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Supply Chain Management of Second Tier Suppliers: The Use of Soft Systems Methodology and its Benefits in a Brazilian Company

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ABSTRACT: This work presents an action research carried out using the Soft System Methodology (SSM) in a major auto parts company. It aims to analyze and propose improvements in the supply relationship between auto parts companies and second tier suppliers in the Brazilian automotive sector by suggesting significant changes in its process, tasks and technology usage.

KEYWORDS: Supply Chain Management (SCM); Brazilian Automotive Industry; Supply Relationship Management (SRM)

1. INTRODUCTION

Since the 1990´s, the industrial environment has been in a deep reflection of paradigms about the development of productive systems. The logistic between industrial production, purchasing (and relationship between companies) and people has been reviewed, bringing up substantial changes in the supply chain of industries. In this context, Supply Chain Management (SCM) appears. The success of an organization depends on the management skills and ability to integrate other parts and players of the supply chain in order to create a true business relationship (Lambert and Cooper, 2000; Mentzer *et al.*, 2001). The objective of SCM is to maximize synergies among all parts of the chain in order to supply the final consumer more effectively, not only by reducing cost but also by adding value to the product. The cost reduction may be obtained through fewer transactions, reduced variability of demand and less transport and inventory. Value may be added through property creation and customized services, by developing distinct competences through all the chain and by helping both, consumers and suppliers, to make more revenue by better understanding their own business (Pires, 1998).

The development and application of supply chain management concepts have been widely carried on in the automotive industry due to the high level of existing competitiveness in the sector and its volatile market (Christopher, 2000). SCM also demands more attention in the automotive industry due to its pioneering adoption of technological and managerial practices within the industrial field. The Brazilian automotive industry is inserted in this context. Its history was always related to transformations in its supply chain structure, going from direct vehicles importation in the early twentieth century to the Completely Knocked Down (CKD), and, finally, up to recent days, to integrate plants when the industry searches SCM implementation as a global competitiveness advantage. Literature already presents some works reporting SCM applications in automotive companies (Marx, Zilbovicius and Salerno,1998; Pires, 1998; Rassameethes *et al.*, 2000; Firmo and

Lima, 2005), however with higher emphasis on the immediate chain (tier 1), namely automotive company chain and first tier suppliers. Literature brings little publication about the subsequent chains and suppliers of suppliers (tier 2, 3).

This work presents an action research carried-out through SSM (Soft Systems Methodology) technique in the auto parts industry, specifically in the category of electrical distribution system to automotive vehicles. The aim is to analyze some benefits of SSM and suggest improvements in the coupling between auto parts companies and its second tier suppliers. The research question raised could have been: *How may SCM be useful in the auto parts companies supply chain?*. It is subdivided into three main fields: *SCM, Integration and Coordination.* After this brief introduction, some concepts of SCM are presented in section 2, among with its main practices and initiatives used in the automotive companies. In section 3, the details of the action research steps carried out through SSM are explored. Finally, section 4 brings conclusions followed by a list of bibliographic references.

2. LITERATURE REVIEW

Supply chain is defined as being a set of activities focused on product distribution to the final consumer, going from raw material acquisition to manufacturing, assembling, stocking, inventory control, material input and output, distribution among parts of the chain, delivery and involved information systems (Lummus and Vokurka, 1999). SCM is already considered an important way to achieve competitive advantages. According to Cooper (1994), SCM was originally discussed in a logistic context of inventory management, throughout the chain. The idea was to deal with the inventory in the most efficient way possible, with no redundant stock among the chain members, decreasing the total cost along the chain. SCM application was amplified to a global management context of supply chain, approaching functions such as purchases, production, distribution and marketing. Its basic principle is to integrate information among suppliers, industry, distributors, retailers, wholesalers and final consumers in order to control, rationalize and optimize production and product flow.

Mentzer *et al.* (2001) defines SCM as an expanded, actual, and holistic vision of a traditional material administration, comprising productive chain management in a strategic and integrated manner, presuming that organizations must define their functional and competitive strategies through their positioning (not only as suppliers, but also as clients) within the productive chains they are inserted in. It depicts as a main objective in this new management model, the synergy increase among the chain parts, seeking a higher customer satisfaction, cost reduction and aggregated value increase.

Through the coordination and collaboration process, the use of SCM brings to the management team opportunities of search and joint implementation. The *Council of Supply Chain Management Professionals (*CSCMP, 2008*)* defines SCM as *"the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers".* In essence, Supply Chain Management integrates supply and demand management within and across companies. The property and service customization, the use of integrated solutions and the development of different competences are the main responsible factors that drive the increase of aggregated value of a given product or service.

Tan (2002) point out some aspects that justify the use of quick, precise and accurate data as part of efficient logistic systems. First, customers agree with the need of order and delivery information and availability. Then, information can be used to better manage demand and control the inventory. Finally, information flow increases business flexibility as it helps to identify and better use the available resources. According to Ballou (2004), the search for more stable relationship has occurred because of the impossibility for one company only to have control of the productive flow, from the raw material supply to the final consumption. Therefore, such long-term relationship should be managed through cooperation and partnership and not by competition or conflicting decisions. Thus, all companies belonging to the chain may reach competitive advantages. Mouritsen, Skjott-Larsen and Kotzab (2003) find that productive chains would represent virtual business units, the real field of recent competition. The most effective SCM practices aim to obtain a virtual unity of businesses that could provide a lot of benefits for the traditional vertical integration without the common disadvantages in terms of costs and of its pertinent flexibility loss. Pires (2004) also emphasizes that SCM reinforce the entrepreneurial ecosystem

by providing a process structure that allows companies to live a mutual evolution, instead of simply competing among themselves.

The SCM evolution has demanded even quicker responses from suppliers, so that companies may adequate themselves to the needs of the final clients. Moreover, as the goal of the work is to analyze and suggest enhancement in the auto parts companies field and suppliers, a brief review of the Supplier Relationship Management (SRM) is necessary. According to Walter *et al*. (2003), SRM is a set of concepts, relationship techniques and tools used to enhance SCM performance, through a better efficiency in the relationship with suppliers in all phases of the supply chain. Thus, the suppliers' relationship management may be understood as a strategy, based on purchasing principles, on long-term partnership processes, on Information Technology (IT) tools, and on simple and effective internal processes. The confidence and reliability among all parts are extremely important to this strategy: each company is responsible for the agreement accomplishment within its organization, and to implement this strategy in its parts. The SCM evolution demanded that SRM also evolved from a passive position to a proactive action. Like SCM, the SRM strategic importance has been acknowledge by enterprises. Therefore, suppliers started to face SRM as an opportunity of value aggregation to the final client and not only as a cost aggregator activity. Hence, like the commercial relationship among companies, their suppliers left behind the focus on price and turned to follow strategic alliance formations.

More than a long-term strategy or a tool that may bring short-term benefits, SRM must be considered as a continuity solution that will allow companies to interact in an open and effective manner, enhancing the performance of the material acquisition cycle through:

- Margin improvement: the mutual understanding of processes of relationship among parts will allow one to understand where it is possible to fit these interfaces so that one may eliminate "fat" used to ensure suppliers margins under every market fluctuation, price variations, stock market change, and other disturbances;
- Cost reduction: information sharing about internal processes of each company and their interfaces will allow one to evaluate cost reduction opportunities, labor reduction which is necessary to process documents and information ambiguities;
- Administration of internal demands: through mutual comprehension of processes and collaborative planning, it is possible to better understand and negotiate internal demands from other departments by always finding opportunities to better supply clients and reduce useless tasks that just add costs to operations;
- Value aggregation to operation: together with the benefits conquered by previous tasks, it is possible, through information sharing process and mutual understanding, to speed up the introduction of new products/models/versions or to generate materials/components that allow the reduction of total production time to client, not only making it easy to prepare machines, but also reducing productive process stages.

According to Pires (2002), the development and application of SCM concepts present a high increase in the automotive industry due to the high level of existing competitiveness in this activity and to its pioneering technological and managerial innovations within the industrial field. For these reasons, some initiatives and practices used in the sector are presented in the following section.

2.1. Scm Initiatives And Practices In The Automotive Industry

As pointed out by Mouritsen, Skjott-Larsen and Kotzab (2003), the "collaboration" within the supply chain occurs when two or more companies share the responsibility for exchanging information in planning, management, execution, and performance measurement. To Alvarado and Kotzab (2001), some clients and suppliers try to reassemble their product flow, and therefore the production and distribution operations through a higher demand and manufacturing information sharing. According to Tan (2002) and Pires (2002), the main practices and initiatives used in the collaborative management of supply chain are:

- *Electronic Data Interchange* (EDI): it emerged with the intention to execute information exchange in a structured way among partner enterprises in determined business, allowing data access to be done in real time;
- *Quick Response* (QR): suppliers receive data collected from the client sales territory and use this information to synchronize their production operations and their stocks with real sales;
- *Efficient Consumer Response* (ECR): practice aims to

improve supply and real client demand through a system capable of automatic replenishment in sales spots;

- *Vendor Managed Inventory* (VMI): vendor is responsible for managing his inventory at the client, including the reposition process;
- *Collaborative Planning, Forecasting, and Replenishment* (CPFR): this tool intends to facilitate company's relationship, mainly when it comes to sales forecasting.

Next, some other SCM practices (Tan, 2002) commonly used in automotive industry are presented - though they are not exclusive to the automotive field:

- Supplier development may vary from an informal evaluation of production operations to the creation of an investment program together with training;
- *Outsourcing*: in that practice other external companies provide part of the products and services used in an enterprise in a collaborative and independent way. The supplying company develops and continuously enhances competence and infrastructure to meet client needs. Nevertheless, they keep on having a narrow and collaborative integration with the supplier (Pires, 2002);
- *In Plant Representatives*: This is characterized by some company representative's presence working full-time with their suppliers, creating a dynamic and more reliable communication among involved companies. This practice is highlighted among the automotive companies since part of their main suppliers make available a full-time representative from the auto parts companies where, through a closer relationship, manufacturing or project failure corrections are carried out in a more effective way;
- *Early Supplier Involvement* (ESI): practice that shows great expansion. In this case, the supplier brings its competence and background to create a product in a quicker way, with lower costs and higher quality;
- *Milk Run*: the intention is to have a supplying system with pre-defined routines and schedules for material collection in the supplier field. The main objective is to reduce logistic supplying costs via scale economies and route enhancement, as well as to increase process reliability as a whole;
- *Modular Consortium*: it was created in the automotive field and is based on the transfer of all assembling operations to the first level suppliers called Modulates. This new system aims, among other things, a more effective production and cost reduction when compared to the traditional assembling model. Firmo and Lima (2005) points out that one of the most relevant aspects within this new industrial model is the need of information exchange among all their constituting parts. All the production decisions are carried out together, searching for the best option for the different partners.

3. THE ACTION RESEARCH / SOFT SYSTEM METHODOLOGY (SSM)

With the objective of analyze and to suggest improvements in supporting the supply chain of an auto part company and its suppliers, an action research was conducted. The object of study was a company responsible for electrical distribution systems into automotive vehicles. It is located in Itajubá, MG, Brazil. Its productive arrangement initiated in 1996, in order to meet a multinational client request (follow sourcing). According to Coughlan and Coghlan (2002), the action research is a type of special research with empirical-basis conceived and performed with a narrow association with solving a collective problem in which researchers and representative participants of the situation or the problem are involved in cooperative and participative basis. The main aspects of the action research are:

- Interaction between researchers and people involved in the situation investigated;
- Problem priorities as an interaction result;
- Relationship of the investigation object with the situation and problems found;
- Focus on the objective that is the problem solution or understanding;
- Increase team knowledge.

To perform the action research, the *Soft System Methodology* (SSM) tool was chosen. According to Checkland (1993) and Cassel and Symon (1994), this technique investigates problems within the system and the process. Its main idea is to provide the studied system the opportunity to extract and implement benefits, which corroborates with these paper objectives. These authors also claim that SSM must be implemented in stages, with the following features:

- Participation of the system members;
- Structuring the process;

- Imagination and innovation;
- Analysis and logic.

SSM begins with data collection carried out by the researcher to define the problem initial situation and its graphical representation. Then, system members, together with the researcher, try to understand the system under the point of view of each integrated sector in the search of a way that provides improvement. A perspective for the problem situation is selected and then developed through a model in which the system should accomplish its objectives. This model is discussed among the system members in order to decide which actions must be implemented. If the chosen way does not offer help to the system members, a new perspective must be adopted until a solution is found. Thus, SSM may be defined in seven stages, as shown in Figure 1. The stages 1, 2, 5, 6 and 7 are considered as real world activities, while stages 3 and 4 are considered as conceptual activities (Checkland, 2000). Next, the stages of the SSM application for the actual study are presented.

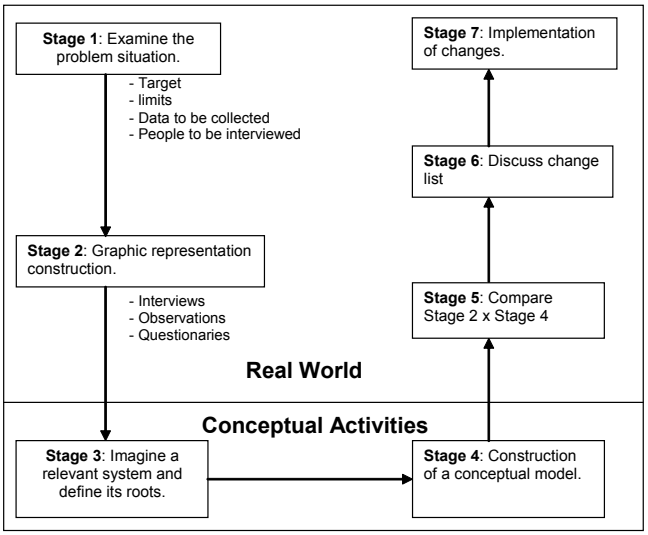

Figure 1 - "Soft Systems Methodology" Stages
Source: Adapted from Checkland, 2000 and Cassel and Symon, 1994.

3.1. Stage 1 – Examine The Problem Situation

This stage comprises a preliminary examination of the problem. The situation is typically a complex system of human activities. During this stage, the researcher defines the research limits and boundaries, the data to be collected and the people to be interviewed. Then, he negotiates the available ways of collecting data from involved people and tries to understand the current system logic. In order to achieve the objective (to analyze and suggest improvement in supporting the chain relation between auto parts companies and its suppliers), main business areas and peoples, roles were defined. For the auto parts company, purchases and planning of materials were the areas defined, along with three participants: a person from each area and the manager for both roles. In order to define the participating suppliers, a classification ABC was carried out and the ones that represent 80% of the total supply activity were selected. As requested by suppliers, they will be called A, B, C and D. The D supplier holds a 34% market share, followed by A (18%), B (14%) and C (14%). Companies B, C and D, which builds connectors and electrical circuits, are direct competitors, with C and D sharing the leadership in the segment. Supplier A, an electric cable manufacturer, is the leader in its sector. All the suppliers, with the exception of A, were designated and had their supply defined by the automotive company, as the component used was designed within the car project. Although it's possible to change suppliers after the startup, this is not common due to the economy of scale involved in the process. Also, sales and material planning areas were chosen, and one person for each function was selected using the criteria of higher relationship time among partners (in case where more than one person was performing that role). Eight people were then selected to represent the previous four suppliers. Finally, the researcher himself was involved, totaling twelve participants. Reports and documents from the company and its suppliers were used as evidence source, together with semi-structured interviews and the researcher's direct observation.

To apply SSM, the following research question was considered: *How is SCM useful or how may it be useful to the supply chain of an auto parts company?* The next step was to sub-divide the research question. For such task, steps from previous work by the *Global Logistics Research Team from Michigan State University* (CLM, 1995) were followed, which establishes that the enterprise that has the best logistics practices is named World Class Logistics is an enterprise that acts strategically by following four competence categories: positioning, integration, agility, and measurement. Competence measurement provides basis for adjustments on the other three logistic competences through evaluation measurement. According to the *World Class Logistics Model*, performance measures or metrics is used by world class enterprises in four areas: service to client/quality; costs; productivity and management of assets. Hence, the research question was sub-divided into three main areas: SCM, Integration and Coordination.

In the SCM field of study, the objective is to identify and present the concepts and features of the supply chain perceived by the participating chains, and, moreover, to emphasize the most used SCM practices in this environment. In Integration, the goal is to understand and specify the existing integration mechanisms within the supply chain, for instance, to mention how the information systems are used and how the way of information exchange is carried out. Finally, the Coordination area seeks for the evidence of how the chain operations are defined as well as the tools used and how release performance among participants is measured. From this subdivision, an interview routine was originated, trying to search for the best visualization of information that needed to be collected from the participants so that a graphic representation could be built (Stage 2). Figure 2 presents the research question development and the main points approached in the interview conduction.

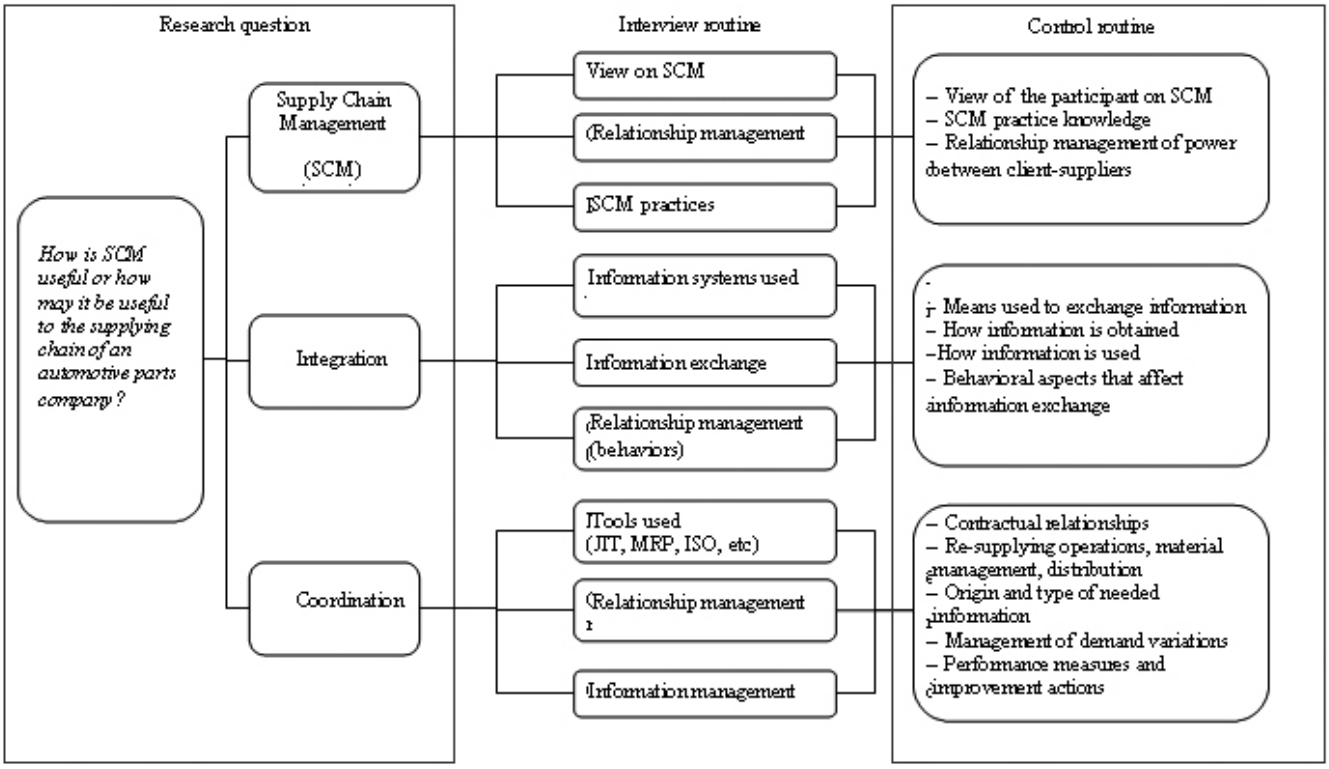

Figure 2 – Research question development

In the first subdivision of the research question (SCM), 90% of the participants declared to beaware of the SCM concept. SCM practices and initiatives are known and perceived to be important, having as the highest citation index the modular consortium of VW Resende (RJ), the industrial condominium of VW in Curitiba (PR) and the milk run Ford of suppliers for the plant in Camaçari (BA). Also, it was reported to be common practice for the manufacturers to have an *in plant representative*. The majority of participants understand that the power management between client-suppliers should be a win-win relationship, which is, according to participants, not always able to be carried out, especially because the automotive company bargaining power is extremely high. In the Integration area, it was observed that, although the company demands collaborative management tools, for instance, EDI, and both the auto parts companies and the suppliers have technological capacity for its use, its usage among them is not relevant. The current information exchange occurs through e-mails and telephone. In Coordination, the technological capacity for processing information using MRP II (*Manufacturing Resource Planning*) and ERP (*Enterprise Resource Planning*) was evident. The majority of participants and all the suppliers did not identify SCM strategies and all of them share only the operational concern of not harming the automotive company manufacturing line, being most of the time focused basically on problems resolution. Moreover, the performance evaluations are currently only part of a three-month release of the quality area. The planning areas of suppliers' materials are not informed about their performance.

3.2. Stage 2 – Construction of The Graphical Representation (Current Situation)

In this stage, data collection is used to represent the system in its graphic form ("Rich Picture") and then it is presented to the systems members. The representation must depict the problem situation and include the collected information and also include information on the tasks the system executes. After the interviews, the participants were motivated to develop together a real situation. The start flow takes place at the moment in which the auto parts company has the supplier's material available in their plant. Figure 3 presents the defined flux by participants as being the real situation. Bold lines are the points in which the participants identify that there may be options for improvement. For SSM, stages 1 and 2 try to describe the day-by-day reality, whereas stages 3 and 4 are predominantly intellectual and conceptual. In practice, they occur simultaneously; however it was chosen to present them separately in this section.

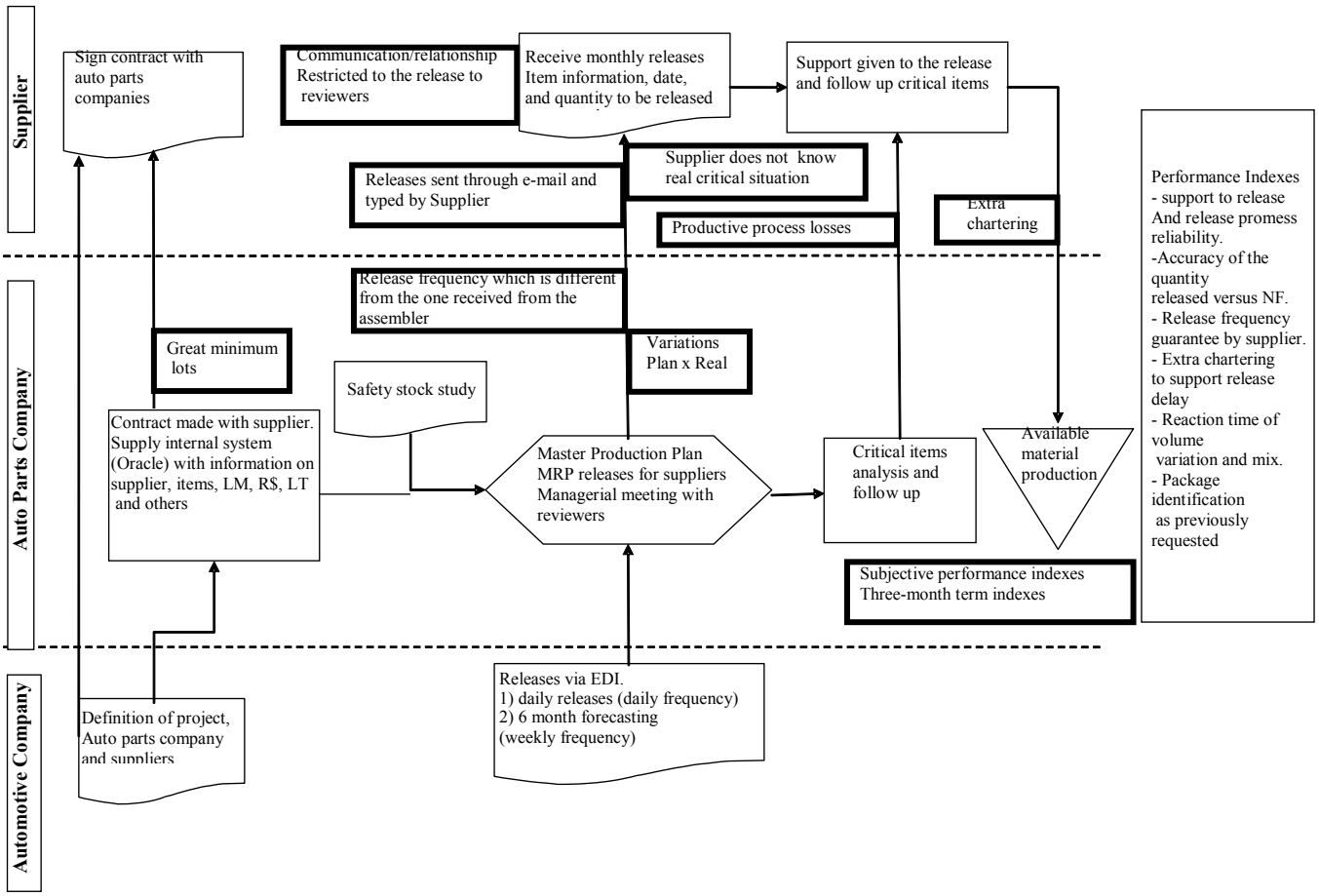

Figure 3 – Construction of the Real Situation

3.3. Stages 3 and 4 – Creating a Relevant System and a Conceptual Model

The researcher and the participants search for new manners of seeing the system under study. The main SCM stages are associated to stages 3 and 4, and these must be connected among themselves (Cassel and Symon, 1994). From the real situation, participants were motivated to build a conceptual model (new model). To this end, their knowledge was used both for explicit knowledge of supply chain management of the automotive industry and the implicit knowledge identified in interviews and in the literature review.

Figure 4 presents the ideal conceptual model developed by the participants. Bold lines are the alterations suggested for the conceptual model with basis on the real model. It was a consensus among participants not to alter the flow direction; but to use initiatives and practices already common in SCM of Brazilian automotive industry, such as:

EDI use. Once auto parts companies and suppliers have this technology, one may just apply it to the

current relationship. This initiative will make it possible to get the right release frequency among auto parts companies and suppliers according to the release frequency of the automotive company.

VMI use. It was suggested by most part of participants the use of VMI for the supplier to manage the automotive parts stock so that it can have a precise and exact view of the real critical situation of the item, and also improving information relationship and reliability.

To make available a supplier's resident in the auto parts companies. Half of the participants were reluctant to this point due to the fact it generates new cost. Nevertheless, it was understood that the inclusion of an index to measure the cost/benefit of this suggestion was necessary. The resident will have the mission to represent the suppliers inside the auto parts companies, not only in what refers to the areas of quality, engineering, commerce, and quality, but mainly, to the supplying area. This contributes to a better information flow and, consequently, a better relationship in between auto parts companies and suppliers. It will also contribute to the definition of a unique safety stock of a chain. Nowadays, the auto parts companies and suppliers both have a safety stock. Together, these stocks may only generate costs and not safety.

Milk run implementation of suppliers B, C and D. The participants from these three suppliers understand that the volume, costs, and geographical position justify a milk run implementation among them.

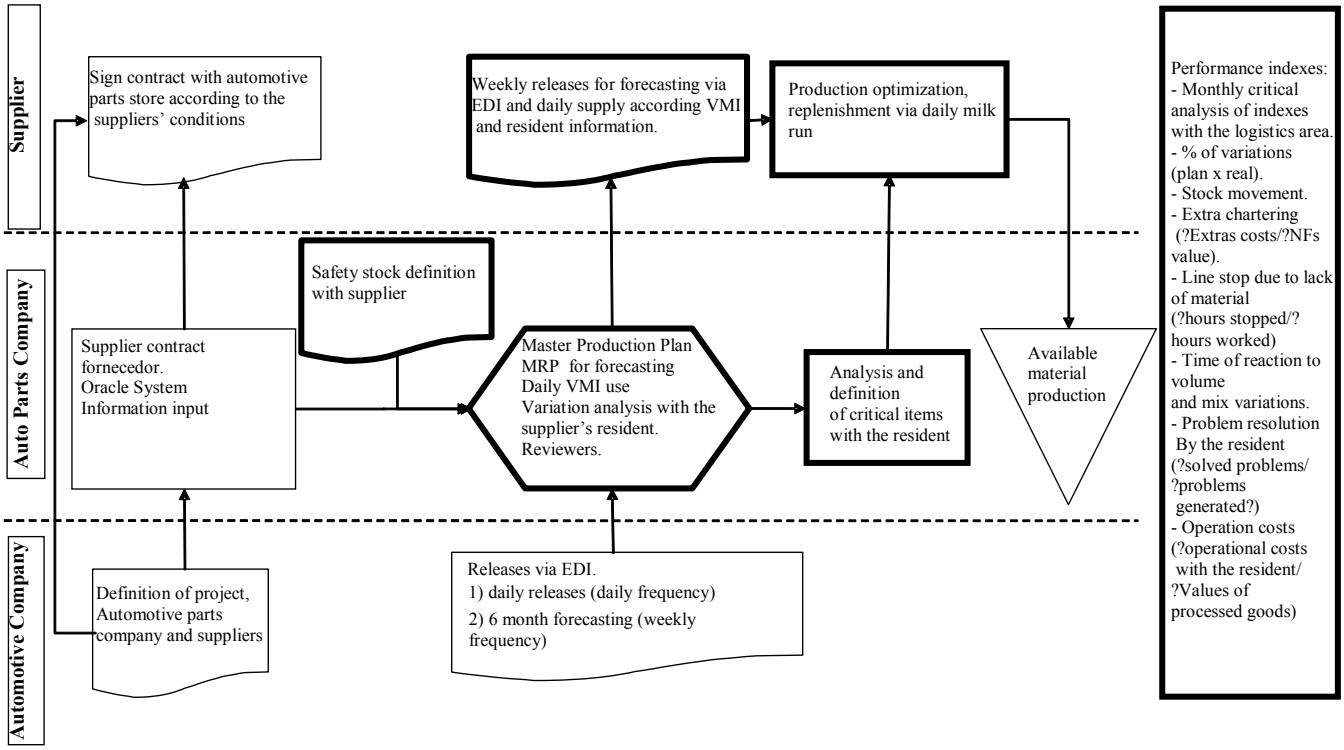

Figure 4 – Construction of Conceptual Situation

Concluding the conceptual model, all participants identified the need to create new indexes that may really measure this flow. Table 1 presents indexes that, according to participants, are the ones that need to be measured at this moment. The indexes were divided after following the literature review; the performance measures used by the world-class enterprises (*world class logistic*) and that belong to four areas are:

- Service to client/quality;
- Costs;
- Productivity and;
- Asset management.

TABLE 1 – Conceptual model performance indexes

AREAS	INDEXES	CALCULUS FORMULAE
Service to clients	% of variations (plan x real).	∑ consumed quantities/ ∑ release forecast quantities
	Production line stop for lack of material	∑ not working hours/ ∑ working hours
Costs	Operation costs with the resident	∑ operational expenses with the resident / ∑values of parts bought
	Extra chartering	∑ extra costs / ∑ value of NFs
Productivity	Problem resolution by the resident	∑ solved problems / ∑ generated problems
Management of activities	Stock change (auto parts companies and suppliers).	Annual consumption / Average stock

It was also the participants' consensus that these indexes will need to be often revised due to their new understanding that indexes are very important. However, they agreed that some indexes may be replaced, deleted or created.

3.4. STAGES 5 AND 6 – COMPARISON OF A REAL GRAPHIC REPRESENTATION WITH CONCEPTUAL MODEL AND CHANGE SUGGESTIONS

Stage 5 aims to identify activities that are part of the conceptual model that do not happen in the real world and also to identify activities from the real world that are not included in the conceptual model. Stage 6 consists of discussing and defining a possible change suggestion list. Table 2 resumes the whole work results by presenting the activities of the conceptual model whose presence may be identified or not in the real world and also evaluated as bad (production stop risk), medium (production stop risk does not exist, but there are improvement to be carried out), and good (considered by the participants as not needing improvement). In the last column, improvement suggestions are presented.

TABLE 2 – Comparison of real situation with the model with a suggestion list.

	Conceptual Model Activty	Presence	Evaluation	Real situation	Suggestions
1	Supplier definition with direct participation of auto parts companies	Yes	Regular	Project, auto parts companies, and suppliers definition done only by automotive companies	Higher auto parts company involvement, making it possible to use the development manual of developed suppliers
2	Auto parts companies and suppliers contract signature	Yes	Regular	Contract signature as part of the process	Detailed definition of responsibilities, rights, duties and penalties
3	Information registration in internal system (ERP-MRP –Oracle)	Yes	Good		
4	Minimum purchase lots	Yes	Bad	Big minimum lots	Jointly quantitative study – auto parts company and suppliers
5	Lead time	Yes	Bad	High lead time	Study of production process optimization of chain and jointly quantitative study to define stock management
6	Study and definition of safety stock (SS)	Yes	Bad	Auto parts company defines its SS and Supplier defines its SS	SS definition in the chain as a whole, making a jointly definition.
7	Receiving *releases* from the automotive company via: daily EDI (release) and weekly EDI (six-month planning)	Yes	Good		
8	PMP and MRP execution to send release to suppliers	Yes	Bad	Monthly PMP and MRP execution	To execute MPS and MRP to send releases to suppliers with the same frequency as from the automotive company
9	R*elease* sending to suppliers	Yes	Bad	E-mail and typing done by the supplier	Usage of EDI and VMI among suppliers
10	Use of an in plant representative	No			In plant representative in order to solve day-by-day problems (quality, engineering and logistics).
11	Mix and volume variation analysis	No			Definition of an action plan after analysing this data with the help of the in plant representative
12	Critical item analyses (production stop)	Yes	Bad	Information of critical and follow-up of suppliers who are not certain of critical situation	Daily analysis (with the resident) for identification and action planning for support.
13	Replenishment through VMI	No			VMI use for replenishment of auto parts companies with the help of a resident.
14	Raw material transport optimization	No			Milk run implementation for suppliers installed in the same route.
15	Peformance indexes	Yes	Bad	Subjective performance indexes which are used or not used for improvement.	Indexes. 1)% of variations 2)Stock movement 3) Extra chartering 4) Line stop for material lack 5) Resident use 6) Resident costs
16	Performance index analysis	Yes	Bad	Three-month index release to the suppliers' quality area	Monthly release and critical result analysis by suppliers' logistics.
17	Communication / frequent relationship to generate improvement	Yes	Bad	Communication / restrict relationship to support critical items and release	Periodical meetings in order to evaluate the real situation and to suggest future improvement

Stage 7 involves change implementations suggested in the previous stage. Nevertheless, implementation based on the suggestions from this formulation will not be approached due to the time limit to end the research. The focus here is on the analysis and discussion on the differences between graphic representation of the real situation, as well as the conceptual model (suggested) and the generation of the suggestion list. However, due to easiness and actual technical capacity, EDI was implemented and is already working in the auto part industry and the D supplier. This fact points out to the participant's level of commitment, integration and their real intention of using the action research results as an SCM improvement. Some other improvement suggestions that demand a longer time to implement are going through the company viability study process.

4. CONCLUSIONS

With the objective to integrate external and internal structure through a holistic point of view, SCM has been used as one of the most important tools in the search of higher profits and market share in diverse fields of activities. Especially in the automotive industry, SCM has presented some initiatives and practices that aim the generation of a competitive differential for the sector focusing on the immediate chain for the automotive companies (*Tier* 1). The paper proposal was to analyze and suggest improvements on the automotive sector chain, that is, auto parts companies and their suppliers (*Tier* 2).

Although some SCM initiatives and practices can be observed among assembler and auto parts companies (such as EDI, *milk run*, resident, suppliers' development, follow sourcing and others), these practices are usually not implemented in the chain continuation, specially between auto parts companies and their suppliers. Even though participants show theoretical knowledge about SCM, such concepts and steps are not applied in the daily relationship among auto parts companies and suppliers, which denotes some improvement opportunities, as mentioned in stage 5 of SSM usage. As observed within the reaction from the participants involved in this study, it is recommended to try to implement the suggestion list obtained in this work (even in a partial and/or gradually manner) so that auto parts companies and suppliers connection could be professionally aligned with the SCM initiatives and practices of Brazilian automotive industry.

In practice, this work reinforced the participant's knowledge related to the approached concepts, even if they have already been understood. Thus, the need to use SCM initiatives and practices in all supply chain levels was evidenced, so that processes were optimized, reducing financial and relationship costs and finally making enterprise daily routines part of the organization objectives and activities.

The increasing use of information technology represents a great opportunity window and stands as a fundamental part of SCM, as it allows information interchange in an effective way and improves the decision making times. Normally, financial issues are used to justify the "no go" decision when it comes to IT. This study helped overcome this barrier: the use of information technology as a SCM facilitator was applied. The main IT achievement was the EDI implementation of supplier D. Both companies had technology and work force available and the decision of going ahead with the implementation came after this research. The attitude change followed by this study became evident to all the people involved: the team changed from *problem solvers* to *improvement generators*.

Finally, it is important to point out that during and after SSM application an enhanced harmony among companies was observed. Companies known for generating conflicts and problems by giving support to chain demands became true partners in the process of integrating their supply chain objectives and tasks. This behavior came as a consequence of a higher team integration and involvement provided by this research. Some involved people emphasized that this relationship, usually called "partnership" by the participants, should occur often not only on problem solving, but also on the future improvement analysis. Some say this is already underway. As a result, the company itself can learn how to work and understand its suppliers, what the difficulties are and how to cooperate in a positive and business driven way.

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