Global Product Development: Some Case Studies in the Brazilian Automotive and Telecommunication Industries

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ABSTRACT

This paper aims to propose some research questions related to the insertion of Brazilian subsidiaries of transnational companies (TNCs) in global product development networks, in particular in the automotive and telecommunications sectors. These questions arise as both sectors have been entering the “productive globalization” in a very fast manner, being sectors with strong presence of transnational companies, which drive the strategies of their productive chains. Then, it matters to verify, beyond production, how the global product development takes place in these chains. The participation of firms located in Brazil in the product development networks would create an important competitive advantage for the country, and incentives mechanisms could be created in order to increase this participation.

The study intends to verify if there is any Brazilian participation in the global product development in the automotive and telecommunications sectors, and to relate the results to the presence – or absence – of some conditions, as the existence of incentives and governmental policies in order to stimulate the de-centralization of the product development activities, the existence of infrastructure – research centers, universities – and local competencies, specially in which refers to the availability of qualified personnel etc. In order to do this, we have been through an extensive bibliographic research and some case studies in firms in both sectors. We also based our arguments in specific literature on the path of the sectors in Brazil, specially in which concerns to the strategies of product development that had been adopted previous to their insertion in globalized markets.

The results point to a tendency of participation of Brazilian teams in the development of some “niche” products, as low motorization vehicles (“popular cars”), special motors components for low quality or alternative fuel (as ethanol) and suspension components in the automotive sector; and software for switching networks, small switches (few channels) and billing and charge systems in the telecommunication sector. The development of these “niche” products in Brazil depends on the strategies of the headquarters.
1. Introduction

This exploratory study was designed around the common premise that some factors and conditions influence whether R&D units are located or not in developing country. Preliminary researches let us create a reference framework which shows the most important of these factors. Then, some case studies were developed in both telecommunication and automotive industries to test this framework in Brazil.

The initial hypothesis is that productive globalization leads to the adoption of strategies of production and commercialization of “global” products, that is, those conceived for production and consumption in different countries and/or regions. The conception of these products may be, or may not be, centralized in laboratories and development centers located in the same country or region where the head offices are located. In the case of Brazil, the centralization in the conception of some specific products mainly in the developed countries may signify the loss of a competitive advantage – the competence for technological development – which could lead to a sustainable growth. On the other hand, in some cases the transnational companies could, taking advantage of the competencies already installed in Brazil, include the Brazilian subsidiaries in the conception process of their products, or even use the local competencies to the development of specific global products for some market niches – for instance, products which would be adequate to markets in developing countries. For this strategy to occur, it would be necessary that some conditions were present, like the existence of incentives and governmental policies in order to stimulate the de-centralization of the product development activities, the existence of infrastructure – research centers, universities – and local competencies, specially in which refers to the availability of qualified personnel; the particular path of the companies worldwide and in Brazil, which in some way shape their present strategies.

The article presents, then, a bibliographic revision on global product development strategies; the factors that influence the choice of these strategies in the present scenario and their relevance; and a brief panorama on the situation of the Brazilian automotive and telecommunication sectors in which refers to the global product development. Finally, some tendencies are pointed out from some case studies which took place in both sectors.

2. Global product development strategies and the role of subsidiaries

Transnational companies are the main agents of productive globalization. The strategies of these enterprises shape the productive configuration either in developed or in developing countries, through foreign direct investments (FDI). Actually, the intensity of FDI in the last decades is one of the characteristics of globalization nowadays, in opposition to, for instance, simply trade flows among countries and firms, which has been as intense, or even more, in other periods of the economy (Hirst and Thompson, 1998).

Productive globalization means that the transnational firms are able to install its facilities in any place that offers the best conditions: low costs, high qualification of workforce, easy access to raw materials etc. It also means that the company may carry out different activities in different places. For instance, it may have production activities spread over the countries where the final products will be commercialized, but it may concentrate financial activities in the headquarters.

Another characteristic of globalization is the commonality of products offered around the world. In many sectors the strategy of “global product”, that is, the same product being produced and commercialized in several countries at the same time, is a strong tendency. The global products, however, may not be able to fulfill specific needs of local markets, due to local conditions, whether they are natural, social, economic or political conditions - different climate, conditions of usage, acquisitive power of population, local content needs, environmental laws etc. Sometimes, transnational companies develop local products based on global technologies; in other cases, there may be an adaptation of global products to local conditions.

Linking these two tendencies, we may say that global product development may imply in a concentration of the activities of R&D and product development in the headquarters. In fact, this centralization is recognized as one of the advantages of a global product, as it may lead to economies of scale and reduced time to market, because the development costs are reduced due to the existence of an unique development center. Also, according to Terpstra (1977), centralized R&D and product development may proportionate better
communication and co-ordination, and backs up profitable home country innovations. So, at a first glance, transnational companies would tend to concentrate these technological activities in their headquarters, deriving competitive advantages in the home countries. As argues UNCTAD (1999b:219), “(...) TNCs in principle do not have an interest in transferring technology to and supporting innovation in foreign affiliates beyond what is needed for the production process of product at hand”.

Nevertheless, according to Reddy (2000), we may find companies adopting different approaches to localization of R&D and product development activities. The author shows that R&D is also becoming an international activity, like production activities. In other words, not only the production of global products may be carried over in different countries, but also its product development process may be spread among different places.

Actually, transnational companies do have different strategies concerning the development and diffusion of knowledge. Some authors use these diverse strategies as a way to classify the companies themselves, establishing the differences, for instance, between multinational and transnational companies. Bartlett and Ghoshal (1991) defend that the development and diffusion of knowledge depend on the different organizational approaches of companies: multinational, global, international and transnational. According to these authors, in multinationals, knowledge is developed and retained within each unit; in global companies, knowledge is developed and retained in the center (home country or main center of R&D); in international companies, knowledge is developed at the center and transferred to overseas units; and finally, in TNCs, knowledge is developed jointly and shared world-wide.

UNCTAD (1999b) also shows that there may be different kinds of relationship between transnational headquarters and their subsidiaries. Focusing on the level of technological development of the host countries and their economic policies, five types of affiliates are presented. Given some activities related to process and product development, the affiliate may perform many or few of these activities, thus characterizing the level of technological independence in relation to the headquarters. The Affiliate 1, for instance, located in a developed economy and serving a regional market, performs the full range of technological, marketing and managerial functions. Technical personnel and information flows from the headquarters to the affiliate as well as in the contrary way. Technologies may be developed in both locations.

Affiliate 2, located in a newly industrializing economy, serving local and regional markets, performs certain design and development functions, interacting with local firms, technical institutes and universities. In this case, the subsidiary has some production, management, marketing and engineering functions, but relies on headquarters for many strategic functions.

In the third case, Affiliate 3, located in a less industrialized country, with an export-oriented economy, has a low local content, and production functions are mainly the assembly of kits. Technological transfers occurs by the transfer of capital goods and training for production and quality management. Affiliate 4 has high local content, due to the exigencies of the government of the country where it is located. The economy is strongly protected and Affiliate 4 produces less sophisticated products aiming the local market. Its quality and cost performance are far from world standards.

Finally, Affiliate 5 is located in the least developed country, and performs some assemblies operations. Local demands are small, workforce skills are low. There is not a good local base of suppliers and research institutes or universities. There is no adaptation or process engineering, and technological transfer is restricted to some operational training. Figure 1 helps to clarify this classification.

In the Brazilian case, Fleury (1999), analyzing 11 Brazilian subsidiaries of transnational companies from different sectors, characterized the trajectories of the transnational firms in Brazil as composed by three stages. In the first one, the installation phase (from 1950 to 1970), the parent companies transferred technology and management policies to the affiliates. In the second one, the accommodation phase (from 1970 to 1980), the technology and knowledge transfer was reduced, due to the good economic performance of the subsidiaries, which became more independent from their parent companies. In this phase, some local competencies were consolidated. In the last phase, after 1990, with the insertion of the country in the
productive globalization, the Brazilian affiliates were re-inserted in the global strategies of their parent companies.

In this last stage, the author identified, through field research, three ways of re-integration of the subsidiaries in the parent companies: the subsidiaries may act as operational arms of the transnational companies; as a relatively autonomous unit; or as a competencies center. In each situation, the relationship between the firms is modified: in the first type, the decisions are taken in a more centralized way, in opposition to the last type, where the subsidiary is a center of competencies and may take some decisions independently. Table 1 shows the main characteristics of each situation.

<table>
<thead>
<tr>
<th>(Re) configuration issues</th>
<th>Type I Subsidiary as operation arm</th>
<th>Type II Subsidiary as relatively autonomous unit</th>
<th>Type III Subsidiary as center of competences</th>
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<tbody>
<tr>
<td>Decision processes are centralized at headquarters/ target is radical rationalisation at world level</td>
<td>Local subsidiary has a voice and a certain degree of autonomy to manage own financial resources</td>
<td>Local subsidiary has autonomy for the organisation of local/ regional business</td>
<td></td>
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<tr>
<td>Coordination issues</td>
<td>Manufacturing Strategy</td>
<td>Organizational Architecture</td>
<td>Management control systems</td>
</tr>
<tr>
<td>Defined at global or regional level; subsidiary follows specifications</td>
<td>Defined according to local features, incorporating criteria of intrafirm transactions</td>
<td>Subsidiary maintains all organizational functions/ strategic decision making and technological functions are recentralised</td>
<td>Designed at central offices</td>
</tr>
<tr>
<td>Globally rationalised; locally, critical functions are production, logistics, technical assistance</td>
<td>Locally defined/ competition and cooperation betweenm subsidiaries</td>
<td>Subsidiary maintains all organizational functions; information systems are a key ingredient for integrated operations</td>
<td>Relative autonomy for local development</td>
</tr>
<tr>
<td>Designed at central offices</td>
<td>Relative autonomy for local development</td>
<td>Relative autonomy for local development</td>
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In which refers specifically to the participation of the subsidiaries in the R&D activities, Ronstadt (1984) presents four different situations: the affiliates may be Technology Transfer Units (TTUs), Indigenous Technology Units (ITUs), Global Technology Units (GTUs) or Corporate Technology Units (CTUs). The main functions of TTUs are to facilitate the technology transfer from the headquarters to the affiliate and to provide local technical assistance. ITUs develop new products to local markets using local technology. GTUs
develop new products and process aiming the main global markets. Finally, CTUs generate basic, exploratory technology, which may be used by the parent company.

Given these different types of insertion of affiliates in the parent companies’ strategies, we may say that basically there are two main approaches for R&D and product development localization. There may be a centralization of these activities in the headquarters, therefore in the “central” countries; that is, those from Western Europe, North America and Japan; or a decentralization of R&D and product development, with the participation of the subsidiaries. From the point of view of the technological development of emerging countries, the later would be the most interesting strategy because it may lead to a competencies building process, which collaborates to the creation and consolidation of “superior” competitive advantages (Porter, 1990) – and these, in turn, may lead to a sustainable economic growth. Thus it would be necessary to investigate what are the factors that influence, or even determine, the decentralization of R&D and product development activities.

3. Factors that influence the localization of R&D activities

There are many reasons for increasing of internationalization of R&D. Terpstra (1977) shows some of them: to transfer technology from headquarters to subsidiaries abroad; in response to host country pressures; to encourage localization of development of technologies; to improve public relations; to access foreign talent and engineering resources; to reduce development costs by utilizing cheaper engineering resources abroad; to take advantage of local ideas and products; to speed up development through parallel efforts by several laboratories simultaneously; in response to greater sensitivity to the market; continuation of R&D facilities after acquisition of a company abroad; and to take advantage of some tax laws. Some of these factors will be discussed in the following paragraphs, but there are other important ones that must be highlighted.

The costs of decentralized development may be, in some cases, lower than the costs of a centralized one. One of the reasons may be related to cheaper engineering resources, that is, lower salaries. Reddy (1997), for instance, says that countries as Brazil, India and Israel are emerging as important R&D and product development centers partially due to lower costs than in traditional technological centers located in the “central” countries. As will be shown, this factor arose in the case studies as an important reason for decentralization of R&D activities.

Another factor is the type of product that will be produced and/or commercialized locally (Galina and Plonski, 2000). Some products need to be adapted to local or regional conditions, while others do not present this necessity; in this case, products sold in different markets may be exactly the same. If there is the demand for adaptation, there is a strong possibility of participation of the affiliates in the product development process.

It is worth noticing that sometimes it is possible to adapt parts of a global product in order to fulfill local demands. For instance, in the automotive industry, a strong trend in product design is the usage of platforms, that is, a group of common parts that are shared among different final products. Thus the platform strategy permits more flexibility in final products while maintaining at the same time economies of scale in design and production of the common parts. In the telecommunication industry, specially in switch systems, it is common to use the same hardware all over the world, doing the local adaptations with modifications in the computer programs. Some examples can be seen in the case studies.

The possibility of adaptation of some parts of a global product may facilitate the participation of the subsidiaries in the development process, but do not determine this participation. For instance, in the automotive industry, Sugiyama and Fujimoto (2000) identified different strategies in product design using platforms. Companies always develop the platforms in a centralized way, but the final products may be designed globally (that is, centralized in the headquarters) or locally.

Some authors argue that the kind of knowledge necessary to develop a product also would influence the decision of whether to centralize or not the development. Subramanian et al (1998) and Carrincazeaux and Lung (1997) shows that in the product development process we may find both tacit knowledge – which can not be easily codified and transmitted – and explicit knowledge. For instance, it is more difficult to determine the preferences of each market than the conditions of the roads in a given country. Sugiyama and Fujimoto
add that even some information necessary for problem solving in the development process may be “sticky”, or difficult to transfer, similarly to the tacit knowledge. If the tacit knowledge or “sticky” information is important in the development process, the physical proximity becomes also more important, because it is more difficult to transfer it to another person.

The choice of whether to concentrate or not the product development process may be affected by some industrial policy issues, as the existence of public direct incentives to local product development activities and the existence (or potential for) of technological infrastructure, universities, research institutes, workforce education etc. Thus the governments play an important role in the attraction of product development activities to their countries (UNCTAD, 1999b).

Finally, the existence of local competencies does play a very important role in the strategic choice. The companies may decide to install a R&D or product development center in a country aiming to profit from local ideas and competencies. Linked to this issue, another factor is the path, or administrative heritage of each company concerning the product development strategies (Sugiyama and Fujimoto, 2000; Bartlett and Ghoshal, 1992), since along the years the existence of some product development or adaptation activities may create some technical competencies in the subsidiaries, and then the company can profit from these existing competencies in order to adapt or develop local, regional or global products, creating a “virtuous circle”.

4. Product development in the automobile sector in Brazil

During the fifties, the automobile industry was chosen by the federal government as one of the symbols of the industrialization process in Brazil. In this period, huge investments in facilities were made by assemblers and some autoparts companies, thus consolidating the sector. Until the nineties, there were in Brazil four big car assemblers – Volkswagen (VW), General Motors (GM), Fiat and Ford –, besides truck assemblers – Scania, Volvo, Mercedes-Benz – and the autoparts companies, many of them being Brazilian companies. The market was quite protected due to the existence of high import taxes. Most of the production was destined to local market, although the government had launched some specific programs which aimed to incentive the exportation of vehicles, parts and components. The autoparts companies that benefited from these programs and entered foreign markets had to achieve high technological and quality performances, while maintaining low costs, in order to compete in these markets. This was the case of some well known Brazilian companies, as Metal Leve, Cofap and Freios Varga, for example.

Concerning the product development strategies of the car assemblers, following the classification proposed by Sugiyama and Fujimoto (2000), in this period it might be observed in Brazil the presence of strategies of global or local design product using an old platform, designed in the headquarters but no longer produced in the developed countries. For example, VW was one of the companies which clearly followed the alternative of local design; it might be considered one of the most de-centralized companies concerning engineering activities – but actually these activities has been, most of the time, dedicated to adaptation of old platforms originally conceived for the central markets. Nevertheless, in some cases the adaptations gave birth to unique models, which may be, in a way, considerate Brazilian models – as the Brasilia or the Gol. These previous activities would have led to the consolidation of some competencies in product development in the Brazilian subsidiary.

The opening of the automotive sector in 1991 marked a change in these strategies. There has clearly been a re-insertion of the Brazilian subsidiaries in the global strategies of the transnational firms, thus confirming the proposition made by Fleury (1999), described previously. Due to the possibility of exploitation of the Brazilian huge internal market as well as the other Mercosur markets, car assemblers and autoparts producers have decided to (re)invest in Brazil, either by inaugurating new plants, modernizing the existing ones and changing the product portfolio in order to face a fiercer concurrence. In the last decade, we have observed a “second immigration” of car assemblers and autoparts companies towards Brazil; for instance, Renault, Peugeot, Chrysler, Honda and Toyota inaugurated new plants; Mercedes-Benz, which previously only produced trucks and bus chassis in the country, started the production of the A Class also in a new plant; and GM, Ford, Fiat and VW are either inaugurating new plants or re-structuring the old ones in order to launch completely new models.
The change in the product portfolio mentioned above meant also a change in the product design strategy, from global or local design using an old platform to a global or local design using newly developed platforms. Actually most of the products introduced in the Brazilian market in the last five years and produced in the country are vehicles conceived as global products, on new platforms, but adapted to local or regional markets. These adaptations – or “tropicalization”, in the case of Brazil – are necessary since there may be some differences among the target markets of the global product; there may be some differences in the customers’ preferences, or in the local conditions of usage or yet in the scale of production, which may demand a different process and/or some differences in the product. For instance, Mercedes Benz A Class was launched simultaneously in Europe and in Brazil. The Brazilian model has suffered some adaptations due to different climate, roads and general conditions of usage.

It must be said that if this alteration in the strategies meant, on one hand, the modernization of models and their production process, and to some extent the introduction of new technologies of process and design, on the other hand it promoted a general “downsizing” in the product engineering departments of the companies.

As argued previously, the choice for a strategy of global platforms over which the final models are designed or adapted for local markets does not determine neither a centralized product design process, nor the contrary. Although all the companies in the automotive sector follow the platform strategy, some of them make the adaptations for local conditions in their headquarters, while others prefer to conduct these adaptations locally. In these cases, generally the Brazilian subsidiaries are responsible for the creation of a derivative model, or the adaptation or the design of some parts or modules over a pre-developed platform.

Taking the product design process as a whole, and following Clark and Fujimoto’s (1991) definitions concerning the stages of this process, we found empirically that, either in car assemblers or transnational autoparts companies, the basic product concept is defined in the headquarters, as well as the advanced vehicle design and styling. The co-ordination of the whole process is also in charge of the central offices. When there is de-centralization in the design process towards the subsidiaries, it appears in the later stages – component or module design, prototype, building and testing and process engineering.

Fiat’s Brazilian subsidiary, Fiasa, is an interesting example of how this decentralization may take place. At Fiasa there are two main possibilities of joining a global product development process. The first one is to be responsible for the adaptations of products or platforms for local or regional conditions; actually this is one of the competencies of the Brazilian product engineering department, together with the development of local suppliers, the testing of the final model and the nationalization of components. For instance, the 178 Project, which gave birth to the Palio and Siena models, was developed with the participation of Brazilian engineering teams from Fiasa or even from some suppliers of modules, with whom there was a co-design scheme. This participation occurred only after the stages of product concept definition and advanced design and styling of the vehicle. Brazilian engineers and purchasing executives went to Italy for some months during the stages of basic definitions. After this period, the design process was centralized in Brazil, under the co-ordination of Fiat Italy.

But Fiasa may take part in a global development process in another way. Fiasa has two “excellence centers” for product development of the company, along with another four centers, all of them located in Italy. The Brazilian centers are responsible for the development of some specific components for motors (to deal with low quality or alternative fuel as ethanol) and for the development of suspension modules. This means that even if Fiat is developing a product not target for the Brazilian or South American market, it can delegate to Fiasa the responsibility for the development of these modules or specific components – always under the co-ordination of Fiat Italy.

Different situations may be found in other carmakers in Brazil. GM is to launch the Blue Macaw, partially developed in Brazil, with the participation of Brazilian engineering teams from the assemblers and the suppliers. VW, firstly, has decided to reduce local design activities regarding the next platform/family (PQ-24), but has turned back, because it would cost less to “tropicalize” and to develop derivatives locally. Ford has increased its design engineering, sending 60 engineers to participate in the development of the Amazon

\[1\] By regional we mean not only Mercosul, but all the Third World countries Palio and derivatives are produced or sold.
platform in Dearborn, USA. On the other hand, the case of Mercedes Benz A Class represents a more centralized design process, since this model was totally developed in the headquarters, even its tropicalization. The same has happened with Renault Scénic.

Turning to Brazilian autoparts companies, it may be noticed that in general they do not participate in co-design with the assemblers. In most of the cases they simply develop the production process to a given product, designed by their clients. In case they supply a very simple product, they can design it in a “supplier’s proprietary part” way.

From the cases that were studied, there is some evidence that, due the existence of some of the factors that were listed in section 3, Brazil is being consolidated as a “peripheral” product development center in specific areas of product design, specially concerning “popular” vehicles, suspension, engine adaptations etc. The important factors will be presented bellow, along with the cases.

The existence of consolidated competencies in some areas is an important issue in the choice for the decentralization in product development. Looking at the trajectories of the carmakers in Brazil, we may notice that there are some companies that has always showed a greater intensity of product development or adaptation activities in their subsidiaries than others, thus consolidating the competencies in design. VW is one example, as we mentioned before.

In the Brazilian autoparts industry, we can also find examples of transnational companies profiting from previously developed competencies in product engineering. During the nineties, specially after the Automotive Regime in 1995, the autoparts sector suffered a strong concentration and internationalization, and many traditional Brazilian companies were acquired by transnational companies. Some of these Brazilian companies had developed technological competencies in specific fields. After the acquisitions, the transnational companies have centralized the product development process in their headquarters; but, in some cases, the competencies developed by the Brazilian company were not found in the transnational company. Thus the Brazilian subsidiary has become the global product development centre for the products related to those competencies. For instance, Metal Leve, a Brazilian autoparts company, had developed competencies in the design and production of bearings. When Mahle bought Metal Leve, it decided to maintain in Brazil the research centre for bearings, as Mahle itself did not have the technological competencies for the development and production of bearings.

The presence of important tacit knowledge or “sticky” information linked to the final market in the development process also makes the physical proximity more important, leading to the decentralization strategy. Fiat’s Brazilian subsidiary, for example, is responsible for the adaptation of products to other countries in South America, South Africa and countries with similar tastes and road conditions. It means a particular development for each country, because conditions and consumers “taste” are never the same.

The importance of tacit knowledge or sticky information in the product development process and the existence of local competencies may influence, but hardly ever determine the localisation of a complete structure for product development in Brazil. Another key factor is the production scale. For example, the carmarkers that entered the market and inaugurated plants in Brazil after 1991, often with a production scale much lower than the previously established companies, as a rule did not create a strong structure for product development in Brazil, as it would demand a great amount of investment. Their technical departments generally look after some small adaptations and mainly technical assistance to customers.

Also the importance of the subsidiary in the business of the parent company helps to define whether the subsidiary will or not participate in the design process, as well as the extent of this participation. In Brazil, subsidiaries of VW, GM and Fiat, which contribute heavily to the economic performance of their parent companies, have stronger participation in their product design processes, in comparison with other subsidiaries as the Mercedes Benz (in the car business), Ford, Renault and Chrysler ones, for instance.

Finally, concerning industrial policy issues, we have observed that this question is not in the agenda of neither the national nor the regional Brazilian governments. Despite the presence of “bidding wars” among several states, characterized by the providing of lands, infrastructure, tax breaks and loans by the states (Arbix and...
Rodríguez-Pose, 1999), these disputes aim only to increase local economic activity and generate employment through the establishment of plants of assemblers and suppliers to their territory. There is no discussion on subjects such as establishment of local technological centers, or the participation of local workforce in product design activities.

5. Product development in the telecommunication industry in Brazil

Since 1876, the beginning of telephony industry, until the sixties, the telecommunication sector increased very little in Brazil. In 1962, Brazilian government created a national policy to the sector, called Código Brasileiro de Telecomunicações – CBT (Brazilian Telecommunication Code), whose intrinsic propose was to appoint the telecommunication as a key sector to the development of the country.

Considered a strategic area by Brazilian government, telecommunication became one of the sectors which most received incentives and investments. In the seventies, the sector had its most important increasing since than when telephonic services became better and more extensive. The services were exploited by a public company, Telebras, and its subsidiaries. In 1976, it was created CPqD, a public R&D center, considered the most important telecommunication research center in the south hemisphere, that was crucial for the development of the sector in Brazil. CPqD, with the best Brazilian specialized labor in telecommunication, developed some important products, for instance, a digital switch system called Tropico (using Brazilian technology), national optic fiber, advanced equipment for satellite communications and some specific software.

At that time, the market was protected, thus guaranteeing total consumption of produced products. It contributed to the success of Brazilian companies, which supplied, by their own, the total demand for switches, cables, and transmission equipment (Siqueira, 1998). This industry policy was good for national companies, but contributed to the increasing on costs when determined that nationalization of components must have been more than 95%. As a consequence of this policy, Brazilian industry did not follow world technology evolution in telecommunications.

The problems caused by the public monopoly got worse from the eighties to the middle of nineties. In 1995, Brazil started a complete reorganization on the telecommunication sector including privatization of the service companies (Telebras), a program for improvement in the sector with investments of US$ 90 billions in 8 years (until 2003), and substitution of CBT by a telecommunication general law (Lei Geral das Telecomunicações) that defines a institutional model for the sector. CPqD continues to be one important research center, but it does not have so many public investments as it used to. Nowadays, it is maintained by its own financial resources and by the companies which bought Telebras, that, in exchange for CPqD’s consultancy services, must invest a part of their sales in researches made by CPqD

Since these changes occurred in the second half of the nineties, Brazilian telecommunication has improved very much. Many global companies came to Brazil as a service provider in both fixed and mobile systems, what made the sector one of the most economically promising in the country. With the sector strengthening the largest global telecommunication manufacturers put special attention in Brazil market, some of them increased their local factories and production units, while others decided to start business in the country.

Those producers can have fiscal incentives from a Brazilian law numbered 8248. This law, created in 1991, establishes fiscal incentive to companies that develop products or services related to technology. The benefits can be obtained when companies invest at least 5% of their local sails in R&D activities (2% of this investment must be applied in projects developed with Brazilian research centers).

These incentives attract research and development to Brazil stimulating local technological development by TNCs investments. Companies have been done agreements with local research centers like universities, public institutes (especially CPqD), and foundations. It can guarantee knowledge exchange between them and, consequently, growth in some specific areas. One of the areas we can most detect technological increasing is software design. Brazil has became an important reference country in software development for digital switches in both fixed or mobile systems. It can be confirmed by the case studies bellow.
The research has been made by studying some subsidiaries of transnational companies located in Brazil. For the telecommunication industry, it has been studied the largest and most important equipment manufacturers. As research instrument, it were used structured questionnaires to interview people from R&D and production departments in the companies. Here we present three of these studies. Common points detected in the studied cases prove the influence of some factors in the choice of location showed in section 3 of this paper.

All studied companies are not only relevant in world market but also in Brazil and Latin America market. Two of them are Europeans and one is North American. They are anonymously mentioned in this paper. Companies A and B are located in Brazil for many years, company C, influenced by privatization of telecommunication services, came in 1998. Table 2 shows a summary of the most important products manufactured and commercialized in Brazil.

<table>
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<th>Company A</th>
<th>Company B</th>
<th>Company C</th>
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<tbody>
<tr>
<td>Switching Systems, Mobile Convergence Systems and Mobile Terminals</td>
<td>Public/Private Switching Systems, and Mobile Convergence Systems</td>
<td>Switching Systems and Mobile Convergence Systems</td>
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Considering the present Brazilian telecommunication scenario and analyzing the most important areas in which these companies perform, it has been detected niches where Brazilian participation in global product development is viable. One of the most clear niches is software development for digital switching and mobile systems and this is better studied in this research.

Brazilian subsidiary of company A is a TNC’s global center in development of billing software. Frequent changes on Brazilian tariff systems let the local subsidiary to improve its knowledge in this area and then let it to be one of the most important global partner. This company is transferring its R&D center for CDMA technology from USA to Brazil (especially software labs). This decision is based mainly in two points: Brazil is one of biggest consumers of this technology and North-American R&D center will concentrate its efforts on the third generation of CDMA technology.

All product development made in company A has specific steps: obtainment of high level product requirements, Pre-Study, Feasibility, Execution, Functional tests and Systems Tests. Brazilian subsidiary participate, in some product niches, from the second to the fourth steps, and in some cases, in the last step too. The first one is the conception of the product, which usually is made by the headquarters or a research center located in a developed country, this main actor in called “product owner”.

When company C came to Brazil, it bought a national company which had a totally Brazilian technology in small switches (few channels). Small switching systems are most used in small towns or neighborhood and it has good potential especially in developing countries. The headquarters of company C did not have this kind of product. Brazilian subsidiary is now the world R&D center of this technology for company C.

The history of company B is completely different. It acquired part of a Brazilian company and tried to interrupt the local production of a national switch system and to replace it by its similar global product. But local market was not receptive and the company is still producing and marketing the national product, but there is no investment for a significant technological improvement on it. Subsidiary of company B seems to have the most weak participation on global product development.

These three companies have several points in common related to the participation of their subsidiaries in global product development. All companies pointed the law 8248 as an important factor for increasing investments on R&D in Brazil. Another factor in Brazil if compared with other specialized centers (in developed countries mainly). The companies also mentioned that local competencies was an important factor when choosing the product development strategies. And finally, interest on Brazilian or Latin American market and the proximity of customers.
On the other hand, there are some factors which are different for each company, for example, the historical path determined the participation of company A as an important global partner, but company B, even being in Brazil for a long period, has not a significant role in the product development.

6. Conclusions

From the case studies presented in telecommunication and automotive industry it might be said that Brazilian subsidiaries in both sectors have a strong possibility of participation in global product development for some specific products. This possibility arises from the existence of some of the factors presented in this paper: costs of resources for local R&D centers – mainly labor costs; type of product and demand for local adaptation; type of knowledge (tacit or explicit) related to product development; existence of incentives derived from public policies; and existence of competencies, specially technological, concerning R&D and product development activities.

It is important to notice that none of these factors determine, by themselves, the choice of centralization or decentralization strategy. In fact, it is the combination of some of these factors that will lead to this choice; for instance, only the existence of low costs do not determine the localization of R&D or product development centers in the affiliates; it is also necessary that the subsidiaries or the countries present competencies or at least potential for developing these competencies.

Finally, it is noteworthy to emphasize that, from the five factors mentioned above, at least four of them can be influenced by the existence of a proper industrial policy. Thus, government could determine the areas to where investments should be directed, such as software design in the case of the telecommunication sector and low motorization vehicles in the case of automotive industry, and launch programs aiming to attract R&D and product development centers to these areas, by offering incentives which could reduce the costs of these centers, improving education systems, creating the need for local adaptations due to specific local patterns in the products that will be commercialized in the country. This work may contribute to settle on the sectors in which this policies could be promoted.

7. References


Bélis-Bergouignan, Marie-Claude; Borderave, Gérard; Lung; Yannick. Global strategies in the automobile industry. Actes du GERpisa. n. 18. nov. 1996.


Galina, Simone V.R.; Plonski, G. Desenvolvimento Global de Produtos no setor de telecomunicacoes – uma taxonomia para a participacao brasileira. IN: 2º Congresso Brasileiro de Gestao de Desenvolvimento de Produto. Anais. Sao Carlos, 30 e 31 de agosto de 2000. (forthcoming)


——. Selected policy issues, measures and programmes on inter-firm partnerships. UNCTAD, Feb. 1998.