NOTES ON CAPITAL CONTROL AND INNOVATIVE CAPABILITY IN THE INDUSTRY OF THE S. PAULO STATE, BRAZIL

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Resumen In the nineties, the Brazilian industry has been undergoing deep sectorial process of restructuration. An important factor related to this process is the increase of foreign direct investment (FDI), of which a significant share is intended for mergers and acquisitions. An issue that arises from this aspect of industrial restructuring refers to the impacts on the technological capability of the Brazilian industry and, consequently, for its long-term competitivity. A way to analyze this question is through the relation between capital control and technological capability in two dimensions: operating capability and innovative capability. This work refers to the relation: capital control – capability based on the innovative dimension. It has as purpose to analyze some data about the characteristics of the patrimonial structure and the innovative capability of industrial sector in the São Paulo State, the most industrialized state in Brazil. The source of information is the Survey on Economic Activity in the São Paulo State – PAEP/SEADE: a wide database for 1996, which considers 10,000 companies in the industrial sector. The information available in PAEP database on innovative activities is according to the directives guidelines of Oslo Manual (OCDE) for innovation surveys. The data will be analyzed according to the source of company's (domestic or foreign) majority capital and by groups of industries according to ISIC Rev. 3 classification.

NOTES ON CAPITAL CONTROL AND INNOVATIVE CAPABILITY IN THE INDUSTRY OF THE S. PAULO STATE, BRAZIL[1]

1. Introduction

During the nineties, several processes of productive restructuring associated to FDI have been occurred in the Brazilian industry.

TABLE 1 – FOREIGN DIRECT INVESTMENT IN BRAZIL – 1993-1998 (US$ billion)

1993	1994	1995	1996	1997	1998
0.71	1.87	5.09	9.98	17.08	26.11

Source: Banco Central do Brasil, 1998

A significant shareof these investments refers to mergers and acquisitions of companies in the country including large international groups, mainly after the recovering of the Brazilian economy in 1994. According to the Brazilian Society of Transnational Companies Studies (SOBEET), in 1997, from the total of the FDI invested in Brazil: 40-45% correspond to transnational corporations (TCs) already installed in the country; 30-35% was related to privatizations; 15-20% was intended for mergers and acquisitions with foreign capital stake and 5-10% was for the entry of new TCs (not related to privatization) (BONELLI, 1998). This restructuration aspect in the Brazilian industrial sector has been identified as an important mean for intensifying denationalization and industrial concentration in the country, since the stock of foreign capital in the Brazilian industrial sector more than doubled during this decade and the mergers and acquisitions, privatizations included, had a prominent role[2].

The discussions on the impacts of the increase in FDI are controversial. Generally, the main point of these discussions relies on the meaning and extent of productivity gains and their impacts on competitiveness.. The simultaneousness of these factors was identified as a result of a positive relation between FDI and competitivenessin Brazil, considering that a high FDI leads to the increase of modernization and then to higher competitiveness(BONELLI, 1998). However, the meaning of this relation is not very clear. Through a sectoral quantitative analysis, which compares indicators of competitiveness and FDI flow to Brazil during the nineties, BONELLI (1998) does not demonstrate that this relation is positive in all industrial sectors. This according to the author, confirms only partially the hypothesis that the increase of FDI is responsible for the growth of competitiveness in the Brazilian industrial sector.

According to MOREIRA (1999), the increase of FDI to the country, which resulted from the commercial liberalization and, after 1994, from the economic stabilization, has a cost-benefit relation

quite favorable to the Brazilian industry , stimulating technological progress and increasing production scales and foreign trade. The information on technological progress considered by the author refers to the aspects related to the modernization, in particular the relation between productivity gains (added value/employees) and the presence of multinational companies. The inherent difficulties in the calculation of productivity and the fact that innovation is simplistically associated to modernization[however, limit the conclusions about the implications of the greater stock of foreign capital in the Brazilian industrial sector.

Considering the effects of intensification of FDI on technological progress, basically, in terms of modernization, these studies concern only the operating dimension of technological capability. In this sense, these studies have suggested that these processes create positive impacts on competitiveness. This positive relation FDI-modernization has been the least controversial point in the discussion. The extension of these effects in a long-term development and the discussions concerning the impacts of the FDI in the innovative capability are not, however, conclusive.

Thus, some questions emerge about the implications of intensified FDI to long-term technological capability of the Brazilian industry, more specifically, about the impacts of higher foreign control on Brazilian innovation capability of the .

As a first step to understand these issues, this article uses some information about innovative activities and capital control available in the São Paulo State, the most industrialized state in Brazil. According to the Foreign Capital Census – 1995 (Central Bank of Brazil, 1998), this State concentrates 69% of the total of employed individuals and 70% of the net operating revenues of the foreign controlled companies of the country.

The information on innovative activities was recently made available (May/1999) as a result of the 1996 Survey on Economic Activity of the São Paulo State (Pesquisa da Atividade Econômica Paulista – PAEP/SEADE), which has a wide database. The PAEP questionnaire about these activities was answered by approximately10,000 industrial companies.. This information was obtained under the guidelines of the Oslo Manual (OCDE) for innovation surveys, adopting the classification of the industrial sector compatible to ISIC Rev. 3, National Classification of Economic Activities (CNAE).

The absence of time-series[3] and the fact that information concerning the technological nature of the innovation introduced in the companies was not obtained represent the main restrictions of PAEP. However, these restrictions are inherent to the evolution status of innovation surveys, as indicated by ARCHIBUGUI and PIANTA (1996).

Besides this Introduction, in Section 2 some concepts reported in the literature on technological capability in developing countries and some aspects of the recent international discussion on technical change concerning the transformation of the world economy are presented, with emphasis to the TCs

role. These observations intend to stress the importance of our subject to which the discussion carried through in the third section represents the starting point. In the last section some final considerations are presented, which will serve as a guide to the following phase, contributing to understand the relation between capital control and innovative capability in the Brazilian industrial sector.

2. Technological Capability and Transnational Corporations: some considerations according to literature

In this section, some concepts are presented according to the literature on technological capability and economic and social development in the developing countries. Some aspects of a recent discussion concerning the transformations in the world economy are considered, underlining those related to the innovative activities and the actions of TCs, with emphasis to the implications of its subsidiaries in host countries. These considerations support the study for the implication of a higher FDI in the innovative capability in the Brazilian industry sector, being, as such, a background to analyze the information presented in the Section 3.

Technological Capability in Developing Countries

The interest of the economic analysis for technical change processes was fostered, during the seventies and eighties, by the economic turbulences and by the intensive technological change process. The limitations of the neoclassic school in explaining these processes made possible new approaches, among them, the neoschumpeterian one, as it put technical change in the center of the analyses of economic change processes. This approach considers technological change as endogenous to the economic system, resulting from a cumulative process that demands efforts to be carried out and produce results. The concept then widely accepted that developing countries are passive receivers of technology generated in developed countries is questioned. The concern about many aspects of how technological capability is developed and supported in developing countries is increasing.

Thus, a vast set of studies from a nonorthodox point of view is developed concerning the analysis of learning and technological capability processes in these countries[4]. These studies examine the nature of technological efforts “to dominate new technologies, adapt to the local conditions, improve , spread in the economy and exploit them through the growth and diversification of the export of manufactured products and even of technologies themselves” (LALL, 1994: 265). The point concerning the economic theory with regard to technology in developing countries changed, therefore,

from a passive import of technology to an examination of learning and technological change processes in these countries (FRANSMAN, 1984).

BELL (1984) underlines the existence of different uses of the term "learning". In the discussion on technological growth, learning means, commonly, varied processes through which individuals or organizations acquire skills and knowledge, i.e., widely considering, the acquisition process of technological capability. BELL calls the attention to the difference between the learning by doing and the widest learning notions. Learning is considered [] as any way through which a company increases its capability in dominating technology and implementing technical change. The learning by-doing processes have three characteristics underlined in the economic analysis: i) result passively (with no explicit actions); ii) are virtually automatic; iii) have no costs, because they are a byproduct of the production itself. Other forms of learning do not present these three characteristics because they need explicit efforts and investments in the acquisition of technological capability.

The studies on the nature of these efforts in the companies in developing countries showed that they can be undertaken in many directions, resulting in different levels of capability, so that the definitions and classifications of technological capability are countless. SANTOS FILHO (1991) presents a definition of technological capability as being a set of "existing capabilities in the company to acquire, assimilate, use, adapt, change or generate technology in three dimensions: i) in the routine activities of the company; ii) in the carrying out of investment projects; iii) in the development of innovations" (apud FREITAS, 1993:11).

According to this line, FRANSMAN (1984) identifies six types of capabilities: 1) search for available technological alternatives and selection of the most appropriate ones; 2) domination of the technology, understood as its successful use when transforming inputs into outputs; 3) adaptation of the technology to specific conditions of production; 4) subsequent development through incremental innovations; 5) institutionalization of R&D activities; and 6) carrying out of basic research.

The last two types are more complex and the first four do not present necessarily an ascendant order of complexity. All these lead to the categorization proposed by LALL (1994) that distinguish between know-how and know-why. Considering technological capability in different dimensions: know-how is related to the operating capability of companies in the areas of production, marketing and sale; and know-why is related to the innovative capability of companies in the areas of applied knowledge and development of new products and processes (BELL, 1984). The transition from the first to the second dimension requires a qualitative leap. The skills and limitations to the companies/countries to take this leap is an important determinant of its long-term development (FRANSMAN, 1984). This is because, according to KATZ (1976), the ability to carry out improvements in products and processes (associated to smaller innovations and know how) is

developed by efforts to solve short-term problems, whilethe ability to carry out greater innovations (associated to know-why) results from efforts to solve long-term problems.

KATZ (1976 and 1993), based on a number of empirical studies on technical change in companies of Latin American countries, suggests that the majority of efforts undertaken by these companies has as purpose the solution of short-term problems, in general to adapt imported technology to local conditions. As a result of these efforts, learning in these countries is adaptive, and so is technological capability. The limitation of these efforts to achieve know-why capabilities in these countries is reinforced, according to the author, by the fact that a significant share of these efforts is carried out by TCs subsidiaries. This happens because these companies, in spite of undertaking adaptive activities, rarely, "engage [in these countries] in more complex activities of R&D, close to the state of the art" (1993: 470).

These considerations call the attention to the relevance of the difference between these two dimensions of technological capability: operating and innovative. The first one, operating capability, associated to modernization processes, is considered as an important factor in determining a short- and mid-term . The second one, innovative capability, is an important element to a long-term competitiveness.

Recent Transformations in the World Economy: multinationals, FDI and technological change

The importance to establish the difference between operating capability and innovation capability is reinforced when the recent large transformations in the world economy are considered, according to which the innovation takes the main role. The challenges imposed by this scenario of transformations – which is identified by many authors as representing a new phase of the economic internationalization process, defined as globalization (OECD, 1992) – lead to issues concerning the possibility to reduce the technological gap between developed and developing countries. This happens because the movements that characterize this process – among them: intensification of inter-companies cooperation and the international mergers and acquisitions, raising FDI levels, increase of intra-company and intra-industrial trade, new forms of financial integration, advancements in the information technologies, introduction of new organizational methods, etc. – are changing the world economy in two senses: on the one hand, an intensification of the international connections , which defines the globalization as a stage of "deep international integration" (UNCTAD, 1994); on the other hand, a greater concentration of the world supply structure, reflected in the consolidation of international big groups, denominated as "world or global oligopolies" (OECD, 1992)[5].

These global oligopolies, constituted by mega-TCs, are in the center of the world transformations, since, in searching for a greater integration and control in all areas of its activities (production, marketing, innovation), they prepare world strategies and determine complex international relation networks (OECD, 1992, DUNNING, 1993). These developments have affected the localization and the characteristics of the economic activity, shaping a new international division of labour. The technological innovation is an important element in these strategies because of its relevance as a competitive factor referring to world transformation process. With the formation of networks, the organization and control of activities related to technology (widely defined as innovative activities) have been undergoing a world rearrangement.

The world reorganization of the innovative activities implies the need to reconsider the role of developing countries in the innovation process and the impacts on the learning and technological capabilities of these countries, mainly, when considering that the TCs, the main changing agents, include in a differentiated manner the countries in its world strategies (DUNNING, 1993). According to ARCHIBUGI and PIANTA, "the characteristics of countries and their national systems of innovation, namely their industrial strengths and field of excellence, remains important for molding the direction taken by international flows of innovative activities and the strategies of multinational companies" (1996: 462). However, since the TCs'innovative activities are considered less internationalized than the productive activities, remaining, in general, concentrated in their home countries, the concern with the position to be occupied by the developing countries in these strategies receives special attention. The comprehensionof the technology globalization effects on localization and organization of innovative activities is essencial to understand the effects and implications of globalization on the national systems of innovation[6] of developing countries (OECD, 1992).

An important step in this sense is the discussion about the interaction forms that the TCs establish with countries receiving its investments, and the implications of these interactions for the development of local technological capabilities. The characteristics of the relation between the TCs and the technological capability in host countries have stimulated the interest even in developed countries. The opinions concerning the intensity and the reason for this relation in these countries are not less divergent than those in the developing countries, as reflects the discussion between TYSON (1991) and REICH (1991) on the impacts of increasing FDI to the competitiveness of USA economy, based on the relations that foreign TCs establish with the national economy.

On this aspect, INZELT (1998) comments that the impact of FDI on technological integration and activities of R&D of the country receiving the investment depends on the interactions between this country and foreign investors. According to FLORIDA (1997), there are two types of FDI, which define different relations between the home countries of the TCs and the countries receiving the

investment: market-oriented and technological-oriented. The first type has the objective of adaptation and manufacturing of products to foreign markets; it is motivated overall by the demand side and defines superficial relations with the host country (skin-deep collaboration). The second type of FDI has as objective to obtain and assure access to the science and technology base, to the human capital and to develop connections with the local scientific community; it is, therefore, motivated by the supply side and defines deep relations (soul-deep collaboration) with the host country (INZELT, 1998).

These concepts (deep and superficial relations) can be combined with the classification of capabilities in two categories defined by CHRISTENSEN (1994): reproductive capabilities and dynamic capabilities. The first category explores and uses existent resources and capabilities, through experiental-based learning process, which is related to the superficial relations. The second category of capabilities – dynamic capabilities – is the one that promotes innovation and creates new routines and capabilities through experimental-based and R&D-based learning process. The dynamic capabilities, according to CHRISTENSEN (1994), since they promote innovation and create new routines, determine long-term competitive advantage bases.

Comparing these concepts to the classification of technological capability according to its dimensions: the superficial relations, which can result in reproductive capabilities, are related to the operating capability; and the deep relations, which can result in dynamic capabilities, are associated to innovative capability. As the differentiated impact of each of those capacities in short-, mid- and long-term is provided, the relevance of considering the technological capability according to its different dimensions is reinforced.

The central point of our discussion about the implications of intensifying the TCs' presence in Brazil concerning the operating dimension of capability, as well as the less conclusive situation of this discussion, called our attention to the differentiated impacts that the greater volume of FDI would have on the innovative capability of local industrial sector and, as a consequence, on the competitivity and long-term development of Brazilian economy.

3. Innovative Activities and Capital Control in the São Paulo State

In this section, some information on the innovative activities is considered, according to the capital control in the São Paulo State (Brazil), from a first contact with the PAEP/SEADE database. In the initial analysis, some simple data tabulations on innovative activities, which will be a base for the construction of indicators to innovative capability, are presented.

It must be underlined that this first analysis does not permit to answer the questions risen herein, related to the implications of a higher volume of FDI under the terms of innovative capability in the country. But, it has the advantage of showing the data potentiality available in PAEP concerning this type of analysis and indicating which directions must be taken in the sense of contribute to the full understanding of this issues.

A first point to be analyzed is the number of companies that introduced innovation, according to the capital origin. In this case, the information of companies with more than 30 employees, which make a total of 10,650 companies, among which 9,932 are domestic companies, 524 are companies with foreign majority capital and 194 are companies with foreign share, is considered(Table 2).

TABLE 2 – INNOVATIVE FIRMS AND CAPITAL ORIGIN – S. PAULO STATE – BRAZIL: 1994/1996 (%)

Firms/Capital	National	Foreign (TCs)	Foreign Share	Total
Innovative Firms	40.9	61.9	69.9	42.4
Non-Innovative Firms	59.1	38.1	30.1	57.6
Total	100	100	100	100

Source: PAEP/SEADE

According to these data, 42% of the companies in the São Paulo State are innovators, since they have introduced any type of innovation. The group of companies with foreign majority capital and with foreign share presents a higher rate of innovative companies: 62% and 70%, respectively. These percentages were above 40.9% observed between the domestic companies. This indicates an apparent tendency of the TCs to be more innovative.

It is important to consider, however, the issue of the company size when these data are analyzed. The literature on industrial concentration and innovation has suggested that larger companies tend more to innovate[7]. The foreign company and company with foreign share, which together represent only 6.7% of the total companies analyzed herein, account for 39% of the added value considering the total companies (32% for foreign companies and 7% for companies with foreign share). The TCs are, therefore, ones of the biggest industrial companies in the São Paulo State, and this helps to explain the high percentage of companies that introduced innovation among these companies, besides the capital origin.

Another important point to be considered is the industrial sectors classified according to its technological intensity[8], in which the shares of TCs are greater considering the generation of added value. The intention is to analyze if there is a relation between the greater share of these companies and the percentage of: (1) innovative companies/total companies; (2) companies that perform internal activities of R&D; and (3) companies with intention to innovation. These three variables are considered herein as approximated indicators of the sector innovativeness level[9] (Table 3).

TABLE 3 - SHARE OF TRANSNATIONAL CORPORATIONS IN ADDED VALUE AND INNOVATIVITY INDICATORS - S. PAULO STATE – BRAZIL: 1994/1996 (%)

Industrial Sector	% TCs Added Value	Innovative Firms/Total	R&D Activities Internally	R&D Activities Continuously	Intention Innovate
High-technology					
Office Machinery, computing	34.6	81.6	77.1	70.3	77
Electronic Material and Telecom Equipment	-	66.3	64.1	49.8	71
Medium-high-technology					
Motor Vehicles	74.6	50.8	61.8	42.2	58
Chemical and Pharmaceutical Products	63.4	57.5	66.3	53.1	62
Medical, Precision and Optical Instruments	50.4	62.4	75.9	62.8	64
Electrical Machinery and Components	46.3	53.8	69.1	42.9	63
Mechanical Machinery	41.8	50.1	54.4	28.2	54
Medium-low-technology					
Rubber and Plastic Products	35.4	44.3	43.9	28.0	57
Stone, Clay and Glass (Non-metalic Mineral)	23.1	32.1	46.7	29.1	40
Fabricated Metal Products(except Machinery)	16.1	45.5	39.5	23.3	50
Basic Metals	13.8	40.8	38.2	27.4	48
Low-technology					
Textiles	33.9	38.7	44.3	31.2	39
Food Products and Beverage	30.9	39.8	35.7	21.3	47
Pulp and Paper	17.7	35.3	39.0	18.6	38
Publisching, Printing and Recorded Media	-	38.0	19.4	10.7	43
Prepar. e Confec. de Artef. de Couro	-	35.7	29.4	18.0	38
Clothing	-	26.7	18.5	12.8	34

Source: PAEP/SEADE

In Table 3, it is observed that the greater shares of the TCs are in the medium-high-technology sectors. When compared to the medium-low-technology sectors and the low-technology sectors, these sectors present a higher percentage for innovative companies, companies with the intention to innovate and companies that perform internal activities of R&D, but, when compared to the high-technology sectors, they present lower percentages. Besides, in the medium-high-technology sectors a direct correlation between the TCs shares and the innovativeness indicators, is not observed.

The difficulty to associate TCs shares to innovativeness level is better noticed since the sectors which present the higher percentages of added value generated by the foreign companies – "Chemical and Pharmaceutical Products and Motor Vehicles – occupying the forth and sixth position,

respectively, according to the shares of the innovative companies on the total companies in the sector. From the considered indicators, therefore, it is not possible to notice clearly the sense and intensity in the relation "foreign control and capital-innovativeness."

A better understanding of the influence by the foreign companies in the industrial sector, with regard to the performance of innovative efforts, requires a more differentiated treatment of this information, according to sector, capital source and company size, but this is not possible in the actual divulgation stage of PAEP. Afterwards, such differentiation will be made available by PAEP/SEADE.

The difficulty in analyzing the relation between a foreign control of capital and a higher innovativeness level increases as the interest from companies which introduced innovation is considered, according to the type of innovation: incremental product, significant product and process. This is because the innovative behavior of the companies is quite similar, whatever is its capital origin (Table 4).

TABLE 4 - INDUSTRIAL FIRMS BY TYPE OF INNOVATION AND CAPITAL CONTROL – S. PAULO STATE – BRAZIL: 1994/1996 (%)

Type of Innovation/Capital	National	Foreign (TCs)	Foreign Share	Total
Incremental	73.7	82.9	72.6	74.3
Significant	54.4	69.1	51.9	55.3
Process	84.7	84.9	93.3	85.0
Product and Process	69.8	78.9	76.3	70.6

Source: PAEP/SEADE

In the case of introduction of the process innovations, the percentage is higher in all companies for the three capital origin categories. In general, the process innovations are combined with product innovations. The percentage of the innovative companies, which introduced product innovation and process of combined form is quite high. All this can be associated to the intense process of modernization which has been occurring in the Brazilian industry sector, pointed out by the need of searching for scale gains, costs reduction, renewal of the production mix and quality improvement, obtained only by the combined improvement of product and process.

In terms of (incremental or significant) product innovation, not considering the capital origin, the incremental innovations are more frequent than the significant ones, and are, however, somewhat higher in the case of foreign majority companies. This is, probably, associated to the adaptive character of the innovations carried out in the country.

In spite of these data do not permit any conclusion on the differentiated innovative profile of the foreign companies and companies with foreign share, they provide a good evidence of the incipient character of the innovative activities carried out in Brazil. This can be more evident when the information related to the factors that motivate the introduction of innovation is considered (Table 5).

TABLE 5 - FACTORS INFLUENCING INNOVATION ACTIVITY INDICATE AS VERY IMPORTANT AND CRUCIAL – S. PAULO STATE – BRAZIL: 1994/1996 (%)

Objectives of innovation	National	Foreign (TCs)	Share Foreign	Total
Improving product quality	**16**	14	8	16
Reduce costs	14	12	15	14
Increase market share	13	**22**	15	13
Open up new markets	12	11	13	12
Work safety	12	9	10	11
Improve production flexibility	10	8	11	10
Reduce environmental damage	8	8	8	8
Extend product range	7	9	10	8
Replace products and/or process being phased out	6	6	7	6
Others	2	2	2	2

Source: PAEP/SEADE
Note: (1) The information of factors refers to the total companies in the FAEP database, that is, 41,350, of which 650 with foreign majority capital and 260 with foreign interest.

The factors: quality, costs, market share and new markets were presented as the most important and crucial in all the companies. Here, the differences concerning the capital origin can not be observed, except for the higher weight (22%) provided by the foreign majority companies in relation to the "market share" factor.

TABLE 6 – SOURCES OF INFORMATION FOR INNOVATION INDICATE AS VERY IMPORTANT AND CRUCIAL – S. PAULO STATE – BRAZIL: 1994-1996 (%)

Sources	National	Foreign (TCs)	Share Foreign	Total
Clients/costumers	24	18	16	24
Suppliers materials and components	15	10	12	15
Competitors	11	9	12	11
Internal R&D department	9	11	8	9
Fairs, exhibitions	9	9	9	9
Suppliers of equipment	6	5	9	6
Other firm departments	5	6	6	5
Research institutes	4	4	4	4
Professional conferences, meetings, journals	4	6	6	4
Patent disclosures and licenses	4	5	4	4
Universities	3	3	3	3
Consultancy enterprises	2	2	3	2
Others	2	4	1	2
Other firms within corporate group	1	10	6	2

Source: PAEP/SEADE
Note: (1) The information of sources refers to the total companies in the FAEP database, that is, 41,350, of which 650 with foreign majority capital and 260 with foreign interest.

The category "other factors", in which is included motivations as the exploitation of scientific and technological potential in the country, was classified as indifferent or less important by the most of companies, whether domestic, foreign or with foreign share. This information reflects the market-oriented profile of the innovative activities carried out in Brazil. That is, regardless the capital origin,

the innovative activities are motivated by certain market factors, and this can be seen from the classification of the innovation sources according to its importance (Table 6).

Both domestic and foreign companies indicated the clients, suppliers and competitors as main reasons to innovation. It must be underlined the better position of the R&D departments as an innovation source between the foreign (second position) and the domestic companies (forth position). Also, it is underlined as an important innovation source "other companies of the group", which is in the third position for the foreign majority companies and in the last position for the domestic companies. All this is expected because of the transfer of technologies among the TCs.

The universities and research institutions were mentioned in the last sources, according to their level of importance, by all the categories of the companies, and this reflects little interaction between the productive agents and the universities in Brazil. The incipience of these sources in the country, as well as the factors that motivated the introduction of innovation and the predominance of incremental innovations, reveal the fragility of the Brazilian National System of Innovation, which defines an innovative environment almost limitative and indicated by the disarticulation of its agents.

The incipient character of the innovative activities carried out in Brazil can be observed considering the total high educated personnel allocated in activities of R&D, by industrial sectors, in the industrial sector in the São Paulo State (Brazil) and in some countries of OECD (Table 7).

TABLE 7 - R&D STAFF BY INDUSTRIAL SECTORS

Industrial Sectors	S. Paulo State (Brazil)	United States	Japan	Germany	Australia	Spain
	1996	1994	1995	1993	1995	1993
Food, Beverage & Tobacco	448	9,000	12,947	715	666	377
Textiles, wear app., fur & leather	441	3,400	3,943	828	87	106
Pulp and Paper	144	10,600	3,955	168	75	74
Publishing, Printing and Recorded Media	80	3,500			138	15
Refined Petroleum Products and Alcohol Fuel	13	9,000	1,946		16	88
Chemical and Pharmaceutical Products	956	91,500	60,056	13,986	**1,209**	**1,920**
Rubber and Plastic Products	445	8,800	10,775	1,877	139	150
Stone, Clay and Glass (Non-metalic Mineral)	222	4,300	8,853	1,169	154	149
Basic Metals	193	6,700	11,080	1,096	**802**	136
Fabricated Metal Products (except Machinery)	266	9,500	7,759	2,425	259	167
Mechanical Machinery	751	35,900	34,728	15,820	437	680
Office Machinery, compunting	185	30,300		7,757	379	322
Eletrical Machinery and Components	617	20,300	40,129	18,551	407	244
Eletronic Material and Telecom Equipment	454	85,200	106,686	27,865	**1,902**	**1,726**
Medical, Precision and Optical Instruments	239	90,600	20,174	3,154	787	485
Motor Vehicles	**2,803**	51,300	33,218	17,294	779	577
Other Trnasport (Aircraft, Shipbuilding, etc)	613	64,500	5,958	8,553	159	760
Outros	205	2,300	6,753	447	148	108
Total Manufacturing	**9,075**	**536,700**	**368,960**	**121,705**	**8,543**	**8,084**

Source: OECD, Basic Science and Technology Statistics and PAEP/SEADE

The total personnel in activities of R&D in Brazil is quite low as compared to USA, Germany and Japan. These data, which show the fragility of the national system of innovation of Brazil, reflect the international concentration of the innovative activities in the developed countries, which represent

the origin of the most TCs which concentrate, in general, the activities of R&D in their head offices or in laboratories located in other developed countries.

When the information in the São Paulo State (Brazil) is compared to that in Australia and Spain, the differences, in total, are quite small, which suggest a certain similarity considering the developing phase of the national systems of innovation in these countries. Some important differences, however, are observed. In Spain and Australia, the chemical and Pharmaceutical products and Electronic Material and Telecom Equipment sectors represent quite higher data of personnel in R&D, as compared to the São Paulo State (Brazil). However, in the Motor Vehicles sector, the data are higher in Brazil, which indicates the specialization of the national systems of innovation in these countries, what in the case of the Motor Vehicles sector in Brazil it represents one of the most important sectors in the economy of the country concerning the productive activities.

4. Final Considerations

The information presented herein is the result of the first part of a study that has been developed on the relation between FDI and innovative capability in Brazil. Therefore, it was not the purpose of this article to fulfill the existing gap in the understanding of this relation. The objective was to present some data, without a statistical analysis, that allowed to make some considerations about the innovative profile of foreign companies installed in the São Paulo State, in comparison to domestic companies.

The presented information does not demonstrate that there is a big difference between the innovative profile of domestic and foreign companies. Generally, both the domestic and foreign companies are motivated in the introduction of innovation by market-oriented factors, that implies greater intensity of incremental innovations compared to more significant innovations.

This reflects the low performance of innovative efforts in Brazil, usually a receiver of imported technology, which jeopardizes the development of a greater innovative capability in the country.

The fragility of the Brazilian national system of innovation, which is characterized by low intensity of innovative activities, establishes a difficulty in analyzing the role performed by the TCs in the country, and, as such, the understanding of the consequences of a greater foreign share in the productive activities to the innovating capabilities of the Brazilian industrial sector. An important step to a better understanding of this issue is the performance of analyses more separated from the information, according to sectors, capital source and size of companies, as well as the utilization of statistical tools.

Other important analysis can be obtained from international comparisons for other variables besides personnel in R&D. This would permit to observe the differences in the industrial sectors concerning the intensity and scope of innovative activities, defined by technological opportunities and structures of each market. This analysis could state the position of NSI in Brazil concerning specialization sectors.

The potential of PAEP information in Brazil must be better exploited, so that the impacts of intensification of FDI in Brazil concerning the innovative capability in local industry can be understood. It is important, however, to combine these information with those available in other countries, so that, international comparisons can be made, with the purpose to capture the sectoral specificity of the relation TCs-local industry. Following these methodological options, we believe that it could be possible to improve the understanding of the consequences in the long term of the increasing share of the TCs in the Brazilian innovation system, concerning the economic and social development of the country.

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[1] This paper is the result of a first fase of Doutoral Thesis that has been carried out in the Department of Science and Technology Policy, University of Campinas (São Paulo, Brazil).

[2] It is underlined that, in spite of the increase of the FDI in all industrial sectors, the services sector is the one which has received the greatest contributions of foreign capital because of the privatization process, among others.

[3] PAEP was build to be bi-annual, so that the information to the base year of 1998 will be divulged in the beginning of year 2001.

[4] These studies have a diverse nature and present a strong empirical point of view, so that they do not constitute a single theoretical body. They treat the technological change in the developing countries based on different perspectives and consider different implications policy. They present a wide number of empirical evidences on the domain of manufacturing technologies and the capability of these countries to introduce adaptations in foreign developed products and process. The authors of theses studies indicate the possibility to close the technological gap between the developing and developed countries (for example the Asian NICs), however, they do not defend that this always occurs (QUEIROZ, 1993 and ERBER, 1993).

[5] Now, the global oligopolies consist of a dominant form in the most of R&D intensive industries or high-technological industries and in the most of intensive manufacturing industries in scale and in increasing number of industrial services (OCDE, 1992).
[6] An interesting definition of NSI is made by FREEMAN (1987) apud OECD (1997:10) as: "(...) the networks of institutions in public and private sectors, whose activities and interactions introduce, modify and diffuse new technologies".
[7] According to ARCHIBUGI and PIANTA (1996), 700 world companies correspond to 60% of filed patents in the world.
[8] This classification of sectors according to technological intensity was prepared by OECD. The adopted criteria of classification was the overall R&D intensity (direct and indirect) (HATZICHRONOGLOU, 1997).
[9] The construction of more precise indicators of innovativeness requires, first of all, a temporal comparison. The intra-sectorial heterogeneity of the Brazilian industry sector makes difficult the construction of indicators of innovativeness. In the following stage of our work, we intend to solve, in great measure, this problem with a greater separation of sectors, classification of companies according to their size, and utilization of statistical methods.