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INTELLECTUAL PROPERTY AND SOCIO-ECONOMIC DEVELOPMENT COUNTRY STUDY BRAZIL

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1. The Annex to this document contains a Study on the use of intellectual property in Brazil prepared under the project on Intellectual Property and Socio-Economic Development (CDIP/5/7 Rev.). This Study has been prepared under the coordination of Ms. Graziela Ferrero Zucoloto, Researcher, *Instituto de Pesquisa Economica Aplicada*, Brazil.

2. The CDIP is invited to take note of the information contained in the Annex to this document.

[Annex follows]

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Executive Summary

This Executive Summary presents the main results of an analysis of intellectual property data in Brazil, based on the World Intellectual Property Organization (WIPO) and Brazilian Technological Innovation Survey (PINTEC/IBGE) databases.

The WIPO dataset included the number of applications and grants of patents for inventions, utility models, industrial designs and trademarks by residents and non-residents. The share of foreign country applicants in Brazil and of Brazilian applicants in the world by country and technological area was also analyzed. Lastly, the dataset presented the number of resident patent filings per US$ billion gross domestic product (GDP) and per million population.

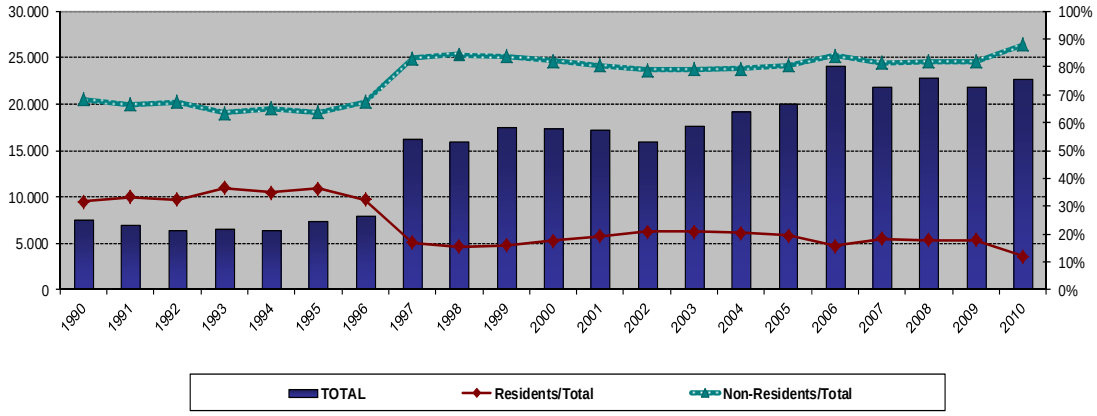
PINTEC is a survey performed biennially by the Brazilian Geography and Statistics Institute (IBGE). It presents information about patent applications and appropriability methods used by firms engaged in innovation in the country. Patent application data are available in the four versions of the survey, which cover the periods 1998-2000, 2001-2003, 2003-2005 and 2006-2008. The appropriability methods data – methods of protection utilized by firms implementing innovation – are available only in the latest three editions. Patents for inventions, utility models, industrial designs and copyright are classified as formal appropriability mechanisms, while industrial secrets, design complexity and lead time over competitors are named “strategic methods”. Monetary values, such as innovative expenditure, correspond to the latest year of each survey. The sectors included in the surveys are: mining and quarrying; manufacturing industries; and, in the latest two versions, selected services. Data are also available per region, including selected Brazilian states or per firm size.

WIPO database analysis showed that:

(a) Brazilian patenting is not in line with its global socioeconomic relevance as a country, measured by GDP and population. Based on “resident patent applications per GDP”, in a comparison with 75 countries, Brazil ranked in 54th position in 2010 (1.38 patents per US$ billion). Regarding population, in the same year Brazil was 55th among 82 countries (13.9 patents per million inhabitants). In addition, the Brazilian patent and trademark office (PTO), the National Institute of Industrial Property (INPI), ranked 12th globally in the number of patent applications, while the country is the 7th largest world economy.

(b) Non-resident patents have historically dominated in Brazilian applications, and their relevance was strengthened following the introduction of the current Industrial Property Law, in 1996. Non-resident applicants use the Patent Cooperation Treaty (PCT) national phase almost exclusively (Graph 1).

Graph 1: Patent Applications in Brazil: Residents and Non-Residents



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total	7.537	6.944	6.474	6.650	6.497	7.448	8.057	16.235	16.037	17.509	17.376	17.204	16.022	17.704	19.272	20.005	24.074	21.825	22.917	21.944	22.686
Residents/ Total	31,7%	33,4%	32,4%	36,5%	34,9%	36,3%	32,4%	17,0%	15,5%	16,1%	17,7%	19,3%	21,0%	20,8%	20,5%	19,5%	15,8%	18,4%	17,8%	17,9%	11,9%

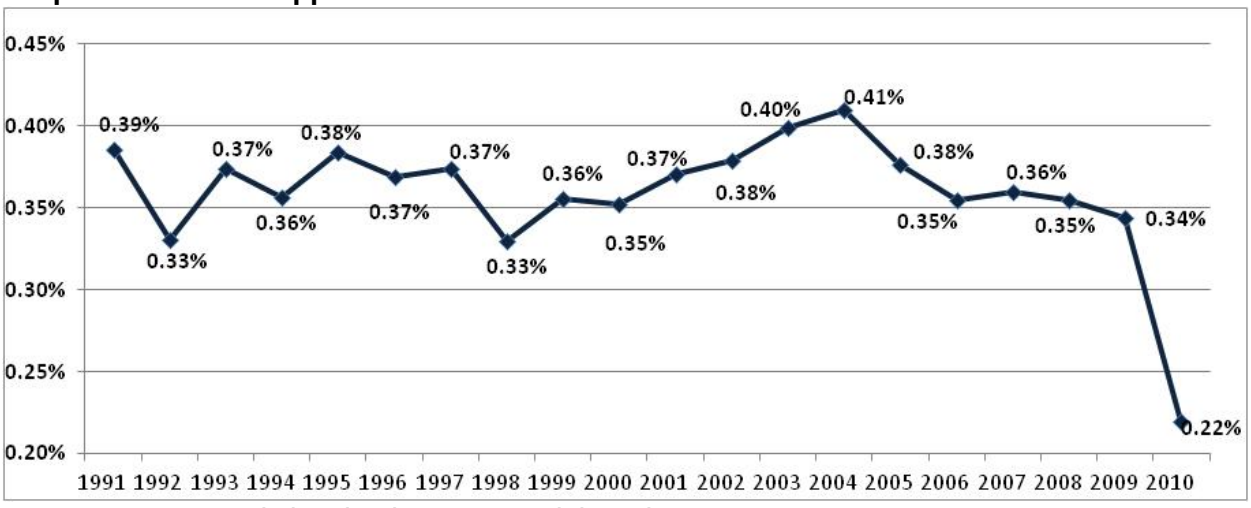
Source: WIPO Statistics database. Own elaboration

(c) Although their share in Brazilian PTO patenting has decreased, Brazilian resident applications and grants abroad have seen growth in the last several years. Among the main offices, these applications were directed not only to major markets, such as the United States (US), Europe and Japan, but also to all the BRICS (Brazil, Russian Federation, India, China, South Africa) nations and to four Latin American countries – Mexico, Colombia, Chile and Uruguay.

(d) International applications in the Brazilian PTO have originated mainly in the US, Germany and Japan; China's and India's shares remain smaller.

(e) The share of Brazilian residents accounting for patent applications worldwide has not evolved in recent decades, with an average of 0.36% between 1991 and 2009 (Graph 2).

Graph 2: Resident Applications: Brazilian/World



Source: WIPO Statistics database. Own elaboration

(f) Residents dominated in applications for utility models, industrial designs and trademarks in the latest year available, with shares of 98.3% 70.0% and 81.5%, respectively.

(g) Industrial design data revealed an increase in the number of applications abroad, from 74 in 1994 to 1,277 in 2010. On the other hand, these showed a decreasing participation of Brazilian resident industrial design applications in the world, from 1.4% in 2000 to 0.7% in 2010. Non-resident industrial design applications in Brazil also originated in developed countries: the US and Japan alone accounted for 44% of foreign applications.

(h) Brazilian trademark applications have seen steep growth since the 1990s, rising from 47,691 in 1992 to 125,654 in 2010. Brazilian trademark applications abroad have been directed to major international markets, including the US, Europe and Japan, as well as China and Latin American offices, such as Chile, Uruguay and Mexico.

Based on the PINTEC dataset of innovative firms, the analysis concluded that:

(i) The "propensity to patent", i.e., the evolution of the number of firms applying for patents out of the total number of innovative firms, increased in the 2000s, reaching 7.4%. However, this percentage is below that observed in the first PINTEC (1998-2000), despite public policies promoting technological innovation and patenting in Brazil in the last decade (Table 1).

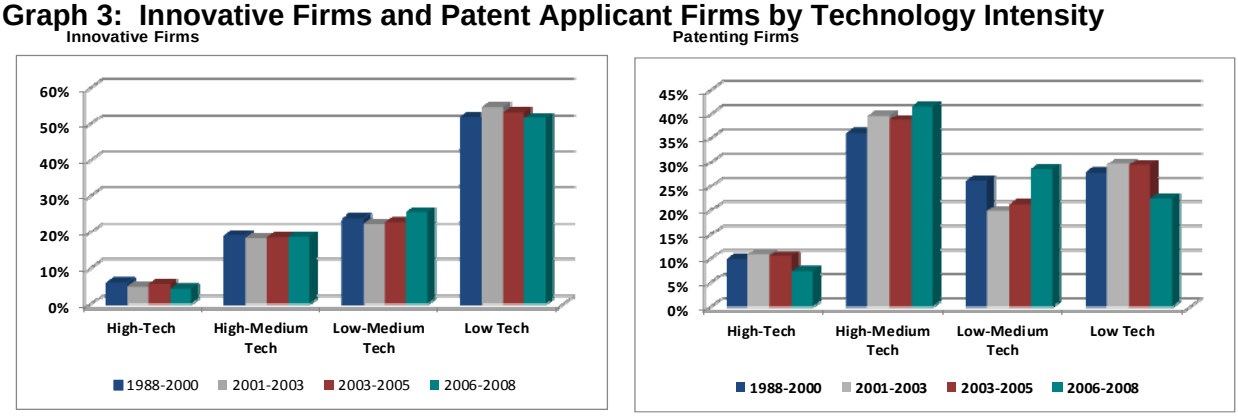
Table 1: Patent Applicant Firms in Brazil

Sectors	Patent applicant firms / Innovative Firms (%)			
	1998-2000	2001-2003	2003-2005	2006-2008
Total	8,1%	6,1%	6,1%	7,4%
Mining and quarrying	2,7%	1,9%	1,7%	2,3%
Manufacturing	8,1%	6,2%	6,2%	7,6%
Services	-	-	5,4%	6,0%

Source: PINTEC/IBGE. Own elaboration

(j) Low-technology industries are the most numerous group of innovative firms in Brazil. Among the firms that applied for patents, high-medium tech ones are the most frequent group in Brazil, driven especially by the "chemical products" and "machinery and equipment" sectors. The high-tech industries are, in both groups, the least represented category (Graph 3).

Graph 3: Innovative Firms and Patent Applicant Firms by Technology Intensity



Source: PINTEC/IBGE. Own elaboration

(k) Regarding appropriation methods, for all categories and periods except patents and lead time (2001-2003), low-tech industries were the main users of protection methods, especially in the case of trademarks.

(l) Trademark protection is the main mechanism of appropriability used by Brazilian firms in most sectors. In the manufacturing industry, patents and industrial designs are, together, the second most important method; in the services sector, second place is occupied by "other" protection methods (which includes copyright), followed by trade secrets. Design complexity and lead time over competitors were rarely accessed by Brazilian firms (Table 2).

Table 2: Appropriability Methods Used by Innovative Firms (2006-2008)

Sectors	Appropriability Methods /Innovative Firms					
	Patents	Trademarks	Design Complexity	Industrial Secret	Lead Time over Competitors	Others
Total	**9,2%**	**25,2%**	**1,9%**	**8,5%**	**2,1%**	**6,3%**
Mining and quarrying	**2,5%**	**40,1%**	**1,3%**	**4,4%**	**1,0%**	**3,9%**
Manufacturing	**9,4%**	**24,1%**	**1,6%**	**8,6%**	**2,1%**	**5,4%**
Services	**6,2%**	**39,6%**	**5,8%**	**7,8%**	**2,5%**	**22,0%**

Source: PINTEC/IBGE. Own elaboration

(m) The regional data indicate that economic and innovative structures – measured by the total number of firms, innovative firms and patent applicant firms – are strongly concentrated in the southeast of Brazil, which absorbed 54.1% of all enterprises and 61.3% of patent applicant firms. However, the propensity to patent in the north was as strong as in the southeast and, in the midwest, this propensity was even more intense (Table 3).

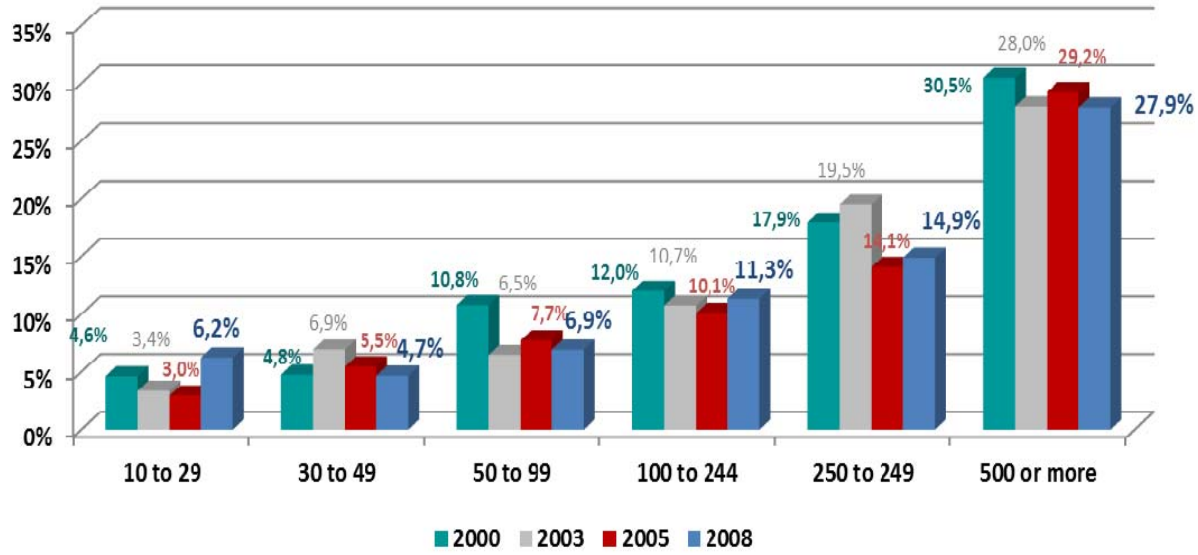
Table 3: Patent Propensity per Region

Regions	Patent Applicant Firms / Innovative Firms
	2006-2008
Brazil	**7,3%**
North	**8,7%**
Pará	17,5%
Northeast	**3,8%**
Southeast	**8,5%**
Rio de Janeiro	9,3%
São Paulo	10,4%
South	**5,4%**
Santa Catarina	4,2%
Rio Grande do Sul	6,5%
Midwest	**11,0%**
Goiás	13,1%

Source: PINTEC/IBGE. Own elaboration

(n) As documented by the international literature, the Brazilian data also show a positive relation between firm size and patent propensity. However, smaller firms with from 10 to 29 employees have shown the most significant growth in patent propensity over the years (Graph 4).

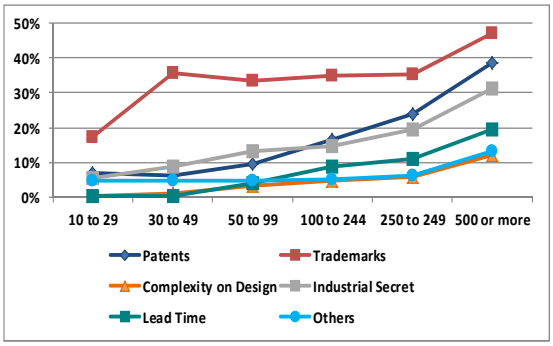
Graph 4: Patent Propensity per Firm Size



Source: PINTEC/IBGE. Own elaboration

(o) In manufacturing industries, the positive correlation between firm size and all appropriability methods is clear (Graph 5). However, in the services sector, this correlation is weaker in the case of trademarks and design complexity.

Graph 5: Propensity to Use Appropriability Methods per Firm Size (2006-2008)
Manufacturing Industry and Mining and Quarrying



	Patents	Trademarks	Design Complexity	Industrial Secret	Lead Time	Others
Total	**9,1%**	**24,3%**	**1,6%**	**8,7%**	**2,1%**	**4,9%**
10 to 29	6,7%	17,3%	0,4%	5,6%	0,3%	4,6%
30 to 49	6,3%	35,6%	1,1%	8,8%	0,4%	4,5%
50 to 99	9,6%	33,6%	3,1%	13,3%	4,1%	4,8%
100 to 244	16,6%	34,9%	4,7%	14,8%	8,6%	5,0%
250 to 249	24,0%	35,3%	6,0%	19,6%	10,9%	6,0%
500 or more	38,8%	47,1%	12,0%	31,3%	19,3%	13,2%

Source: PINTEC/IBGE. Own elaboration

(p) According to the latest PINTEC (2006-2008), 6.1% of national innovative firms applied for patents. This percentage reached 26.4% in the case of foreign firms and 36.5% for mixed (national and foreign) enterprises. The average national applicant firm had 199.7 employees and a revenue of US$40,624,000. A total of 23.3% were export firms; however, this percentage reached more than 43% in prior years (the 2008 world financial crisis can be associated with this recent fall). Their average research and development (R&D) effort (R&D expenditure / revenue) increased from 0.65% (in 2003) to 1.36% (in 2008) (Table 4).

Table 4: Characterization of Firms that Applied for Patents

Patent Aplicants	2006 - 2008				
	Yes - Brazil	Yes - Abroad	Yes - Brazil and Abroad	No	Total
National Firms	5,3%	0,0%	0,8%	93,8%	100,0%
Foreign Firms	6,6%	10,6%	7,5%	75,4%	100,0%
National and Foreign Firms	13,8%	1,4%	21,0%	63,5%	100,0%
Total Revenue per Firm (1000 US$)	40.624	123.655	473.981	9.395	16.898
Export (average value per firm) (1000 US$)	4.258	13.851	60.088	869	1.787.946
Import (average value per firm) (1000 US$)	1.641	10.542	37.769	574	1.099.477
Exporting Firms (%)	23,3%	49,7%	55,9%	9,9%	11,3%
Importing Firms (%)	22,5%	51,6%	57,0%	10,3%	11,6%
R&D expenditures per Firm (1000 US$)	553,7	719,2	6.955	62,7	171,9
R&D expenditures / Revenue (%)	1,36%	0,58%	1,47%	0,67%	1,02%
Employees per Firm	199,7	675,2	1.181	84,8	105,8
Engineers per Firm	1,9	3,5	22,2	0,21	0,57
Master and PhDs' employees per Firm	0,8	0,8	12,6	0,08	0,26
Engineers / Total Employees (%)	0,95%	0,52%	1,88%	0,25%	0,54%

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

(q) On average, large firms that used formal methods invested more in innovation than those adopting strategic methods, except in the case of trademarks. However, a different picture emerges when small and medium-sized firms are analyzed: on average, those that have opted for strategic methods tended to invest more in innovation activities than firms that chose formal appropriability.

(r) In general, a small percentage of the firms identified cooperation as being important. Suppliers are considered the main partners: “customers and consumers” is the second main cooperation type employed by innovative firms, patent applicants and firms that used strategic methods of appropriation (Table 5).

Table 5: Cooperation* - Patent Applicants and Users of Appropriation Methods

Cooperation	2006-2008							
	Customers and Consumers	Suppliers	Competitors	Other firms of the group	Consulting Firms	Universities and Research Institutes	Training and Technical Assistance Centers	Total
Total	**3,8%**	**5,4%**	**1,1%**	**1,2%**	**2,0%**	**2,1%**	**1,7%**	**100%**
Patent Applicants								
In Brazil	5,3%	5,3%	1,6%	1,5%	1,9%	4,2%	1,3%	100%
Abroad	13,1%	11,1%	0,7%	26,8%	2,0%	4,6%	0,7%	100%
In Brazil and Abroad	30,1%	27,5%	3,1%	10,7%	5,9%	32,6%	1,4%	100%
Formal Methods of Appropriability								
Invention Patent	9,8%	9,1%	2,5%	5,6%	3,3%	7,7%	1,7%	100%
Utility Model	11,2%	10,0%	1,4%	3,9%	5,1%	7,3%	3,7%	100%
Industrial Design	6,7%	11,3%	2,2%	2,9%	2,8%	8,0%	4,0%	100%
Trademark	5,0%	7,7%	1,5%	2,0%	3,2%	3,4%	2,2%	100%
Copyright	12,9%	11,7%	0,5%	3,1%	2,2%	10,3%	1,0%	100%
Strategic Methods of Appropriability								
Design Complexity	12,5%	16,8%	3,1%	5,4%	5,4%	8,7%	4,3%	100%
Industrial Secret	8,3%	13,7%	1,3%	4,5%	2,4%	6,5%	0,9%	100%
Lead time over competitors	13,1%	14,1%	2,5%	8,8%	4,4%	8,1%	2,8%	100%

**Percentage of firms that considered cooperation highly important*
Source: PINTEC/IBGE, Central Bank of Brazil and Secex. Own elaboration

(s) Regarding public incentives to innovate, funding for the acquisition of machinery and equipment (M&E) for innovative activities is the main type of instrument; the second most used are fiscal incentives for R&D and technological innovation (Table 6).

Table 6: Public Incentives – Patent Applicants and Users of Appropriation Mechanisms

Public Incentives	2006-2008				
	Fiscal incentives to R&D and to technological innovation	**Information Technology Laws**	**Funding to R&D and innovative projects**	**Funding to the acquisition of machineries and equipments employed in innovation activities**	**Scholarships - RHAE Program**
Total	**1,1%**	**1,7%**	**1,1%**	**13,0%**	**0,6%**
Patent Applicants					
In Brazil	8,1%	2,2%	2,3%	18,7%	1,2%
Abroad	9,2%	1,3%	0,7%	2,6%	0,0%
In Brazil and Abroad	12,7%	4,7%	25,4%	6,1%	17,8%
Formal Methods of Appropriability					
Invention Patent	8,0%	3,6%	4,4%	16,9%	1,7%
Utility Model	5,9%	2,3%	3,3%	9,9%	1,4%
Industrial Design	11,0%	3,8%	3,0%	10,2%	1,7%
Trademark	2,3%	1,3%	1,8%	13,6%	1,0%
Copyright	5,3%	4,5%	12,8%	14,5%	7,3%
Strategic Methods of Appropriability					
Complexity on Product Design	8,5%	3,0%	4,8%	11,7%	1,3%
Industrial Secret	3,5%	1,5%	4,5%	16,3%	3,7%
Time Lead over Competitors	9,6%	3,9%	3,8%	13,9%	1,7%

Source: PINTEC/IBGE, Central Bank of Brazil and Secex. Own elaboration

Future analysis of descriptive statistics should examine the relationship between appropriation methods and different types of innovative activities, as well as the joint use of different types of appropriability, as observed in the international literature.

1. Introduction

Intellectual Property Rights (IPRs) systems involve the set of rules, procedures and institutions that regulate appropriability, transfer, access and the right to use the knowledge and intangible assets. They grant an exclusive and, in some cases, temporal right for the use and commercialization of technologies. These temporary monopolies aim to balance the existing tension between, on one side, needing to ensure the appropriation of innovation's outcomes and, on the other side, favoring the diffusion of new knowledge. While the monopoly may stimulate the generation of new knowledge through R&D investments, it promotes the increase in production costs, reducing the short-term benefits to consumers. If in a static approach IPRs emerge as a barrier to competition, dynamically they may stimulate competition among firms through the emergence of innovative firms.

Invention patents, utility models, industrial designs, trademarks and copyrights belong to the formal IPRs[1]. However, firms frequently opt to use, instead of formal methods, strategic mechanisms, such as lead time over competitors, secrecy or complexity of design.

The costs and benefits of patenting are strongly debated in the international literature. From an investor's point of view, a patent allows some return from innovation investments and, from a social perspective, it is justified by the disclosure of the new knowledge, avoiding duplications of research expenditures and promoting the diffusion of improved technologies. They are valued as technological indicators that allow high international comparability, for being relatively homogeneous measures, existing in many countries and available for several years[2]. On the other hand, there are some restrictions in their use as technological indicators: i) patents represent inventions - the creation of something new - but not necessarily innovation, as the creation may not reach the market; ii) they reflect new technical knowledge, but do not necessarily have economic value; iii) furthermore, the economic sectors have different propensities to patent, making it a better indicator for specific segments. In several sectors, innovations occur through incremental improvements that, in spite of raising product quality and competitiveness of companies, are not necessarily patentable.

Moreover, the innovators can enjoy other forms to protect their technologies, such as trademarks, industrial secrets, design complexity and lead-time advantages over competitors[3]. They are all methods of technological appropriation (or appropriability), defined as the different means an economic agent may use to profit from its inventions or innovations by temporarily enjoying some kind of monopolistic power over the knowledge created. The appropriability mechanisms can interact with each other (for example, patents may help to create lead-time advantages) and thereby be jointly implemented; or they can be sequentially employed in distinct moments of the innovation process. Also, the effectiveness of the different mechanisms varies over time: patents expire and the industrial secret may be discovered, but on the other hand trademarks tend to increase in value.

Innovating firms differ in the methods they use to protect the knowledge they create, and those differences are mainly related to firms' characteristics (such as size or strategies) and also to specific factors of knowledge (tacit or codified), technology (product or process innovations), industry (technological opportunities of each sector) and a country's legal environment (López, 2009). Thus, these characteristics directly affect the appropriability methods the firm will choose.

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[1] Titles granted to the creators of a new useful processes or products, which allow their holders to prevent third parties from manufacturing and marketing the protected product or process during the period of its duration

[2] Patents' documents include a complete description of the invention, the technological field, characteristics of the inventor and the applicant, previous references or citations and scientific articles which the invention is related to, among other descriptive characteristics.

[3] It involves inserting innovation in the market with substantial gain over competitors and high costs of absorption of new knowledge by imitators.

The international literature shows significant differences in the propensity to use appropriability methods by firms from developed and developing countries. Developing countries are not a homogenous group - Asian and Latin American nations show substantial diversity in their development degree - and, inside each country, there is found significant disparities in their inter-sectorial innovative capabilities. However, these countries are, in general, adopters of foreign technologies (López, 2009), a reason why their debate is mainly concentrated on strengthening or weakening their IPRs to promote their technological progress. Despite these facts, domestic innovative activities also exist, involving activities beyond copying, but they are mainly concentrated on incremental innovations, which makes utility models and industrial designs more relevant than invention patents in many cases. Also, in many developing countries, such as Brazil, there is a widespread presence of MNCs affiliates, which has some implications for the national use of IPRs.

According to López and Orlicki (2007) apud López (2009), in Latin America countries no more than 10 per cent of innovating firms used patents, a percentage below what is observed in developed countries and, additionally, larger and foreign-owned firms prevail, as well as firms operating in the chemical, machinery and electric-electronic sectors. Also, trademarks are by far the most commonly employed IPR in Latin America, which may indicate the prevalence of product differentiation over genuine innovations in the region. The authors affirm that Latin American firms use all appropriability mechanisms less than developed countries, except trademarks, but this difference is greater in the case of strategic methods and when small and medium enterprises (SMEs) are considered. This point is also mentioned in WIPO (2011).

The main results found in the international literature of appropriability methods of technological innovation are presented below.

1. Patents and other appropriability methods:

   (a) Most studies indicate that patents are not the main appropriability method employed by firms. Strategic mechanisms, including lead time, secrecy and/or other non-formal IP mechanisms, were indicated as the most effective methods in almost all industries (Cimoli and Primi, 2009; Arundel, 2001; Cohen et al, 2000; Harabi, 1995). According to Arundel (2001), firms tended to prefer secrecy especially when the disclosure propitiated by a patent was a disadvantage. This result was observed in different countries, such as Spain (Gonzales-Alvarez and Nieto-Antolin, 2007), United Kingdom (Laursen and Salter, 2005), India (Basant, 2004), France (Mairesse and Mohnen, 2003) and Swiss (Harabi, 1995). Besides, many innovative firms use no appropriability method at all (Hall et al, 2012).

   (b) Firms tend to use more than one appropriability method, simultaneously and/or sequentially (Cohen et al, 2000).

2. Appropriability and firm size: large firms perceived patents as more effective than SMEs (Sattler, 2005; Blind et al, 2006; Byma and Leiponen, 2007; Gonzales-Alvarez and Nieto-Antolin, 2007). According to Arundel (2001), in a study involving seven European countries, firms of all sizes considered secrecy more relevant then patents, but in the case of product innovations, the relative importance of secrecy declines with an increase in firm size. For Hanel (2005), not only patents, but the use of all IPR types increased with firm size.

3. Patent propensity: R&D expenditures, firm size, origin of capital and sectorial characteristics are the explanatory variables usually correlated to patent propensity (Arundel and Kabla, 1998; Hall and Ziedonis, 2001; López and Orlicki, 2007), as well as exportations (Licht and Zoz, 1998). Moreover, patents seem to be more relevant as an appropriability mechanism for product innovations. Hussiger (2005) identified the patent stock and the use of other appropriability mechanisms as relevant explanatory variables of patent propensity.

4. Sectorial propensities: patent propensity presents significant differences according to the sectors. Patents are considered more relevant for pharmaceuticals and chemical firms (Mansfield, 1986), but not very effective in protecting products in low-tech industries such as food and textiles and in some high-tech industries, including electronics and instrumentation segments (Cohen et al, 2000). In the cases where patents are considered crucial, they tend to be complemented by other methods to secure appropriability (Kavis and Kjaer, 2003).

5. Patent paradox:

(a) Although firms claim that patents are of the relatively low importance, there has been observed a sharp rise in patent applications around the world. So, why do firms increasingly patent? The presented reasons are prevention of copying, patent blocking, prevention of suits, reputation enhancing and use of patents to negotiate. In general, earning through licenses was seen as the least important motivation (Cohen et al, 2000).

(b) On the other hand, the main reasons why firms do not use patents are knowledge disclosure and ease of inventing-around (Cohen et al, 2000; Harabi, 1995). In the case of small firms, application costs and the costs to defend patents from infringement are considered a relevant impediment to patent. Chang (2001) argued that when the inventor looks favorably upon the possibility of secrecy, he will go this route it and will not deposit the patent. According to this author, patent protection does not stimulate the description of concealable inventions, acting only on inventions that by reverse engineering would be revealed.

6. Appropriability methods in the service sectors: patents are not seen as highly effective in the services sectors; copyrights and trademarks are more commonly used (Paallysaho and Kuusisto, 2006; Baldwin et al, 1998). Blind et al (2003) suggested that the propensity to patent was significant lower in services compared to manufacturing sectors, but Mairesse and Mohnen (2003) concluded that although innovative service 5 firms utilized appropriability methods less than high-tech manufacturing firms, their use is higher when compared to low-tech manufacturing sectors.

7. Appropriability and cooperation: participation in cooperative R&D arrangements reduces the probability that a firm would prefer secrecy to patents (Arundel, 2001).

Besides this introduction, this report includes two additional sections. The first presents an overview of Brazilian IP applications and grants, focusing on patents, industrial designs and trademarks. The second topic describes the characteristics of Brazilian innovative firms according to their propensity to apply for patents and their use of appropriability methods. The analysis to be presented is based on the Brazilian Technological Innovation Survey (PINTEC) data, a research performed biennially by the Brazilian Geography and Statistics Institute (IBGE). Initially, it analyzes the data available at the PINTEC web site[4] and in its second part concentrates on the statistical description compiled from the PINTEC microdata. At the very least, this report presents some conclusions based on the descriptive statistics.

[4] http://www.pintec.ibge.gov.br/index.php?option=com_content_extjs&view=article&id=17&Itemid=6

IP Indicators in Brazil[5]

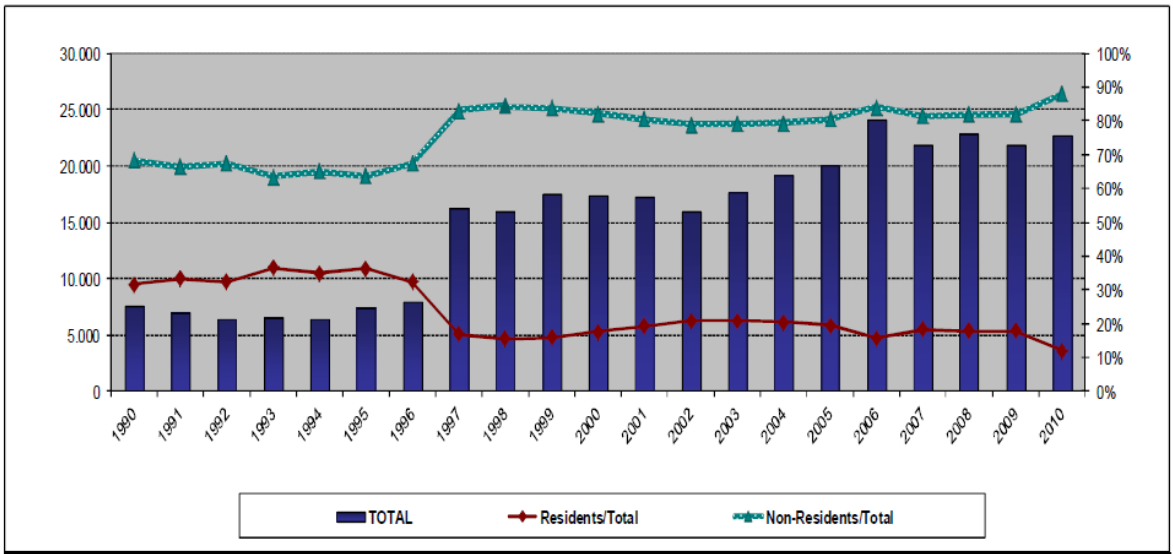
1.1. Invention Patents

1.1.1 Patent applications after Law 9279/96

The launch of the present Industrial Property Law (Law 9,279/96) led to significant changes in Brazilian patenting. The number of patent applications in the country went from 8,057 in 1996 to 16,235 in 1997, reaching a peak in 2006, with 24,074 patents applied for. This growth was fueled by non-residents, whose applications increased 148% between 1996 and 1997, leading to an immediate reduction of residents' share from 32.4% to 17.0% (graph 1)[6].

The prevalence of non-residents in patent applications is not a Brazilian peculiarity, being common in most developing countries. China is an exception: since 2003, most patents have been applied for by residents, who accounted for 74.9% of applications in 2010 (WIPO, 2013). In Brazil, the prevalence of non-residents was partially reversed in 1998; but, after 2003, once again the residents lost participation in total applications and, in 2010, they achieved their lower share: 11.9%.

Graph 1.1: Patent Applications in Brazil: Residents and Non-Residents



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total	7.537	6.944	6.474	6.650	6.497	7.448	8.057	16.235	16.037	17.509	17.376	17.204	16.022	17.704	19.272	20.005	24.074	21.825	22.917	21.944	22.686
Residents/ Total	31,7%	33,4%	32,4%	36,5%	34,9%	36,3%	32,4%	17,0%	15,5%	16,1%	17,7%	19,3%	21,0%	20,8%	20,5%	19,5%	15,8%	18,4%	17,8%	17,9%	11,9%

Source: WIPO Statistics database. Own elaboration.

Most of these applications, in the case of non-residents, have occurred through the PCT route[7]. On the other hand, the resident applicants rarely have accessed the treaty (table 1.1).

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5 A historical review of Brazilian Industrial Property Legislation is presented in Appendix A.

6 It is worth noting that this sharp increase might be smoother than indicated by these figures, as suggested by other sources (e.g. EPO's PATSTAT and RICYT). Currently, the Brazilian INPI and WIPO are developing a new IP statistical database which will address the discrepancies.

7 The Patent Cooperation Treaty (PCT) is an international patent law treaty, concluded in 1970, which provides a unified procedure for filing patent applications in order to protect inventions in each of its contracting states. A single filing of an international application is made with a Receiving Office (RO) in one language. It results in a search performed by an International Searching Authority (ISA), accompanied by a written opinion regarding the patentability of the invention,

[Footnote continued on next page]

Table 1.1: PCT National Phase Entries in Total Applications (%): Residents and Non-Residents

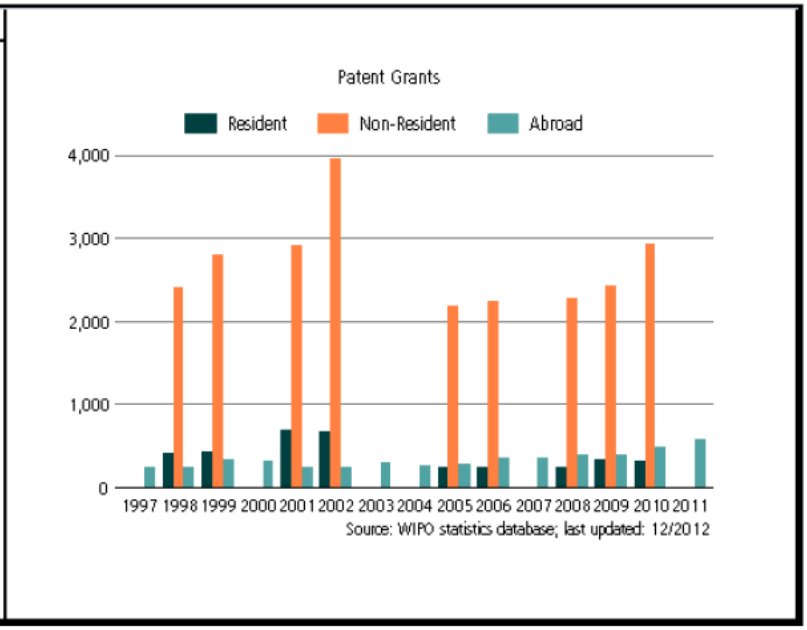
	Residents	Non-residents
1997	0,5%	64,1%
1998	1,4%	73,4%
1999	0,9%	74,2%
2000	0,6%	74,7%
2001	0,5%	76,5%
2002	0,6%	80,6%
2003	0,7%	84,5%
2004	0,7%	84,6%
2005	0,3%	84,9%
2006	0,7%	89,0%
2007	1,0%	87,6%
2008	0,7%	89,3%
2009	1,8%	89,3%
2010	2,3%	93,0%

Source: WIPO Statistics database. Own elaboration

Figure 1.1: Brazil: Patent Grants

Patent Grants

Year	Resident	Non-Resident	Abroad
1997			247
1998	406	2,419	244
1999	424	2,795	338
2000			310
2001	685	2,904	236
2002	674	3,949	237
2003			302
2004			255
2005	249	2,190	286
2006	233	2,232	360
2007			350
2008	234	2,279	396
2009	341	2,431	391
2010	314	2,937	491
2011			567



Source: WIPO "Statistical Country Profile"

Relatively speaking, only a small amount of patents are granted every year. The pattern is similar to the one from patent applications, where most of the granted patents have a non-resident applicant. Figure 1 shows that compared to the period 2005-2010, in the years 1998-2002 the

[Footnote continued from previous page]

which is the subject of the application. It is optionally followed by a preliminary examination, performed by an International Preliminary Examining Authority (IPEA). Finally, the national or regional authorities administer matters related to the examination of application (if provided by national law) and issuance of the patent. The contracting states, which are parties to the PCT, constitute the International Patent Cooperation Union. The PCT now has 146 contracting states (WIPO, 2013).

number of granted patents was 50% higher, in the case of residents, and 20%, with reference to non-residents. After a fall in the mid-2000s, in both cases the patent grants have increased again since 2009, but have not achieved the numbers from the early 2000s.

However, considering Brazilian patents applied for by residents abroad, the number of grants increased during all the period.

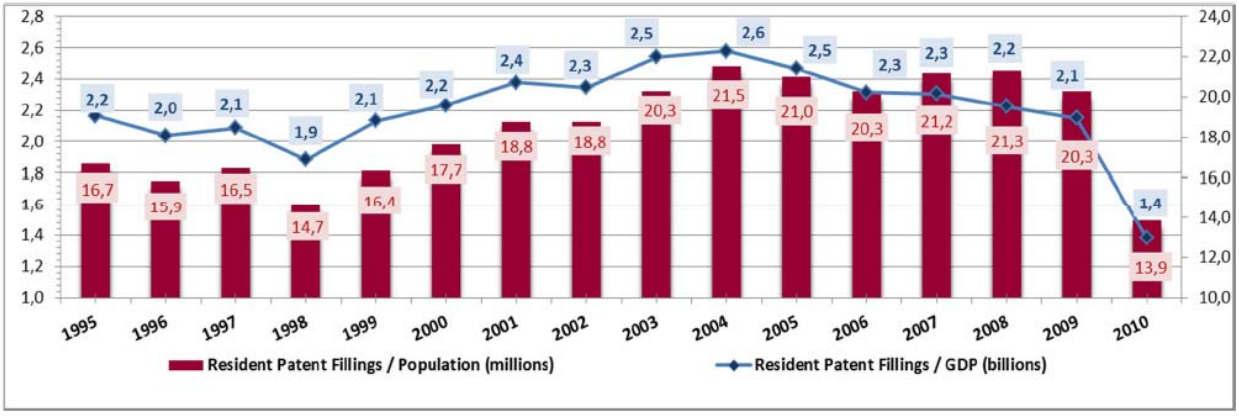
1.1.2 Patent Applications in Brazil: international comparisons

Brazilian patenting is still not in line with its global the socioeconomic relevance as a country, measured by gross domestic product (GDP) and population.

Based on "resident patent applications per GDP", in a comparison with 75 countries, Brazil ranked in the 54th position in 2010 (1.38 patents per US$ billion). Regarding population, in the same year Brazil was 55th among 82 countries (13.9 patents per million inhabitants). In both cases, Brazil ranked below the average country rank.

Patent applications per million population showed a growth tendency over the years; regarding GDP, stability could be verified. In 2010, nevertheless, a reversal of tendency was found, with a decrease in both indicators (graph 1.2).

Graph 1.2: Brazil: Resident Patent Applications per GDP and Population



Source: WIPO Statistics database. Own elaboration.

For comparison, table 1.2 presents the resident patent applications per GDP in selected countries.

Table 1.2: Resident Patent Applications per GDP[8] in Selected Countries (2010)

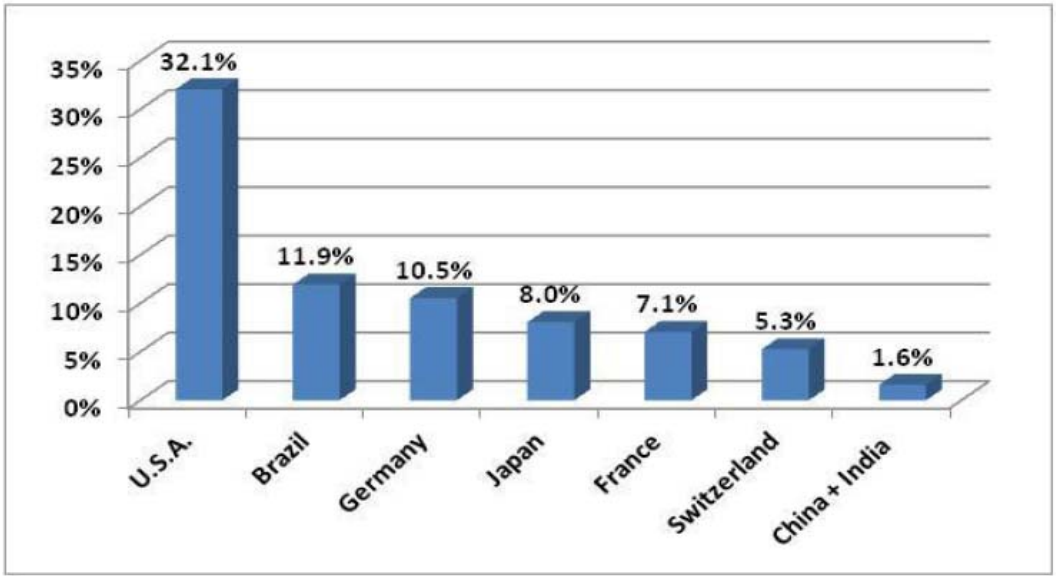
1	Republic of Korea	99,78
2	Japan	73,65
3	China	32,16
4	United States of America	18,36
5	Germany	17,19
7	Russian Federation	14,29
8	New Zealand	14,10
20	Israel	7,31
37	Singapore	3,39
41	Greece	2,57
46	Portugal	2,16
49	Argentina	1,91
51	South Africa	1,73
53	Chile	1,41
54	Brazil	1,38

Source: WIPO Statistics database. Own elaboration.

1.1.3 Foreign Applicants in Brazil

In the Brazilian PTO, non-resident patent applications mainly originate from developed countries: USA, Germany and Japan jointly accounted for 50.6% in 2010 (graph 1.3). Emergent economies, as China and India, still represented, together, only 1.6% of these applications.

Graph 1.3: Patent Applications in the Brazilian PTO: Country of Applicants (2010)



Source: WIPO Statistics database. Own elaboration.

It is noteworthy that the Brazilian PTO is an important receiver of patent applications. Considering average patent applications between 2008 and 2010, the Brazilian PTO ranked 12nd in the world. However, this position is negligible compared to its relevance in economic terms: in 2010, Brazil was the 8th world economy; in 2011, the 6th, and in 2012 it ranked 7th.

8 Gross Domestic Product (GDP) data are in billions of US dollars based on 2005 purchasing power parities.

Also, compared to Chinese[9] and Indian PTOs, which respectively growth 409% and 262%, the Brazilian PTO increase is seen as low: 33.5% (table 1.3).

Table 1.3: Ranking of PTOs: by Average Number of Applications

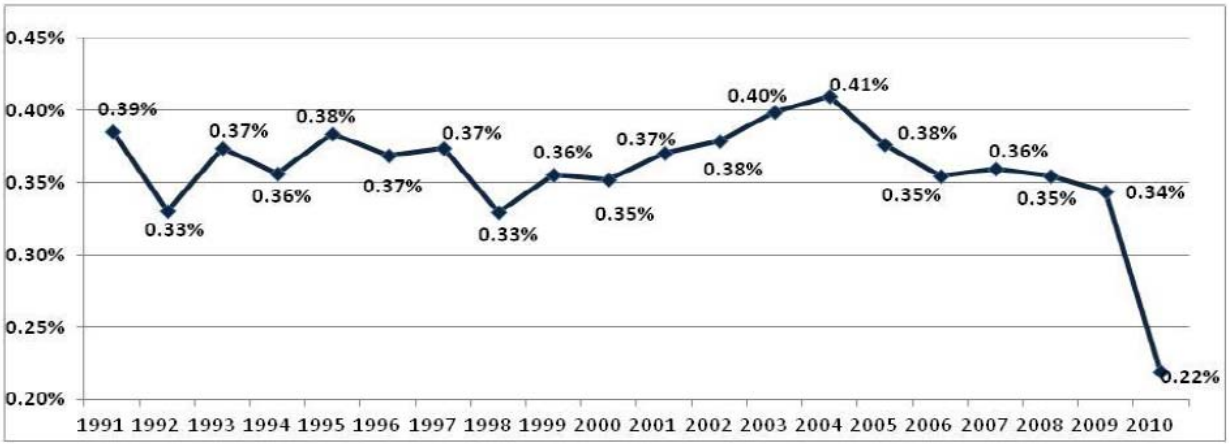
	PTOs	2000-2002	2008-2010	VAR.
1	U.S.A.	318.937	467.551	46,6%
2	Japan	427.199	361.399	-15,4%
3	China	65.196	331.873	409,0%
4	Republic of Korea	104.253	168.085	61,2%
5	E.P.O.	105.654	143.897	36,2%
6	Germany	60.268	60.415	0,2%
7	Russian Federation	33.245	40.971	23,2%
8	Canada	39.693	38.338	-3,4%
9	India	10.198	36.954	262,4%
10	Australia	22.427	24.971	11,3%
11	United Kingdom	32.120	22.591	-29,7%
12	Brazil	16.867	22.516	33,5%
13	France	17.122	16.231	-5,2%
14	Mexico	13.229	15.146	14,5%

Source: WIPO Statistics database. Own elaboration.

1.1.4 Brazilian Applications in the World

This section presents the evolution of Brazilian residents' applications'[10] share in the world. Graph 1.4 shows that these applications showed no progress in the last decades (1991-2010), maintaining an average share of 0.36%. The lowest percentage was observed in 2010, when Brazilian participation in international patent applications represented only 0.22%[11].

Graph 1.4: Residents Applications: Brazilian/World



Source: WIPO Statistics database. Own elaboration.

Complementarily, in order to understand the main international markets for Brazilian innovative agents, Graph 1.5 presents the patent dataset by country of application. Unsurprisingly, the main international PTOs were the USPTO and the European Patent Office (EPO), which jointly represented 49.6% of the 1,477.3 foreign Brazilian patents applied for, on average, between 2009 and 2011. Among the 14 most active offices, were found the BRICS nations and four Latin American countries – Mexico, Colombia, Chile and Uruguay.

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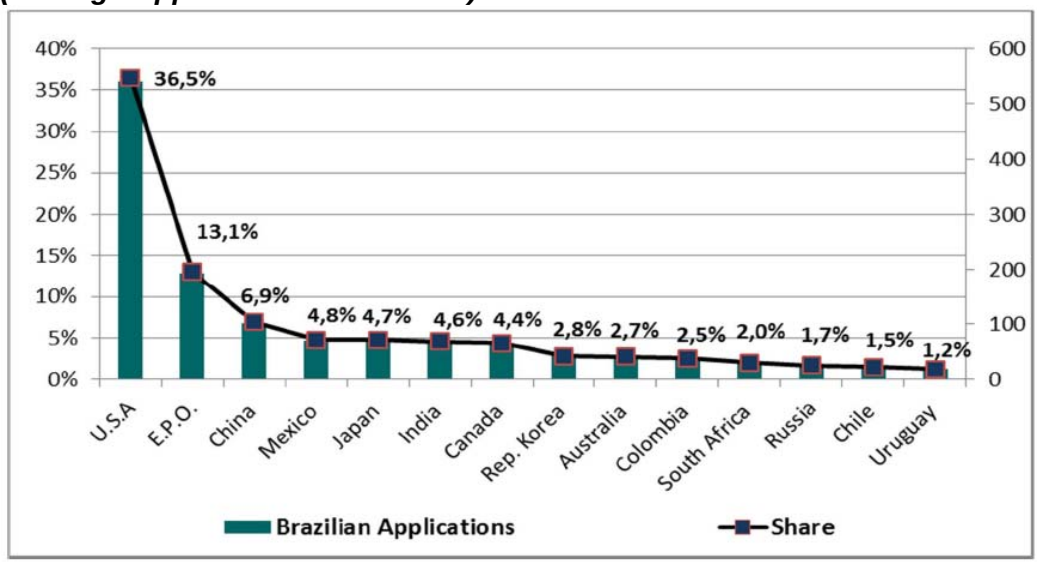
9 In 2010, the Chinese Office surpassed the Japanese, becoming the 2o most important in patent applications.

10 Brazil as the residence of the main applicant.

11 Refer to footnote 6.

Graph 1.5: Brazilian Patent Applications in International PTOs (Average Applications: 2009-2011)



Source: WIPO Statistics database. Own elaboration

Brazilian patent grants are poorly represented in all technological fields, and this participation did not change over the years. For example, in 1995-1997 the Brazilian share was 0.04%, whereas in 2009-2011 it achieved 0.06%. On the other hand, in a comparison according to selected area, Brazilian share in world grants ranked proportionally better in “textile and paper machines”, “metallurgy” and “basic materials chemistry” (table 1.5).

Table 1.5: Brazilian Share in World Patent Grants - By Field of Technology

TECHNOLOGIES	1995-1997	2009-2011
1 - Electrical machinery, apparatus, energy	0.04%	0.05%
2 - Audio-visual technology	0.01%	0.01%
3 - Telecommunications	0.01%	0.01%
4 - Digital communication	-	0.01%
5 - Basic communication processes	-	0.02%
6 - Computer technology	0.02%	0.01%
7 - IT methods for management	-	0.07%
8 - Semiconductors	-	0.01%
9 - Optics	0.01%	0.01%
10 - Measurement	0.01%	0.03%
11 - Analysis of biological materials	0.08%	0.04%
12 - Control	0.02%	0.07%
13 - Medical technology	0.03%	0.06%
14 - Organic fine chemistry	0.02%	0.08%
15 - Biotechnology	0.02%	0.08%
16 - Pharmaceuticals	0.07%	0.08%
17 - Macromolecular chemistry, polymers	0.02%	0.06%
18 - Food chemistry	0.02%	0.08%
19 - Basic materials chemistry	0.04%	0.15%
20 - Materials, metallurgy	0.08%	0.19%
21 - Surface technology, coating	0.02%	0.05%
22 - Micro-structural and nano-technology	-	-
23 - Chemical engineering	0.08%	0.13%
24 - Environmental technology	0.06%	0.10%
25 - Handling	0.07%	0.13%
26 - Machine tools	0.09%	0.06%
27 - Engines, pumps, turbines	0.09%	0.15%
28 - Textile and paper machines	0.02%	0.06%
29 - Other special machines	0.04%	0.20%
30 - Thermal processes and apparatus	0.05%	0.13%
31 - Mechanical elements	0.12%	0.10%
32 - Transport	0.06%	0.08%
33 - Furniture, games	0.03%	0.04%
34 - Other consumer goods	0.08%	0.11%
35 - Civil engineering	0.14%	0.07%
TOTAL	**0.04%**	**0.06%**

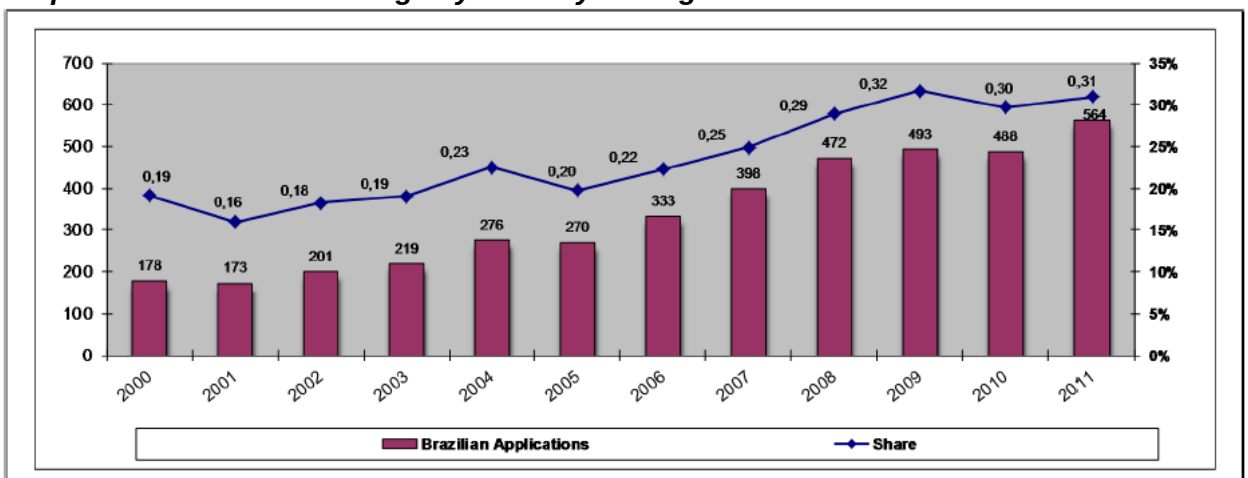
Source: WIPO Statistics database. Own elaboration.

1.1.5 PCT – International Phase

The number of Brazilian patent applications passing through PCT increased from 178 in 2000 to 564 in 2011. The Brazilian participation in total PCT filings has also risen in the last decade, achieving 0.31% in 2011. However, this share is still modest if compared to other BRICS countries, such as China (9.13%), India (0.60%) and Russia (0.44%) (graph 1.6).

On average, 92.6% of the PCT applications having INPI as the receiving office were filed by Brazilian residents.

Graph 1.6: Brazil: PCT Filings by Country of Origin



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Brazilian Applications through INPI	89,9%	93,1%	96,0%	94,5%	92,8%	97,4%	94,0%	95,0%	85,4%	89,7%	91,8%	92,0%

Source: WIPO Statistics database. Own elaboration

1.2. Utility Models

Only a small but significant number of countries and regions provide the option of utility model protection. According to WIPO (2013), the main differences between utility models and patents are the following:

- The requirements for acquiring a utility model are less stringent than for patents. While the requirement of "novelty" is always to be met, that of "inventive step" or "non-obviousness" may be much lower or absent altogether. In practice, protection for utility models is often sought for innovations of a rather incremental character which may not meet the patentability criteria.

- The term of protection for utility models is shorter than for patents and varies from country to country (usually between 7 and 10 years without the possibility of extension or renewal).

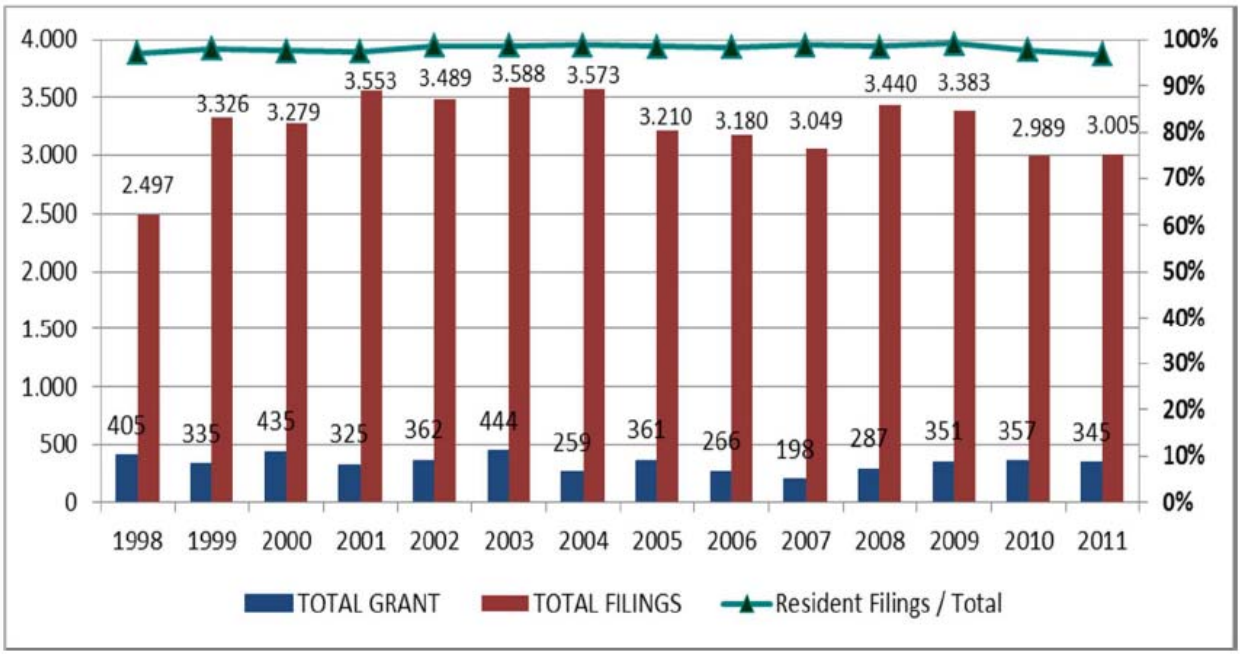
- In most countries where utility model protection is available, patent offices do not examine applications as to substance prior to registration. This means that the registration process is often significantly simpler and faster, taking, on average, six months.

- Utility models are much cheaper to obtain and to maintain. In some countries, utility model protection can only be obtained for certain fields of technology and only for products but not for processes.

Utility models are considered particularly suited for SMEs that make "minor" improvements to, and adaptations of, existing products. Utility models are primarily used for mechanical innovations and are, sometimes, referred to as "petty patents" or "innovation patents." Utility models are mainly applied for by residents: on average (1998-2011), Brazilians represented 98.1% of applications. Also, graph 1.7 reveals that the number of applications and grants did not increase in the period observed[12].

[12] Specifically, in the case of utility model, the analysis was based on INPI database, because WIPO data eas incomplete in many recent years.

Graph 1.7: Utility Model Applications in Brazil



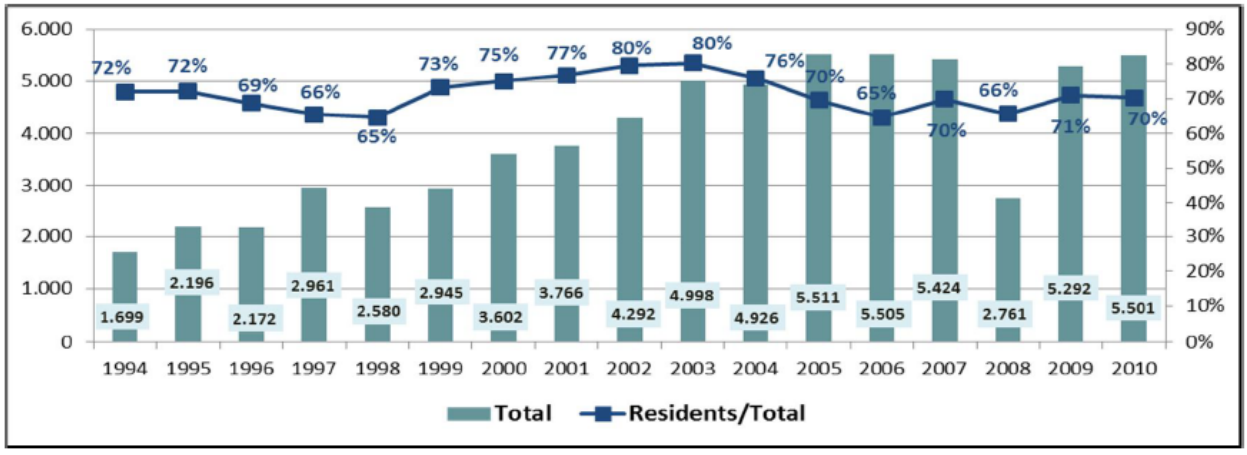
Source: INPI. Own elaboration.

According to the WIPO database, only one UM was applied for by a resident through PCT, in 2005; among non-residents, in 2009 11 applications passed through PCT, and in 2010, another 16. Also, based on the same dataset, during the 2000s, the Brazilian UM applications abroad represented less than 1% of their filings and, in 2010, this percentage reached 2.4% (48 UM applications abroad versus 1926 in the Brazilian PTO).

1.3. Industrial Designs

Graph 1.8 shows an increasing number of industrial design (ID) applications from 1994 to 2005. After which it seems to stabilize around five thousand per year, with the only exception of 2008. During all the period, residents have dominated the scenario, representing, on average, 71.4% of applications between 1994 and 2010.

Graph 1.8: Industrial Designs Applications in Brazil

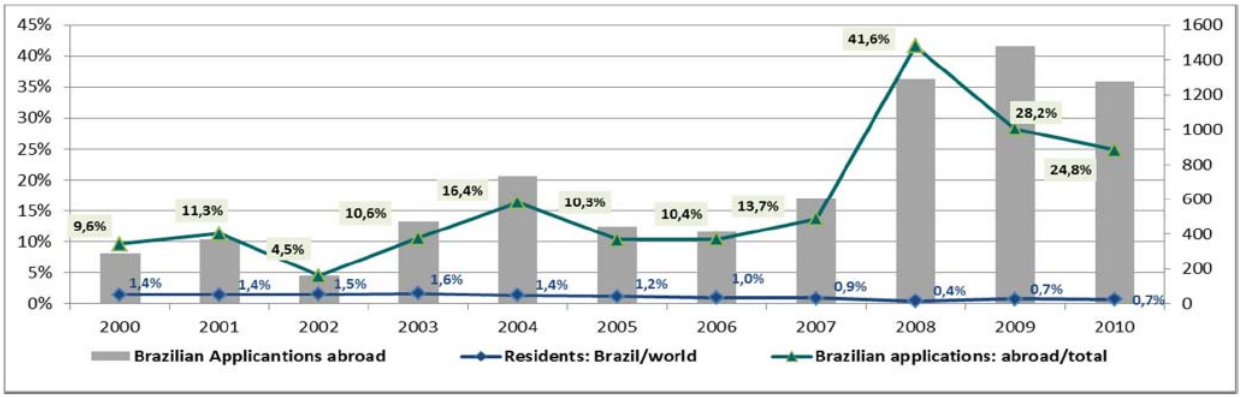


Source: WIPO Statistics database. Own elaboration.

Another trend has been the steep increase in the number of applications abroad, from 74 in 1994 to 1,277 in 2010, also representing 24.8% of all Brazilian ID applications for this year. On the other

hand, graph 1.9 shows the decreasing participation of Brazilian resident ID applications compared to the applications made in the rest of the world, from 1.4% in 2000 to 0.7% in 2010.

Graph 1.9: Brazilian ID Application: Abroad and World Share



Source: WIPO Statistics database. Own elaboration.

Non-resident ID applicants in Brazil also originated from developed countries: U.S.A. and Japan alone represented 44% of foreign applications. But, contrary of the case of invention patents, here countries such as China and India were included among the main applicants (table 1.6).

Table 1.6: ID Applications in Brazilian PTO: by Country of Origin (Average: 2007-2008)

Country	ID applications
U.S.A.	451
Japan	135
France	110
Netherlands	86
Germany	82
Italy	68
Republic of Korea	67
United Kingdom	65
Switzerland	42
Sweden	38
China	22
India	18
Others	144

Source: WIPO Statistics database. Own elaboration.

Table 1.7 presents the ID applications in 2008 according to the International Classification for ID[13]. It shows main differences among resident and non-resident applications: in Brazil and worldwide, the resident applications are concentrated in "clothing", "furnishing" and "packages" – classes 2, 6 and 9, respectively. "Packages" also appears as relevant among non-residents, together with "communication equipment" (class 14). Brazilian applications abroad were concentrated in different segments, such as "articles of adornment" (class 11), "games, toys and sports goods" (class 21) and, once again, "packages".

[13] http://www.wipo.int/classifications/nivilo/locarno/index.htm#

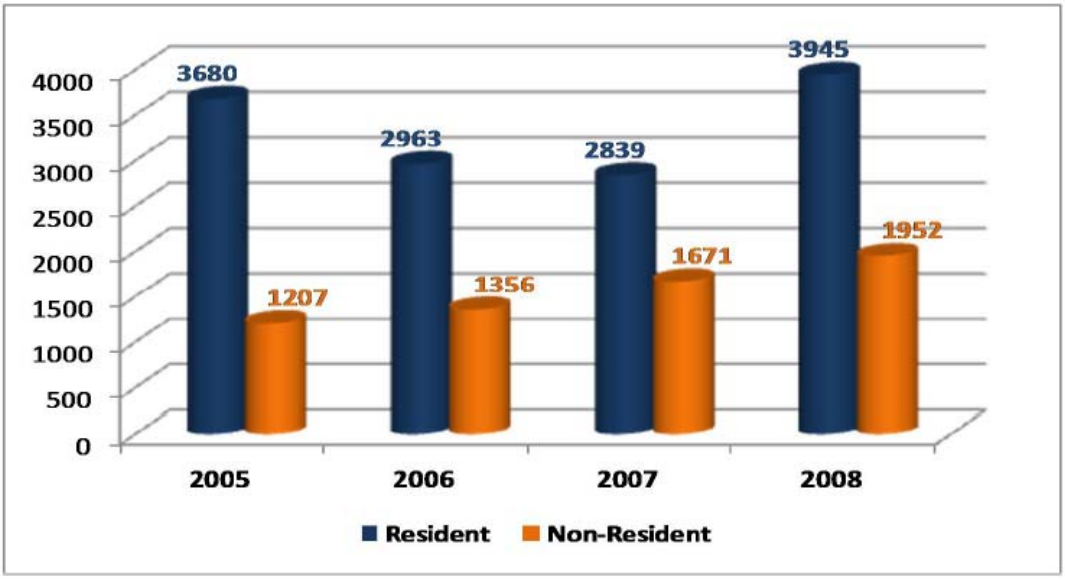
Table 1.7: Distribution of ID Applications by Class (2008)

Classes		Brazilian PTO		World		Brazilian applicants: abroad
		Residents	Non-residents	Residents	Non-residents	
Class 01	Foodstuffs	0,22%	0,54%	0,63%	0,78%	0,00%
Class 02	Articles of clothing and haberdashery	13,76%	9,72%	9,22%	5,86%	1,19%
Class 03	Travel goods, cases, parasols and personal belongings, not elsewhere specified	2,76%	0,32%	2,57%	1,63%	6,77%
Class 04	Brushware	1,71%	0,97%	0,44%	0,74%	0,00%
Class 05	Textile piecegoods, artificial and natural sheet material	0,33%	3,35%	1,49%	0,82%	0,00%
Class 06	Furnishing	14,10%	1,40%	13,87%	5,60%	1,60%
Class 07	Household goods, not elsewhere specified	4,98%	3,02%	6,49%	4,34%	0,06%
Class 08	Tools and hardware	6,47%	1,73%	4,58%	3,32%	4,06%
Class 09	Packages and containers for the transport or handling of goods	12,77%	10,69%	7,17%	9,92%	13,83%
Class 10	Clocks and watches and other measuring instruments, checking and signalling instruments	1,55%	1,19%	2,69%	11,09%	0,02%
Class 11	Articles of adornment	1,38%	0,11%	4,84%	3,80%	37,59%
Class 12	Means of transport or hoisting	5,97%	25,70%	4,23%	7,46%	1,22%
Class 13	Equipment for production, distribution or transformation of electricity	2,49%	1,62%	2,02%	2,65%	0,06%
Class 14	Recording, communication or information retrieval equipment	2,65%	13,28%	3,70%	12,95%	0,51%
Class 15	Machines, not elsewhere specified	3,32%	4,43%	2,23%	2,97%	1,17%
Class 16	Photographic, cinematographic and optical apparatus	0,22%	0,65%	0,78%	0,86%	0,00%
Class 17	Musical instruments	0,06%	0,00%	0,18%	0,13%	0,00%
Class 18	Printing and office machinery	0,11%	0,43%	0,30%	0,33%	0,00%
Class 19	Stationery and office equipment, artists' and teaching materials	2,60%	1,73%	3,53%	2,59%	0,00%
Class 20	Sales and advertising equipment, signs	1,16%	0,11%	1,50%	1,06%	0,04%
Class 21	Games, toys, tents and sports goods	4,53%	0,76%	4,35%	2,88%	18,29%
Class 22	Arms, pyrotechnic articles, articles for hunting, fishing and pest killing	0,28%	0,54%	0,38%	0,34%	0,00%
Class 23	Fluid distribution equipment, sanitary, heating, ventilation and air-conditioning equipment, solid fuel	7,63%	3,67%	7,14%	5,04%	9,33%
Class 24	Medical and laboratory equipment	1,88%	3,02%	1,62%	2,82%	1,05%
Class 25	Building units and construction elements	4,15%	1,94%	6,00%	1,77%	0,17%
Class 26	Lighting apparatus	0,83%	5,08%	4,73%	4,27%	3,05%
Class 27	Tobacco and smokers' supplies	0,11%	0,22%	0,23%	0,17%	0,00%
Class 28	Pharmaceutical and cosmetic products, toilet articles and apparatus	0,55%	2,05%	0,86%	2,14%	0,00%
Class 29	Devices and equipment against fire hazards, for accident prevention and for rescue	0,22%	0,65%	0,19%	0,38%	0,00%
Class 30	Articles for the care and handling of animals	0,44%	0,22%	0,51%	0,26%	0,00%
Class 31	Machines and appliances for preparing food or drink, not elsewhere specified	0,55%	0,86%	0,35%	0,47%	0,00%
Class 32	Graphic symbols and logos, surface patterns, ornamentation	0,00%	0,00%	0,92%	0,08%	0,00%
Others		0,22%	0,00%	0,25%	0,47%	0,00%
TOTAL		1.809	926	85.954	44.011	5.315

Source: WIPO Statistics database. Own elaboration.

With respect to registrations, at least, the ID dataset is available only for four years, as shown in graph 1.10.

Graph 1.10: Number of ID Registrations in the Brazilian PTO



Source: WIPO Statistics database. Own elaboration.

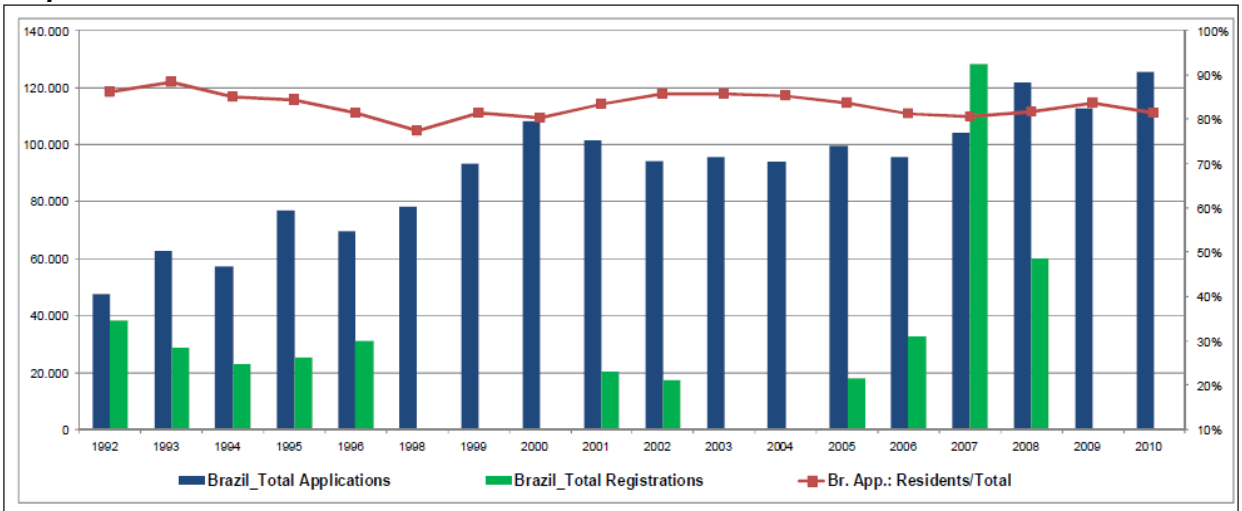
1.4. Trademarks

Trademarks are the most used form of IP in Brazil. Their resident class count per million populations was 526 in 2010, slightly below the global indicator, 693.

Brazilian applications have shown a strong growth since the 1990s, rising from 47,691 in 1992 to 125,625 in 2010. The trademark registrations also have increased, but to a lesser extent. The residents dominated the applications, representing on average 83.2% between 1992 and 2010 (graph 1.11).

In 2008, 10 countries represented 76.9% of total non-residents applications, (21.574), as shown in graph 1.12.

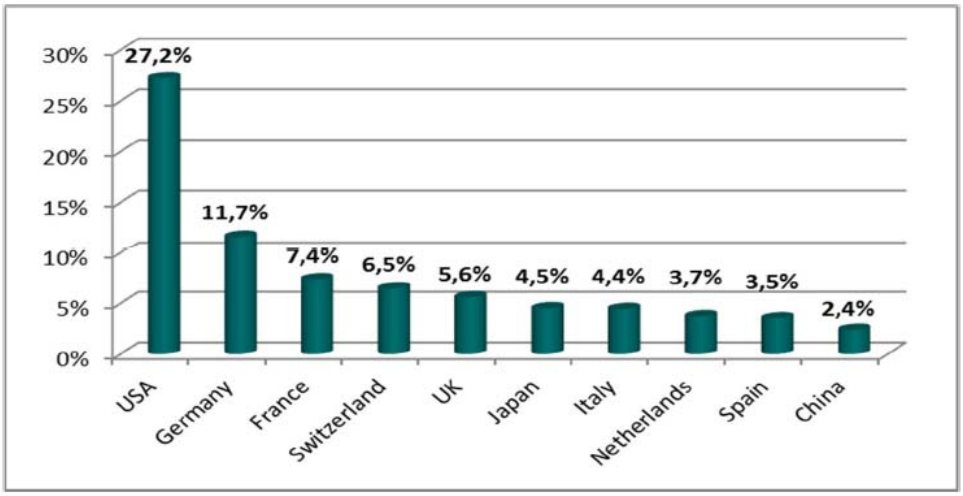
***Graph 1.11: Trademarks in Brazil*[14]**



	1992-1995 (average)	1996-1999 (average)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Brazil_Total Applications	61.085	80.255	108.231	101.617	94.312	95.580	94.039	99.310	95.724	104.125	121.712	112.661	125.654
Br. App.: Residents/Total	86,0%	80,1%	80,4%	83,4%	85,7%	85,6%	85,3%	83,7%	81,1%	80,6%	81,7%	83,8%	81,5%
Brazil_Total Registrations	28.692	31.202	-	20.263	17.263	-	-	17.867	32.673	128.342	60.086	-	-

Source: WIPO Statistics database. Own elaboration.

Graph 1.12: Non-residents Trademark Applications by Country of Origin

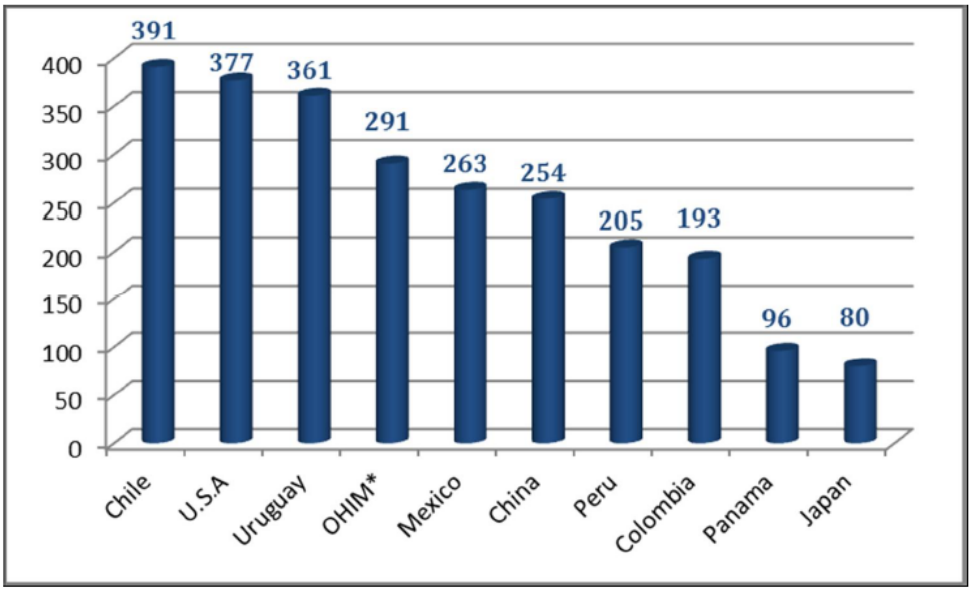


Source: WIPO Statistics database. Own elaboration.

Between 2008 and 2010, Brazilian trademark applications abroad represented 3.9% of the global total. The main receptors of these applications included not only the main international markets, such as the U.S.A., Europe and Japan, but also, and especially, China as well as Latin-American offices, such as Chile, Uruguay and Mexico.

14 Data is not available for the year 1997.

Graph 1.13: Brazilian Trademarks Applications Abroad: By Office
Average Number of Applications: 2008-2010



** Office for Harmonization in the Internal Market, i.e., Trademarks European Office*
Source: WIPO Statistics database. Own elaboration

Comparatively, in 2008, while Brazil received 21,574 trademarks from foreigners, it applied for only 3,308.

Patents and other appropriability methods of technological innovation: PINTEC database

The Brazilian Technological Innovation Survey (PINTEC/IBGE) presents information about patent applications and appropriability methods used by firms that were engaged in innovations in the country. Patent application data is available in the four versions of the survey, which cover the periods 1998-2000, 2001-2003, 2003-2005 and 2006-2008, respectively. The appropriability methods data – methods of protection utilized by firms that implemented innovation – are available only in its last three editions.

Invention patents, utility models, industrial design and copyrights are classified as formal appropriability mechanisms, while industrial secret, design complexity and lead time over competitors are named "strategic methods". The section "patents and other methods of protection" of PINTEC's Survey presents the following question: "Does the firm use any of the methods, described below, to protect the innovation in product and/or process?" Questions 163 to 167 describe the formal methods, while questions 168 to 171 focus on the strategic methods. Question 172 inquires if the firm applied for a patent in the observed period either in Brazil, abroad or both.

These questions are answered only by a sub-sample of firms that introduced product or process innovation or had an incomplete or abandoned project. For simplicity, this sub-sample is named "innovative firms" in the present report.

Monetary values, such as innovative expenditures, correspond to the last year of each survey. The sectors included in the surveys are mining and quarrying, manufacturing industries and, in the last two versions, selected services. Data are also available per region, including selected Brazilian states or per firms' size.

The Survey classifies the firms' origin of capital as national, foreign and mixed, according to the following definitions:

- National: the firm is under direct or indirect ownership of individuals or legal entities resident and domiciled in the country;

- Foreign: the firm is under direct or indirect ownership of individuals or legal entities resident and domiciled abroad; and

- National and foreign (mixed): both domestic and foreign ownership have similar shareholdings.

In all the topics, this report will present firstly the analysis of patent application, followed by the exploration of appropriability methods data. In both cases, it is concentrated on the subgroup of firms that performed innovative activities.

1.5. Sector, regional and firm size analysis based on PINTEC web site data

1.5.1 Sector Analysis

1.5.1.1. Patent Applicants

Table 3.1 presents the "propensity to patent" of innovative firms in the "mining and quarrying", manufacturing industries and services sector. The data indicate that the total percentage increased in the 2000s, reaching 7.4%, however, it is below that observed in the first PINTEC (1998-2000), in spite of all the public policies to promote technological innovation and patenting in Brazil in the last decade. Comparing the first and last survey, the recovery was driven by specific sectors such as beverages, garments, petroleum, chemicals and rubber and plastic products.

In the service sector, in which there is available information only in the last two editions of PINTEC, there was an increase in the percentage of patent applicants. But, different from what has been observed in international studies (e.g., Blind et al, 2003), the propensity to apply for a patent in the service sector is only slightly smaller than in the manufacturing industries[15].

The propensity to patent' rates, and their role in stimulating R&D performance, vary among sectors. This difference is associated with many factors, such as the technological opportunities[16] presented in each industry and the relevance of innovative activities and their appropriability on the financial returns of the firm. Besides, in sectors where a firm can easily copy new products, patents may be more important to support the necessary R&D investments. But in industries in which the reverse engineering is difficult and expensive, patents tend to be less relevant. In certain scenarios, the time gap for imitating may be long enough to ensure the financial return of the inventor, whereas in cases in which the product or process developed is easily imitable, innovation would require formal protection. It suggests a positive correlation between the speed of knowledge dissemination and patent protection.

Table 3.1 shows that, in 2006-2008, the main patent applicants' industries, on a 2 digit CNAE 1.0[17] analysis, were 'research and development services', 'machinery and equipment', 'tobacco products', 'rubber and plastic products', 'instrumentation', 'chemicals', 'computer industry' and 'other transport equipment'. Considering 3 digit sectors, the highest propensity to apply for patents also included 'beverages', 'pharmaceutical products' and 'electronic components'. On the other hand, 'textiles', 'wearing apparel', 'leather and related products' and 'products of wood' presented a small patent propensity.

In general, the technology-intensive sectors presented the highest patent propensity. But, as the data are concentrated on the percentage of firms that applied for a patent, and not the percentage of patents applied for, other factors should be considered in this analysis: i) the influence of oligopolistic industries: if there are fewer companies in certain sectors, each patent applicant firm has a higher weight; ii) especially in technology-intensive sectors, the Brazilian technological effort and patent propensity is lower than observed in developed country firms. Other hypotheses for the decrease in patenting propensity in the 2000s are the costs and the "backlog" of patenting in Brazil, which may discourage the firms' applications, and an increase in the propensity to innovate, from 32% in 2000 to 38% in 2008, which was not followed in the same magnitude by a growth in patenting propensity, which rose from 2.5% to 2.8%. The data may suggest that the growth of

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15 It has to be taken into account that PINTEC only covers some particular selection of services sectors, which are more prone to use IP than the average service sectors.

16 The likelihood of occurrence of an innovation given that some effort to make it occurs.

17 CNAE means "National Classification of Economic Activities". Its 1.0 version is based on ISIC 3.1.

Brazilian innovative efforts was mainly directed toward incremental innovations, which is not, in general, patentable.

Table 3.1: Patent Applicant Firms in Brazil

Sectors	Patent applicant firms / Innovative Firms (%)			
	1998-2000	2001-2003	2003-2005	2006-2008
Total	**8,1%**	**6,1%**	**6,1%**	**7,4%**
Mining and quarrying	2,7%	1,9%	1,7%	2,3%
Manufacturing	**8,1%**	**6,2%**	**6,2%**	**7,6%**
Food products and beverages	5,6%	4,9%	2,9%	4,7%
Food products	5,2%	4,2%	2,0%	3,2%
Beverages	9,6%	14,4%	11,7%	27,7%
Tobacco products	18,8%	18,2%	37,6%	18,3%
Textiles	2,4%	1,4%	5,5%	1,0%
Wearing apparel	0,6%	0,3%	1,3%	1,9%
Leather and related products	4,6%	3,3%	3,3%	2,5%
Wood and products of wood and cork, except furniture	6,0%	3,6%	2,3%	0,6%
Paper and paper products	11,2%	7,0%	5,0%	5,7%
Pulp	17,9%	22,2%	6,7%	10,6%
Paper and paper products	11,0%	6,7%	4,9%	5,7%
Publishing, printing and reproduction of recorded media	2,2%	5,3%	1,6%	3,7%
Coke, refined petroleum products and nuclear fuel	2,2%	4,6%	2,4%	5,9%
Coke, alcohol, nuclear fuel	-	-	-	2,6%
Refined petroleum products	8,0%	12,0%	5,3%	12,5%
Chemicals and chemical products	11,5%	13,8%	9,2%	13,6%
Chemical products	10,4%	14,0%	9,4%	13,4%
Pharmaceutical products	16,3%	13,3%	8,4%	14,6%
Rubber and plastics products	13,4%	5,9%	10,7%	15,8%
Other non-metallic mineral products	5,8%	2,1%	1,9%	3,9%
Basic metals	7,7%	8,0%	10,3%	6,0%
Basic iron and steel	14,3%	12,9%	23,4%	9,2%
Non-ferrous metals	6,2%	5,9%	7,2%	4,5%
Fabricated metal products, except machinery and equipment	7,8%	6,6%	3,8%	7,7%
Machinery and equipment n.e.c.	22,0%	15,1%	16,6%	23,9%
Office, accounting and computing machinery	14,5%	15,0%	15,5%	12,6%
Electrical machinery and apparatus n.e.c.	9,1%	11,4%	11,6%	8,5%
Radio, television and communication equipment and apparatus	12,3%	10,7%	10,2%	9,1%
Medical, precision and optical instruments, watches and clocks	14,8%	20,9%	16,5%	15,3%
Motor vehicles, trailers and semi-trailers	14,1%	9,7%	11,1%	9,4%
Other transport equipment	11,3%	3,3%	1,8%	10,4%
Furniture; manufacturing n.e.c.	7,0%	5,2%	6,7%	5,9%
Recycling	-	-	18,0%	0,0%
Services	-	-	**5,4%**	**6,0%**
Telecom		-	2,8%	5,7%
Computer and related activities		-	4,5%	5,1%
Research and development		-	61,0%	56,4%

Source: PINTEC/IBGE. Own elaboration.

Table 3.2: Sector distribution of Innovative Firms and Patent Applicant Firms

Sectors	Sectoral Share			
	(2003-2005)		(2006-2008)	
	Innovative Firms	Patent Applicants' Firms	Innovative Firms	Patent Applicants' Firms
Total	**100,0%**	**100,0%**	**100,0%**	**100,0%**
Mining and quarrying	**1,3%**	**0,4%**	**1,2%**	**0,4%**
Manufacturing	**91,3%**	**93,1%**	**93,1%**	**95,0%**
Food products and beverages	11,5%	5,4%	11,6%	7,4%
Food products	10,5%	3,5%	10,9%	4,6%
Beverages	1,0%	1,9%	0,7%	2,8%
Tobacco products	0,1%	0,3%	0,0%	0,1%
Textiles	4,2%	3,8%	3,5%	0,5%
Wearing apparel	10,4%	2,3%	13,1%	3,3%
Leather and related products	4,5%	2,5%	4,6%	1,5%
Wood and products of wood and cork	4,4%	1,7%	3,0%	0,2%
Paper and paper products	1,7%	1,4%	1,8%	1,4%
Pulp	0,0%	0,0%	0,02%	0,03%
Paper and paper products	1,7%	1,4%	1,8%	1,4%
Publishing, printing	4,4%	1,2%	4,6%	2,3%
Coke, refined petroleum products and nuclear fuel	0,3%	0,1%	0,3%	0,2%
Coke, alcohol, nuclear fuel	-	-	0,2%	0,1%
Refined petroleum products	0,1%	0,1%	0,1%	0,2%
Chemicals and chemical products	5,8%	8,8%	5,4%	9,9%
Chemical products	4,8%	7,4%	4,6%	8,4%
Pharmaceutical products	1,0%	1,4%	0,8%	1,5%
Rubber and plastics products	5,5%	9,7%	5,7%	12,1%
Other non-metallic mineral products	4,7%	1,5%	6,4%	3,4%
Basic metals	2,1%	3,5%	1,6%	1,3%
Basic iron and steel	0,4%	1,5%	0,5%	0,7%
Non-ferrous metals	1,7%	2,0%	1,1%	0,7%
Fabricated metal products	8,1%	5,0%	9,7%	10,1%
Machinery and equipment n.e.c.	7,0%	19,0%	7,8%	25,1%
Office, accounting and computing machinery	0,4%	1,1%	0,3%	0,5%
Electrical machinery and apparatus n.e.c.	2,6%	5,1%	2,3%	2,7%
Radio, television and communication equipment and apparatus	1,1%	1,9%	0,9%	1,1%
Medical instruments, watches and clocks	1,9%	5,2%	1,6%	3,3%
Motor vehicles, trailers and semi-trailers	2,5%	4,6%	2,6%	3,3%
Other transport equipment	0,6%	0,2%	0,5%	0,7%
Furniture; manufacturing n.e.c.	7,0%	7,8%	5,7%	4,5%
Recycling	0,3%	1,0%	0,1%	0,0%
Services	**7,4%**	**6,5%**	**5,7%**	**4,6%**
Telecom	0,5%	0,3%	0,8%	0,6%
Computer and related activities	6,7%	5,0%	4,8%	3,3%
Research and development	0,1%	1,3%	0,1%	0,7%

Source: PINTEC/IBGE. Own elaboration.

Table 3.2 shows the sector distribution of innovative and patent applicants' firms in the last surveys[18]. It indicates that in 2006-2008, some sectors were more representative among patenting applicants than in innovative firm group, such as 'machinery and equipment', 'rubber and plastic products' and 'chemical products'. The opposite scenario is seen in 'wearing apparel' and 'food products'. It was also possible to observe a fall in the services share compensated by a growth in the manufacturing sector share among innovative and patenting firms.

Graph 3.1 presents the sector share of innovative and patent applicant firms according to the OECD classification of manufacturing industries into categories based on technological intensities[19]. It classifies the industries as high technology, medium-high technology, medium-low technology and low technology, as follows:

- High-technology industries: i) aircraft and spacecraft; ii) pharmaceuticals; iii) office, accounting and computing machinery; iv) radio, TV and communications equipment; v) medical, precision and optical instruments.

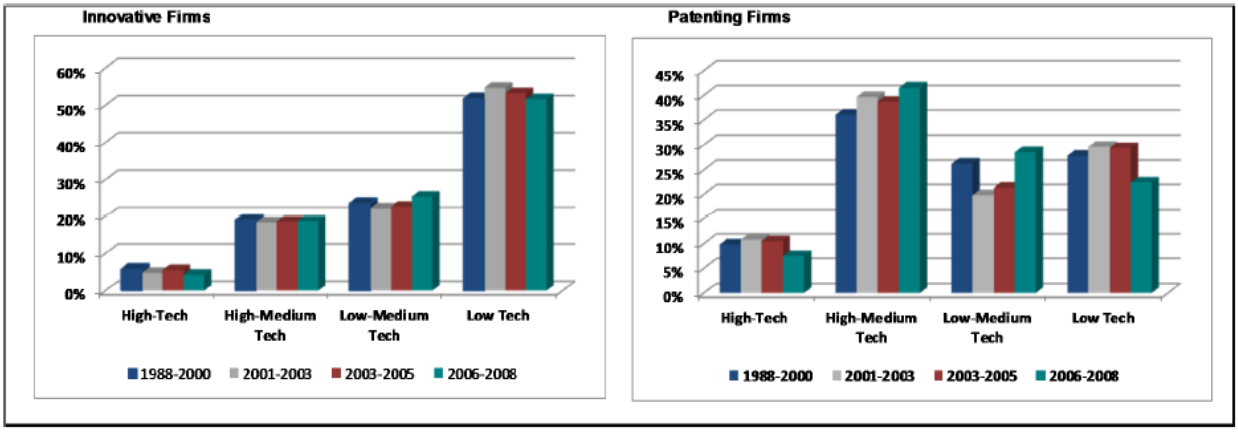
- Medium-high-technology industries: i) electrical machinery and apparatus; ii) motor vehicles, trailers and semi-trailers; iii) chemicals excluding pharmaceuticals; iv) railroad equipment and transport equipment; v) machinery and equipment.·

- Medium-low-technology industries: i) building and repairing of ships and boats; ii) rubber and plastics products; iii) coke, refined petroleum products and nuclear fuel; iv) other non-metallic mineral products; v) basic metals and fabricated metal products.

- Low-technology industries: i) manufacturing n.e.c., recycling; ii) wood, pulp, paper, paper products, printing and publishing; iii) food products, beverages and tobacco; iv) textiles, textile products, leather and footwear.

Regarding this methodology, the only difference is that the sector "others transport equipment", which includes "aircraft"; "building and repairing of ships and boats" and "railroad equipment and transport equipment" were fully classified as "high-tech industries", because the disaggregated data were not available.

Graph 3.1: Innovative and Patent Applicants' Firms by Technology Intensity



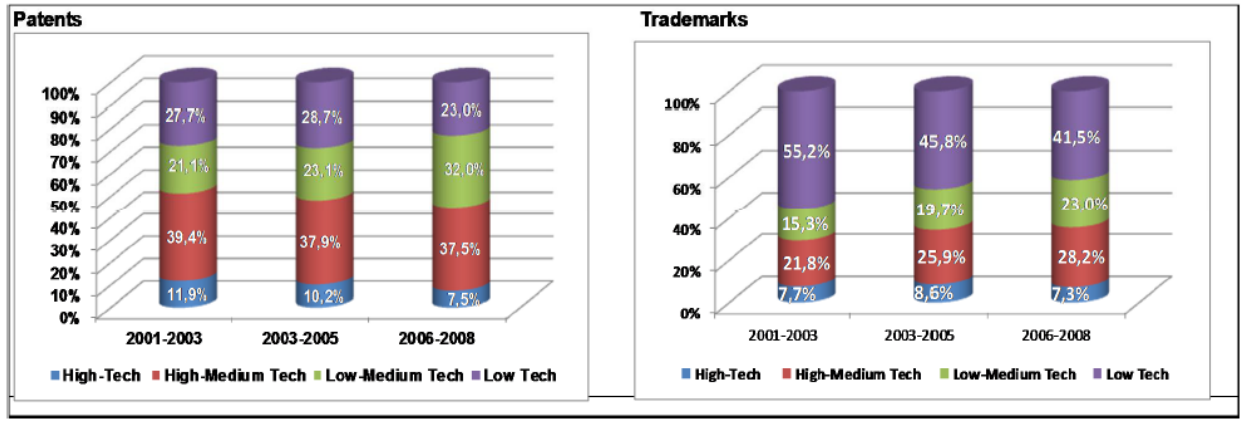
Source: PINTEC/IBGE. Own elaboration.

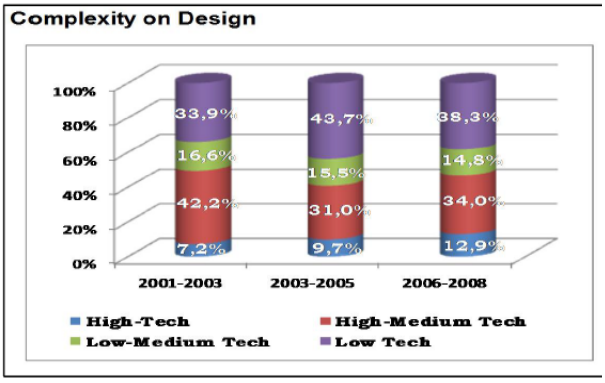
18 The first surveys were not included because service sector was not available.

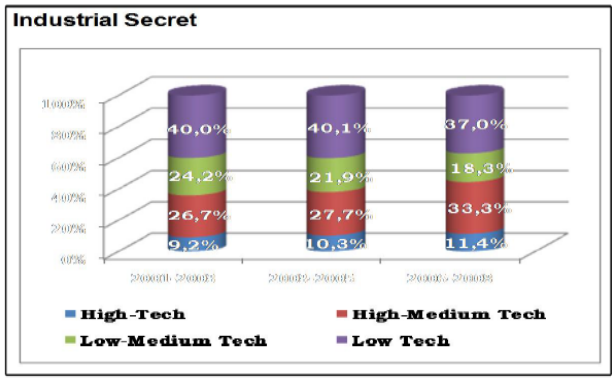
19 http://www.oecd.org/sti/industryandglobalisation/48350231.pdf.

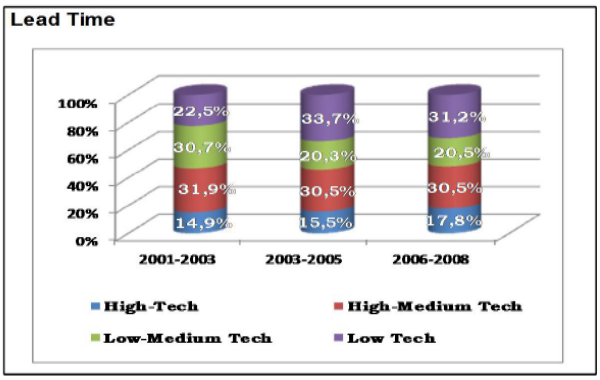
The graph indicates that low-technology industries are the most representative group of innovative firms in Brazil. Among the group of firms that applied for patents, high-medium tech is the most expressive group in Brazil, especially "chemical products" and "machinery and equipment"[20]. High-tech industries are, in both groups, the least representative category.

Graph 3.2: Methods of Protection by OECD Classification









Source: PINTEC/IBGE. Own elaboration.

1.5.1.2. Appropriability Methods

Graph 3.2 presents the OECD technological classification in each formal and strategic appropriability method. In all categories and periods, except patents and lead time (2001-2003), low-tech industries were the main users of protection methods, especially in the case of

[20] Some sectors can be poorly represented among patenting firms but may have high participation in patent applications.

trademarks[21]. In the case of patents, medium-high technology industries were the most significant users, and the most expressive growth was observed in the low-medium-technology industry share, which rose from 21% to 32%, boosted by "rubber and plastic products".

It is also important to mention that high-technology industries lost participation in the formal methods of protection (patents and trademarks) category, while their share increased in strategic methods, during the observed periods.

Table 3.3: Appropriability Methods Utilized by Innovative Firms (2006-2008)

Sectors	Appropriability Methods /Innovative Firms					
	Patents	Trademarks	Design Complexity	Industrial Secret	Lead Time over Competitors	Others
Total	**9,2%**	**25,2%**	**1,9%**	**8,5%**	**2,1%**	**6,3%**
Mining and quarrying	**2,5%**	**40,1%**	**1,3%**	**4,4%**	**1,0%**	**3,9%**
Manufacturing	**9,4%**	**24,1%**	**1,6%**	**8,6%**	**2,1%**	**5,4%**
Food products and beverages	4,2%	25,2%	1,3%	10,8%	2,0%	5,2%
Food products	2,5%	22,0%	1,2%	9,2%	2,0%	3,9%
Beverages	29,6%	72,4%	3,5%	35,3%	3,1%	23,7%
Tobacco products	12,2%	45,2%	0,0%	18,3%	25,8%	6,1%
Textiles	2,1%	25,6%	0,3%	5,1%	2,2%	1,9%
Wearing apparel	2,9%	13,1%	0,4%	3,0%	0,2%	2,8%
Leather and related products	4,4%	27,2%	1,1%	3,4%	0,9%	1,0%
Wood and products of wood and cork, except furniture	1,3%	9,5%	0,1%	1,3%	1,5%	7,4%
Paper and paper products	11,1%	36,5%	1,2%	6,5%	2,4%	2,7%
Pulp	31,8%	53,0%	0,0%	31,8%	10,6%	0,0%
Paper and paper products	10,9%	36,3%	1,2%	6,2%	2,3%	2,7%
Publishing, printing and reproduction of recorded media	3,6%	12,7%	0,4%	5,7%	0,6%	11,2%
Coke, refined petroleum products and nuclear fuel	6,3%	18,0%	2,0%	10,6%	2,0%	2,0%
Coke, alcohol, nuclear fuel	1,3%	7,9%	1,3%	5,3%	1,3%	0,0%
Refined petroleum products	16,5%	38,5%	3,3%	21,2%	3,3%	6,0%
Chemicals and chemical products	16,1%	50,6%	2,2%	24,6%	5,6%	12,0%
Chemical products	15,9%	47,1%	1,7%	23,6%	3,8%	11,4%
Pharmaceutical products	17,5%	71,6%	5,6%	31,0%	17,0%	15,6%
Rubber and plastics products	20,1%	33,2%	1,4%	8,8%	2,1%	7,1%
Other non-metallic mineral products	4,2%	12,1%	0,5%	4,8%	0,9%	4,4%
Basic metals	19,6%	25,6%	1,4%	7,6%	4,5%	3,9%
Basic iron and steel	45,5%	48,5%	2,1%	9,5%	11,6%	7,4%
Non-ferrous metals	7,0%	14,4%	1,0%	6,6%	1,0%	2,3%
Fabricated metal products, except machinery and equipment	11,0%	20,8%	0,9%	5,2%	1,5%	8,2%
Machinery and equipment n.e.c.	24,5%	32,6%	3,2%	11,7%	2,6%	2,8%
Office, accounting and computing machinery	16,7%	38,1%	7,5%	12,6%	11,7%	10,2%
Electrical machinery and apparatus	14,1%	33,2%	4,0%	18,7%	4,1%	4,7%
Radio, television and communication equipment and apparatus	19,2%	25,6%	6,4%	11,5%	9,4%	5,4%
Others	26,4%	42,2%	10,9%	15,8%	15,1%	7,4%
Medical, precision and optical instruments, watches and clocks	14,7%	41,7%	3,7%	29,6%	5,1%	15,3%
Motor vehicles, trailers and semi-trailers	12,4%	32,3%	3,7%	8,2%	4,8%	4,1%
Other transport equipment	14,2%	19,7%	2,9%	11,4%	4,2%	6,7%
Furniture; manufacturing n.e.c.	8,3%	15,6%	4,2%	8,2%	1,7%	1,8%
Recycling	0,0%	48,8%	21,8%	50,6%	0,0%	24,0%
Services	**6,2%**	**39,6%**	**5,8%**	**7,8%**	**2,5%**	**22,0%**
Telecom	5,9%	43,2%	3,9%	8,6%	2,4%	6,2%
Computer and related activities	5,2%	39,0%	6,1%	7,2%	2,3%	24,1%
Research and development	61,5%	38,5%	7,7%	30,8%	15,4%	53,8%

Source: PINTEC/IBGE. Own elaboration.

[21] In a study of Canadian manufacturing firms, Hanel (2005) also observed that low-tech sectors rely more on trademarks.

Table 3.3 reveals that trademarks appeared as the main mechanism of appropriability utilized by Brazilian firms in most sectors. In the case of manufacturing industry, “patents” appear as the second most important method; in the service sector, the second place is occupied by "other" protection methods (which includes copyrights), followed by trade secrets. In the extractive industry, patents occupy just the fourth place in the ranking.

Comparing these results with the reviewed international literature, Brazilian data presents a higher importance of patents, compared to a smaller relevance of lead time among appropriability methods. In the first case, “patents” data presented at the PINTEC web site include not only invention patents, but also utility models and industrial designs, which jointly enlarge the number of users[22].

1.5.2 Regional Analysis

1.5.2.1. Patent Applicants

The regional data indicates that the economic and innovative structures, measured by the number of total firms, innovative firms and patent applicants’ firms, are strongly concentrated in the Southeast of Brazil, which absorbed 54.1% of total enterprises and 61.3% of patent applicant’ firms, according to the last PINTEC (table 3.4). This region lost participation in Brazilian economic and innovative structure along the analyzed periods, but in the case of patent applicants, in 2006-2008 it recovered the same percentage as in the first PINTEC. This recovery was pushed by Rio de Janeiro state, whose share achieved 5.7%.

Table 3.4: Regional Participation of Brazilian Firms:

a) Total

Regions	Regional Share			
	1998-2000	2001-2003	2003-2005	2006-2008
Brazil	**100,0%**	**100,0%**	**100,0%**	**100,0%**
North	**2,7%**	**3,0%**	**3,2%**	**3,4%**
Amazonas	0,6%	0,6%	0,6%	0,7%
Pará	1,0%	1,3%	1,4%	1,6%
Northeast	**9,4%**	**9,7%**	**10,0%**	**10,6%**
Ceará	2,0%	2,1%	2,2%	2,1%
Pernambuco	2,0%	2,0%	2,1%	2,3%
Bahia	2,1%	2,3%	2,4%	3,0%
Southeast	**57,6%**	**55,7%**	**55,0%**	**54,1%**
Minas Gerais	11,5%	11,9%	11,9%	12,5%
Espírito Santo	2,7%	2,1%	2,2%	2,7%
Rio de Janeiro	6,5%	6,5%	5,8%	5,2%
São Paulo	36,9%	35,2%	35,1%	33,8%
South	**25,7%**	**26,4%**	**26,6%**	**26,0%**
Paraná	8,4%	8,4%	8,6%	8,5%
Santa Catarina	7,3%	8,2%	8,3%	8,4%
Rio Grande do Sul	10,0%	9,8%	9,7%	9,1%
Midwest	**4,5%**	**5,2%**	**5,2%**	**5,8%**
Goiás	1,9%	2,6%	2,6%	3,3%

[22] According to Alessandro Pinheiro, manager of Pintec. In future researches, it is possible to disaggregate invention patents, utility models and industrial designs through Pintec microdata.

Goiás state presented the most significant growth among patenting firms, from 0.3%, in 1998-2000, to 5.9%, in 2006-2008. A relevant growth was also observed in the case of Pará[23]. This growth was counterbalanced by loss in the South region, especially in Rio Grande do Sul state, whose share of patent applicants decreased from 16.0% to 9.4% between the surveys.

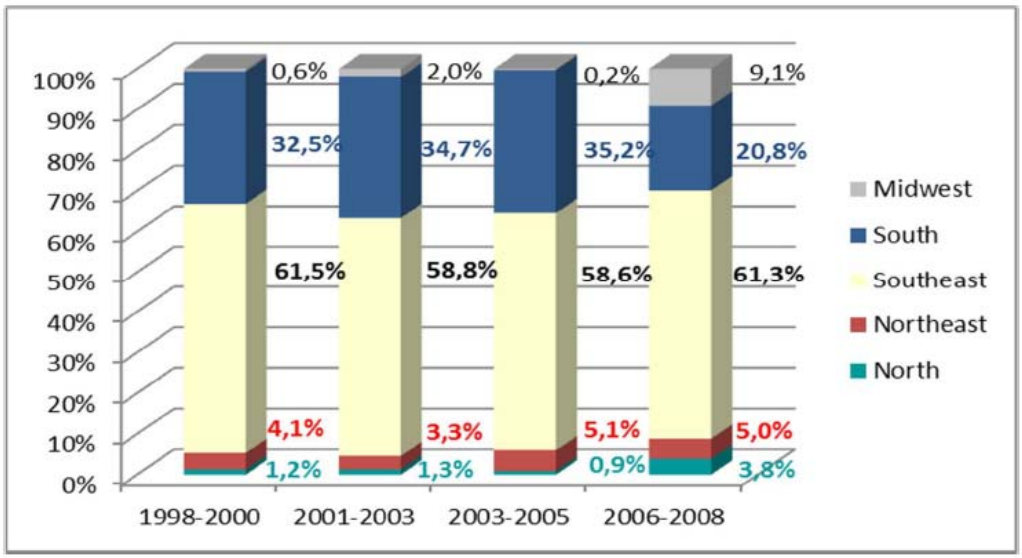
b) Innovative and Patent Applicants

Regions	Regional Share							
	1998-2000		2001-2003		2003-2005		2006-2008	
	Innovative Firms	Patent Applicants' Firms	Innovative Firms	Patent Applicants' Firms	Innovative Firms	Patent Applicants' Firms	Innovative Firms	Patent Applicants' Firms
Brazil	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**
North	**2,6%**	**1,2%**	**3,1%**	**1,3%**	**3,1%**	**0,9%**	**3,2%**	**3,8%**
Amazonas	1,0%	0,7%	0,7%	0,8%	1,0%	0,8%	1,2%	1,1%
Pará	0,5%	0,4%	1,3%	0,3%	1,4%	0,1%	1,1%	2,7%
Northeast	**9,3%**	**4,1%**	**9,5%**	**3,3%**	**9,6%**	**5,1%**	**9,4%**	**5,0%**
Ceará	2,2%	2,9%	2,2%	0,4%	1,7%	1,7%	2,2%	1,0%
Pernambuco	2,1%	0,4%	1,7%	0,6%	2,3%	1,1%	1,9%	0,5%
Bahia	2,0%	0,3%	2,3%	0,1%	2,1%	0,8%	2,8%	3,1%
Southeast	**55,7%**	**61,5%**	**52,5%**	**58,8%**	**52,8%**	**58,6%**	**52,9%**	**61,3%**
Minas Gerais	10,1%	5,5%	12,5%	8,6%	10,5%	6,8%	13,6%	9,2%
Espírito Santo	2,1%	0,2%	2,3%	0,7%	2,4%	1,3%	2,5%	0,5%
Rio de Janeiro	5,3%	4,5%	4,9%	3,4%	4,5%	2,9%	4,5%	5,7%
São Paulo	38,2%	51,3%	32,8%	46,1%	35,3%	47,5%	32,3%	46,0%
South	**28,0%**	**32,5%**	**29,9%**	**34,7%**	**29,7%**	**35,2%**	**28,4%**	**20,8%**
Paraná	8,3%	7,5%	9,3%	8,7%	10,4%	11,3%	9,5%	6,6%
Santa Catarina	9,0%	9,1%	8,8%	8,9%	8,7%	5,8%	8,4%	4,8%
Rio Grande do Sul	10,6%	16,0%	11,8%	17,0%	10,6%	18,0%	10,5%	9,4%
Midwest	**4,4%**	**0,6%**	**5,0%**	**2,0%**	**4,8%**	**0,2%**	**6,0%**	**9,1%**
Goiás	2,0%	0,3%	2,6%	0,5%	2,1%	0,2%	3,3%	5,9%

Source: PINTEC/IBGE. Own elaboration

The graph 3.3 shows the regional share of patent applicants' firms included in the table above.

Graph 3.3: Percentage of Patent Applicants' Firms per Region



Source: PINTEC/IBGE. Own elaboration

[23] According to Pintec (2005), wood product industry concentrated 44.7% of Pará firms, followed by food industries (13.3%).

The regional analysis can also be done by observing the percentage of patent applicants among innovative firms (table 3.5). The most recent PINTEC data suggested that the propensity to patent in the North, led by the state of Pará, was as strong as in the Southeast. In the Midwest, this propensity was even more intense. Therefore, the concentration of patenting firms in the Southeast shown in graph 3.3 above is more driven by the significant presence of total and innovative firms than by a specific patent bias in the region.

Data also shows an increase in Brazilian total patent propensity, but this growth was not sufficient to reach the percentage achieved in 1998-2000 period. The expressive propensity to apply for patents seen in firms from the North and Midwest could not compensate for the reduction in percentages observed in the South of Brazil.

Table 3.5: Patent Propensity per Region

Regions	Patent Applicant Firms / Innovative Firms			
	1998-2000	2001-2003	2003-2005	2006-2008
Brazil	**8,1%**	**6,1%**	**6,1%**	**7,3%**
North	**3,8%**	**2,5%**	**1,8%**	**8,7%**
Amazonas	5,5%	6,7%	5,3%	7,1%
Pará	5,8%	1,5%	0,3%	17,5%
Northeast	**3,5%**	**2,1%**	**3,3%**	**3,8%**
Ceará	10,2%	1,1%	5,9%	3,3%
Pernambuco	1,5%	2,0%	3,1%	1,9%
Bahia	1,2%	0,3%	2,3%	7,9%
Southeast	**8,9%**	**6,9%**	**6,8%**	**8,5%**
Minas Gerais	4,3%	4,2%	3,9%	4,9%
Espírito Santo	1,0%	1,9%	3,4%	1,4%
Rio de Janeiro	6,7%	4,2%	3,9%	9,3%
São Paulo	10,8%	8,6%	8,2%	10,4%
South	**9,4%**	**7,1%**	**7,2%**	**5,4%**
Paraná	7,2%	5,8%	6,7%	5,1%
Santa Catarina	8,1%	6,2%	4,1%	4,2%
Rio Grande do Sul	12,1%	8,9%	10,4%	6,5%
Midwest	**1,2%**	**2,5%**	**0,3%**	**11,0%**
Goiás	1,3%	1,2%	0,5%	13,1%

Source: PINTEC/IBGE. Own elaboration

1.5.2.2. Appropriability Methods

It is also possible to evaluate the use of appropriability methods in Brazilian regions. As already shown, trademarks have been the most utilized method, followed by patents – which, as mentioned, include industrial designs - and industrial secrets. Design complexity and lead time over competitors were rarely employed by Brazilian firms.

São Paulo's firms present the highest propensity to use all appropriability methods (table 3.6).

Table 3.6: Propensity to Use Appropriability Methods: by Region (2006-2008)

Regions	Patents	Trademarks	Complexity on Design	Industrial Secret	Lead Time over Competidors	Others
Brazil	**9,1%**	**24,3%**	**1,6%**	**8,7%**	**2,1%**	**4,9%**
North	**3,4%**	**16,7%**	**1,0%**	**16,7%**	**1,8%**	**3,2%**
Amazonas	9,1%	18,5%	1,4%	10,0%	3,9%	4,2%
Pará	0,2%	22,2%	0,5%	29,8%	0,5%	3,1%
Northeast	**4,4%**	**25,3%**	**1,1%**	**5,6%**	**1,5%**	**3,7%**
Ceará	4,1%	22,6%	2,9%	6,5%	1,6%	2,2%
Pernambuco	2,3%	15,0%	0,8%	5,5%	1,4%	10,6%
Bahia	8,9%	33,4%	0,7%	7,0%	1,8%	2,8%
Southeast	**10,9%**	**26,5%**	**1,9%**	**9,3%**	**2,5%**	**4,9%**
Minas Gerais	6,0%	21,1%	0,8%	3,8%	1,1%	3,1%
Espírito Santo	2,6%	25,8%	0,4%	2,2%	0,5%	1,4%
Rio de Janeiro	6,0%	18,3%	1,1%	5,2%	2,6%	2,5%
São Paulo	14,3%	30,0%	2,7%	12,7%	3,2%	6,3%
South	**8,0%**	**22,1%**	**1,3%**	**7,9%**	**2,0%**	**4,7%**
Paraná	6,3%	20,0%	1,3%	6,6%	1,6%	2,6%
Santa Catarina	8,6%	21,7%	1,3%	9,1%	1,8%	3,6%
Rio Grande do Sul	9,2%	24,4%	1,4%	8,1%	2,4%	7,4%
Midwest	**8,1%**	**18,1%**	**1,2%**	**7,8%**	**0,9%**	**9,3%**
Goiás	13,8%	24,0%	1,5%	12,0%	1,1%	6,1%

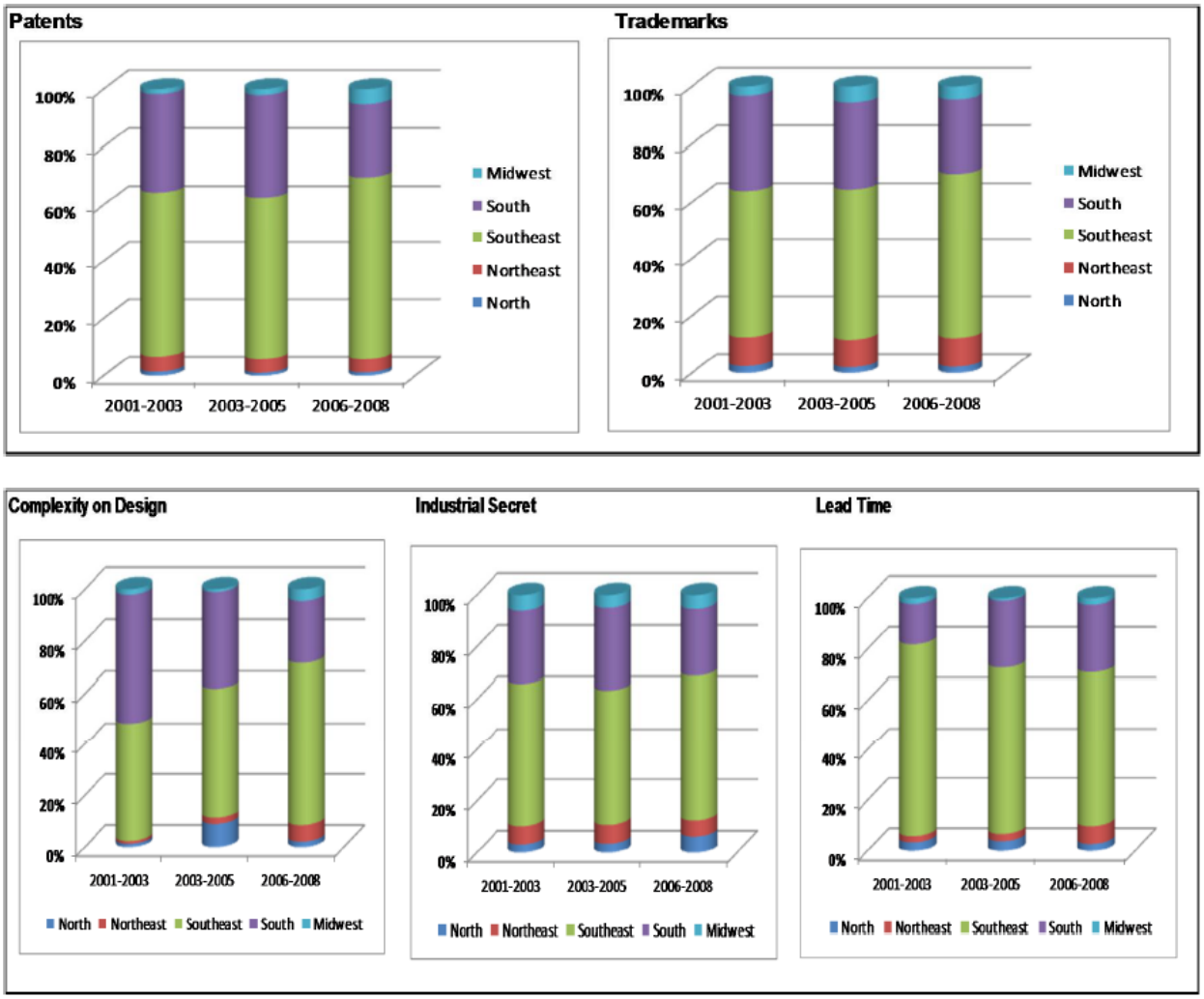
Source: PINTEC/IBGE. Own elaboration

Graph 3.4 presents the evolution of the regions' share with each appropriability method. In the case of patent users, the same logic of patent applicants already shown was maintained: a growing presence of the Midwest, propelled by Goias state, and a fall in the users from the South.

Midwest representativeness also grew in the use of trademarks (from 3.2% to 4.5%) and complexity of design (from 2.0% to 4.6%). On the other hand, the South's participation among Brazilian regions felt in all appropriability methods analyzed, except in the "lead time over competitors", for which its share increased from 15.8%, in 2001- 2003, to 26.5% in 2006-2008. It is interesting to note that the South region is not losing presence among total and innovative firms in Brazil in the last years, but exclusively amidst the users of patent and other appropriability methods.

The Northeast stands out for its proportionately increased use of informal methods of protection. Its presence increased in the use of "complexity of design" and "lead time over competitors".

Graph 3.4: Appropriability Methods: Percentage of Users per Region



Source: PINTEC/IBGE. Own elaboration

1.5.3 Firm size analysis

1.5.3.1. Patent Applicants

Table 3.6 shows the distribution of patent applicants by firm size, comparing them to total and innovative firms. In all cases, smallest firms represent the main group, but their presence is less relevant among patent applicants.

Table 3.6 Sector Distribution by Firm Size: Total, Innovative Firms and Patent Applicants (2006-2008)

	Total Firms	Innovative Firms	Patent Applicant Firms
Total	**106.862**	**41.262**	**2.968**
10 to 29	64,6%	62,6%	52,5%
30 to 49	15,3%	14,1%	9,9%
50 to 99	10,9%	11,4%	10,8%
100 to 244	5,6%	6,4%	9,9%
250 to 249	1,9%	2,4%	4,9%
500 or more	1,7%	3,1%	12,0%
Manufacturing Industry and Mining and Quarrying	**100.496**	**38.299**	**2.794**
10 to 29	64,2%	62,1%	53,0%
30 to 49	15,6%	14,4%	9,2%
50 to 99	11,0%	11,6%	11,0%
100 to 244	5,7%	6,4%	10,0%
250 to 249	1,9%	2,4%	4,9%
500 or more	1,7%	3,1%	11,9%
Services	**6.366**	**2.963**	**174**
10 to 29	71,1%	69,6%	44,3%
30 to 49	10,7%	10,7%	21,0%
50 to 99	9,7%	8,6%	8,6%
100 to 244	4,6%	5,5%	9,2%
250 to 249	1,7%	2,2%	4,1%
500 or more	2,3%	3,4%	12,8%

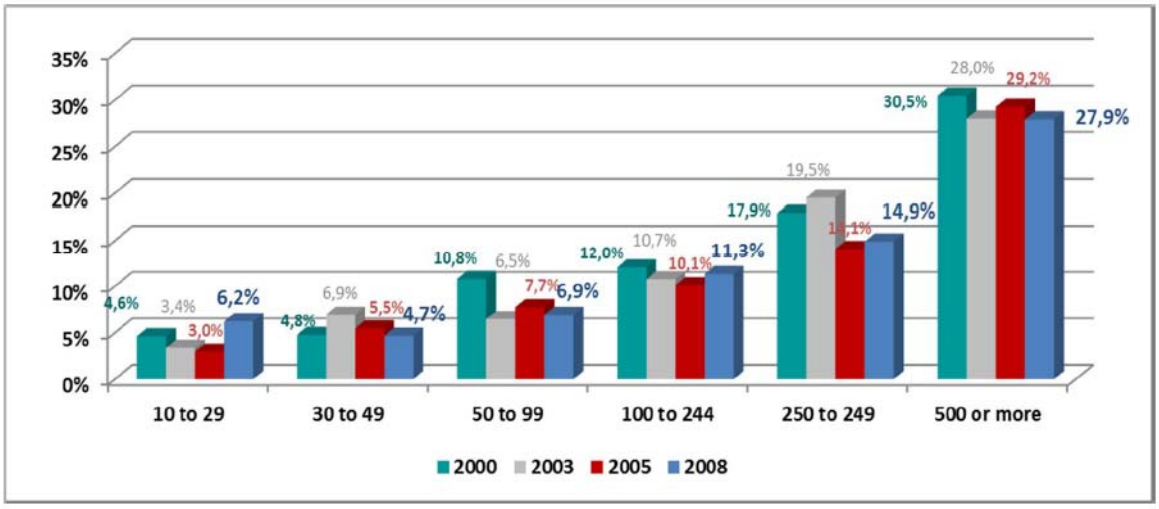
Source: PINTEC/IBGE. Own elaboration

Graph 3.5 presents the percentage of innovative firms that applied for a patent, based on the PINTEC classification of firms' size by number of employees. It includes only the "manufacturing industry" and "mining and quarrying", because service sectors were not available in the first reports. Furthermore, the 2006-2008 data is based on CNAE 2.0, while the other years are based on the 1.0 version of this sector classification, which implies some sector differences in the analysis[24].

As documented by international literature, the data show a positive relation between the firms' size and patent propensity. Smaller firms, from 10 to 29 employees, presented the most significant growth in patent propensity of all groups. In all the other groups of firms, it is noted a maintenance or decrease in the propensity to apply for a patent among innovative firms.

[24] For a comparison between CNAE 1.0 and 2.0, see: www.cnae.ibge.gov.br.

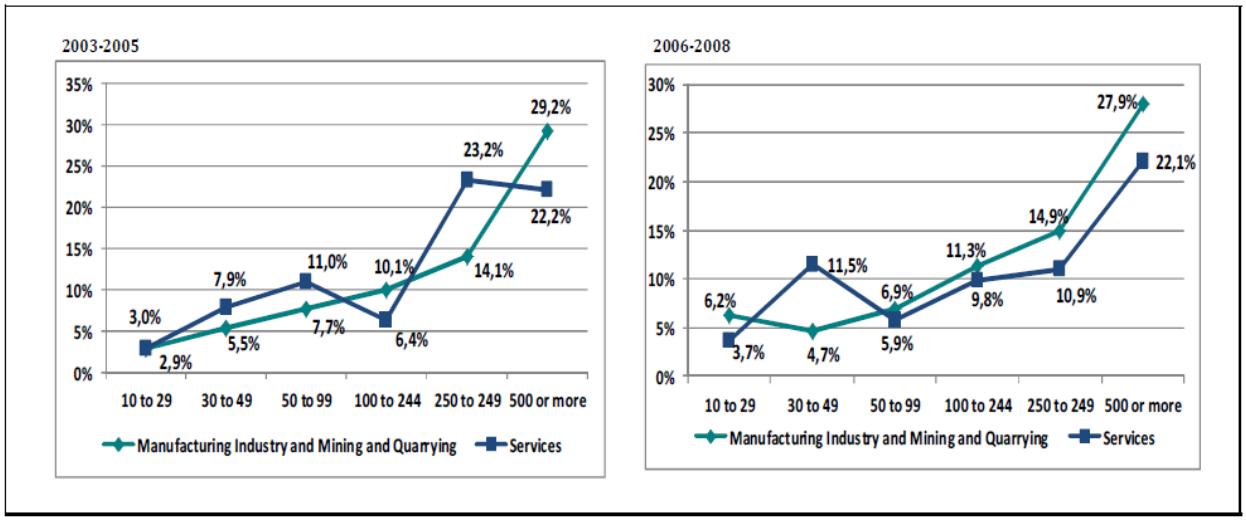
Graph 3.5: Patent Propensity by Firm Size



Source: PINTEC/IBGE. Own elaboration

The patent propensity per firms' size in the services sector was evaluated in graph 6. Although occasional exceptions can be identified, also noted is a positive correlation between size and patent propensity.

Graph 3.6: Patent Propensity by Firm Size: A Comparison Including the Services Sector



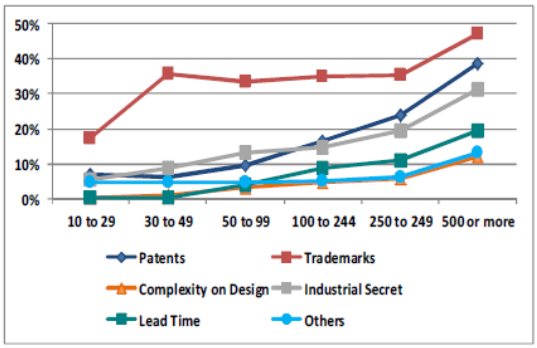
Source: PINTEC/IBGE. Own elaboration.

Complementarily, graph 3.7 presents the propensity to use of appropriability methods, per firms' size, in 2006-2008. Firstly, the propensity to use patent and industrial secrets is stronger in the manufacturing sector, compared to services. The opposite is observed in trademarks, design complexity and, especially, others – which includes copyrights. In these cases, the services sector appears as a more intensive user of protection methods, which helps to demystify the idea that innovative activities are mainly concentrated in the industrial segment. It seems more accurate to say that services and manufacturing sectors perform different kinds of innovative activities and, consequently, the intensity with which they use each appropriability method is not the same.

Secondly, in manufacturing industries, the positive correlation between firms' size and all appropriability methods is evidenced. But in the services sector, this correlation is weaker in the case of 'trademarks' and 'design complexity.

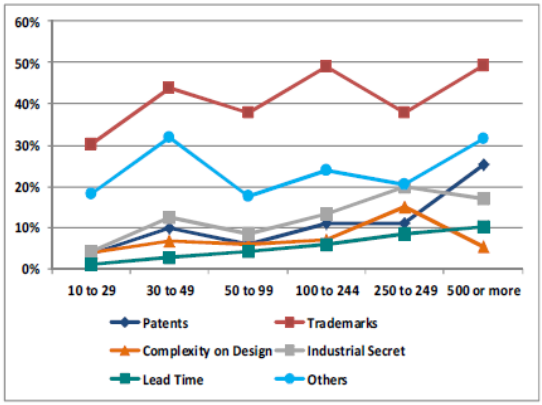
Graph 3.7: Propensity to Use Appropriability Methods per Firm Size (2006-2008)

Manufacturing Industry and Mining and Quarrying



	Patents	Trademarks	Design Complexity	Industrial Secret	Lead Time	Others
Total	**9,1%**	**24,3%**	**1,6%**	**8,7%**	**2,1%**	**4,9%**
10 to 29	6,7%	17,3%	0,4%	5,6%	0,3%	4,6%
30 to 49	6,3%	35,6%	1,1%	8,8%	0,4%	4,5%
50 to 99	9,6%	33,6%	3,1%	13,3%	4,1%	4,8%
100 to 244	16,6%	34,9%	4,7%	14,8%	8,6%	5,0%
250 to 249	24,0%	35,3%	6,0%	19,6%	10,9%	6,0%
500 or more	38,8%	47,1%	12,0%	31,3%	19,3%	13,2%

Services



	Patents	Trademarks	Design Complexity	Industrial Secret	Lead Time	Others
Total	**5,9%**	**34,2%**	**4,9%**	**6,7%**	**2,2%**	**20,4%**
10 to 29	3,8%	30,3%	4,0%	4,1%	1,0%	18,1%
30 to 49	9,9%	43,8%	6,7%	12,3%	2,7%	31,8%
50 to 99	5,8%	37,9%	6,0%	8,5%	4,2%	17,7%
100 to 244	11,1%	48,9%	7,1%	13,4%	5,8%	24,0%
250 to 249	10,9%	38,0%	14,9%	20,0%	8,3%	20,5%
500 or more	25,3%	49,2%	5,3%	17,0%	10,3%	31,6%

Source: PINTEC/IBGE. Own elaboration.

1.6. Patents and other appropriability methods: descriptive statistics based on microdata

The international literature has already shown relevant differences between the firms that protect their innovations and those that do not use any of these methods of appropriability. They represent distinct universes of firms. In general, firms of the former group are larger (considering average revenue or number of employees) and more intensive in foreign trade. They also present higher R&D efforts and incorporate more skilled workers (measured by the presence of engineers and master's and PhD employees). But this correlation does not imply a causality relation between the appropriability of innovative outputs and the mentioned variables. A patent grant may boost the firms' growth as well as their participation in foreign trade. But the causality may be reversed: larger firms have more resources to invest in R&D and thereby to apply for a patent.

In Brazil, we can infer a correlation between size, foreign trade participation, R&D effort, presence of qualified workers and the use of patents and other appropriability methods.

The following statistical analysis is mainly based on PINTECs' information. But in this section, the examined data is not available at the web site; it was obtained through the analysis and extraction of PINTEC microdata[25], which in some cases was associated with other databases, such as the financial incentives data provided by public institutions.

[25] Available only at IBGEs safe room.

1.6.1 Characterization of firms

The following table presents the characterization of "innovative firms" according to their revenue, investment, exports and imports. Regarding R&D data, the table shows R&D expenditures per revenue - a traditional variable of 'technological effort' - and average R&D expenditures. Finally, with respect to the labor force, it presents the average number of employees, engineers and master's and PhD workers, as well as the percentage of engineers in the total number of employees. The latter data indicate the average qualification of the firms' workforce[26] (table 3.7).

Table 3.7: Characterization of "Innovative Firms"

Innovative Firms	2001-2003	2003-2005	2006-2008
National Firms	29.155	33.631	42.364
Foreign Firms	978	1.159	1.279
National and Foreign Firms	218	205	362
Total Revenue per Firm (1000 US$)	9.387,6	15.613,2	16.897,6
Investiment per Firm (1000 US$)	544,5	828,1	1.091,0
Export (average value per firm) (1000 US$)	4.879,3	2.659,9	1.787,9
Import (average value per firm) (1000 US$)	3.217,2	1.624,1	1.099,5
Exporting Firms (%)	17,8%	17,8%	11,3%
Importing Firms (%)	16,4%	17,7%	11,6%
R&D expenditures per Firm (1000 US$)	67,4	144,1	171,9
R&D expenditures / Revenue (%)	0,72%	0,92%	1,02%
Employees per Firm	104,0	117,8	105,8
Engineers per Firm	0,56	0,75	0,57
Master and PhDs' employees per Firm	0,13	0,37	0,26
Engineers / Total Employees (%)	0,54%	0,63%	0,54%

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration.

National firms represented 96% of the innovative firms in the three periods. In the last survey (2006-2008), the average firm had 106 employees and a revenue of U$ 16,898,000, which falls into the medium-size firm category. Taking part in foreign trade (exports and/or imports) were 11% of the firms, but this percentage reached 17% in the years before (the 2008 world financial crisis can be associated with this fall). The average R&D effort (R&D expenditures / revenue) increased over the periods from 0.72% (2003) to 0.92% (2005) and 1.02% (2008).

Table 3.8 presents the characteristics of the innovative firms that applied for patents in Brazil and/or abroad during the mentioned periods.

In general, a very small percent of innovative firms (around 7%) applied for patents, and this percentage did not change during the considered periods.

A smaller percentage of national firms applied for patents, if compared to foreign or mixed firms, and this difference is stronger in the case of applications abroad. A possible explanation is that the national efforts are proportionally more concentrated on incremental innovations, which cannot be patented. Also, foreign firms in Brazil are, on average, larger and more structured, while the nationals tend to include proportionally a greater number of smaller firms which do not produce, in general, patentable inventions.

[26] The dollar figures were calculated using the exchange rate (R$ / US$) of the last day of the year: 2.89 in 2003 and 2.34 in 2005 and 2008. Source: Central Bank of Brazil / www.bacen.gov.br

Comparing, respectively, the groups of firms that (i) did not apply for a patent; (ii) applied for a patent only in Brazil; (iii) applied for a patent abroad and (iv) applied for a patent in Brazil and abroad, most indicators present increasing values. Respectively, they are larger and more intensive in foreign trade. Also, the average R&D expenditures and the number of engineers and "master's and PhDs" per firm are more than a hundred times higher in (iv) if compared to (i).

Table 3.8: Characterization of Firms that applied for patents

Patent Aplicants	2006 - 2008				
	Yes - Brazil	Yes - Abroad	Yes - Brazil and Abroad	No	Total
Innovative Firms*	5,6%	0,4%	1,0%	93,0%	100,0%
National Firms	5,3%	0,0%	0,8%	93,8%	100,0%
Foreign Firms	6,6%	10,6%	7,5%	75,4%	100,0%
National and Foreign Firms	13,8%	1,4%	21,0%	63,5%	100,0%
Total Revenue per Firm (1000 US$)	40.624	123.655	473.981	9.395	16.898
Investiment per Firm (1000 US$)	1.021	6.649	42.589	555	1.091.035
Export (average value per firm) (1000 US$)	4.258	13.851	60.088	869	1.787.946
Import (average value per firm) (1000 US$)	1.641	10.542	37.769	574	1.099.477
Exporting Firms (%)	23,3%	49,7%	55,9%	9,9%	11,3%
Importing Firms (%)	22,5%	51,6%	57,0%	10,3%	11,6%
R&D expenditures per Firm (1000 US$)	553,7	719,2	6.955	62,7	171,9
R&D expenditures / Revenue (%)	1,36%	0,58%	1,47%	0,67%	1,02%
Employees per Firm	199,7	675,2	1.181	84,8	105,8
Engineers per Firm	1,9	3,5	22,2	0,21	0,57
Master and PhDs' employees per Firm	0,8	0,8	12,6	0,08	0,26
Engineers / Total Employees (%)	0,95%	0,52%	1,88%	0,25%	0,54%

Patent Aplicants	2001 to 2003					2003 to 2005				
	Yes - Brazil	Yes - Abroad	Yes - Brazil and Abroad	No	Total	Yes - Brazil	Yes - Abroad	Yes - Brazil and Abroad	No	Total
Innovative Firms*	5,2%	0,1%	0,8%	93,9%	100,0%	5,0%	0,1%	0,9%	93,9%	100,0%
National Firms	5,0%	0,1%	0,6%	94,4%	100,0%	4,7%	0,0%	0,7%	94,6%	100,0%
Foreign Firms	12,2%	1,7%	6,3%	79,9%	100,0%	10,2%	2,4%	7,8%	79,7%	100,0%
National and Foreign Firms	6,0%	0,0%	6,0%	87,2%	100,0%	6,8%	2,4%	5,4%	85,4%	100,0%
Total Revenue per Firm (1000 US$)	28.126	109.719	324.490	5.578	9.388	50.164	123.934	451.378	9.326	15.613
Investiment per Firm (1000 US$)	1.659	3.465	25.191	272	544.548	2.023	9.182	33.561	429	828
Export (average value per firm) (1000 US$)	4.531	16.660	71.013	930	1.688	8.701	13.991	94.165	1.419	2.660
Import (average value per firm) (1000 US$)	81	27.877	40.183	706	1.113	3.345	16.505	63.526	898	1.624
Exporting Firms (%)	43,1%	58,3%	91,2%	15,7%	17,8%	43,7%	82,2%	78,3%	15,8%	17,8%
Importing Firms (%)	38,0%	69,4%	72,0%	14,7%	16,4%	45,5%	93,3%	81,7%	15,5%	17,7%
R&D expenditures per Firm (1000 US$)	182,5	1.256	2.876	35,9	67,4	457,8	806,6	6398,2	64,6	144,1
R&D expenditures / Revenue (%)	0,65%	1,14%	0,89%	0,64%	0,72%	0,91%	0,65%	1,42%	0,69%	0,92%
Employees per Firm	277,0	825,7	1377,9	82,8	104,0	312,5	719,0	1617,1	91,9	117,8
Engineers per Firm	2,0	25,0	15,5	0,32	0,56	3,2	7,1	22,9	0,39	0,75
Master and PhDs' employees per Firm	0,4	1,8	4,4	0,08	0,13	1,3	2,9	18,7	0,14	0,37
Engineers / Total Employees (%)	0,74%	3,02%	1,13%	0,39%	0,54%	1,03%	0,99%	1,42%	0,42%	0,63%

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

The tables below present the characteristics of firms that used formal and/or strategic methods of appropriability to protect innovations.

Table 3.9 features the firms that used invention patents (IP) or utility models (UM) as appropriability methods. The data shows: ·

- A growth in the percentage of firms that used IP or UM, especially in the case of 'national and foreign' firms;

- A growing difference between firms that used and did not use IP or UM along the periods. Respectively, the average revenue of the first group in relation to the second was 16.7 in 2001-2003 and 23.8 in 2006-2008; the proportion of average exports between the two groups rose from 12.8 to 27.7, and, in the case of average R&D expenditures, this proportion increased from 15.9 to 32.2.;

- The average R&D expenditures per firm are considerably different between the two groups of firms, but their R&D efforts (R&D expenditures per revenue) are comparatively close. It may indicate that the difference among the groups is mainly determined by firms' size;

- In addition, among the periods, the R&D efforts grew in both groups. On the other hand, it was not followed by a growth in the average number of employees, engineers and 'master's and PhD' employees, which decreased in both groups in the last period.

- The percentage of firms that took part in foreign trade (exports and/or imports) was reduced in the last PINTEC, in both groups, maybe reflecting the world crises.

Table 3.9: Characterization of Firms: IP or UM users

Invention Patent or Utility Model	2001 to 2003		2003 to 2005		2006 to 2008	
	No	Yes	No	Yes	No	Yes
Total	**94,47%**	**5,53%**	**94,47%**	**5,53%**	**93,56%**	**6,44%**
National Firms	94,9%	5,1%	95,0%	5,0%	94,4%	5,6%
Foreign Firms	82,0%	18,0%	80,6%	19,5%	76,3%	23,7%
National and Foreign Firms	91,7%	8,3%	86,3%	13,7%	58,8%	41,2%
Total Revenue per Firm (1000 US$)	6.120,4	65.249,8	9.373,4	122.159,3	8.184,4	143.527,2
Export (average value per firm) (1000 US$)	1.021,6	13.087,9	1.391,0	24.326,7	657,8	18.211,9
Import (average value per firm) (1000 US$)	742,1	7.458,5	887,1	14.209,0	527,5	9.412,3
Exporting Firms (%)	16,0%	47,8%	15,8%	51,5%	9,2%	41,1%
Importing Firms (%)	15,0%	40,4%	15,7%	52,0%	9,5%	41,9%
R&D expenditures per Firm (1000 US$)	36,9	588,2	64,7	1499,6	57,1	1840,3
R&D expenditures / Revenue (%)	0,60%	0,90%	0,69%	1,23%	0,70%	1,28%
Employees per Firm	85,6	418,8	92,7	547,2	78,5	502,4
Engineers per Firm	0,33	4,48	0,39	6,83	0,20	6,02
Master and PhDs' employees per Firm	0,08	1,03	0,14	4,41	0,08	2,94
Engineers / Total Employees (%)	0,39%	1,07%	0,42%	1,25%	0,25%	1,20%

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

Table 3.10 presents the performance of firms that used industrial designs (ID) as an appropriability method. The differences for the firms that did not use this method are not as significant as observed in table 3.9.

Compared to the firms that used IP or UM between 2006 and 2008: ·

- A smaller percent of firms used industrial design; ·

- There was a lower percentage of exporting and importing firms among firms that used ID; ·

- Firms that used ID were slightly more R&D intensive, considering R&D effort and the R&D expenditures per firm.

- Firms that used ID presented higher average revenue, but there was a lower number of employees per firm; and

- Firms that used ID were slightly more “engineer intensive”, but less intensive in “master’s and PhD workers”.

- In many cases, the presented differences were not significant.

The data shows growth in R&D effort among the surveys of both groups (firms that used and did not use ID).

Table 3.10: Characterization of Firms: ID users

Industrial Design	2001 to 2003		2003 to 2005		2006 to 2008	
	No	Yes	No	Yes	No	Yes
Total	96,2%	3,8%	97,0%	3,0%	96,1%	3,9%
National Firms	96,5%	3,5%	97,2%	2,8%	96,4%	3,6%
Foreign Firms	90,0%	10,0%	92,3%	7,9%	88,1%	11,8%
National and Foreign Firms	90,4%	9,6%	95,1%	4,4%	88,1%	11,9%
Total Revenue per Firm (1000 US$)	6.716,2	77.838,3	14.577,1	48.930,4	11.595,8	148.433,9
Export (average value per firm) (1000 US$)	1.196,8	14.284,6	2.470,4	8.755,0	1.149,1	17.636,5
Import (average value per firm) (1000 US$)	809,9	8.885,8	1.462,2	6.832,3	762,3	9.464,7
Exporting Firms (%)	16,6%	46,3%	17,1%	40,9%	10,7%	24,5%
Importing Firms (%)	15,7%	35,6%	16,8%	45,1%	11,2%	22,1%
R&D expenditures per Firm (1000 US$)	40,5	755,4	118,6	961,9	99,4	1970,7
R&D expenditures / Revenue (%)	0,6%	1,0%	0,8%	2,0%	0,9%	1,3%
Employees per Firm	89,7	471,2	112,3	296,3	92,4	439,4
Engineers per Firm	0,4	4,8	0,6	4,1	0,3	6,9
Master and PhDs' employees per Firm	0,1	0,9	0,3	2,9	0,2	2,4
Engineers / Total Employees (%)	0,4%	1,0%	0,6%	1,4%	0,3%	1,6%

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

The use of trademark is comparatively more common than IP, UM or ID, as already demonstrated by the international literature. In Brazil, the same logic prevails. The percent of firms that used trademark has been significantly higher, if compared to the other mentioned appropriability methods.

Compared to firms that used IP, UM or ID, the firms that used trademarks were:

- On average, smaller (according to average revenue or number of employees) and less intensive in foreign trade (based on the percent of exporting and importing firms);

- Less intensive in “highly skilled workers”, based on the inclusion of engineers and PhD employees.

But, although their average R&D expenditures are considerably lower, their R&D efforts are almost the same: 1.2% for firms that used trademarks between 2006 and 2008, compared to 1.3% for firms that used IP, UM or ID in the same period. And, as in the other cases, compared to foreign and mixed firms, the percentage of national firms that has a trademark is proportionally smaller.

The differences between firms that used and did not use trademarks are smaller than was observed in the appropriability methods analyzed above. The firms of the first group are larger (average revenue and number of employees), more intensive in foreign trade (exports and imports) and in skilled workers. The less relevant difference between the groups is in R&D effort: 1.2% and 0.8% in the last period. The increasing efforts observed in both groups may reflect the public policies to support innovation that have entered into force since the year 2000 (table 3.11).

Table 3.11: aracterization of Firms: trademarks users

Trademark	2001 to 2003		2003 to 2005		2006 to 2008	
	No	Yes	No	Yes	No	Yes
Total	78,9%	21,1%	76,0%	24,0%	75,2%	24,8%
National Firms	79,1%	20,9%	76,4%	23,6%	75,9%	24,1%
Foreign Firms	75,4%	24,7%	68,0%	32,1%	61,5%	38,5%
National and Foreign Firms	67,4%	32,1%	56,6%	42,9%	46,4%	53,6%
Total Revenue per Firm (1000 US$)	5.474,5	24.044,0	8.378,4	38.472,5	8.067,3	43.713,4
Export (average value per firm) (1000 US$)	962,7	4.406,1	1.385,9	6.685,6	870,1	4.575,4
Import (average value per firm) (1000 US$)	604,4	3.019,0	782,8	4.282,4	549,4	2.770,1
Exporting Firms (%)	17,2%	19,8%	14,9%	27,0%	8,5%	19,6%
Importing Firms (%)	15,8%	18,8%	14,6%	27,3%	8,9%	19,9%
R&D expenditures per Firm (1000 US$)	24,4	228,3	52,1	434,7	61,3	507,7
R&D expenditures / Revenue (%)	0,45%	0,95%	0,62%	1,13%	0,8%	1,2%
Employees per Firm	82,9	182,9	87,9	212,3	75,6	197,5
Engineers per Firm	0,3	1,7	0,4	1,9	0,2	1,6
Master and PhDs' employees per Firm	0,1	0,4	0,2	1,1	0,2	0,6
Engineers / Total Employees (%)	0,32%	0,91%	0,42%	0,91%	0,29%	0,83%

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

Lastly, table 3.12 shows the firms that used copyrights – which, in Brazil, include software. Since PINTEC is focused on industrial firms, copyrights are the least used form of appropriability.

Table 3.12: Caracterization of Firms: copyrights users

Copyrights	2001 to 2003		2003 to 2005		2006 to 2008	
	No	Yes	No	Yes	No	Yes
Total	98,8%	1,2%	96,7%	3,3%	97,0%	3,0%
National Firms	99,0%	1,0%	96,8%	3,2%	97,2%	2,8%
Foreign Firms	95,3%	4,7%	92,4%	7,9%	93,9%	6,1%
National and Foreign Firms	98,6%	1,4%	97,1%	2,4%	93,1%	6,9%
Total Revenue per Firm (1000 US$)	7.572,1	164.552,2	12.286,6	111.776,6	13.349,2	132.639,2
Export (average value per firm) (1000 US$)	1.393,2	26.917,2	2.008,0	21.506,2	1.390,1	14.763,0
Import (average value per firm) (1000 US$)	858,7	22.865,1	1.183,6	14.358,9	822,3	10.140,4
Exporting Firms (%)	17,6%	27,9%	17,5%	26,0%	11,1%	15,7%
Importing Firms (%)	16,3%	29,6%	17,4%	26,7%	11,5%	16,0%
R&D expenditures per Firm (1000 US$)	48,9	1.644,3	77,8	2061,0	101,6	2466,2
R&D expenditures / Revenue (%)	0,65%	1,00%	0,63%	1,84%	0,76%	1,86%
Employees per Firm	98,5	573,2	109,9	347,8	100,4	282,5
Engineers per Firm	0,5	9,9	0,50	8,0	0,44	4,99
Master and PhDs' employees per Firm	0,1	1,8	0,19	5,7	0,12	5,05
Engineers / Total Employees (%)	0,46%	1,73%	0,45%	2,29%	0,43%	1,77%

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

The “strategic methods of protection” were adopted by 12.2% of firms, according to the last PINTEC (table 3.13). In general, the data do not reveal strong differences between these firms and the ones that used formal methods. Compared to firms that used IP or UM, this group includes, on average:

- Smaller firms (based on average revenue and number of employees);
- Firms less intensive in foreign trade;

- Smaller participation of skilled workers, such as engineers or master's and PhDs employees.

On the other hand, the R&D efforts of both groups are almost the same (1.2% and 1.3%). Once more, R&D effort increased among users and non-users of strategic methods and foreign trade participation decreased in the last survey.

Table 3.13: Characterization of Firms: users of strategic methods of protection

Strategic Methods of Protection	2001 to 2003		2003 to 2005		2006 to 2008	
	No	Yes	No	Yes	No	Yes
Total	**88,8%**	**11,2%**	**89,9%**	**10,1%**	**87,8%**	**12,2%**
National Firms	89,6%	10,4%	90,8%	9,2%	88,2%	11,8%
Foreign Firms	68,6%	31,4%	70,2%	29,9%	62,9%	37,1%
National and Foreign Firms	61,0%	39,0%	62,4%	37,6%	77,6%	22,4%
Total Revenue per Firm (1000 US$)	4.612,4	46.915,4	8.083,0	82.692,4	8.394,5	75.972,7
Export (average value per firm) (1000 US$)	742,4	9.122,5	1.264,7	15.088,8	728,6	9.147,8
Import (average value per firm) (1000 US$)	473,9	6.138,0	612,2	10.638,1	433,4	5.726,7
Exporting Firms (%)	15,6%	35,1%	15,5%	37,9%	9,0%	26,9%
Importing Firms (%)	14,3%	33,5%	15,3%	39,1%	9,4%	27,4%
R&D expenditures per Firm (1000 US$)	19,3	445,3	56,2	927,1	66,3	905,5
R&D expenditures / Revenue (%)	0,4%	0,9%	0,7%	1,1%	0,8%	1,2%
Employees per Firm	77,4	312,6	89,2	372,5	76,2	311,4
Engineers per Firm	0,2	3,2	0,3	4,5	0,2	2,9
Master and PhDs' employees per Firm	0,1	0,6	0,2	2,1	0,2	0,8
Engineers / Total Employees (%)	0,3%	1,0%	0,4%	1,2%	0,3%	0,9%

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

1.6.2 Appropriability by Firm Size

1.6.2.1. Innovation Expenditures by Firm Size[27]

Investments in innovative activities include the amount spent on R&D performance (internal and external to the firm), acquisition of external knowledge (license to patent exploitation and trademark use, know how and other scientific knowledge); purchase of software, acquisition of machines and equipment, training, introduction of technological innovations to the market (including market research and advertising) and other preparations for production and distribution.

Table 3.14 compares these investments, by firm size, among the users and non-users of methods to protect the innovative efforts. In the last period, the investments made by the first group were generally higher, except in the case of medium-size firms for the most formal methods, such as utility model, industrial design and trademark.

Considering the firms that used formal methods, the data show that in 2006-2008 the highest average expenditure was performed by large firms that used ID and, among small and medium firms, by firms that utilized IP.

On average, large firms that tried formal methods invested more in innovation than the ones that employed strategic methods, except in the case of trademarks. But the scenario is different when

[27] The data on investments in innovation made by patent applicant firms presented some inconsistencies and must be reviewed.

small and medium size firms are analyzed: on average, those that have opted for strategic methods invested more in innovation activities than the firms that chose formal appropriability. Among small firms, the largest investment was made by lead time firms and, among medium firms, by those which used IP, followed by firms that utilized strategic methods.

These data suggest that, depending on the characteristics of the firm, strategic methods were associated with higher investments in innovation in comparison to formal methods. They also show that, in most cases, the difference between investments in innovative activities of users and non-users has diminished over the years.

Table 3.14: Innovation Expenditures by Firm Size

a) Formal methods of appropriability

Investments in Innovative Activities per Firm (1000 US$)		Formal Methods of Appropriability											
		Invention Patent			Utility Model			Industrial Design			Trademark		
		Large	Medium	Small	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
2001-2003	No	3.790,9	244,2	38,0	4.241,1	246,9	37,0	3.889,9	248,5	36,7	2.668,4	225,3	34,2
	Yes	11.487,9	448,1	103,9	11.132,9	373,9	112,7	10.903,1	330,1	144,7	9.112,0	412,1	57,6
2003-2005	No	5.104,2	451,7	74,8	6.989,7	477,7	94,2	7.237,9	479,6	76,2	4.426,7	427,5	71,5
	Yes	17.518,8	1.025,8	861,7	12.841,8	729,9	163,7	14.768,4	763,7	911,9	12.126,7	650,6	184,1
2006-2008	No	7.036,2	502,3	60,7	9.398,1	537,4	65,1	8.201,0	537,5	64,7	6.829,6	583,3	58,4
	Yes	22.208,4	932,8	273,8	22.715,3	507,9	146,5	30.399,2	506,0	130,1	16.514,8	453,2	99,3

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

b) Strategic methods of appropriability

Investments in Innovative Activities per Firm (1000 US$)		Strategic Methods of Appropriability								
		Complexity on Product Design			Industrial Secret			Lead Time		
		Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
2001-2003	No	4.425,8	248,1	39,3	2.836,9	232,7	37,7	4.159,3	230,0	37,9
	Yes	13.670,4	609,0	44,7	10.806,0	499,3	59,3	8.818,5	1.510,7	169,5
2003-2005	No	7.242,2	476,6	94,7	4.809,2	417,7	59,9	6.989,1	463,3	92,3
	Yes	17.087,2	1.198,7	175,9	15.292,9	1.209,4	582,7	12.269,5	1.202,9	805,4
2006-2008	No	10.270,1	530,1	65,5	7.277,4	533,1	61,3	9.430,8	523,5	65,7
	Yes	18.519,6	675,9	197,5	20.809,6	555,0	145,5	19.413,4	723,6	300,8

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

1.6.3 Cooperation for Innovation

"Cooperation for innovation" involves the active participation in joint projects of R&D and other innovative activities with other organizations (firms or institutes). Hiring services from other organizations, without active collaboration, is not considered cooperation.

Table 3.16 indicates the types of cooperation that are considered of high importance by innovative firms in Brazil, according to the appropriability method used by them, in the period 2006-2008. For example, 9.8% of the 2,068 firms that used invention patents considered highly important the cooperation with 'customers and consumers'.

In general, a small percent of the firms identified cooperation as important. Suppliers are considered the main partner, especially by firms that applied for patents in Brazil and abroad: 27.5% of these firms considered cooperation with suppliers highly important.

"Customers and consumers" is the second main cooperation type employed by innovative firms, patent applicants and firms that used strategic methods of appropriation. It is also in the second place by most firms that utilized formal methods of appropriability, except for those that opted for industrial design, for whom "universities and research institutes" are most important. The cooperation with these institutes is also the most important for firms that applied for patents in Brazil and abroad.

"Other firms of the group" are the most relevant kind of cooperation for firms that applied patents abroad. It probably indicates a relationship with headquarters or other subsidiaries: as showed before, foreign firms are the ones that most often apply patents abroad.

Except in the mentioned cases, "universities and research institutes", "training and technical assistance centers" and "consulting firms" are, comparatively, not so significant, despite the traditional public incentives the Brazilian government offers to foster universities-firms partnerships.

Finally, the least relevant partners are, in general, the competitors.

Table 3.16: Cooperation* to patent applicants and users of appropriation methods

a) 2006-2008

Cooperation	2006-2008							
	Customers and Consumers	Suppliers	Competitors	Other firms of the group	Consulting Firms	Universities and Research Institutes	Training and Technical Assistance Centers	Total
Total	**3,8%**	**5,4%**	**1,1%**	**1,2%**	**2,0%**	**2,1%**	**1,7%**	**100%**
Patent Applicants								
In Brazil	5,3%	5,3%	1,6%	1,5%	1,9%	4,2%	1,3%	100%
Abroad	13,1%	11,1%	0,7%	26,8%	2,0%	4,6%	0,7%	100%
In Brazil and Abroad	30,1%	27,5%	3,1%	10,7%	5,9%	32,6%	1,4%	100%
Formal Methods of Appropriability								
Invention Patent	9,8%	9,1%	2,5%	5,6%	3,3%	7,7%	1,7%	100%
Utility Model	11,2%	10,0%	1,4%	3,9%	5,1%	7,3%	3,7%	100%
Industrial Design	6,7%	11,3%	2,2%	2,9%	2,8%	8,0%	4,0%	100%
Trademark	5,0%	7,7%	1,5%	2,0%	3,2%	3,4%	2,2%	100%
Copyright	12,9%	11,7%	0,5%	3,1%	2,2%	10,3%	1,0%	100%
Strategic Methods of Appropriability								
Design Complexity	12,5%	16,8%	3,1%	5,4%	5,4%	8,7%	4,3%	100%
Industrial Secret	8,3%	13,7%	1,3%	4,5%	2,4%	6,5%	0,9%	100%
Lead time over competitors	13,1%	14,1%	2,5%	8,8%	4,4%	8,1%	2,8%	100%

**Percentage of firms that considered cooperation highly important*
Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

The tables 3.16 b) and c) present the cooperation indicators for the periods 2001- 2003 and 2003-2005, which maintain the basic characteristics previously pointed out. The main change was a generalized increase in the percentage of firms for which the various types of cooperation were highly important, observed in the last PINTEC.

b) 2003-2005

Cooperation	2003-2005							
	Customers and Consumers	Suppliers	Competitors	Other firms of the group	Consulting Firms	Universities and Research Institutes	Training and Technical Assistance Centers	Total
Total	**4,0%**	**3,7%**	**0,9%**	**1,0%**	**1,2%**	**1,6%**	**0,9%**	**100%**
Patent Application								
In Brazil	12,1%	10,3%	2,1%	2,0%	4,8%	6,3%	2,7%	100%
Abroad	28,9%	26,7%	2,2%	37,8%	0,0%	6,7%	4,4%	100%
In Brazil and Abroad	22,3%	19,0%	2,1%	17,1%	6,1%	16,2%	4,0%	100%
Formal Methods of Appropriability								
Invention Patent	15,2%	12,8%	1,3%	6,0%	4,4%	9,6%	2,4%	100%
Utility Model	16,9%	13,0%	3,2%	4,6%	5,3%	6,5%	3,2%	100%
Industrial Design	15,5%	12,1%	2,8%	4,0%	4,1%	4,0%	2,9%	100%
Trademark	8,0%	7,2%	1,3%	2,4%	2,3%	3,4%	1,5%	100%
Copyright	9,6%	8,7%	1,2%	5,0%	3,1%	6,6%	1,9%	100%
Strategic Methods of Appropriability								
Complexity on Product Design	15,9%	12,2%	1,6%	8,1%	2,9%	5,0%	2,1%	100%
Industrial Secret	10,4%	10,4%	0,9%	4,5%	3,6%	5,2%	2,0%	100%
Time Lead over Competitors	20,6%	18,7%	3,0%	11,9%	3,0%	10,8%	2,7%	100%

**Percentage of firms that considered cooperation highly important*
Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

c) 2001-2003

Cooperation	2001-2003							
	Customers and Consumers	Suppliers	Competitors	Other firms of the group	Consulting Firms	Universities and Research Institutes	Training and Technical Assistance Centers	Total
Total	**1,3%**	**1,4%**	**0,1%**	**0,6%**	**0,3%**	**0,8%**	**0,3%**	**100%**
Patent Application								
In Brazil	3,9%	4,1%	0,0%	2,3%	0,7%	2,1%	0,9%	100%
Abroad	19,4%	27,8%	8,3%	30,6%	11,1%	5,6%	2,8%	100%
In Brazil and Abroad	14,6%	11,3%	2,9%	12,1%	2,9%	13,4%	2,1%	100%
Formal Methods of Appropriability								
Invention Patent	8,5%	8,2%	0,9%	6,0%	1,4%	5,2%	1,4%	100%
Utility Model	4,4%	4,5%	0,6%	3,2%	0,7%	2,0%	0,9%	100%
Industrial Design	5,4%	4,8%	0,7%	4,1%	1,2%	3,2%	1,3%	100%
Trademark	2,0%	3,0%	0,4%	1,6%	0,5%	1,7%	0,4%	100%
Copyright	7,1%	7,1%	1,1%	6,6%	2,0%	4,3%	1,7%	100%
Strategic Methods of Appropriability								
Complexity on Product Design	9,3%	9,0%	0,5%	9,3%	1,8%	3,8%	2,3%	100%
Industrial Secret	7,8%	5,6%	0,5%	3,9%	1,9%	4,6%	2,0%	100%
Time Lead over Competitors	13,8%	14,2%	1,9%	9,8%	2,4%	7,4%	3,0%	100%

**Percentage of firms that considered cooperation highly important source: PINTEC/IBGE, Central Bank and Secex. Own elaboration*

1.6.4 Public Incentives for Innovation

Public policies for scientific and technological development started explicitly in the 1950s, influenced by developed countries' policies which assumed that technical progress was the driving force of the economic growth. These countries reformed their educational system and their public programs to support S&T activities and launched special programs to finance research at universities.

The Brazilian efforts led to the creation of new public institutions and instruments, such as the National Research Council (CNPq), in 1951, aimed at coordinating and fostering scientific development; the National Economic Development Bank (BNDES), in 1952, for supporting industrial and infrastructure projects; and in the next decade, the Financier of Studies and Projects (FINEP, 1967). The creation of National Institute of Industrial Property (INPI) in 1970 was another step to consolidate the national system of innovation.

The Ministry of Science and Technology – renamed as the Ministry of Science, Technology and Innovation (MCTI), in 2011 – was created in 1985 to attend an old demand of the scientific community. At the beginning, it was responsible for the coordination of the national system of S&T, including international cooperation and the research policy. Gradually, it assumed the coordination of the following areas: biosafety, special, nuclear energy, computer and automation and exports of sensible products (Zucoloto, 2009). Nowadays, Finep, Cnpq and other agencies are part of the MCTI System.

The "MCTI system" is the main responsible for the elaboration and implementation of S&T policies and instruments, together with BNDES. Presently, Finep supports basic and applied research and the improvement and development of products, services and processes. It also supports the incubation of technology-based firms, the implantation of technological parks, the structuring and consolidation of research processes and market development. It executes its programs through reimbursable and non-reimbursable financial support. Its main programs involve the support of innovative firms, scientific and technological institutions (STI) and the cooperation between firms and STIs.

Presently, the main laws and instruments that support innovation in Brazil, based on the classification made by Technological Innovation Research (PINTEC), is presented below:

a) Fiscal incentives for R&D and technological innovation

The Law 8661 from 1993 – regulated by Decree 949/93 – aimed to stimulate private investments in R&D and innovative activities. This was a re-launch of the 1988 Industrial and Agricultural Technological Development Programs (PDTI/PDTA), which were based on tax rate reduction. The programs were conducted through projects proposed by firms – alone or in partnerships – and evaluated by the Science and Technology Ministry (Zucoloto, 2009; Avellar, 2010). The complexity of the paperwork to apply for the tax reduction was considered one of the main barriers to its success (Matesco and Tafner, 1996 apud Zucoloto, 2010).

In 1997, a severe fiscal adjustment required the redesign of the program, curtailing many of its benefits. As a result, in 1998 the number of projects submitted to the program was strongly reduced in comparison to the prior years. Thereafter, the program was complemented by Laws 10.332/2001 and 10.637/2002, which expanded the previous incentives. In 2005, this legislation was replaced by Law 11.196/05 – known as the "Good Law" – which expanded the prior mechanism through simplification of the evaluation process (Avellar, 2010).

The law's main benefits are an additional tax exclusion of R&D expenditures – including those related with equipment and wages – and accelerated depreciation and amortization. It also gives incentives for the application of patents and plant varieties, as well as for remittances abroad related to the registration and maintenance of trademarks, patents and plant varieties (Kanembley and Porto, 2012).

In contrast to other programs, this law does not establish differentiated incentives according to regional criteria or the size of the firm, even though the benefits are available only to firms that opt for a specific form of taxation ("real profit"), which are not commonly used by small

firms. Firms which choose the tax regime of "presumed profit" can benefit from a small part of the incentives, such as the one related to remittance abroad for the payment of royalties (Kanembley and Porto, 2012).

The Law 11.774/2008 modified the Good Law to include firms that utilize the "Information Technology Law", as shown as follows.

b) Information Technology Laws[28]

The first Information Technology Law was passed in 1984 (Law 7232), instituting the market reserve in the Brazilian computer industry. It was soon replaced by Law 8248, which promoted the IPI exemption for products manufactured in the country according to the "Basic Productive Process" (PBB). It also encouraged fiscal benefits regarding R&D&I expenditures and included preferential access to governmental purchases. In return, the firm promised to apply at least 5% of their revenues to R&D activities, where part of it (2%) to be carried in partnerships with technological institutes. They were also obliged to obtain the ISO 9000 certificate.

This Law was modified by Law 10.176 in 2000/2001, which maintained the same principles and instruments, but it increased the proportion for external partnerships with a preference for the poorest regions in Brazil (Northeast, Amazonia and Midwest). In 2003, it was amended by Law 10.664, which revised the import tariff on microcomputers components and parts seeking to stimulate national production, among other measures (BNDES, 2012). The Law 11.077/2004 extended the benefit term until 2019 and added a new gradual reduction of fiscal exemptions. It also favored smaller firms and those firms operating in the poorest regions.

c) Subvention of R&D activities and the insertion of researchers

The Law 10.973/2004 – known as the "Innovation Law" – has established the possibility of direct financing of R&D activities through a specific subvention for the private sector. It enables the use of the public institutions' infrastructure, especially universities and research centers, by the private sector. It also facilitates the movement of public servants, researchers and professors to the private sector and other research institutions.

Additionally, the Article 21st of the above mentioned Law 11.196/2005 subsidizes salaries of researchers with Master or PhD degrees that are employed in technological activities.

d) Funding for R&D activities and innovative projects

This section refers to those credit lines and other policy instruments applied by banks such as Finep and BNDES, among others, to promote research and innovative projects.

From this kind, it is worth mentioning:

- *Inova Brasil*[29] (Finep) seeks to promote research, development and innovative projects at medium and large firms. It aims at supporting Strategic Investment Plans of Brazilian firms' innovation according to the Federal Industrial Policy in force, respecting the following directives: (i) Improvement of competitiveness; (ii) Increase of R&D activities performed in Brazil; (iii) Innovation projects with regional relevance or insertion in local clusters, according to MCTI programs; (iv) Contribution to the technological improvement of supply chains; (v) Partnerships with Brazilian universities or research institutes.

[28] See Kannembley and Porto, 2012
[29] http://www.finep.gov.br/pagina.asp?pag=25.35.10

- Paiss (BNDES and Finep) which jointly selects the business plans and support projects for the development, production and commercialization of new industrial technologies directed at biomass processing deriving from sugarcane. It focuses on second generation bioethanol, new products of sugarcane and gasification.

- Funtec IT (BNDES)30 aims to support applied research, technological development and innovation projects performed by technological institutions selected according to the priorities established by the bank. The selection of projects is based on their technological challenges, originality, potential application in other sectors and the credibility of the institutions and team involved in them. The main supported areas are: energy, environment, electronics, new materials, chemistry and electric vehicles. This instrument also funds those partnerships of the Brazilian System of Technology (SIBRATEC) network.

- Other similar instruments include: BNDES Innovation31, BNDES Automatico, BNDES Card, BNDES Credit Limit and Finep Sectorial Funds32.

e) Acquisition of machinery and equipment employed in innovation activities

The Program *BNDES Innovation*[33] aims at supporting innovative investments to foster Brazilian competitiveness. The firms must present an investment plan in order to request the resources. The program finances, for example: (i) Acquisition of new machinery and equipment, produced in Brazil; (ii) imports of equipment without a similar national version; (iii) acquisition of software developed with national technology or, if there is no similar national version, with foreign technology; (iv) acquisition, transference and absorption of technology; and, (v) training related to the investment plan for innovation;

Two other public banks, Banco do Brasil and Banco do Nordeste do Brasil, also make available credit for the acquisition of equipment for innovative activities. (PINTEC, 2011).

f) Scholarships (RHAE Program)34

The "Human Resources Training in Strategic Areas" Program – RHAE Program – was launched in 1987 managed by the Science and Technology Ministry[35] and executed by National Council for Scientific and Technological Development (CNPq). It uses a set of 'technological fostering' scholarships created to incorporate highly qualified researchers to the firms' R&D activities and to capacitate human resources in applied research or technological development projects.

In 1997 the RHAE Program was renamed as the "Human Resources Training to Technological Development" and began to be managed by CNPq. Also, their actions started to be conducted through regular competitive tenders. From 2002 to 2006, four calls were launched and the program was once again renamed as *RHAE-INOVAÇÃO*.

30 http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Areas_de_Atuacao/Inovacao/Funtec/index.html

31 http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/inovacao.html

32 The Sectoral Funds' revenues originate from different sources, as the exploration of natural resources belonging to the Central government. They are the main government instrument to finance the S&T system in Brazil.

33 http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/inovacao.html

34 http://www.cnpq.br/web/guest/rhae

35 Presently known as the Ministry of Science, Technology and Innovation (MCTI)

In 2007, CNPq and MCT started to foster projects on the insertion of researchers (Masters and PhDs) in SMEs, prioritizing the projects related to the industrial policy in force.

Besides RHAE, other scholarships are offered to support the development of R&D projects at the enterprises, such as Innovative Research at Small Enterprise (PIPE), from FAPESP, a foundation to support research from São Paulo state.

g) Others instruments

Some venture capital/private equity (VC/PE) have been put in place in Brazil. The first one was *ADTEN* (Finep) in the 1970s. The tough macroeconomics conditions during the 1980s and a lack of legal framework and fiscal incentives led to discontinuity of this program in 1991 (ABDI, 2011).

Since 1995, the VC/PE industry has developed due to economic stability and new business opportunities that emerged from the broad privatization process in Brazilian economy. At present, the main Brazilian initiative in venture capital is the *Inovar Project* (Finep), launched in 2000. In addition, the program *Inovar Semente* was launched in 2005 to stimulate small innovative firms. In 2008, *Inovar II* was launched to promote the consolidation of the venture capital and private equity industry and to help the structuring of the seed capital industry in Brazil. BNDES has developed its own seed capital Investment fund, the Criatec Fund[36], which is directed at innovative emergent firms (Velez-Agudelo, 2011).

Other kinds of public support exists for innovative activities not mentioned before, such as direct order without a public tender, development of innovative activities through governmental purchases, PRODETAB (support to agricultural technologies), fiscal incentives granted by states to R&D and the resources originated from the Sectoral Fund of Electric Energy (Law 9991/00)

3.2.4.1. Public incentives for innovation: PINTEC database

The funding for the acquisition of machinery and equipment (M&E) for innovative activities is the main type of instrument, accessed by 13% of the sample. It is the main source of funding by most firms that used appropriability methods, except for industrial designs users. It is also relevant to firms that applied for patents in Brazil.

The second most used source of incentives is the fiscal incentives for R&D and technological innovation. The funding for R&D activities and innovative projects, which includes partnerships with universities and research institutes, is especially used by firms that applied for patents in Brazil and abroad, for whom the RHAE program is also relevant.

In general, scholarships are the least used financing program, followed by IT support.

[36] http://www.fundocriatec.com.br/

Table 3.17: Public incentives: by patent applicants and users of appropriation mechanisms.

a) 2006-2008

Public Incentives	2006-2008				
	Fiscal incentives to R&D and to technological innovation	Information Technology Laws	Funding to R&D and innovative projects	Funding to the acquisition of machineries and equipments employed in innovation activities	Scholarships - RHAE Program
Total	**1,1%**	**1,7%**	**1,1%**	**13,0%**	**0,6%**
Patent Applicants					
In Brazil	8,1%	2,2%	2,3%	18,7%	1,2%
Abroad	9,2%	1,3%	0,7%	2,6%	0,0%
In Brazil and Abroad	12,7%	4,7%	25,4%	6,1%	17,8%
Formal Methods of Appropriability					
Invention Patent	8,0%	3,6%	4,4%	16,9%	1,7%
Utility Model	5,9%	2,3%	3,3%	9,9%	1,4%
Industrial Design	11,0%	3,8%	3,0%	10,2%	1,7%
Trademark	2,3%	1,3%	1,8%	13,6%	1,0%
Copyright	5,3%	4,5%	12,8%	14,5%	7,3%
Strategic Methods of Appropriability					
Complexity on Product Design	8,5%	3,0%	4,8%	11,7%	1,3%
Industrial Secret	3,5%	1,5%	4,5%	16,3%	3,7%
Time Lead over Competitors	9,6%	3,9%	3,8%	13,9%	1,7%

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

The 2006-2008 scenario is, to some extent, different from that observed in previous years. In 2008, the funding for the acquisition of M&E lost part of its importance and, at the same time, other incentives became slightly more important, if compared to the data showed in the previous PINTEC surveys.

Fiscal incentives for R&D and for technological innovation were especially improved in 2005, through the 11.196/05 law, which simplified the access to public resources directed toward R&D and innovation. Between 2003 and 2008, its relevance grew mainly for firms that applied patents or used invention patents as a appropriability method.

Also, funding for R&D, innovative projects and scholarships became more relevant to firms that applied patents in Brazil and abroad and used copyrights.

b) 2003-2005

Public Incentives	2003-2005					
	Fiscal incentives to R&D and to technological innovation	Information Technology Laws	Funding to R&D and innovative projects	Funding to the acquisition of machineries and equipments employed in innovation activities	Scholarships - RHAE Program	Total
Total	**0,8%**	**1,3%**	**1,6%**	**11,6%**	**0,4%**	100%
Patent Application						
In Brazil	4,2%	4,2%	4,2%	19,0%	1,4%	100%
Abroad	4,4%	8,9%	4,4%	13,3%	2,2%	100%
In Brazil and Abroad	12,8%	7,6%	18,0%	25,4%	6,1%	100%
Formal Methods of Appropriability						
Invention Patent	5,5%	4,5%	7,5%	21,6%	2,9%	100%
Utility Model	6,3%	5,2%	5,9%	17,1%	2,0%	100%
Industrial Design	4,9%	4,5%	3,8%	15,1%	0,9%	100%
Trademark	1,9%	1,9%	3,6%	15,8%	0,7%	100%
Copyright	2,2%	3,3%	6,2%	21,7%	2,6%	100%
Strategic Methods of Appropriability						
Complexity on Product Design	4,3%	4,7%	13,8%	12,2%	0,8%	100%
Industrial Secret	2,6%	2,9%	6,9%	18,2%	1,3%	100%
Time Lead over Competitors	7,4%	7,1%	10,7%	19,0%	2,8%	100%

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

c) 2001-2003

Public Incentives	2001-2003					
	Fiscal incentives to R&D and to technological innovation	Information Technology Laws	Funding to R&D and innovative projects	Funding to the acquisition of machineries and equipments employed in innovation activities	Scholarships - RHAE Program	Total
Total	**0,7%**	**0,9%**	**1,6%**	**13,6%**	**0,5%**	100%
Patent Application						
In Brazil	1,5%	1,6%	1,1%	17,2%	1,7%	100%
Abroad	5,6%	16,7%	8,3%	11,1%	2,8%	100%
In Brazil and Abroad	23,0%	5,9%	5,4%	32,6%	3,8%	100%
Formal Methods of Appropriability						
Invention Patent	7,0%	3,9%	3,1%	12,5%	1,3%	100%
Utility Model	1,8%	2,1%	1,1%	21,2%	0,6%	100%
Industrial Design	2,4%	3,0%	4,3%	19,0%	2,8%	100%
Trademark	1,4%	1,5%	1,3%	17,6%	1,3%	100%
Copyright	2,3%	4,6%	2,3%	10,5%	1,7%	100%
Strategic Methods of Appropriability						
Complexity on Product Design	2,3%	4,5%	1,3%	8,5%	9,0%	100%
Industrial Secret	3,2%	3,2%	2,7%	13,9%	2,3%	100%
Time Lead over Competitors	6,4%	8,9%	4,4%	15,0%	2,0%	100%

Source: PINTEC/IBGE, Central Bank and Secex. Own elaboration

1.6.5 A deeper analysis of patent users

Patents are the most studied appropriability method in the literature about technological innovation. Their capacity to stimulate and protect innovation is one of the most debated topics in this literature

and the controversy about the patents' power to encourage technological development has lasted decades.

Due to the relevance of patentability, this topic presents some additional data analysis about patent users in Brazil.

1.6.5.1. R&D expenditures by firm size

In most cases, the users and applicants for patents spent, on average, more on R&D activities than non-users. The main difference can be seen among the firms that applied and did not apply for patents in Brazil and abroad.

Table 3.18: R&D Expenditures by Firm Size: IP users and patent applicants

Internal and External R&D Expenditures (1000 US$)		IP users			Patent Applicants								
					In Brazil			Abroad			In Brazil and Abroad		
		Large	Medium	Small	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
2001-2003	No	885,7	31,7	4,9	1.551,5	32,1	4,5	1.500,4	34,6	5,7	993,2	36,0	5,5
	Yes	4.461,6	149,8	44,2	1.227,9	86,8	38,2	1.637,3	2.231,4	12,0	6.167,1	127,3	105,8
2003-2005	No	1.281,8	75,3	11,1	2.822,7	94,2	12,5	2.831,0	106,9	13,3	1.561,5	92,6	11,9
	Yes	8.027,1	549,8	95,3	2.757,1	265,1	36,7	1.371,4	618,3	137,2	12.846,2	1.353,0	487,0
2006-2008	No	1.726,7	66,8	6,0	4.470,7	74,5	6,7	4.774,2	84,9	8,4	2.492,7	78,8	7,7
	Yes	12.719,5	306,2	90,5	6.687,5	226,9	43,0	3.316,2	237,0	10,2	21.773,7	633,1	107,8

Source: PINTEC/IBGE. Own elaboration

1.6.5.2. Sector Analysis

Table 3.19 presents the sector division of firms that applied or used patents. Compared to the firms that did not used or applied for a patent, these firms are proportionally more concentrated in high-technology and medium-high-technology sectors, as electrical; electronics, instrumentation, vehicles, machinery and equipment, chemicals, and also rubber and plastic products.

Table 3.19: Industrial distribution: users and non-users of IP/UM and patent applicants (2006-2008)

Industry	IP or UM		Patent Applicants	
	NO	YES	NO	YES
Total	**100,0%**	**100,0%**	**100,0%**	**100,0%**
Food products and beverages	13,3%	4,3%	13,1%	7,9%
Tobacco products	0,0%	0,1%	0,0%	0,1%
Textiles	4,2%	1,0%	4,3%	0,5%
Wearing apparel; dressing and dyeing of fur	14,7%	1,3%	14,7%	2,2%
Leather products; luggage, handbags, saddlery, harness and	4,9%	2,8%	5,0%	1,6%
Wood and of products of wood and cork	3,4%	0,6%	3,4%	0,2%
Paper and paper products	1,9%	2,0%	1,9%	1,6%
Publishing, printing and reproduction of recorded media	5,0%	2,6%	5,0%	3,0%
Coke, refined petroleum products and nuclear fuel	0,3%	0,3%	0,3%	0,2%
Chemicals and chemical products	5,4%	8,2%	5,4%	8,5%
Rubber and plastics products	6,1%	10,2%	5,8%	13,0%
Other non-metallic mineral products	7,1%	4,2%	7,2%	3,9%
Basic metals	1,8%	2,1%	1,9%	1,4%
Fabricated metal products, except machinery and equipment	10,1%	13,1%	10,3%	10,7%
Machinery and equipment n.e.c.	7,2%	25,7%	6,9%	27,7%
Office, accounting and computing machinery	0,3%	0,7%	0,3%	0,5%
Electrical machinery and apparatus n.e.c.	2,4%	4,7%	2,5%	3,0%
Radio, television and communication equipment and apparatus	0,9%	1,6%	0,9%	1,1%
Medical, precision and optical instruments, watches and clocks	1,8%	3,0%	1,7%	3,6%
Motor vehicles, trailers and semi-trailers	2,7%	4,6%	2,7%	3,7%
Other transport equipment	0,5%	1,0%	0,5%	0,8%
Furniture; manufacturing n.e.c.	5,9%	6,0%	6,0%	4,8%

Source: PINTEC/IBGE. Own elaboration

1.6.5.3. Patent and Public incentives

In this section, patents' applicants and users were classified according to their access to Finep and BNDES, public institutions dedicated to finance economic and innovative development in Brazil. This analysis is based on Finep data from 2003 to 2008 and BNDES data from 2006 to 2008.

The industrial sector represented 93% of innovative firms at PINTEC 2008. Among them, 6.5% used patent invention or utility model as an appropriability model (column 1). Only 0.6% of innovative firms utilized Finep, but a higher percentage, 13.1%, accessed BNDES.

Comparatively, "machinery and equipment" and "computer industry" are the segments in which, proportionally, most firms used IP or UM in Brazil. On the other hand, these methods are less used in the wearing, wood products and textile sectors, which are low-technology intensity industries.

Finep's incentives are accessed by a small percentage of firms in most sectors. The main exceptions are computer, electronic (radio, TV and communication) and instrumentation industries, in which the incentives were used by more than 5% of the firms. But BNDES resources were most frequently accessed by these firms. It is important to highlight that our BNDES database include many types of resources made available by the Bank, and not the incentives exclusively directed to innovation. So, part or all firms that used BNDES resources can have financed investment activities, not necessarily innovative ones.

Table 3.20: IP/UM, Finep and BNDES users by industry (2006-2008)

Industry	IP or UM	FINEP	BNDES
Total	**6,5%**	**0,6%**	**13,1%**
Food products and beverages	2,2%	0,3%	18,3%
Tobacco products	10,0%	0,0%	19,0%
Textiles	1,6%	0,2%	12,2%
Wearing apparel; dressing and dyeing of fur	0,6%	0,0%	5,1%
Leather products; luggage, handbags, saddlery, harness and	3,7%	0,2%	6,5%
Wood and of products of wood and cork	1,1%	0,1%	18,3%
Paper and paper products	6,9%	0,0%	14,5%
Publishing, printing and reproduction of recorded media	3,4%	0,1%	10,9%
Coke, refined petroleum products and nuclear fuel	6,8%	1,9%	34,6%
Chemicals and chemical products	9,4%	2,3%	14,4%
Rubber and plastics products	10,4%	0,2%	22,0%
Other non-metallic mineral products	3,9%	0,2%	13,6%
Basic metals	7,4%	1,9%	23,9%
Fabricated metal products, except machinery and equipment	8,2%	0,1%	11,9%
Machinery and equipment n.e.c.	19,9%	0,7%	12,0%
Office, accounting and computing machinery	15,2%	9,6%	14,4%
Electrical machinery and apparatus n.e.c.	11,8%	1,3%	9,3%
Radio, television and communication equipment and apparatus	10,8%	7,4%	18,7%
Medical, precision and optical instruments, watches and clocks	10,6%	5,3%	9,3%
Motor vehicles, trailers and semi-trailers	10,7%	0,8%	20,0%
Other transport equipment	11,6%	3,0%	15,0%
Furniture; manufacturing n.e.c.	6,5%	0,2%	12,1%

Source: PINTEC/IBGE, Finep and BNDES. Own elaboration

The following tables present the share of patent users among firms that accessed and did not access Finep or BNDES' resources. In almost all cases, the percentage of firms that used patents in significantly higher in the group that accessed public institutions.

Table 3.21 shows the percentage of applicant firms that accessed or not Finep's resources by sector. Among Finep's users, 39.5% of firms applied patent in 2006-2006; this percentage reduced to 6.8% among those who did not accessed Finep. The difference is highlighted in wood and non-metallic mineral products, but in both cases, the percentage of firms that applied patents is relatively small.

Table 3.21: Finep resources per patent applicants

Industry	Patent Applicants / TOTAL	
	FINEP	NO FINEP
Total	**39,5%**	**6,8%**
Food products and beverages	22,2%	4,3%
Tobacco products	-	15,0%
Textiles	0,0%	0,9%
Wearing apparel; dressing and dyeing of fur	-	1,1%
Leather products; luggage, handbags, saddlery, harness and	66,7%	2,3%
Wood and of products of wood and cork	100,0%	0,5%
Paper and paper products	-	6,0%
Publishing, printing and reproduction of recorded media	0,0%	4,3%
Coke, refined petroleum products and nuclear fuel	50,0%	5,9%
Chemicals and chemical products	39,6%	10,0%
Rubber and plastics products	50,0%	14,3%
Other non-metallic mineral products	57,1%	3,8%
Basic metals	42,9%	4,6%
Fabricated metal products, except machinery and equipment	20,0%	7,2%
Machinery and equipment n.e.c.	48,0%	23,1%
Office, accounting and computing machinery	50,0%	8,0%
Electrical machinery and apparatus n.e.c.	42,9%	7,7%
Radio, television and communication equipment and apparatus	21,4%	7,4%
Medical, precision and optical instruments, watches and clocks	50,0%	11,6%
Motor vehicles, trailers and semi-trailers	55,6%	8,8%
Other transport equipment	14,3%	9,8%
Furniture; manufacturing n.e.c.	33,3%	5,6%

Source: PINTEC/IBGE and Finep. Own elaboration

Table 3.22 presents the same structure, but BNDES instead of Finep. In this case, the difference between the group that accessed and did not access the public institution is not so expressive: 9.9% and 6.6%, respectively. In most cases, the sector difference between the percentages of applicants is smaller.

The percentage of firms that did not use any of these instruments and applied for a patent is approximately the same. The main difference is that the percentage of firms that accessed Finep and applied patents is significantly higher than those that accessed BNDES. As mentioned before, the BNDES database include various types of incentives made available by the bank, thus firms demanded BNDES resources for reasons other than support to innovative activities.

Table 3.22: BNDES resources per patent applicants

Industry	Patent Applicants / TOTAL	
	BNDES	NO BNDES
Total	**9,9%**	**6,6%**
Food products and beverages	4,8%	4,2%
Tobacco products	0,0%	17,6%
Textiles	2,5%	0,6%
Wearing apparel; dressing and dyeing of fur	0,3%	1,1%
Leather products; luggage, handbags, saddlery, harness and	10,2%	1,9%
Wood and of products of wood and cork	2,5%	0,1%
Paper and paper products	6,1%	6,0%
Publishing, printing and reproduction of recorded media	2,3%	4,5%
Coke, refined petroleum products and nuclear fuel	5,6%	7,4%
Chemicals and chemical products	14,2%	10,1%
Rubber and plastics products	6,7%	16,5%
Other non-metallic mineral products	4,1%	3,9%
Basic metals	6,1%	5,1%
Fabricated metal products, except machinery and equipment	16,4%	6,0%
Machinery and equipment n.e.c.	26,8%	22,8%
Office, accounting and computing machinery	22,2%	10,3%
Electrical machinery and apparatus n.e.c.	27,6%	6,2%
Radio, television and communication equipment and apparatus	22,9%	5,2%
Medical, precision and optical instruments, watches and clocks	28,6%	12,0%
Motor vehicles, trailers and semi-trailers	13,2%	8,2%
Other transport equipment	29,4%	6,6%
Furniture; manufacturing n.e.c.	12,2%	4,8%

Source: PINTEC/IBGE and BNDES. Own elaboration

A similar comparison can be made if we compare the users of IP or UM, instead of patent applicants. 47.1% of Finep's clients used IP or UM, compared to 6.2% of firms that did not accessed Finep (table 3.23). In the case of BNDES, these percentages are, respectively, 13.5% and 5.4% (table 3.24).

Table 3.23: Finep resources per users of IP or UM

Industry	IP or UM / TOTAL	
	FINEP	NO FINEP
Total	**47,1%**	**6,2%**
Food products and beverages	33,3%	2,1%
Tobacco products	-	10,0%
Textiles	25,0%	1,6%
Wearing apparel; dressing and dyeing of fur	-	0,6%
Leather products; luggage, handbags, saddlery, harness and	33,3%	3,7%
Wood and of products of wood and cork	100,0%	1,1%
Paper and paper products	-	6,9%
Publishing, printing and reproduction of recorded media	50,0%	3,4%
Coke, refined petroleum products and nuclear fuel	50,0%	5,9%
Chemicals and chemical products	50,9%	8,4%
Rubber and plastics products	50,0%	10,3%
Other non-metallic mineral products	28,6%	3,9%
Basic metals	50,0%	6,6%
Fabricated metal products, except machinery and equipment	20,0%	8,2%
Machinery and equipment n.e.c.	70,8%	19,5%
Office, accounting and computing machinery	50,0%	11,5%
Electrical machinery and apparatus n.e.c.	42,9%	11,4%
Radio, television and communication equipment and apparatus	28,6%	9,4%
Medical, precision and optical instruments, watches and clocks	57,5%	7,9%
Motor vehicles, trailers and semi-trailers	44,4%	10,4%
Other transport equipment	14,3%	11,6%
Furniture; manufacturing n.e.c.	66,7%	6,4%

Source: PINTEC/IBGE and BNDES. Own elaboration

Table 3.24: BNDES resources per users of IP or UM

Industry	IP or UM / TOTAL	
	BNDES	NO BNDES
Total	**13,5%**	**5,4%**
Food products and beverages	1,5%	0,3%
Tobacco products	4,5%	1,6%
Textiles	0,0%	11,8%
Wearing apparel; dressing and dyeing of fur	3,5%	1,4%
Leather products; luggage, handbags, saddlery, harness and	0,0%	0,6%
Wood and of products of wood and cork	17,3%	2,7%
Paper and paper products	2,5%	0,8%
Publishing, printing and reproduction of recorded media	14,9%	5,5%
Coke, refined petroleum products and nuclear fuel	6,0%	3,1%
Chemicals and chemical products	5,6%	7,4%
Rubber and plastics products	19,7%	7,7%
Other non-metallic mineral products	15,2%	9,0%
Basic metals	5,4%	3,7%
Fabricated metal products, except machinery and equipment	12,2%	5,9%
Machinery and equipment n.e.c.	19,8%	6,6%
Office, accounting and computing machinery	31,5%	18,3%
Electrical machinery and apparatus n.e.c.	22,2%	14,0%
Radio, television and communication equipment and apparatus	29,6%	10,0%
Medical, precision and optical instruments, watches and clocks	33,8%	5,8%
Motor vehicles, trailers and semi-trailers	47,1%	6,9%
Other transport equipment	14,9%	9,6%
Furniture; manufacturing n.e.c.	34,3%	8,1%

Source: PINTEC/IBGE and BNDES. Own elaboration

1.6.5.4. Patent in force: protecting innovations?

An important part of the international literature mentioned in the introduction of this report showed that, although firms have not considered patents as the main mechanism of technological appropriation, patents' applications and grants have grown over the years. In many cases, this increase is related to the strategic use of patents, i.e., firms have not been patenting to protect the their innovations, the products they want to produce and sell into the market, but mainly to improve their bargaining power, to limit the competitors' actions and, also, to avoid being litigated.

In Brazil, the available data do not allow us to understand the reasons behind the firms' behavior. But PINTEC 2005 includes two questions that can indicate if there are differences between patenting to protect innovations and patenting for other reasons: (1) if a firm had any patents in force; and, (2) if a firm used patents to protect some of its innovations. According to IBGE, (2) included not only the patents already in force specifically protecting the firms' innovations – i.e., products or process already brought to the market – but also those utility models and industrial designs. So, if a firm used these three methods – IP, UM and ID – it would be counted three times in this table[37].

[37] PINTEC 2005, table 1.1.5.

Table 3.25 shows the difference between 1) and 2). If the firms' patents were specifically linked to their innovations, the number of firms with patents in force would be at least as large as the users of patents as appropriability method. However, the opposite is observed (table 3.25). The difference may involve patents related to inventions that were not yet launched into the market, but it is not possible to know if the firms really intend to transform them into real innovations, or only keep them to limit the access of competitors.

Table 3.25: The users of patents (2003-2005)

Sectors	2003-2005	
	Number of firms with patents in force	Patents as a method to protect innovation
mining and quarrying	12,6	7,4
manufacturing	3453,6	2025,5
services	240,1	147,8

Source: PINTEC 2005.

Final Comments

This report aimed to present an overview of data on intellectual property in Brazil, based on WIPO and PINTEC/IBGE statistics.

The applications and grants' dataset showed that:

(a) Brazilian domestic patenting seems below the economic relevance of the country;

(b) Non-resident patents have historically dominated the Brazilian applications, and their relevance was strengthened after the introduction of the present Industrial Property Law, in 1996. Also, they use the PCT national phase almost exclusively;

(c) Although they have had a decreasing share in Brazilian PTO patenting, Brazilian residents' applications and grants abroad have shown growth in the last several years. Among the main offices, these applications were directed not only to the main markets, such as the U.S.A, Europe and Japan, but also to all the BRICS nations and to four Latin American countries – Mexico, Colombia, Chile and Uruguay;

(d) International applicants has been mainly from the U.S.A, Germany and Japan; China and India have presented a reduced participation;

(e) The Brazilian PTO, INPI, is ranked 12th globally in its number of patent applications, while the country is the 7th biggest world economy;

(f) The share of Brazilian residents accounting for world patent applications has not evolved in the last decades. It has maintained an average of 0.36%; moreover, by technological area, Brazilian patent grants are almost inexistent;

(g) Residents dominate utility model, industrial design and trademark' applications;

(h) Industrial design data revealed an increase in the number of applications abroad, from 74 in 1994 to 1,277 in 2010. On the other hand, it showed a decreasing participation of Brazilian resident ID applications in the world, from 1.4% in 2000 to 0.7% in 2010.

(i) Non-resident ID applicants in Brazil also originated from developed countries: U.S.A. and Japan alone represented 44% of foreign applications;

(j) In trademarks, Brazilian applications have shown steep growth since the 1990s, rising from 47,691 in 1992 to 125,654 in 2010;

(k) Brazilian trademark applications abroad have been directed to the main international markets, including the U.S.A., Europe and Japan, and also to China and Latin-American Offices, as Chile, Uruguay and Mexico.

In addition, based on the dataset of innovative firms, it concluded that:

(l) The "propensity to patent", i.e., the evolution of patent applicants' firms out of the total innovative firms, increased in the 2000s, reaching 7.4%, however, it is below that observed in the first PINTEC (1998-2000), despite all the public policies to promote technological innovation and patenting in Brazil during the last decade;

(m) Low-technology industries are the most representative group of innovative firms in Brazil. Among the group of firms that applied for patents, high-medium tech is the most expressive group in Brazil, especially driven by the “chemical products” and “machinery and equipment” sectors. High-tech industries are, in both groups, the least representative category;

(n) Regarding appropriation methods, in all categories and periods, except patents and lead time (2001-2003), low-tech industries were the main users of protection methods, especially in the case of trademarks;

(o) Trademark is main mechanism of appropriability utilized by Brazilian firms in most sectors. In the case of manufacturing industry, patents and ID are, together, the second most important method; in the service sector, second place is occupied by "other" protection methods (which includes copyrights), followed by trade secrets. Design complexity and lead time over competitors were rarely accessed by Brazilian firms.

(p) The regional data indicates that the economic and innovative structures, measured by the number of total firms, innovative firms and patent applicants’ firms, are strongly concentrated in the Southeast of Brazil, which absorbed 54.1% of total enterprises and 61.3% of patent applicant’ firms. However, the propensity to patent in the North was as strong as in the Southeast and, in the Midwest, this propensity was even more intense;

(q) As documented by the international literature, the Brazilian data also shows a positive relation between the firms’ size and patent propensity. But smaller firms, from 10 to 29 employees, presented the most significant growth in patent propensity over the years.

(r) In manufacturing industries, the positive correlation between firms’ size and all appropriability method is evidenced. But in the services sector, this correlation is weaker in the case of ‘trademarks’ and ‘design complexity’.

(s) National firms represented 96% of the innovative firms in the three periods. In the last survey (2006-2008), the average firm had 106 employees and a revenue of U$ 16,898,000, which falls into the medium-size firm category. A total of 11% of the 61 firms took part in foreign trade (exports and/or imports), but this percentage reached 17% in the years before (the 2008 world financial crisis can be associated with this recent fall). The average R&D effort (R&D expenditures / revenue) increased over the periods from 0.72% (2003) to 0.92% (2005) and 1.02% (2008).

(t) On average, large firms that tried formal methods invested more in innovation than the ones that employed strategic methods, except in the case of trademarks. But the scenario is different when small and medium size firms are analyzed: on average, those that have opted for strategic methods tended to invest more in innovation activities than the firms that chose formal appropriability.

(u) In general, a small percent of the firms identified cooperation as important. Suppliers are considered the main partner; “Customers and consumers” is the second main cooperation type employed by innovative firms, patent applicants and firms that used strategic methods of appropriation.

(v) Regarding public incentives to innovation, the funding for the acquisition of machinery and equipment (M&E) for innovative activities is the main type of instrument; the second most used source of incentives is fiscal incentives for R&D and technological innovation.

Future analysis of descriptive statistics should detail the relation between appropriation methods and different types of innovative activities and also the joint use of different types of appropriability, as observed in the international literature.

References

ANDERSEN, B. (2004) If intellectual property rights is the answer, what is the question? Revisiting the patent controversies. In: Economics of innovation and new technology. Vol. 13 (5), p. 417-442.

ARUNDEL, A. (2001) The relative effectiveness of patents and secrecy for appropriation. Research Policy, vol. 10, p. 611-624.

ARUNDEL, A and Kabla (1998) 'What Percentage of Innovations are Patented? Empirical Estimates for European Firms', Research Policy, Vol. 27: 127-141.

BALDWIN, R., G. Gellatly, J. Johnson and V. Peters (1998) 'Innovation in Dynamic Service Industries', Statistics Canada, Ministry of Industry.

BARBOSA, D. (1997) The New Brazilian Patent Law. Available at: http://www.denisbarbosa.addr.com/paginas/papers/papers.html

BASANT, R. (2004), 'Intellectual Property and Innovation. Changing Perspectives in the Indian IT Industry', Strategies for Building Software Industries in Developing Countries Conference, Honolulu, 19-21.

BLIND, K., J. Edler, R. Frietsch and U. Schmoch (2006), 'Motives to Patent: Empirical Evidence from Germany', Research Policy, Vol. 30: 655-672.

BLIND, K., J. Edler, U. Schmoch, B. Anderson, J. Howells, I. Miles, J. Roberts, L. Green, R. Evangelista and C. Hipp (2003), 'Patents in the Service Industries – Final Report', Fraunhofer Institut für Systemtechnik und Innovationsforschung, Karlsruhe.

BYMA, J. and A. Leiponen (2007), 'Can't Block, Must Run: Small Firms and Appropriability', Working Paper Series 1-07, The Mario Einaudi Center for International Studies.

CHANG (2001). Intellectual property rights and economic development – Historical lessons and emerging issues. Journal of Human Development.

CIMOLI, M. and PRIMI, A (2009) Propiedad intelectual y desarrollo: una interpretación de los (nuevos) mercados del conocimiento. In: MARTINEZ, J. M. (Coord.). Generación y protección del conocimiento – Propiedad intelectual, innovación y desarrollo econômico. CEPAL.

COHEN, W., R. NELSON AND J. WALSH (2000). 'Protecting Their Intellectual Assets: Appropriability Conditions and Why US Manufacturing Firms Patent (or Not)', Working Paper N. 7552, National Bureau of Economic Research, Cambridge, US.

GONZÁLEZ-ÁLVAREZ, N. AND M. NIETO-ANTOLÍN (2007). 'Appropriability of Innovation Results: An Empirical Study in Spanish Manufacturing Firms', Technovation, Vol. 27, pp. 280-295.

HALL, B.; HELMERS, C.; ROGERS, M. and SENA, V. (2012) The choice between formal and informal intellectual property: a literature review. WP 17983, NBER.

HALL, B.H. and R.H. ZIEDONIS (2001) 'The Patent Paradox Revisited: An Empirical Study of Patenting in the US Semiconductor Industry, 1979-1995', Journal of Economics, Vol. 32, N. 1: 101-128.

HARABI, N. (1995) 'Appropriability of Technical Innovations. An Empirical Analysis', Research Policy, Vol. 24: 981-992.

HUSSINGER, K. (2005), 'Is Silence Golden? Patent versus Secrecy at the Firm Level', Discussion Paper N. 37, Center for European Economic Research

IBGE (2000, 2003, 2005 and 2008) Pesquisa de Inovação Tecnológica. PINTEC. www.PINTEC.ibge.gov.br.

LAURSEN, K. and A. SALTER (2005), 'My Precious – The Role of Appropriability Strategies in Shaping Innovative Performance', Working Paper N. 05-02, Danish Research Unit for Industrial Dynamics

LICHT, G. and K. ZOZ (1998), 'Patents and R&D. An Econometric Investigation using Applications for German, European and US Patents by German Companies', Annales d´Économie et Statistique, N. 49/50.

LÓPEZ, A (2009). Innovation and Appropriability: Empirical Evidence and Research Agenda. In: The Economics of Intellectual Property - Suggestions for Further Research in Developing Countries and Countries with Economies in Transition. WIPO.

LÓPEZ, A. and E. ORLICKI (2007), Innovación y mecanismos de apropiabilidad en el sector privado en América Latina, WIPO-ECLAC Research Project, mimeo.

MAIRESSE, J. and MOHNEN, P. (2003), 'Intellectual Property in Services. What Do We Learn from Innovation Surveys?' Patents Innovation and Economic Performance.

MANSFIELD, E. (1986), 'Patents and Innovation: An Empirical Study', Management Science, Vol. 32, No. 2: 173-181.

SATTLER, H. (2003), 'Appropriability of Product Innovations: An Empirical Analysis for Germany', Research Papers on Marketing and Retailing N. 003, University of Hamburg, 2003.

WIPO (2013). IP Statistics database, www.wipo.int/ipstats

WIPO (2011). World Intellectual Property Report 2011: The Changing Face of Innovation. Geneva: World Intellectual Property Organization.

ZUCOLOTO, G (2010). Propriedade Intelectual, Origem de Capital e Desenvolvimento Tecnológico: a Experiência Brasileira. TD 1475, IPEA.

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Appendix A: Historical Review of Brazilian Industrial Property Legislation

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Patricia Porto[39]

The present appendix will expose, in general lines, a historical review of Brazilian Industrial Property Legislation. The report aims, in a descriptive form, point out the most relevant changes in the current Brazilian Industrial Property Law, including the provisions set by the statutes and Executive Orders amending such law. It will also list the Brazilian Patent and Trademark Office's (INPI) main regulations.

Also, the Report presents the definitions of the main financial and fiscal incentives related to innovation in Brazil.

A.1. Historical review of Brazilian Industrial Property Legislation

The first patent statute in Brazil was promulgated in 1809. Brazil is generally considered to be the fourth country to have a patent law, and it is a member of the Paris Convention (CUP) since the beginning.

In 1923, entered into force the first encompassing industrial property statute, which created a specific Industrial Property Office and regulated, besides patents, also trademarks. Beyond the industrial property law of 1923, Brazil had many other industrial property statutes, most of them named "Codes", in 1934, 1945, 1967, 1969, 1971 and 1996.

In 1994, the Trade-Related Aspects of Intellectual Property Rights - TRIPS agreement, established the minimum standards requirement as the applicable legal criterion. The Law nº 9279/96 - LPI, the current Brazilian industrial property law, was created, among other objectives, to fulfill TRIPS required levels. The 1996 statute innovated in many aspects and is more comprehensive than the previous one, 5772/71 – Industrial Property Code (CPI). The CPI was more restrictive regarding to the protection of industrial property and excluded, for example, the possibility of patenting chemicals products, food and pharmaceutical inventions, as a result of industrial policy at the time of law enactment.

The present law in general achieved the objectives for which it was created, but some of its points were criticized for overreach the scope of protection to levels far higher than required by TRIPS, for example, with the prevision of the so called pipeline patent. On the other hand, LPI does not allow patenting of some biological material´s inventions, as the ones related to microorganisms (except transgenics), cells and tissues. Presently, Brazilian society has discussed if changes on the present law are necessary.

The main changes derived from LPI are listed in the topic below.

A.2. Main changes of the Industrial Property Law (Law 9279/96)

A.2.1. General Aspect

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The Law 9279/96 stipulated that the Industrial Property Rights should be deemed chattels (art. 5 of LPI) and replaced the term privileges by patent (art. 2 of LPI) (the term however is ingrained in the Constitutional text).

A.2.2. Patents

A.2.2.1. Kind of patents (Art. 8 e 9 of LPI)

In LPI, patents are granted for inventions and utility models. The LPI creates a new system of *registration* for industrial designs, whereas the prior statute listed them as patents.

For *invention* patents, novelty, industrial application and inventive activity are the requisites of patentability. The inventive activity was specifically included in the LPI as one more requisite even though it was already in force through Office practice and case law. Inventions are evaluated under the light of the generally accepted concept of *inventive step* (Barbosa, 1997). For utility models are required novelty, industrial application and *inventive act*. Utility models (improvements on physical object of practical utility) are therefore assessed under a lesser standard of inventive activity.

A.2.2.2. Patentability

The LPI restricted what cannot be patented, thus including items not covered by prior law. Chemical products, food and pharmaceutical inventions can be patented according the current law. The previous law only granted patents for the processes or means for obtaining them.

The LPI provided into two articles what it is not considered an invention or utility model (art. 10 of LPI) and what is not possible to be patented, even if consists in an invention or an utility model (art. 18).

According the current law it was not deemed to be inventions or utility models

> *a) discoveries of natural occurring laws and items; b) mathematical or otherwise scientific theories and purely abstract concepts; c) commercial, financial, advertisement, accountancy and similar schemes; d) works of art; e) computer programs by itself; f) presentations of information; f) rules of games; and g) surgical procedures and therapeutic methods for human and animal body. Also excluded as non inventions are the whole or part of any live natural being and biological material found in Nature, even isolated thereof, including the genom or germoplasm, and the natural biological processes.*

The current law does not allow granting patents, even if such items are considered an invention to:

> *a) the inventions offensive to morals, good customs, security, to public order and public health; b) items resulting from the transformation of atomic nuclei; and c) the whole or a part of living bodies (even though not found in nature), except in case of transgenic microorganisms that satisfy all the patent requirements.*

A.2.2.3. Grace Period (Art. 12)

The current industrial property law does not consider lack of novelty the disclosure of the invention's content in the twelve months before the patent application filing date, if the disclosure is made: by the inventor; by the Brazilian PTO, through the official publication of the patent application filed without the consent of the inventor; based on information obtained from or due to

acts performed by him; or by third parties based on information obtained directly or indirectly from the inventor or the result of his acts[40].

This prediction is an exception to the principle of the total novelty adopted by the international patent system**.** For this reason, it is valid only for national protection.

A.2.2.4. Unity and sufficient disclosure

The article 22 of LPI brought to the law the notion of the "*inventive concept*". The patent request must refer to a single invention or a group of interrelated inventions in order to comprise a single inventive concept. This concept was already used by the PTO, including in the Regulation of that body, but in Law 9279/96 it can be found its first statutory provision (Dannemann, 2001).

The article 24 established that the descriptive report must describe clearly and sufficiently the object of the patent application and must indicate the best mode to execute the object of the invention. The single paragraph established that in case of inventions which involve biological materials, the mentioned requisite must be supplemented by a deposit of the whole or portions of the object of the applications in an accredited depository institution.

The article 32 broadened the scope of the previous law and allowed the applicant to modify the application to conform PTO requests, provided that the limits of the matter originally claimed are not exceeded.

Article 41 stipulates that the protection conferred by the patent will be determined by the content of their claims, interpreted on the basis of the specification and drawings. The law 9279/96 defines the scope of patent rights and also provides that it gives to the holder the right to limit the patent use by others (art. 42).

A.2.2.5. Prior user and replevin[41]

The LPI, under the article 45, introduces the legal concept of prior possession of an invention. Under this concept, the legal user of an invention eventually patented by a third party may continue working with the patent, even in face of the exclusive rights of the patent owner, but cannot license or transfer its possession except in the whole of its assets. Other novelty in the law is the possibility, in the cases when the first to file party is not an inventor on its own right, of going to the court and require annulling or seizing the patent, through the action of replevin (art. 49).[42]

A.2.2.6. Inventions made by employees

The LPI, in the articles 88 to 93, regulates the ownership of the work performed by the inventor employee.

The articles state that the invention belongs:

a) to the employer: when they arise from the employment contract, which the execution occurs in Brazil and having as objective research or inventive action, or if the nature of the services for which the employee was hired results in such purpose;

[40] Case law and Office practice have tended to reserve Grace Periods to individuals or small firms, denying such advantages to larger players.

[41] Replevin is the reintegration of the patent to its true holder.

b) to the employee: when the invention or utility model is developed by him, provided that it is unconnected to the employment contract and does not issue from the use of resources, facilities, data, materials, facilities or equipment of the employee;

c) to both, in equal parts: when it results of the employee's personal contribution and includes resources, data, methods, materials, facilities or equipment of the employer, except in the case of an explicit contractual provisions to the contrary. To the employer is granted by the statute an exclusive license to file and explore the patent; full title is forfeited to employee in case the employer does not explore the patent.

A.2.2.7. Pipeline Patents

The Law 9279/96 brought a special provision of what is usually called "Pipeline", covering patents of chemical products, food and pharmaceutical inventions, which could not be protected under the previous legislation.

The articles 230 and 231 of the present law allowed the deposit, for a period of one year, starting in May 1996, to patent application of chemicals products, pharmaceuticals and food inventions (products and process). It included inventions of patents already granted in other countries and patents applied in Brazil during the previous law and in current examination, since the following requirements were respected: a) the object has not been placed in any market by direct initiative of the holder or by third parties with his consent; and b) serious and effective preparations for exploiting the subject matter of the invention or patent has not been done by third parties in this country.

The law 10.196/01 changed the article 229 to include the Mail Box provision of the TRIPs Agreement: the patent applications in progress, which the object of protection comprises substances, materials or products obtained by chemical means or processes or substances, materials, mixtures or food products, chemical-pharmaceutical and medication of any kind, as well as the respective processes of obtaining or modification and whose depositors have not exercised the option provided in arts. 230 and 231 of this Law shall be considered rejected by the PTO; the claims relating to pharmaceutical products and chemicals for agriculture, which were filed between January 1, 1995 and May 14, 1997, apply the patentability criteria of this Act, effective on the date of filing in Brazil or priority, if any, ensuring protection from the date of grant of the patent, for the remaining period from the date of filing in Brazil, limited to the period provided in the single paragraph of Art. *40.*

It was also stipulated that the granting of patents for pharmaceutical products and processes depend on the prior consent of the National Sanitary Surveillance Agency – ANVISA.

A.2.2.8. Fair Usage and limitations

The LPI, in art. 43, differently than the last Industrial Property Law, sets a list of practices excluded from the exclusive right: I - acts performed by unauthorized third parties, privately and without commercial purposes, provided they do not prejudice the economic interests of the patentee; II - acts performed by unauthorized third parties for experimental purposes, related to studies or scientific or technological research; III - the preparation of medicine according to prescription for individual cases, performed by a qualified professional, as well as the medicine thus prepared; IV - the product manufactured according to patent a process or product that has been placed on the internal market directly by the patentee or with his consent; V - to third in the case of patents related to living matter, use, without economic purpose, the patented product as an initial source of variation or propagation for obtaining other products; VI - third parties, in the case of patents related to living matter, use, place in circulation or sell a patented product that has been lawfully introduced

into commerce by the patentee or his licensee, provided that the patented product is not used for commercial multiplication or propagation of living matter in question; VII - to acts performed by unauthorized third parties related to patented inventions, intended exclusively for the production of information, data and test results, to procure commerce registration, in Brazil or another country for the exploitation and marketing of the patented product after the expiry of the period stipulated in art 40.
The last provision is called the “bolar exception” and was inserted in the 1996 statute by law nº 10.196/01.

A.2.2.9. Compulsory Licenses

The Decree 3201/99 as amended by Decree 4830/03, respectively, regulate the grants, ex officio, of compulsory licenses in cases of national emergency and public interest, in accordance with the art. 71 of the current Industrial Property Law.

Thus, it may be granted, ex officio, a compulsory licensing of patents in cases of national emergency or public interest if so declared by the Government, when the patent holder, directly or through license, does not meet these needs. It is understood that the national emergency is imminent danger to the public, even if only in part of the country and consider public interest the facts, among others, public health, nutrition, environmental protection, as well as those of prime importance for the technological or socio-economic of the country. Only the Minister of State, through the official gazette, can declare the compulsory license in these cases.

The act of granting the compulsory license shall establish the validity term, possibility of prorogation and conditions of the patent owner remuneration.

The exploitation of a patent licensed may be undertaken directly by the Union or by a contract or agreement, remaining prevented the reproduction of the subject matter for other purposes, under penalty of being considered as illicit.

It is also possible to import the patented product when the national emergency or public interest cannot be supplied by national production.

A2.2.10. Expiration Date and Annulment

In the present law, the invention patent term was extended to 20 years counting from filing date, and the utility model to 15 years; but it is assured a minimum duration of 10 or 7 years, respectively, counted from issuance of letters patent, except if INPI was prevented from examining the application by court order (art. 40 of LPI). In the prior law, the term date to the invention and utility model was 15 and 10 years respectively, no extension assured.

The current law, in articles 76 and 77, provides for an addition certificate to secure any improvement or development introduced in the object of the invention, even if devoid of inventive activity, assured novelty and provided that the material is included in the same inventive concept.

A.2.3. Industrial Designs

The current law treats the industrial design as an independent institute. In the prior law it was treated as a patent.

The present Law grants an industrial design registration for the ornamental plastic form of an object or any ornamental arrangement of lines and colors that can be applied to a product, providing new

and original visual result in its external configuration and can serve as a type industrial manufacturing.

The law grants registration through the examination of the items provided by the article 100 of the present law, but does not examine nor the novelty nor the originality of the industrial design. The substantive examination, which inspects the novelty and originality of the industrial design, can be request by the design owner to the Brazilian PTO after registration. The Office may decree annulment by its own initiative, when, through the substantial examination, the body verify the absence of any requirement for the industrial design registration, like novelty or originality.

The registration will be valid for 10 (ten) years from the filing date, renewable for 3 (three) successive periods of five (5) years each.

A.2.4. Trademarks

The present Law grants trademark registration for a period of ten years, renewable indefinitely for equal periods, for a sign visually perceptive, in every cases not prohibited under the Law (art. 122).

A.2.4.1. Prohibitions

The prohibitions are exposed in the article 124. In the words of Denis Barbosa (1997):

> *Registration is denied is all the cases where other foreign law standards apply: basically, a) where a prior registration or application is found; b) where the claimed words or images are in public domain; c) where the rights of third parties could be infringed by the registration, or d) where the words or images or combination thereof are misleading to the public or otherwise contrary to the rules of fair competition. An extensive list of cases is included in art.*

A.2.4.2. Kinds of trademarks

In addition to the registration of products and services' trademarks, the LPI innovates once more, by providing the registration of collective and certification trademarks. These trademarks must be registered along the respective regulations of use.

The certification mark is used to attest the conformity of a product or service with certain technical standards or specifications, particularly regarding the quality, nature, material used and methodology employed (art. 123, I, LPI).

The collective mark is used to identify products or services originated by members of a given entity (123, II, LPI)

A.2.4.3. Special protections

The article 126 internalizes the express provision in Article 6 bis of the CUP. It is an exception for the principle of territoriality and determines that: well-known trademark in its field of activity in terms of art. 6a (I) of the Paris Convention for the Protection of Industrial Property will enjoy special protection, regardless of whether previously filed or registered *in Brazil.*

The current Law keeps the special protection through all fields of activities for the high renowned trademarks (art. 125). No composite protection (international plus all fields of activity) is provided by statute.

The article 129, par. 1º, brings, again, to the current Law the provision of the right of precedence. This provision was present in the Industrial Property Code of 1945 and was removed by subsequent laws. The right of precedence establishes that *every person* who in good faith at the date of filing or priority, used in the country for at least 6 (six) months, identical or similar mark, to distinguish or certify a product or service that is identical, similar or related, will have preferential right to the register.

The owner or the applicant of the trademark assures the right to use and license it and to keep sign in good fame and reputation (art. 130).

A.2.4.4. Fair Usage and limitations

The article 32 establishes that the trademark owner shall not: prevent tradesmen or distributors from using distinctive signs that belong to them, along with the product brand, as they carry out its promotion and marketing; II - prevent manufacturers of accessories using the mark to indicate the use of the product, provided they obey practices of fair competition; III - prevent the free circulation of products placed on the domestic market by himself or by another with his consent, except as provided in § 3 and 4 of art. 68. IV - prevent the mention of the mark in speeches, literary or scientific or any other publication, provided that there is no commercial connotation and without prejudice *to its distinctive character.*

A.2.4.5. Revocation

The term to revoke a trademark register for non use was extended to 5 years from de date of the registration. On the previews law the term was 2 years. To contest the revocation, any legitimate reason may be used as defense. Revocation also is provided in cases where the owner does not maintain an attorney in Brazil.

A.2.4.6. License and transfer

The transference must include all registrations or applications on behalf of the transferor of identical or similar trademarks relating to a product or service identical, similar or related, subject to cancellation of the registrations or shelving of the unassigned applications (art. 135).

The trademark owner or the applicant of the trademark request may celebrate license agreement for its use, without prejudice to the right to exercise effective control over the specifications, nature and quality of their products or services. The license agreement must be registered at INPI to produce effect with respect to third parties (arts. 139 and 140 LPI).

A.3. Brazilian PTO'S main regulations

Law No. 10.196/2001 - Amends and adds provisions to Law No. 9279 of May 14, 1996, which regulates the rights and obligations relating to industrial property, and other matters. Available at: http://www.planalto.gov.br/ccivil_03/leis/LEIS_2001/L10196.htm

Law No 9279/1996 – Brazilian Industrial Property Law. Available at: http://www.planalto.gov.br/ccivil_03/leis/L9279.htm

Normative Act No. 161/2002 - Provides for the implementation of the Industrial Property Law in relation Industrial Design registration. Available at: http://www.inpi.gov.br/images/stories/downloads/desenho_industrial/pdf/Ato_Normativo_161_Itens_revogados.pdf

Normative Act No. 127/1997: Provides for the implementation of the Industrial Property Law regarding patents and certificates of addition to invention. Available at: http://www5.inpi.gov.br/menu-esquerdo/patente/pasta_legislacao/atos-normativos/copy_of_ato_127_97_html

Resolution PR No. 296/2012 - Provides on the submission and examination of the regulation regarding the use of collective trademarks. Available at: http://www.inpi.gov.br/images/stories/downloads/marcas/pdf/Resolucao_PR_296_2012_Regulamento_de_utilizacao_Marcas_coleti.pdf

Resolution INPI n º 291/2012 – Discipline the procedures for the entry into the national phase of the patent applications filed under the Patent Cooperation Treaty (PCT), with the INPI, as the Body Appointed or Elected in order to adapt such applications to the provisions of Law No. 9279 of May 14, 1996. Available at: http://www.inpi.gov.br/images/stories/Resolucao_291.pdf

Resolution No. 283/2012 - This Resolution regulates the priority examination of Green Patents applications, the procedures for the Pilot Program related to the topic and other related issues. Available at: http://www.inpi.gov.br/images/stories/downloads/patentes/pdf/Resolucao_283_Patentes_Verdes.pdf

Resolution 121/2005: Standardize procedures for the application of art. 125 of Law No. 9279 of May 14, 1996, INPI and revoke Resolution No. 110 of January 27, 2004. Available at: http://www6.inpi.gov.br/legislacao/resolucoes/res_121_2005.htm.

Resolution 075/2000: Establishes the conditions for registration of geographical indications. Available at: http://www6.inpi.gov.br/legislacao/resolucoes/re_075_00.htm?tr4.

Guidelines for examination of patent utility model - Published in 2185 RPI of 21/11/2012. Available at: http://www.inpi.gov.br/images/stories/downloads/pdf/Diretriz_de_MU.pdf

Guidelines for trademarks analysis - 11/12/2012. Available at: http://www.inpi.gov.br/images/stories/downloads/marcas/pdf/inpi-marcas_diretrizes_de_analise_de_marcas_versao_2012-12-11.pdf

Guidelines for patent examination (except biotechnology and chemical areas), December 2002. In the review process. Available at: http://www5.inpi.gov.br/menu-esquerdo/patente/pasta_oquee/Diretrizes%20de%20Exame%20de%20Patentes/

Guidelines for the examination of patent applications in biotechnology and pharmacological filed after 31/12/1994. In the review process Available at: http://www5.inpi.gov.br/menu-esquerdo/patente/pasta_oquee/Diretrizes%20de%20Exame%20de%20Patentes/

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