

# **Technological and Market Related Capabilities and Competitiveness in the Brazilian Computer Industry: a Case Study.**

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## **Abstract**

The world computer industry, conditioned by the so called Wintel paradigm, can be divided into two groups of enterprises. The first group encompasses the two enterprises, Microsoft and Wintel, responsible for constructing the computer's platform, which is the operational system and the microprocessor. The second group is composed by the enterprises that master the secondary or peripheral competences of the paradigm, related to the production of components that will be connected to the computer platform.

The two enterprises that control the paradigm's core technology restrain the innovative scope of the other firms. This fundamental characteristic of the paradigm arises from the commitment of the firms of the second group to develop innovations that must be compatible to the Microsoft's and Intel's platform. In that sense, these two enterprises set both industry's technological frontier and its technological trajectory.

The computer producers, on which this article is focused, comprise the second group. These companies have their strategy determined by the paradigm, in other words, their innovations are focused on the secondary elements of the paradigm and their capabilities have very limited influence over the industry's technological trajectory. These firms seek to differentiate their products, always respecting the technological

limits imposed by the platform. The competitiveness of the computer producers is kept through their innovations, economies of scale and internationally known trademarks.

The computer producers rely on innovations in order to maintain their competitiveness, for example: Dell invented the direct sales system, HP developed a battery based on a kind of iron sulfite that increases its durability; Samsung developed a three second long reboot for the notebooks, created different ways of maximizing the battery use and the notebooks' connectivity. All these types of innovations create differentials and advantages for the multinational computer enterprises.

Many major computer enterprises are established in Brazil, such as Dell, HP, Samsung among others. These enterprises are distinguished by their economies of scale, R&D's investment capacity, the efficiency of their technological activities and more technological products. Nevertheless, when the Brazilian computer industry is analyzed, an interesting fact emerges: in 2010, the eight major computer producer enterprises controlled over 51% of the national market. Among them, four were nationally owned enterprises and had 24% of total market share. The Brazilian enterprise called *Positivo informática* controls alone almost 16% of the national market. In this context, the national private enterprises, especially *Positivo*, are capable to compete with the multinational enterprises and even win market share over them, although *Positivo* is unable to insert itself internationally in a competitive way. The Brazilian computer industry presents a paradox that can hardly be seen in other high technology sectors, indeed it is evident that the national's private computer producers have a distinguish role when competitiveness is analyzed in Brazil.

The Brazilian paradox raises some questions about technology as a competitiveness driver in the Brazilian computer industry. First, the established paradigm hampers the type of innovations done by the national computer industry. This fact obstructs the competitiveness that could be improved by the accumulation of technological competences. Second, the market leader company *Positivo*, albeit not being a great developer of technological competences, is able to compete with major multinational companies such as Dell and HP, but just inside the Brazilian territory. The *Positivo* case implies that in Brazil, non-technological variables may surpass the technological ones as a source of competitiveness. *Positivo* has as advantage the fact of being the only desktop supplier of the major retail chain in Brazil.

Based on the *Positivo* case, the objective of this article is to discuss how the national private enterprises can compete in complex markets, accumulating not only technological competences but non technological ones. *Positivo* presents itself as an example that elucidates why the Brazilian computer industry is marked by the high competitiveness of the nationally owned enterprises. This article seeks to show that, in Brazil, the technological competences are important elements that improve competitiveness, but the non technological facts cannot be neglected as variables capable of maintaining the computer producer enterprise's competitiveness.

In order to accomplish the proposed objective, the article will be divided in three sections plus introduction and conclusion. The first section describes the Wintel paradigm, in order to identify the competitiveness drivers in the world computer industry. It will be shown how Intel and Microsoft were able to establish the computer platform and how the computer producer enterprises behave in this paradigm. In this section, it is argued that the enterprises which control the computer platform-operational system and microprocessor- are able to control the paradigm and then establish the industry's technological trajectory.

The second section briefly describes the national computer industry after 1993. It is shown that the Brazilian computer industry even being fragile in its consolidation has a strong presence of the private national enterprises on its overall competitiveness.

The third explain the Brazilian computer industry's peculiarity through the *Positivo* case. It is shown what elements that give *Positivo* its competitiveness and how this enterprise could construct them over the years

### **Key Words:**

technological paradigm, computer industry, competitiveness, technological competences, appropriability, innovation, Brazilian industry.

### Introduction

The possibility to construct a functional computer can be considered, as pointed out by Freeman and Soete (2008), the birth of the greatest innovation in the twenty century. This artifact is a turning point in the capitalism history. The computer spread throughout several industries allows an enormous cost reduction and productive improvement never seen before. This industry can be highlighted by its continuous and always breakthrough technological development. This never-stopping evolution means that the world computer industry accumulated several paradigmatic changes over the years. That fact makes the computer industry an interesting case for studying the role of paradigms over the enterprises technological capabilities development.

The world computer industry, nowadays conditioned by the so called Wintel paradigm, can be divided into two groups of enterprises. The first group encompasses the two enterprises, Microsoft and Wintel, responsible for constructing the computer's platform, which is the operational system and the microprocessor. The second group is composed by the enterprises that master the secondary or peripheral competences of the paradigm, related to the production of components that will be connected to the computer platform.

The two enterprises that control the paradigm's core technology restrain the innovative scope of the other firms. This fundamental characteristic of the paradigm arises from the commitment of the firms of the second group to develop innovations that must be compatible to the Microsoft's an Intel's platform. In that sense, these two enterprises set both industry's technological frontier and its technological trajectory.

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Several major computer enterprises are established in Brazil, such as Dell, HP, Samsung, among others. These enterprises are distinguished by their economies of scale, R&D's investment capacity, the efficiency of their technological activities and more technological products. Nevertheless, when the Brazilian computer industry is analyzed, an interesting fact emerges: in 2010, four nationally owned enterprises had 24% of total market share (the eight major computer producer enterprises controlled over 51% of the national market). The Brazilian enterprise called *Positivo informática* controls alone almost 16% of the national market. In this context, the national private enterprises, especially *Positivo*, are capable of competing with the multinational enterprises and even of winning market share over them, although *Positivo* is not internationally competitive. The Brazilian computer industry presents a paradox that can hardly be seen in other high technology sectors, indeed it is evident that the national's private computer producers have a distinguish role when competitiveness is analyzed in Brazil.

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technological ones as a source of competitiveness. *Positivo* has as advantage the fact of being the only desktop supplier of the major retail chain in Brazil.

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The second section briefly describes the national computer industry after 1993. It is shown that the Brazilian computer industry even being fragile has a significant participation of the private national enterprises on its overall competitiveness. Although, the Brazilian computer industry has a poor innovative behavior associated to a poor exportation rate.

The third explain the Brazilian computer industry's peculiarity through the *Positivo* case. It is shown what elements give *Positivo* its competitiveness and how this enterprise could construct them over the years.

## **1 The World computer industry under the Wintel paradigm.**

This section explains that the world computer industry can be divided in two groups of enterprises: the ones of the paradigm core and the companies focused on the secondary elements of the paradigm. It presents the platform as the main computer component that defines the paradigm characteristic and establishes the industry technological standards. It also demonstrates that enterprises innovative efforts are modeled by this paradigm.

Since the late eighties, the world computer industry structure has two main enterprises, Microsoft and Intel. This dominance originates from the main products produced by these companies, which compose the paradigm core. The name Wintel is the combination of Windows (the operational system created by Microsoft) and Intel (the microprocessor producer), the two companies being responsible for the key elements of the computer's platform (Bresnahan and Greenstein 1999). For Bresnahan and Greenstein (1999, pg 5) platform is "a bundle of standard components around which buyers and sellers coordinate efforts". The platform is therefore the computer industry main component. Hence, all enterprises, during their innovation process, must consider how the components produced by them can be connected to the platform.

When Microsoft and Intel set its platform as the industry standard, these enterprises determined the industry's technological prescriptions. Any other enterprise that produce computer components must be committed to the platform technological requirements. In that sense, the firms focused on the secondary paradigm elements have its technological development tied to the platform development. (Bresnahan and Greenstein, 1999).

After calling attention to the platform importance, we can analyze how the enterprises deal with the platform conditioning elements. A brief discussion about the IBM entry in the PC age shows the role played by the platform in the computer industry. IBM entered the Personal Computer (PC) age constructing a computer using several suppliers, in a "deverticalized" way (Teece, 1986; Sturgeon, 2002). The enterprise's strategy was to focus its capabilities on the sales channels and the suppliers

organization (Bresnahan, 2007; Bresnahan and Greenstein, 1999; Teece, 1986; Bresnahan and Malerba, 1999).

IBM chose Intel and Microsoft as the platform suppliers, thereby these enterprises held the technological competences over the industry fundamental element. IBM lost the industry control when the computer platform was outsourced, and the company would no longer hold the competences which define the industry's technical advance and technological trajectory. Thus, in the PC age, Intel and Microsoft became responsible for setting the industries technological frontier in the world market, in other words, these two firms were in control of the computer industry paradigm. (Bresnahan, 2007; Bresnahan and Greenstein, 1999).

This process defined the rise of the Wintel's paradigm, and was not encompassed by a technological breakthrough: nevertheless this process ended up in the IBM's PC segment exit and the industry leadership transference to Intel and Microsoft (Bresnahan, 2007; Bresnahan and Greenstein, 1999; Hagedoorn *et al* 2001). The origins of the Wintel paradigm are pointed out by Hagedoorn *et al* (2001). These authors argue that the Wintel paradigm is a kind of hybrid from the IBM-PC paradigm and the Apple Macintosh paradigm. The Wintel standard borrowed Macintosh's user friendliness characteristics such as the icons. From the IBM-PC paradigm, the Wintel inherited the Microsoft's operational system Windows and the Intel's microprocessor, also the IBM-PC contributed with the "deverticalized" way the computer industry is organized (Hagedoorn *et al* 2001).

Intel and Microsoft established the industry's technological standards through the paradigm core dominance. The platform segment was surrounded by highly complex competences that create high entry barriers that could hardly be overcome by the enterprises in the computer industry. As the paradigm rulers, Intel and Microsoft enjoyed a high appropriability level (Dedrick *et al* 2009). These characteristics constitutes a mechanism that maintain these enterprises as platform leaders (Dedrick and Kraemer 2008; Dedrick *et al* 2009).

The other enterprises held the so-called secondary competences that have minimal influence over the industry technological trajectory. These enterprises operate outside the paradigm core and must fit their innovation processes on the technological

prescriptions elaborated by Intel and Microsoft. Hence, all innovations introduced by these companies are technologically constrained by the standards imposed by Intel and Microsoft (Bresnahan, 2007, Bresnahan and Greenstein, 1999, Dedrick and Kraemer, 2008). Although the computer producers are tied to the secondary paradigm elements, these elements are diversified enough to allow the companies some room to innovate.

The separation of the computer industry in two distinguished groups is fundamental to explain the technological limitations suffered by the second group of enterprises. These firms are specialized in the non core computer components, such as wireless and batteries technologies (Dedrick and Kraemer 2008).

Innovations over the secondary paradigm elements have a diminished appropriability, as was demonstrated by Dedrick *et al* (2009) in their analysis of the HP nc6230 notebook's value chain. These authors attempted to identify which enterprises among the value chain would capture most part of the value. As a conclusion, Dedrick *et al* (2009) postulate that the Wintel paradigm leaders managed to appropriate more value than all other enterprises, even HP. The conclusion of Dedrick's *et al* (2009) is similar than that given by Teece (1986). According to this author, in a high appropriability regime, enterprises that control the paradigm core can have higher profit over its own innovations. Teece (1986) also demonstrated that in low appropriability regimes enterprises that held complementary capacities over the paradigm core have increasing difficulties to profit with their own innovations, as happens to the computer producers.

The computer companies, thus, enjoy low appropriability over their innovations, whereas the central elements are dominated by Intel and Microsoft. In that case, if the producers wish to differentiate their products by adding innovations, there is no certainty that the customer is willing to accept and pay for that differentiation (Dedrick and Kraemer, 2008).

Two interesting examples can be cited as innovative answers given by the computer producers to avoid or diminish the low appropriability in the paradigm. The first is the direct sales creation, an innovation that expelled the retailers from the value chain and made possible for Dell to capture more value over its own innovations and computers (Dedrick and Kraemer, 2001). The other example is given by Dedrick *et al* (2009), as they analyzed the n630 HP notebook; the authors mentioned that HP made a

lighter notebook due to different material usage rather than plastic. The enterprises concerns in developing some new competences, complementary to the paradigm core, are a key process to be a competitive enterprise inside a paradigm, (Patel and Pavitt, 1997).

The computer enterprises must maintain its competitiveness through a strong innovative behavior. Some examples of computer producers are Lenovo, Dell, HP and *Positivo*. These firms are focused basically on two products, desktops and notebooks, which contain many differences from each other (Dedrick and Kraemer, 2008). The secondary capacities held by the computer enterprises in the desktop segment are focused on the value chain's end. In that sense, these enterprises are devoted to the sales and market identification, whereas the secondary competences related to the notebooks are more knowledge intensive and related to engineering and the development of certain kinds of components.

The accumulation of technological competences is essential for the enterprise to enhance its competitiveness, according to Dedrick and Kraemer (2008) these competences, in the desktop segment, are: (i) combining software and hardware to work together more efficiently; (ii) innovations related to the enterprises brand; (iii) user's interface; (iv) cost reduction and (v) quality improvement. The desktops production is basically settled upon highly standard components offered by several suppliers; it is possible to assemble a desktop using component from different enterprises and sizes. These equipments are in a certain way very simple to be build and the components do not need any adjustment to fit into the desktop internal space.

The notebook segment is far more complex. The reduced size of these devices requires advanced competences on engineering, especially related to energy consumption and batteries autonomy. Although notebooks have some standard components, most of it are very specific to each model, such as batteries and motherboards (Dedrick and Kraemer, 2008). The notebook's components require a specific shape and size to fit into the small space dedicated to each one, each kits being produced and sold as a closed package by only one supplier, generally an Original Device Manufacturer (ODM).

This close package is called barebone<sup>1</sup>, which contains all the computer parts except memories, hard disks and other standard components. Each notebook package is extremely linked to the device architecture, thus it is difficult to assemble a notebook relying on several suppliers, and also impossible to construct different notebooks families with the same components, because each component is specific to each notebook family. Indeed if the computer producers wish to alter their notebooks design and add some special features, the knowledge needed for this kind of activity is highly complex and competences related to component engineering are required. In that sense, the notebook's size becomes a barrier to the addition of new features. To conduct such activities, the computer producers need to dominate capacities related to reducing the number or size of components.

The technological differences of the products demand from the enterprises distinguished groups of capabilities to deal with innovations and production of these equipments. The desktops are technologically stable products and the major innovations are originated in the suppliers, especially the platform constructors. The computer enterprises just assemble the product without any concerns about the components engineering. The desktops follow a particular trajectory of competences accumulation that encompasses mainly the product cost reduction (Dedrick and Kraemmer, 2008).

Thus the innovations options offered by the notebooks in these secondary elements allow the computer enterprises to reduce the paradigm constraints. In that sense the notebooks innovations have higher appropriability level for the enterprises. The diversity of innovations also conduces to the accumulation of capabilities that encompass: (i) improving the microprocessor capacity, (ii) reducing the energy consumed by the same microprocessor, (iii) constructing more durable batteries, (iv) improving the notebooks' connectivity, portability, (v) using new materials, besides plastic, in the notebook construction. All these capabilities create differentiation among notebooks creating specific products to each firm.

As was shown in this section, the dynamic of the world computer industry led to the existence of two groups of enterprises which interact in a hierarchical way . The

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<sup>1</sup> Barebone is a partially assembled platform, or an unassembled kit. The barebone have only the basic elements on which will be connected the central processing unit, memories, hard disk, wireless internet card, among others.

core paradigm enterprises define the paradigm technological characteristics through the platform, the standards imposed by Microsoft and Intel being technical limits that all enterprises must respect. These two companies establish the industry standards and also set the technological frontier, defining the industry's technological trajectory. The other enterprises are enclosed in the paradigm borders, and have to deal with the paradigm constraints through their innovative efforts. The less technologically complex products are the desktops, which offers little space to innovate and therefore low appropriability for its producers. However, in a more technologically complex devices, as the notebooks, there is a vast set of elements that can generate innovations and that can lead to better appropriability conditions over the notebook's innovations. Thus the computer producer enterprises' strong innovative behavior is a way of overcoming the paradigm restrictions.

## **2 The current Brazilian computer industry: the period after the liberal reforms**

This section seeks to present the current Brazilian computer industry, the analyses start in 1993, when the government establishes the new information technology policy. This new institutional framework represents the implementation of new policies in Brazils. This section is focused on the role played by the national industry and a special attention is given to analyses of some performance variables which are: the innovative expenditure, exportation and importation performance, industry revenue and computer consumption. Finally this section presents the new institutional framework that was essential for the private national enterprises keep their market share.

At the end of the 1970s, the Brazilian government started a program to construct a national computer industry. This effort was heavily based on protectionist barriers. These policies had a good effect on its beginning, and made possible for the Brazilian industry to accumulate some competences over the computer industry (Schmitz e Hewitt, 1992; Schmitz and Cassiolato, 1992; Tigre, 1988). Nevertheless, the prolonged

use of protectionist measures created an industry that was able to make profits even being highly ineffective (Fanjzylber, 1983).

The Brazilian effort was discontinued in the end of the eighties especially because of the debt crises. In the nineties, the country set a series of liberal policies that had several consequences to the national industry<sup>2</sup>. In this context, the electronic sector had been restricted to a group of assembler enterprises that imported all the components, a pattern that has been described as “regressive specialization” (*especialização regressiva*) (Castro, 1995). The nationally owned enterprises were reduced, but the computer production increased from 1992 to 1996 focused only in the internal market (Botelho *et al.* 1999).

The liberal reforms brought to Brazil new enterprises such as Compaq, Dell and Gateway, giving a boost to the computer production. Although, the end of the protectionist barriers and the liberal policies based on the Washington *consensus* could evidence the reduction of the nationally owned enterprises, this fact hasn't occurred in the computer industry. Indeed the liberal reforms extinguished several value chain links, but even in this “new” institutional framework the nationally owned computer producers had a distinguished role over the Brazilian computer industry, as can be seen in table 2.1.

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<sup>2</sup> Due to the inefficiency accumulated in the period of protectionism the nationally owned enterprises could not compete with the global players, when the national market was opened (for a better understanding see: Fanjzylber, 1983; Schmitz and Cassiolato, 1992; Castro, 1995)

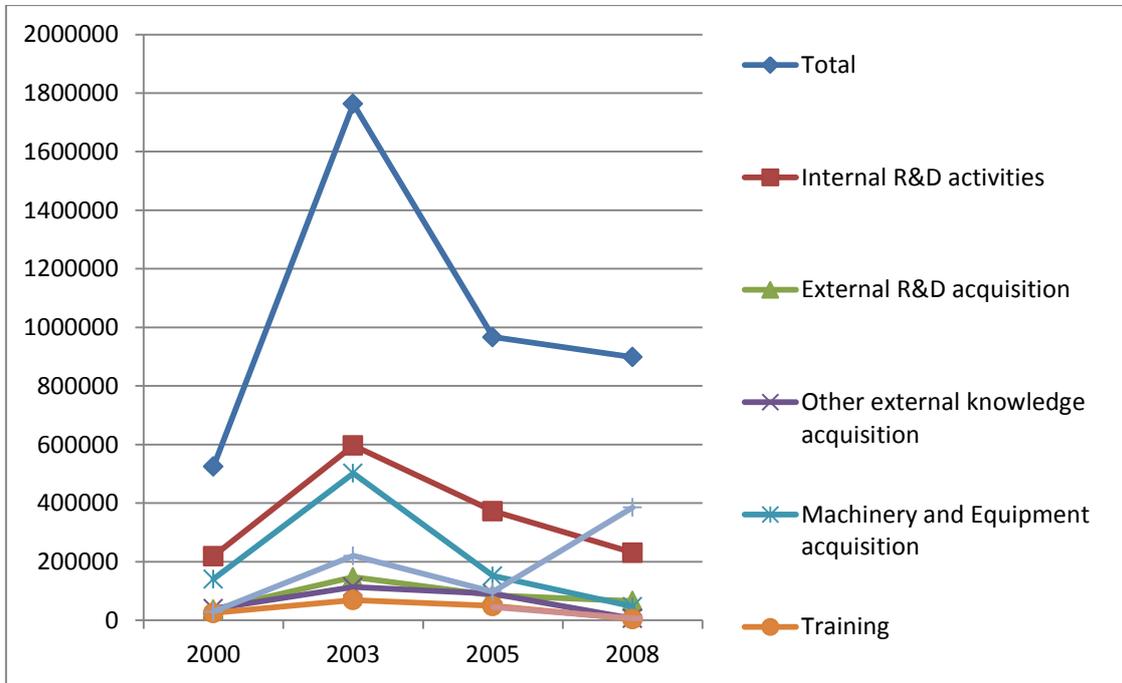
**Table 2.1: Major computer producer in Brazil.**

Enterprise	National Market Share in 1997*	Enterprise	National Market Share in 2009**
Compaq (USA)	10,40%	Positivo (Brazil)	16%
Itautec (Brazil)	6,80%	HP (USA)	7%
IBM Brasil (USA)	5,60%	Dell (USA)	8%
UIS (Brazil)	4,90%	CCE (Brazil)	5%
Tropcom (Brasil)	4,70%	Acer (Taiwan)	4%
Byte On (Brazil)	3,40%	Lenovo (China)	4%
HP (USA)	3,10%	STI (Brazil)	4%
Microtec (Brazil)	2,90%	Itautec (Brazil)	3%
Fivestar (Brazil)	2,9%	Nationally owned enterprises market share	24%
Accer (Taiwan)	2,5%		
Nationally owned enterprises market share	25,6%	MNCs market share	28%
MNCs market share	21,6%	Total	51%
Total	47,2%		

Source:\* Kraemer *et al* 2001 and \*\* IDC report of February of 2010

It is an interesting fact that the Brazilian owned enterprises have significant market share in the national market, but the competitiveness achieved by the nationally owned enterprises cannot be explained by the enterprise's R&D activities, as can be seen in graphic 2.1.

**Graphic 2.1: Enterprises expenditure on innovative activities at 2000, 2003, 2005 and 2008 (values in US\$ dollars)**

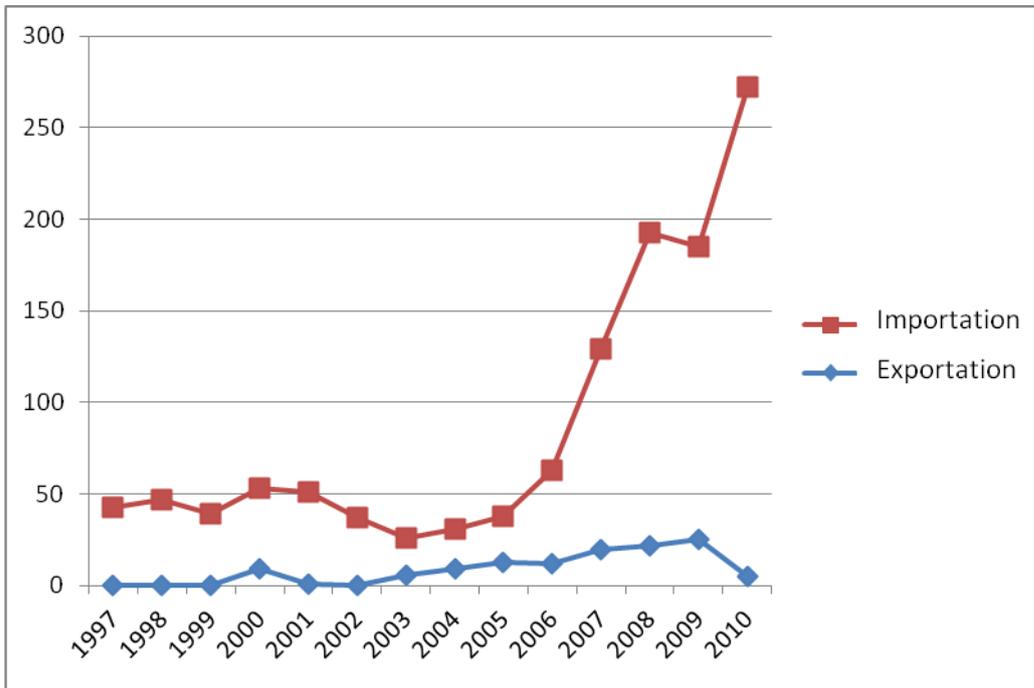


Source: Pintec, 2000, 2003, 2005 and 2008

The graphic above shows that, in comparison to all other variables, the R&D activities have been reducing since 2003. The introduction of technological innovations on the market, in other hand, is growing. This variable is closely related to marketing expenditures. In other words, the Brazilian computer industry is letting behind its own efforts in developing technology and replacing them with marketing expenditures. Thus the national competitiveness cannot be explained by the constant technology development.

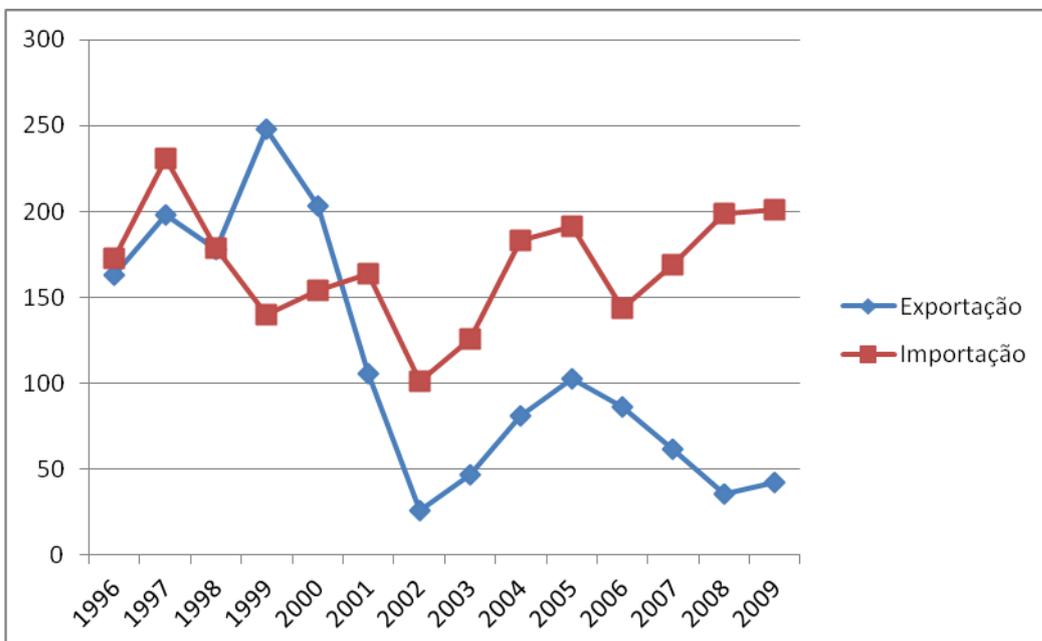
Besides its poor innovative behavior, the Brazilian computer industry is also a non exporting industry, as can be seen in graphics 2.2 and 2.3.

**Graphic 2.2: Notebooks exportation and importation, from 1996 to 2010 (data in US\$ millions)**



Source: Secex, according to BNDES sector definition

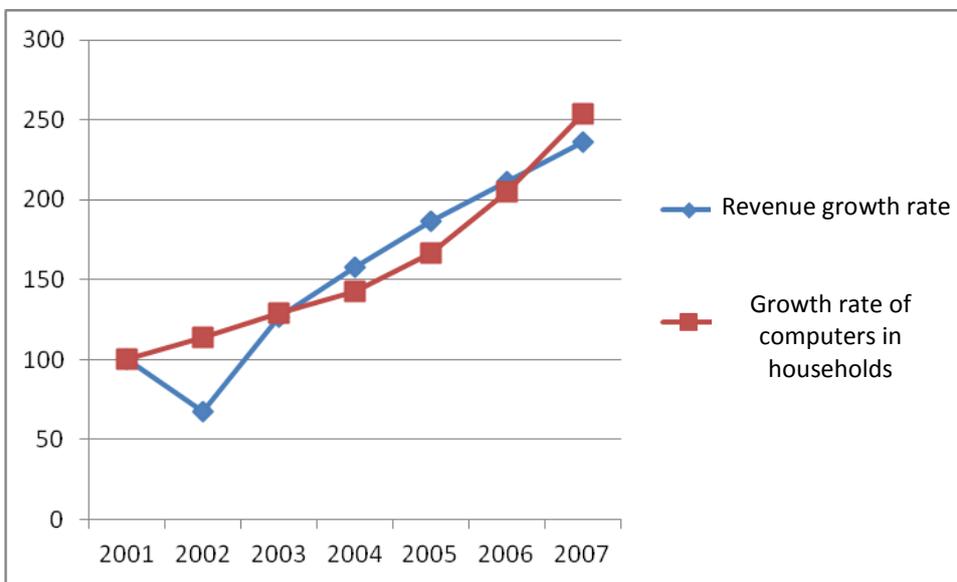
**Graphic 2.3: Desktops exportation and importation, from 1996 to 2010 (data in US\$ millions)**



Source: Secex, according to BNDES sector definition

It is clear that Brazil do not export its production, although the exportation level of desktops is higher than the notebooks. This fact shows that the Brazilian industry might be more consolidated over desktops, but the export performance in both segments is almost absent. It is worth noting that, in the context described above, the industry revenue remains growing, as can be seen in graphic 2.3. In that sense, the lack of exportation and the rise of importations indicate that the computer industry is highly dependent on importations to satisfy the growing production.

**Graphic 2.3: Computer industry revenue and households with computers growths rates**



Source: PIA and PIB report

The graphic 2.3 shows that the increasing revenue follows the computer consumption in Brazil: as the population buys more computers the revenue grows at the same pace. The data provided in graphics 2.1 and 2.3 indicates that the Brazilian computer industry is highly based on the internal market, at the same time as it lacks an accumulation of technological competences. The increasing computer industry revenue and the market share of national owned industry are related to the new policies conducted by the Brazilian government.

In 1991, the Brazilian state created a new policy called new information technology law (*nova lei de informática*). The new policy inaugurated a new model of incentive for the computer industry. The policy succeeded to bring the equality of taxes over the Brazilian territory. Two main mechanisms were created; the incentive to R&D

and the Basic Productive Process (*Processo Produtivo Básico*, known as PPB). The PPB is an incentive that reduces the taxes, if the enterprises performs some well determined production activities inside the Brazilian territory. To be fully benefited from this policy, the enterprises need to expend 5% of its revenue in R&D and 2% of these must be done in a collaborative research with an university. In a summarized way, the new information technology law attempted to promote learning in the stages of production and stimulate R&D in an attempt to promote learning process based on research. However this new policy can be understood as a measure to maintain in the Brazilian territory the productive activities that survive from the liberal reforms.

The Brazilian government also created, in 2005, an incentive for computer consumption called: “*PC conectado- Computador para todos*”. This program was a consumption stimulus that offered a cheaper and accessible computer for all social classes, but to be included in this program the enterprises had to follow the PPB. The *PC-conectado* program consists in several measures that facilitate the costumers to buy computers in the retail market.

These two policies had also two effects. The first was to make cheaper and easier the production of computers with more quality and low prices, extinguishing the “gray market”<sup>3</sup>. The other effect was the commerce centralization of computer consumption in the retail stores, by the clauses of the *PC conectado* program.

The Brazilian computer industry is not an innovative sector, the section two shows that the expenditures devoted to the technological capabilities accumulation are declining. The low exportation rate implies a not internationally competitive industry, in addition the differences related to the notebooks and desktops exportations indicates that the Brazilian computer industry has a better consolidation in the desktop segment. However the computer consumption and the enterprises revenue are growing, this fact indicates that the consumption stimulus policies are successful, and the national enterprises are growing based only in the internal market.

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<sup>3</sup>Gray market are computers commercialized without being reported to the Brazilian State, so they have no guarantee and quality, because the computer is assembled by someone e not under a brand name.

### **3 The *Positivo* case**

The section aims to discuss, through the *Positivo* case, how an enterprise can be the market leader without a strong innovative behavior. The *Positivo* choice is due to its large market share (16,10% in 2009) and fast expansion in the national market. In the Brazilian territory, *Positivo* can compete with global players such as Dell, HP and Lenovo. However, as any other enterprise, *Positivo* suffers restraints from the paradigm with reflexes over the company competitiveness in the Brazilian territory. In addition the enterprise fits in the Brazilian computer industry stereotype, in other words, *Positivo* is not a highly innovative firm. Thus, section three brings back the discussions elaborated in section one and two to analyze *Positivo* as the market leader.

*Positivo informática* was founded in 1989 but started to commercialize its computer in the retail market only in 2004. In 2006, the enterprise entered the stock market. The commercialization of desktops and notebooks correspond to 97,6% of *Positivo informática* revenue. The enterprise enjoys a peculiar position, having a competitiveness restricted to the Brazilian market, despite, the end of protectionist barriers. The comprehension of this localized competitiveness can elucidate the distinguished position occupied by the nationally owned enterprises in the computer industry.

#### **3.1 The *Positivo* competence accumulation process**

*Positivo* has three groups of competences: (i) the capabilities require by the PPB; (ii) the competences resulting from the enterprise internal effort, and (iii) the non technological competences. The competences accumulated through the PPB are important but they won't be discussed in this article. The PPB can be considered the minimum technological requirement needed for an enterprise to compete in the Brazilian computer industry. Indeed, any enterprise that is not fully benefited from the

new information technology law, due to its inability to follow the PPB has little chance to survive in this industry. The subsections that will follow pretend to discuss the technological competences accumulated through internal innovative efforts and the non technological competences that are also related to the paradigm constrains and the recent government policies.

### **3.1.1 The accumulation of technological competences by *Positivo*: the focus on the lower income population.**

*Positivo* is an enterprise focused on the lower income population, the enterprise consolidation on such specific societal stratum enhances the enterprise knowledge about the Brazilian market, allowing the enterprise to produce and conceive computers that are not expensive and have a good performance. In others words, through an intensive learning by doing process *Positivo* keeps itself even more specialized in the population that its products focus. Also *Positivo* has some hardware competences that allow the enterprise to change and construct some components without jeopardizing the computer's performance, those competences are mainly obtained by trial and error, indeed *Positivo*'s learning process is heavily based on *learning by doing*.

According to *Positivo*, its capacities related to software are the ones that add more value to the computers, especially because the cost of reproducing software is almost zero. The enterprise has developed a series of software such as: batteries management, camera usage helpers, photo organizer. That kind of software is focused on secondary paradigm elements, but it brings differentiation to *Positivo*'s computers. Indeed this software does not represent a *Positivo* exclusive strategy, the tendency of creating software is observed in all MNCs. The *Positivo* strategy is to copy that kind of software using internal development efforts and adapt this software to the Brazilian costumer.

The software competences that differentiate *Positivo* form other Brazilian private enterprises are the operation system and Bios<sup>4</sup> optimization. Those kinds of

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<sup>4</sup> The BIOS are the first codes to be loaded when the computer is turned on. The primary function of the BIOS is to load and start the operational system, also the BIOS must recognize and link the computer components "handling" the PC control for the user

competences are the capacity to adjust or rewrite some primary codes to enhance the computer performance and reduce the failures. In other words, the software optimization allows a better communication between the software and hardware.

To construct a competence that allows the enterprise to optimize software needs training conducted by the suppliers, due to the complex knowledge that is needed to learn the software code and to change them. These training are associated to the level of trust the enterprise share with their BIOS and operational system suppliers. Nevertheless, it is known that no MNCs do the software optimization in Brazil and few national private enterprises have this capability.

The *Positivo* competence in optimizing software was constructed through training conducted in the USA with the BIOS supplier. The operational system optimization required from *Positivo* high interaction with Microsoft: first the enterprise needed to show for Microsoft the competences that its R&D team had accumulated, after that Microsoft gave the Windows codes to *Positivo*. This interaction evolved in a way that nowadays Microsoft helps *Positivo* in some optimization process and even gives some suggestions to the enterprise. Besides that *Positivo* is one of the few enterprises in Brazil that had a Microsoft support for optimizing the Windows 8, that was based on monthly meeting. The construct of software competences, at *Positivo*, is made by interactive learning mainly because of the product's nature.

Finally *Positivo* has three laboratories that simulate the Brazilian roads and test the materials resistance. This kind of test aims to adequate the computer to the Brazilian environment giving more reliability to the product. As can be seen, the competences accumulated by *Positivo*, let the enterprise even more specialized in the Brazilian market, a fact that restrains the enterprise international insertion.

*Positivo* claims that its strategy is to focus in the internal market, which has been experiencing a fast growth since 2005. Nowadays only 32% of the Brazilians households have computers. Indeed, considering the increase income of the poorer population; the internal market is a great opportunity for *Positivo*'s expansion. Nevertheless, any computer producer can survive based only in the Brazilian internal market.

The *Positivo*'s expansion to other countries and even to other societal stratum is restrained by the limitations originated in the Wintel paradigm. Although being competitive, *Positivo*, occupies in Brazil a specific gap resulting from the MNCs inability to produce computers to the poorer population. The *Positivo* insertion in the computer industry is heavily limited due to its specialization in the national market. In the Brazilian context *Positivo* has founded a strategy of continuous specialization through the development of competences and products specific to a certain kind of customer in the Brazilian market.

There is no doubt that *Positivo* has a strong competitive position in the desktops segments and the competences acquired in this segment gave the enterprise advantages over its national competitors. However, the enterprise founds itself limited by the technology and its desktop capacities cannot be applied in notebooks. The enterprise fragility is clearer, when the lack of competences devoted to notebooks is analyzed under the recent process of replacing desktops by notebooks.

The growing consumption of notebooks in Brazil is associated to a *Positivo*'s market share reduction. It is clear that *Positivo* could not enjoy the increasing consumption of notebooks as it enjoyed the desktops consumption increase. Nevertheless, the MNCs scale and competences to develop new batteries and produce notebooks in new materials; are absent in *Positivo*. These kind of competences enhance any enterprises competitiveness enable it to compete internationally in diverse markets.

The *Positivo* case shows that this enterprise competitiveness success is not related to the accumulation of technological competences but is, at large, related to the enterprise entering in the retail market and its adequacy to the lower income population. The enterprises competences and its scale only give advantage over its national competitors. The enterprise competitiveness is only possible inside the national borders due to MNCs badly adapted to the population that had the major income increase in the recent years.

The notebook segment shows that *Positivo* has not the same advantages as in the desktops ones. Those products generate higher appropriability over innovations, and the focus on the poorer population is not an advantage in the notebooks segments. The *Positivo* dependency and adequacy to the Brazilian market it is a barrier to its

international expansion. Indeed the localized competitiveness enjoyed by the Brazilian computer industry is maintained without the development of an innovative behavior.

The *Positivo*'s technological competences do not distinguish this enterprise from the MNCs corporations, although some competences are more advanced in *Positivo* than other Brazilian computer enterprise. It became clear that the *Positivo*'s competitiveness is not based on its technological capabilities and this fact was already shown in section two, thus *positivo* is no different from the whole Brazilian private enterprises.

### **3.1.2 The accumulation of non technological competences by *Positivo*: the entrance in the retail market**

In its beginnings, *Positivo* produced computers only through government public order. However, in 2002, this strategy changed as the Brazilian State diminished its computers orders. At the same period, in 2004, another Brazilian company called Metron, the market leader in 2002 and 2003, entered into bankruptcy. Metron deserves attention because it was an enterprise present in the major Brazilian retail stores such as: *Casas-Bahia*, *Ponto Frio*, *Extra*, *Makro* and *Wal-Mart*.

When Metron bankrupt, it created an opportunity to enter the retail market, taken by *Positivo*. First, the enterprise offered technical assistance for the computers sold by *Casas-Bahia* that couldn't offer this service anymore due to Metron bankruptcy. Not only *Positivo* could offer technical assistance, but the enterprise managed to establish a contract to be the exclusive desktop supplier at *Casas-Bahia*, the major retail store in Brazil. Another element that gave *Positivo* advantage over its competitors was hiring the whole sales personnel from *Metron*. The *Positivo* entered in the retail in a so successful way, that in two months the enterprise had revenue equal to the whole year of 2003.

*Casas-Bahia* became a fundamental link for *Positivo*, the exclusiveness enjoyed by the enterprise as the only desktop supplier creates an enormous advantage over the enterprise competitors. The capacity of *Positivo* to establish such contract was possible

due to *Positivo* group business diversity; the group was already the supplier of *Casas-Bahia* advertising material. Departing from this previous contract, *Positivo informática* was able to establish the exclusiveness contract of computer sales, which also made this company highly dependent on *Casas-Bahia*. The sales through *Casas-Bahia* corresponded to 70% of *Positivo*'s revenue in 2008.

The *Casas-Bahia* role in *Positivo* competitiveness is unquestionable, but the enterprise tried to diversify into other retail stores through its several brands, that are: (i) *Positivo*, the main enterprise brand, only sold for retailers as closed package and at a minimum price; (ii) *Sim+*, are simpler and cheaper computers that can be bought separately by the retailer; (iii) *Kennex*, was a strategic acquisition made to enter in the *Pão-de-Açúcar* group; (iii) *Neo PC*, is a brand created to enter in the *Ponto Frio* retail stores

*Positivo* started selling computers in the retail market when it became the only desktop supplier for *Casas-Bahia*, whose customers are in its majority from the poorer social stratum in Brazil (stratum C and D). The successful *Positivo* trajectory is, at large, explained by the adequacy of its computers to the *Casas-Bahia* customers. Indeed the *Positivo* specialization on a specific Brazilian social class is a reflex of its entrance in the retail market. The enterprise consolidated itself in societal stratum that had major increase in consumption (table 3.1) in the recent years, this was essential to the enterprise expansion and for enhancing the enterprise's competence accumulation.

**Tabela 3.1: Households with PCs as Percentage**

Stratum	Number of households (in millions)	Year				
		2005	2006	2007	2008	2009
A	2,5	89,5	86	88	95	94
B	5,1	56,9	63,2	63,2	70	77
C	18,2	16,4	18,8	25	25	32
D/E	26,9	2	2,8	4	3	5

Source: IDC report, February of 2010

The *Positivo* entrance in the retail market is followed by a process of competence creation that leads to a specific knowledge accumulation about the

Brazilian context. These processes had an overall influence over *Positivo's* competitiveness. Nevertheless the knowledge elements that enhance *Positivo's* competitiveness aren't related to a long run strategy associated to an efficient industrial policy; indeed the company competitiveness can be, at large, a reflex of the Wintel's paradigm implementation in Brazil.

The Wintel paradigm restrains *Positivo's* expansion options and shapes the enterprise innovative efforts. The pressures faced by *Positivo* also come from the other computer producer enterprises that are established in the market, specially the multinational corporations (MNCs). These global players have enormous scales and knowledge about the industry that enhances their innovative efforts efficiency, even though their efforts are focused on the secondary paradigm elements.

As discussed above, the computers evolution is the result of technological development made by the enterprises that dominate the paradigm core, Intel and Microsoft. The computer producer enterprises, as a way of increasing its innovation appropriability, have to innovate on the secondary paradigm elements. The innovations that can be add to a computer, as a way of differentiate the product, increases the computer price. The customers, which the MNCs focus, are willing to accept this price increase from innovations. In the end, that process enhances the consumption of more technologically developed computers. However the *Positivo's* customers cannot afford a price increase. Indeed *Positivo* founds itself in an intricate position, which limits the enterprise in the type of product it can deliver.

In Brazil the MNCs corporations have difficulties to adapt its products to the Brazilian consumers specificity, thus these enterprises have little capacities to create computers for the internal market, majorly composed by the lower income social classes (as can be seen in table 3.1). The poor product adaptation enjoyed by the MNCs, at large, explains the gap created in the Brazilian computer industry when Metron bankrupt. This allowed *Positivo* to insert itself as computer producer devoted to the lower social stratum in Brazil. The *Positivo's* specialization is a two edged sword, on one side this extremely focus is responsible for the fast enterprise growth and competitiveness enhancing process; on other side this specialization restrains the enterprise capacity to add differentials that result from internal innovative efforts. *Positivo* can only add differential to its products as the technology is stabilized, what.

would not increase the final product price. This process, in a certain matter, would follow the population income increase; while the MNCs can add differentials to its computers without consumption variations allowing these enterprises to open new markets.

The *Positivo* case, along with the previous sections of this article, indicates that the Brazilian private computer industry is extremely dependent on the internal market expansion, specially the lower income classes. The national Brazilian computer industry expansion is limited to the income increase of the poorer population that, for a while, is not the MNCs focus. In that sense the real *Positivo* competitors are the other national enterprises which carries out the same strategy as *Positivo*. In other words, the whole nationally owned Brazilian computer industry is focused in the lower income population.

The *Positivo*'s characteristic of being specialized in lower income segment can be seen as a choice that allows this enterprise to avoid the direct competition with the MNCs inside the national borders. *Positivo*'s trajectory inserts itself in a gap existent in the national computer industry and inside the Wintel paradigm, which could not be filled by the MNCs given the little relevance the lower income population had over the computer consumption in 2004 and 2005 (year that *Positivo* started to sell its computers in retailers stores, see table 3.1). It is interesting to observe that *Positivo* entrance in the retail market coincide with the government policies that boost the computer consumption for the poorer population. Thus, any nationally owned company could occupy the same position as *Positivo*.

When *Positivo* entered in the retail segment, the notebooks were not disseminated over the Brazilian market. However, nowadays the desktops are being replaced by the notebooks. If this fact is brought to the *Positivo* analyses, the enterprise technological fragilities are deepened. *Positivo* insertion in the computer industry is not only limited by the type of consumer, but also by the kind of products offered by this enterprise. *Positivo*'s competitiveness is, at large, settled in the desktops segment; and the enterprise has not the major market share in the notebook segment. As discussed before notebooks are technologically more complex than desktops, the innovations related to notebooks can generate higher appropriability. Thus notebooks are still not consumed by the *Positivo*'s costumers.

Despite the success of *Positivo* in filling the gap of supplying for lower income population, MNCs have also been developing strategies and competences that consider this market segment. The internal market expansion open way to MNCs that can deliver cheaper products such as: Lenovo and Acer.

The *Positivo* case shows that the enterprise localized competitiveness is at large explained by its non technological competences, specially the exclusive contract with *Casas-Bahia*. *Positivo* is an interesting example of the paradigm restrains, the enterprise is steered by the paradigm to be specialized in the lower income population and in the desktop segment. *Positivo* is unable to dominate more technological competences related to the notebooks and rely only in its market competences to compete with the MNCs enterprises. Through the *Positivo* can be inferred that in Brazilian computer industry an enterprise can be competitive without accumulating technological competences and a strong innovative behavior.

## **Conclusion**

The concept of technological paradigms developed by Dosi (1984), allow to treat the innovations inside the computer industry as a systemic action that is conducted by a group of enterprises. In this system, each component has different consequences over the industry's technological trajectory. The several components of the computer paradigm are distinguished in levels of appropriability and opportunity.

When this concept is applied to the world computer industry together with Teece's (1986) idea of complementary assets and competences, it is possible to divide the paradigm in two: the paradigm core and paradigm border. The paradigm division in distinguish competences and levels of appropriability implies that there exist a hierarchy inside the paradigm, which influence differently both the industry's technological trajectory and a paradigm shift. Through the world computer industry analysis, two group of companies and competences were set: the paradigm core enterprises (Intel and Microsoft), which control the computer platform capabilities and the non-paradigm core

enterprises, that control the secondary competences in the computer industry, in other words these enterprises produce the components that will be connected to the platform.

These two groups of enterprises are extremely different. Intel and Microsoft as the core paradigm companies are responsible for setting the paradigm standards through their platform. The industry technological trajectory is underpinned by the platform and the paradigm core enterprises enjoy a high appropriability level over their innovations, the platform segment generates few opportunities to enterprises due to high barriers of entry.

Among the second group of enterprises, are the computer producer companies. These economic agents must construct components that are compatible with the computer platform, fitting itself into the paradigm. In that sense, the computer producer enterprises must obey the technological prescriptions established by the enterprises that dominate the paradigm core.

The desktops producers enjoy a low appropriability regime in a high opportunity sector, because their products are constructed under standard components. The desktop innovations are generated basically from the suppliers. Nevertheless, in the case of notebooks production, the higher complexity of the artifact allows the enterprises to have higher appropriability level.

In both segments notebooks and desktops, the paradigm shows its main characteristic: to steer the enterprises innovative activities, especially the computer producer enterprises, that focus their innovations on the secondary elements of the paradigm. Indeed, inside the paradigms, the enterprises have very specific *locus* to innovate, which can be described as a reflex of the organization and technological characteristics of the paradigm. Although the computer producer enterprises keep focused on the secondary paradigm elements, they enhance its competitiveness through peripheral innovations.

In Brazil the enterprises do not expend high amounts in innovative activities (graph 2.1), but the private national enterprises are the ones that have the major market share (table 2.1). Thus in Brazil the computer producer enterprise can be competitive letting behind the development of technological competences. A brief analysis of the Brazilian computer industry shows that the companies are devoted to the internal

market and their production rise is, at large, explained by the national policies that incentivize the computer consumption and production.

In a way to understand that Brazilian peculiarity, the major national computer producer was analyzed. The *Positivo* enterprise has the largest market share and is extremely competitive inside the national borders, but internationally, its market share is irrelevant.

Through the *Positivo*, it is possible to infer that the enterprise does not neglect the technological development, but the accumulation of technological competences is not responsible for the enterprise competitiveness. *Positivo's* competitiveness is, at large, underpinned by the company exclusive contract with *Casas-Bahia*, which allows *Positivo* to have an great demand over its desktops.

The *Positivo* entry in the retail market is an interesting example of the Wintel paradigm influence in Brazil. When this paradigm was brought to the Brazilian context it could not fulfill the entire Brazilian computer industry. A spot appeared for enterprises that could construct computers for the low income population and use the retail market as a channel for selling these computers. In that case, the MNCs are badly adapted to the Brazilian market, so *Positivo* was the national enterprise that could fill this gap in the Brazilian computer market. The position that *Positivo* occupies now is a direct influence of the Wintel paradigm inside the Brazilian computer industry.

*Positivo* was able to consolidate itself in this specific position of national market leader, but that process bring some difficulties the company in its manner of accumulating technological competences and to evolve in direction of more technologically complex computers, as the notebooks. The enterprise extreme specialization in a specific market segment encloses *Positivo* over its options to expand.

As an overall conclusion of this paper, it can be inferred that the competitiveness enjoyed by the Brazilian computer industries are not based on the accumulation of technological competences. Also as a result of the paradigm influence in the Brazilian computer industry all the nationally owned enterprises are specialized in the lower income population and in the desktop segment.

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´problemas: cap 1 sem definição melhorar terminar melhor, treminar seção mostrar o q a seção deseja mostrar, conclusão no final de seção pouco inconclusivo

Começo dizer pra onde eu vou: destacar características centrais e secundarias, primeiro paragrafo objetivo

Conclusão na seção II

Seção III competecias tec e não tec a novidade estão nas não tec