costs, also presenting indicators that include aspects related to the logistics performance, the suppliers' evaluation, the customers' satisfaction, among others. Additionally, which one can call a "measurement system" of the studied chain (same that he/she comes a form no structured and formalized), it is still for the most part contained in the immediate supply chain. That corroborates the authors' work, such as Lambert and Pohlen (2001), who point out that the companies usually end up just measuring the performance in the immediate chain and avoiding measuring the performance in the whole chain.

Considering what was pointed out by Beamon (1999): inclusion (measure of all the pertinent aspects); universality (to allow the comparison among the different levels); measuring (the necessary data can be measured) and consistence (solid measures with strategic goals), it is possible to state that it has adherence to the studied system. However, the measures are not integrated in a unique system.

As it is expected the supply chain performance measurement tends to be more intense in most cooperative relationships. The systems supplied by the systemists are of high aggregated value, with high specificities and also involving characteristics on the vehicle safety. According to that, the automaker exercises high control on the performance measurement evaluation. However, one of the automaker logistics executives has mentioned how easy it is to deal with systemists suppliers, because of geographic proximity and professionalism. The supplier, installed physically inside the automaker plant, presents a high performance in all the requirements measured by the automaker. That fact reinforces the idea that the supply chain configuration is a decisive factor in the way it dimensions and controls the chain performance measures.

Another important subject to be pointed out is about supply chain governance. This research, takes into consideration the chain asymmetric power. A car industry is typically run by the producer, i.e., industries such as: metal mechanics, electronics, chemistry, development of products and processes. On the other hand, it is clear their progresses towards a cooperation with key suppliers, as it can be seen with systemists suppliers and the distribution channels.

Sharing information was always a fundamental element to build a cooperative relationship. In this research, sharing information is more intensity within the automaker and immediate chain. The automaker can have access to several types of information, so much in its inbound as in the outbound. The opposite, most of the time, is not true. In general, it can be considered that sharing information along the supply chain is fragmented. That means that the automaker works with content and frequency of information not necessarily similar to the relationships of its immediate chain, although the basic information on its master production schedule is shared with all its immediate suppliers.

Finally, it is important to emphasize the fact that the immediate supply chain studied has presented a supply chain configuration including a dealer and systemists suppliers which provided a very contemporary and interesting research for other studies involving the supply chain performance measurement.

Author details

Mário Sacomano Neto and Sílvia R. I. Pires

Methodist University of Piracicaba (UNIMEP), Rodovia do Açúcar, Piracicaba (SP), Brazil

8. References

- Beamon, B. N. (1998), Supply chain design and analysis: Models and methods. *International Journal of Production Economics*, Vol. 55, No. 3, pp. 281-294.
- Beamon, B. M. (1999). Measuring supply chain performance. *International Journal of Operations & Production Management*, Vol.19, No. 3, pp. 275-292.
- Brandão, H. P., Guimarães, T. A. (2001). Gestão de Competências Gestão do Desempenho: tecnologias distintas ou instrumentos de um mesmo constructo? *Revista de Administração de Empresas*, Vol.41, No.1, pp. 8-15.
- Carvalho, R. Q. et al. (2000). Globalização e reestruturação da cadeia produtiva na indústria automotiva: qual é o papel do Mercosul? Convênio IPEA-DPCT/IG/UNICAMP. Relatório Final. FUNCAMP, 252p.
- Croxtan, K. L., Sebastián, J. G. D., Lambert, D. M., Rogers, D. S. (2001). The Supply Chain Management Processes. *International Journal of Logistic Management*. Vol. 12, No. 2, pp. 13-36.
- Eccles, R. G. (2000). Manifesto da mensuração do desempenho . In: *Medindo o Desempenho empresarial*. Rio de Janeiro: Campus Publishing.

- FPNQ (1990). Fundação para o prêmio nacional da qualidade - Critérios de excelência: o estado da arte da Gestão da Qualidade Total. São Paulo, 76 p.
- Gasparetto, V. (2003). Proposta de uma sistemática para avaliação de desempenho em cadeias de suprimentos. Florianópolis. 248 p., Thesis Doctorate, UFSC.
- Gereffi, G. (1999). International trade and industrial upgrading in the apparel commodity chain. *Journal of International Economics*, Vol. 48, No. 1 pp.37-70.
- Gunasekaran, A., Patel, C., Tirtiroglu, E. (2001). Performance measures and metrics in a supply chain environment. *International Journal of Operations & Production Management*, Vol. 21, No. 1/2, pp. 71-87.
- Helper, S. (1991). How much has really changed between U.S. automakers and their suppliers? *Sloan Management Review*, Vol. 32, No. 4, pp.15-28.
- Holmberg, S. (2000). A systems perspective on supply chain measurements. *International Journal of Physical Distribution & Logistics Management*. Vol. 30, No.10, pp. 847-868.
- Hronec, S. M. (1994). *Sinais Vitais - Usando Medidas de Desempenho da Qualidade, Tempo, e Custos para traçar a rota do futuro da sua empresa*. São Paulo: Makron Books.
- Kaydos, W. (1991). *Measuring, managing and maximizing performance*. Portland: Productivity Press.
- Lambert, D.M., Cooper, M.C., Pagh, J. D. (1998). Supply Chain management: Implementation Issues and Research Opportunities, *The International Journal of Logistics Management*, Vol. 9, No. 2, pp.1-19.
- Lambert, D., Pohlen, T. (2001). Supply Chain Metrics. *The International Journal of Logistics Management*, Vol.12, No.1, pp. 1-19.
- Nauri, M. H. C. (1998). As medidas de desempenho como base para a melhoria continua dos processos: o caso da Fundação de Amparo à Pesquisa e Extensão Universitária (FAPEU). Thesis Master Degree, UFSC.
- Neely, A. (2000). Performance measurement system design: developing and testing a process-based approach. *International Journal of Operations & Production Management*. Vol. 20, No. 10. pp. 1119-1145.
- Pires, S. R. I., Sacomano Neto, M. (2008). New Configurations in Supply Chains: The Case of a Condominium in Brazil's Automotive Industry. *Supply Chain Management: an International Journal*, Vol. 13, pp. 37-48.
- Pires, S. R. I. (2004). *Gestão da Cadeia de Suprimentos: conceitos, estratégias, práticas e casos*. São Paulo, Atlas Publishing, 310p.
- Pires, S. R. I.; Aravechia, C. H. M (2001). *Measuring Supply Chain Performance*. POMS, 2001, Orlando.
- Slack, N. (1993). *Vantagem Competitiva em Manufatura*. São Paulo, Atlas Publishing.
- Stewart, G. (1995). Supply chain performance benchmarking study reveals keys to supply chain excellence. *Logistics Information Management*, Vol. 8, No. 2, pp. 38-44.
- Storper, M.; Harrison, B. (1991). Flexibility, hierarchy and regional developments: the changing structure of industrial production systems and their forms of governance in the 1990s. *Research Policy*, North-Holland, Vol. 20, No. 5.
- Trienekens, J. (1999). *Management of Process in chains: a research framework*. Thesis. Wageningen University.

- Suzigan, W.; Garcia, R.; Furtado, J. (2002). Governança de Sistemas de MPMEs em *clusters* Industriais. Text presented at the International Symposium: "Políticas para Sistemas Produtivos Locais de MPMEs", Rio de Janeiro.
- Waggoner, D. B. Nelly, A. D., Kennerley, M. P. (1999) The forces that shape organizational performance measurement systems: An interdisciplinary review. *International Journal of Production Economics*. Vol. 60, No. 61, pp. 53-60.