USING TRANSACTION COST ECONOMICS AS A TOOL TO ANALYSE BRAZILIAN AUTOMOTIVE SUPPLY CHAINS

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ABSTRACT
The worldwide automotive industry has undergone a process of important changes in the forms of organizing production, in the supplier-assembler relationships, and in product development activities. In Brazil, such changes have been reinforced by the impacts on supply chains resulting from investments made by new assemblers in order to install assembly plants in the country, as well as those made to modernize the already installed ones.

In order to better understand such changes in Brazilian automotive supply chains, the paper here presented uses case studies from two Brazilian engine-assembly companies and three of their suppliers, to analyze the structural and relational aspects taking place into the chains they are inserted into, based on the analysis tools provided by the Transaction Cost Economics.

The main results of the work make contribution to understanding the pattern of relationships taking place between the companies studied, included the development of closer and longer-term relations in some cases and arm’s length relations in others. Also, some characteristics of the outsourcing process that is happening in the industry seem to be justified by the analysis factors embraced by the Transaction Cost Economics approach.

INTRODUCTION
Supply Chain Management is a concept developed with a holistic focus, managing across the company’s borders. It’s recognized, by its practitioners, that there are meaningful benefits to be derived from strategically managing a whole network in order to satisfy the end-clients. (Cooper, Lambert & Pagh, 1997), (Tan, 2002), (Lumus, Vokurka & Alber, 1998). Concomitantly to the development of the SCM concept, according to (Salerno et al., 2003), the worldwide automotive industry has undergone a process of changes in the forms of organizing production, in the supplier-assembler relationships, and in product development activities.

In Brazil, such changes have been reinforced by investments made by new assemblers in order to install assembly plants in the country, as well as those made to modernize the already installed ones. Such investments have had major impacts on the structure of the supply chains and on the assembler-supplier relations. (Alves Filho et al., 2000) and (Alves Filho et al., 2001)

In the context of this transformation, meaningful impacts can also be observed in the engine-assembly units, which supply the car-assembly companies. According to (Maia & Cerra, 2004) Brazilian phenomena like “1000cc” and bi-fuelled engines had also brought important changes in the supply chains of the engine assemblers.

One school of thought that can provide interesting tools for analyzing inter-company relationship is the Transaction Cost Economics (TCE). According to this school, the costs of transacting goods between different firms must not be neglected, and suitable governance structures must be chosen in order to minimize opportunistic behavior. Besides TCE, other schools of thought like Network Theory and Resource Dependency Theory adopt an institutional perspective to analyze the supply chains, focusing the possibilities of connections, the forms of coordination, and also the institutional environment (Tripkens, 1999).

Transaction Cost Economics embraces a set of hypothesis that are determining factors in transaction costs: asset specificity, complexity and uncertainty, transaction frequency, bounded

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rationality and opportunism. Analyzing such factors can account for a better understanding of how companies inserted into a supply chain behave, assessing quantitative and qualitative aspects of the buyer-supplier relationships, as well as the development of partnerships and long-term relation between them. (Alves Filho et al, 2004).

Besides the TCE factors, (Bensaou, 1999) has proposed a relationship typology that analyses the investments on specific assets made by buyers and suppliers, identifying 4 groups: market exchange, captive buyer, captive supplier and strategic partnerships. This typology has also been used in the paper as a manner to provide initial discussion about the structural and relational characteristics of the supply chain into which the companies are inserted.

In this sense, the paper here presented uses case studies from two Brazilian Engine-assembly companies and three of their suppliers, in order to analyze the structural and relational aspects taking place into the supply chains they are inserted into, based on the analysis tools provided by the Transaction Cost Economics, here included Bensaou’s typology.

The paper initially shows a literature review on Transaction Cost Economics, its factors and possible governance structures. Based on some of these factors, the relationship typology proposed by Bensaou is revisited, as a manner to categorize inter-company relations. Then, the studied cases are presented, and the appropriate analyses are made, based on the TCE.

**TRANSACTION COST ECONOMICS (TCE)**

The concept of transaction cost has been largely applied by the institutionalists of rational choice, and considers that the company (organization) is composed of many transactions, being such transactions the basic units of analysis.


The main issue embraced by the TCE is, according to Williamson (1994), the alignment of transactions (which differ in their attributes) with governance structures (which differ in their costs and competencies). According to (Barney, 1999), governance consists in a mechanism used by the organizations during the accomplishment of economic exchanges, aiming to attenuate the threaten of opportunism. There are three forms of governance (Barney, 1999; Mcnally, 2002): Spot market (transactions in which occurs instantaneous exchange of products and services), Vertical Integration or Hierarchy (mechanism to manage economic exchanges inside the organization) and Hybrid (used to manage transactions like subcontracting, alliances and franchises, combining aspects from Spot Market and Vertical Integration).

Fiani (2002) asserts that the basic unit of analysis regarding transaction costs is the contract. Once that costs are assigned to contracts, one of the main hypotheses of the classical microeconomics approach is broken: information symmetry. In its place, a new set of hypotheses emerges. Such hypotheses are the determining factors of the transaction costs: asset specificity, complexity and uncertainty, bounded rationality and opportunism. The three first aspects concern environmental factors, while the last two ones embrace behavioral issues.

Asset specificity refers to assets that when used to another application, different from the one initially agreed, suffer losses of value, thus constituting durable investments committed to a specific transaction.

The uncertainty assigned to a transaction maybe an essential aspect in the choice of a governance structure. The role that uncertainty plays is the one of revealing the boundaries of rationality, which results from informational asymmetry. (Farina, Azevedo & Saes, 1999)

The frequency of exchanges has also great impact on transaction costs. As a result of reiterated relations, the partners may acquire knowledge about each other (thus reducing uncertainty), creating a reputation around a brand (generating asset specificity) and, in some cases, creating a trustworthy commitment to the continuity of the relation. (Farina, Azevedo & Saes, 1999).
Bounded rationality and opportunistic actions increase transaction costs, and such costs rise according to increases in the asset specificity and in the uncertainty assigned to the transaction. (Grover & Malhotra, 2003).

According to Trienekens (1999), the TCE has as a starting point the analysis of “make or buy” decisions, i.e., the decision of producing internally or outsourcing, and the extent to which the outsourcing is accomplished.

Given the bounded rationality of the decision-makers, the asymmetrical distribution of information, and the inability to specify completely the behavior of the agents in the presence of multiple contingencies, the TCE considers that all contracts are incomplete, thus susceptible to renegotiations and possibilities of opportunistic behaviors. (Leiblein & Miller, 2003).

**RELATIONSHIP PATTERNS**

In order to analyze the relations between assemblers and suppliers in this paper, besides the aforementioned TCE elements, the work of Bensaou (1999) is used. Based on the investments made in specific assets (tangible and intangible) both by the suppliers and by the buyers, the author has identified four patterns of relationship between the companies:

- **Market Exchanges**: (Few investments made in specific assets both by the buyer and the supplier) Represents a group of relationships in which none of the partners has developed specific assets to work with each other. This type of relationship is suitable to products not susceptible to technological innovations or frequent design changes. Producers may easily find many suppliers with capability of engineering, manufacturing and delivering such product;

- **Captive buyer**: (High level of investment made by the buyer, but few investments made by the supplier) Consists in asymmetrical relationships in which the buyer is held hostage by a supplier free to switch to another customer. Such relationships encompass complex components which require some degree of customization, but which are still based on a well-known and stable technology. The supplier market is highly concentrated, with few large and well-established suppliers.

- **Captive Supplier**: (High level of investment made by the supplier, but few investments made by the buyer) Asymmetrical relationship in which the supplier makes large investments in order to do business with the consumer. It encompasses highly complex products, based on new technology developed by the own supplier, which must make great capital investments. However, the buyers are used to switching quickly between suppliers as the technology evolves, and other suppliers provide improvements in product functionality and performance. In this sense, despite owning the technology, the supplier has limited bargaining power.

- **Strategic Partnerships**: (High level of investment made in specific assets both by the buyer and the supplier) In this case, both the buyer and the supplier have invested in the relationship. The partners exchange information on a regular basis, through reports, standardized rules, and procedures, among others. Buyers electronically exchange data with the suppliers and supplier engineers visit the buyer’s plants. The buyer makes efforts to make the supplier committed and coordinate tasks.

According to Bensaou, for the companies to succeed in managing effectively their supply chains, they must choose a kind of relationship suitable to each product, market and supplying conditions. Besides, it’s necessary to adapt the management practices to the type of relationship chosen.

**RESEARCH METHODOLOGY**

The research strategy adopted was the case study, once that in tune to (Yin, 1994:23), this research aimed at “investigating a current phenomenon inside its reality context, when the bor-
ders between the phenomenon and the context are not clearly defined, and when various sources of evidence are used.”

The data collection technique here used was the interview, which according to (Selltiz et al, *apud* Gil, 1999:117), “is quite suitable for gathering information about what people know, believe, hope, fell or wish, intend to do, do or did, as well as about their explanations or reasons about the preceding things.” With this intent, semi-structured interviews were conducted based on a questionnaire, developed from the aforementioned literature review.

Given the objectives of this research, the interviewees were preferentially those working in the purchasing and product development areas.

### CASE STUDIES

In this section, we present case studies from two Brazilian Engine-assembly companies and three of their suppliers, in order to analyze the structural and relational aspects taking place into the supply chains they are inserted into, based on the analysis tools provided by the TCE and Bensaou’s typology. Except for company “D”, which is a Brazilian organization, all the analyzed companies are branches of multinational companies.

In order to make it easy to compare the cases, the data were tabulated, and are shown in two different tables. The first table presents the main characteristics of the companies studied, while the second table compares the relationships established between them.

<table>
<thead>
<tr>
<th>Workers</th>
<th>Car-engine assembler “A”</th>
<th>Car-engine assembler “B”</th>
<th>Supplier (common and B)</th>
<th>“C” to A (supplies with auto parts)</th>
<th>“D” to “A” (supplies autoparts)</th>
<th>“D” to “B” (supplies with autoparts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>535</td>
<td>1750 (engines and transmission plant)</td>
<td>370</td>
<td>200</td>
<td>450</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clients</th>
<th>Car assembler</th>
<th>Car assembler</th>
<th>All the assemblers but one, for whom provides spare parts</th>
<th>About 90% of receipts is related to “A”</th>
<th>Some assemblers, included “B”. Stopped supplying “A” two years ago</th>
</tr>
</thead>
</table>

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<thead>
<tr>
<th>Main products in the studied plants</th>
<th>Car engines (1000 to 1600cc)</th>
<th>Car engines (1000 to 1800cc and 2000 to 2400cc)</th>
<th>Clutches for light and heavy vehicles and aftermarket</th>
<th>Exhaust collector (foundry iron)</th>
<th>Gears, chassis, oil carter, and engine small parts</th>
</tr>
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</table>

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<tr>
<th>Technological autonomy from headquarters</th>
<th>It has autonomy to develop engines based on previously existent ones. Autonomy also to accomplish process innovations.</th>
<th>It has autonomy to develop engines based on previously existent ones. Autonomy also to accomplish process innovations.</th>
<th>It has autonomy to develop clutches based on previously existent ones. Autonomy for process innovations.</th>
<th>It has autonomy to develop products together with the assembler, besides process innovations.</th>
<th>It develops processes to manufacture products which design is given by the clients. The clients invest in needed tools.</th>
</tr>
</thead>
</table>

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<tr>
<th>Number of suppliers</th>
<th>129</th>
<th>100</th>
<th>80</th>
<th>-</th>
<th>10</th>
</tr>
</thead>
</table>

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<thead>
<tr>
<th>Technological content of the products</th>
<th>There are parts whose technology is owned by suppliers, and development involves both assembler and supplier. In other cases, the assembler transfers the design to the supplier or acquires the part from the headquarters.</th>
<th>There are parts whose technology is owned by suppliers, and the development involves both assembler and supplier. In other cases, the assembler transfers the design to the supplier or acquires the part.</th>
<th>The company dominates the technology of the product supplied to the assembler(s). It has autonomy to develop new clutches based on specifications imposed by car-engine assemblers when they release new products.</th>
<th>The assembler “A” has developed the company “D” to supply “A” with products according to specifications from the headquarters.</th>
<th>The company has autonomy to generate innovations in production processes, in order to adapt them to the product design given by its clients.</th>
</tr>
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* Originally presented at the 10th ISL International Symposium on Logistics 2005*
Table 1: Main characteristics of the studied companies

<table>
<thead>
<tr>
<th></th>
<th>Relationship: “A” and “C”</th>
<th>Relationship: “B” and “C”</th>
<th>Relationship: “A” and “D”</th>
<th>Relationship: “B” and “E”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asset specificity</strong></td>
<td>Moderate asset specificity, both regarding supplier and assembler. When the assembler develops a new engine, it sends specifications for “C” to develop clutches for this new engine. During this phase, a large amount of information is exchanged, and the supplier product experiences incremental changes. Meaningful portion of “C” production is destined to “A”.</td>
<td>Moderate asset specificity, both regarding supplier and assembler. When the assembler develops a new engine, it sends specifications for “C” to develop clutches for this new engine. During this phase, a large amount of information is exchanged, and the supplier product experiences incremental changes. Small portion of “C” production is destined to “B”.</td>
<td>Very high asset specificity. The assembler has invested in physical (machines, equipment and tools) and human assets (technology, information and assembler engineers working at the supplier’s plant). After this initial phase, the supplier has made investments to meet assembler’s demands regarding product quality, techniques, delivery dates, etc.</td>
<td>High asset specificity involved. It’s a case in which the assembler transfers the product design and the supplier develops its production process. In most of the cases, the investments in tools for producing a new product are made by the assembler.</td>
</tr>
<tr>
<td><strong>Relation frequency</strong></td>
<td>It releases orders to its suppliers every 15 days, and receives parts daily.</td>
<td>Varies according to assembler needs and batch size. Daily in most cases.</td>
<td>The deliveries to the assembler are accomplished daily (milk run)</td>
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</tr>
<tr>
<td><strong>Uncertainty and bounded rationality</strong></td>
<td>Uncertainty and bounded rationality have moderate weight in the relation. The car-engine assembler has knowledge about the production process of the part supplied, although it doesn’t own the technology needed to produce it.</td>
<td>Uncertainty and bounded rationality have moderate weight in the relation. The car-engine assembler has knowledge about the production process of the part supplied, although it doesn’t own the technology needed to produce it.</td>
<td>Uncertainty and bounded rationality have low influence on the relation, once that the own car-engine assembler has developed the supplier, thus holding knowledge about the whole process.</td>
<td>Uncertainty and bounded rationality have low influence on the relation, once that the product and process development are accomplished by Simultaneous Engineering.</td>
</tr>
<tr>
<td><strong>Opportunism</strong></td>
<td>The possibility of opportunistic actions is low, once that both brands are well known. A fraudulent behavior by the supplier would make it loose the sales of a meaningful portion of production. An improper behavior by the assembler would obligate it to buy from one single company, once that the assembler has two suppliers per part.</td>
<td>Although the amount of production involved in those transactions is small, the possibility of opportunistic actions is low, once that both brands are well-known, with a mutual reputation established through time.</td>
<td>The possibility of opportunism is low. Opportunistic actions by the supplier would make it go bankrupt, once that 90% of the supplier production is destined to “A”. Opportunistic actions by the assembler would hinder it from achieving higher returns on the investment made in the supplier.</td>
<td>The possibility of opportunism is low. Opportunistic actions by the supplier would do it much harm once that much of its production is destined to “B”. Opportunistic actions by the assembler would hinder it from achieving higher returns on the investment made in the supplier.</td>
</tr>
<tr>
<td><strong>Relationship pattern according to BENSAOU (1999)</strong></td>
<td>“Market exchanges”, despite the high frequency of relations and the confidence between companies.</td>
<td>“Market exchanges”, despite the high frequency of relations and the confidence between companies.</td>
<td>“Captive Supplier”, given the asymmetry of the relation and the supplier limited bargaining power.</td>
<td>“Strategic Partnership”.</td>
</tr>
</tbody>
</table>

Table 2: Analyses of the relationships established

**FINAL REMARKS**

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In this paper we aimed at analyzing the relationship between two car-engine assemblers and three of their suppliers, based on the analyze tools provided by Transaction Cost Economics and by the typology of relationship patterns proposed by Bensaou (1999).

The study indicates that the relationships encompassed in this work are close to some types established in Bensaou’s typology, although they don’t fit perfectly in them. That’s because the suppliers are generally dependable on the strategies undertaken by the assemblers, accepting demands regarding technical specifications and quality of products supplied, besides prices and delivery deadlines. Despite those asymmetries, in most cases there is confidence in the supplier-assembler relationship.

Both assemblers studied have a relationship close to “market exchange” with a supplier that owns the technology of product and process of manufacturing provided parts. Although those relations were considered “market exchanges”, there are confidence and recurrent transactions, which are characteristics of “strategic partnership” relations.

It could also be verified a “captive supplier” relationship. In this case, although the supplier has an extremely limited bargaining power, we could also verify that the assembler also depends on it, once that there isn’t any other company able to manufacture exhaust collectors according to the assembler specifications.

In the relationship that was close to Bensaou’s “strategic partnership” we have an example of Simultaneous Engineering, although the assembler imposes the rules, as already mentioned.

The assemblers here studied have undergone a deep process of deverticalization of their production. The production of a meaningful amount of pars was outsourced, and just items considered technologically strategic are still produced internally.

In this sense, it’s possible to analyze why the assemblers haven’t chosen to adopt vertical integration in the relationships studied. In the relationship between “A” and “D” and between “B” and “E”, the strongest reason seems to emerge from lower transaction costs, if compared to production costs. In the case of the relationships between the assemblers and supplier “C”, besides the transaction costs, the supplied components are manufactured by means of processes in which the equipments, human resources, and other meaningful assets have an important generic dimension, once that they may serve other assemblers, fact that enables scale gains and increased efficiency for the companies.

Besides, in the case of company “C”, some explanations seem to come from the Innovation Economics, where the partially tacit aspect and the issue of cumulativeness have hindered the assembler from performing this stage of the productive process. It must also be mentioned the possibility of technological advances made in projects for a certain assembler be transferred to other assembler, generating cost and quality gains which are important to the market in which the company is inserted.

The cases studied indicate that aspects like the specificity of assets involved in the transactions, relation frequency, degree of uncertainty and opportunistic behavior may lead to changes in the power relation between buyer and supplier.

The different patterns of relationship occur due to the different structures of supply chains, and to distinct supplying policies, once that an assembler with more small-sized suppliers, with limited technological capability, must make bigger efforts in order to develop them and ensure an adequate performance. Assemblers having a bigger amount of large-sized suppliers, and more technologically capable, must make bigger efforts in negotiating (transactions) with suppliers, and less efforts in developing them.
BIBLIOGRAPHY


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