

PATENTS OF BRAZILIAN UNIVERSITIES IN MECHANICAL AREA

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Abstract. *The patent applications from universities have increased in recent years. In Brazil, this phenomenon has expanded with the entry into force of the Law of Innovation and the creation of Centers of Technological Innovation (NIT) in the Institutions of Science and Technology (ICT). This article aims to present the results of a study about the patents of Brazilian universities in the mechanical area. The research presents bibliometric approach based on information contained in patent documents filed by Brazilian universities in the National Institute of Industrial Property - INPI. Patent documents were recovered in the Derwent Innovation Index database of the Institute for Scientific Information (ISI) accessed through the Capes Portal for Periodicals. Additional information was obtained from the curricula Lattes of the inventors/researchers. The results show the main universities and inventors/researchers who have filed patents in the country; the profile of these inventors/researchers and the relation between patents and scientific papers; and the relationships collaboration between the universities and other institutions.*

Keywords: *University Patenting; Relation science-industry; Mechanical engineering*

1. INTRODUCTION

Among the several kinds of technology transfer of the universities to the industries – spin-off, licensing agreements and patents, contract research, consultancy and reach-out, and graduate and researcher mobility (POLT et al., 2001; WRIGHT et al., 2008), patent applications have shown the greatest growth in recent years (GUSMÃO, 2002). This phenomenon can be explained, among other factors, by the creation of laws and regulations that have allowed universities to deposit and to license patents resulting from researches financed by public funding. An example is the Bayh-Dole Act of the USA (1980) considered an international reference.

In Brazil, the named Law of Innovation (Law 10.973 of December 2nd 2004) provides that Scientific and Technological Institutions (STIs), including universities, should have a Technological Innovation Office in order to manage their innovation policies. Within the actions of the NITs, there is great concern with the intellectual property rights, especially patent applications.

According to Oliveira and Velho (2009), the number of patents applied by Brazilian universities increased almost five times in the last decade in relation to previous one (PÓVOA, 2008; OLIVEIRA and VELHO, 2009). This is a recent phenomenon that requires studies to better understand the characteristics of these patents and their effects on the academic environment. As the Engineering is a field of knowledge which has great potential for patenting, it is important to conduct studies on the subject.

The article aims to present the results of a survey about the patents of Brazilian universities in the mechanical area to identify: 1) the main characteristics of these patents; b) the relationships collaboration between the universities and other institutions; and 3) the profile of the inventors/researchers.

The study presents bibliometric approach based on information contained in the patent documents deposited in the National Institute of Industrial Property (INPI) by Brazilian universities. Patent documents were recovered from Derwent Innovation Index (DII) / Institute for Scientific Information (ISI) accessed through the Capes Portal. The profile of the inventors / researchers was based on information from *curricula vitae* contained in the “Plataforma Lattes” of the CNPq.

2. UNIVERSITY PATENTING

According to Gusmão (2002), the approximation between the public and private sectors for research and technological development (R&D) is not new, and it is present in the German system since the nineteenth century. However, it was in recent decades that this practice has intensified in the most countries. Etzkowitz et al. (2000) say that the new configuration of the university, named "entrepreneurial", has emerged with the strengthening of the role of these institutions in the process of technological innovation in consonance with the Triple Helix Theory, which is based on the relationship between academia - industry - government.

Especially with regard to issues involving intellectual property rights, government support is explicit in initiatives such as the Bayh-Dole Patent and Trademark Amendments Act of the U.S. (1980), which allowed universities to make deposits and grant licenses of the patents resulting from publicly funded research (Rafferty, 2008), and to receive royalties from commercialization. This new scenario has stimulated the increase of the university patenting.

In the case of Brazil, the regulatory model of interaction between academia and private sector can be considered the called Law of Innovation that establishes incentives for innovation and for scientific and technological research in the production environment (Law 10,973 of December 2nd, 2004). According to this law, the STIs – universities and research institutes – must have a Technological Innovation Office that, among other functions, should ensure the policy of innovation and intellectual property rights of the institution. In the scope of the activities of this office, special attention is given to patenting.

The initiative to have technology innovation offices in the universities and research institutes was before the Law of Innovation. Even in the 80s, CNPq supported the creation of offices of technological innovation in universities and research institutions to promote innovation, technology transfer to industry, and studies of technological forecasting. This initiative, however, was abandoned with the economic crisis (Etzkowitz et al., 2005). Few universities such as USP and Unicamp maintained a structure capable of providing support to researchers on issues of patenting. The most of universities in the country only recently organized themselves for this purpose.

In addition to the Law of Innovation, the following factors contributed to the creation and consolidation of these offices of technological innovation and to the increase of patenting in the universities and research institutes: awareness of the importance of patenting in the academic environment; the structuring of networks such as REPICT –Intellectual Property, Cooperation, Negotiation and Technology Commercialization Network and others; the creation of FORTEC - National Forum of Managers of Innovation and Technology Transfer; the existence of resources for support the creation of these offices of technological innovation; the Decree n^o. 2553 / 98 which allowed the receiving of royalties by the inventors; the inclusion of clauses related to intellectual property rights in the contracts of research funded by public agencies and in the contracts of partnerships with companies such as Petrobras and other. It is also important to note that patents have become valued by funding agencies.

Several other initiatives were implemented to stimulate innovation in the country, encouraging the science-industry interaction as a way to promote technological development and to increase the competitiveness. In a study about public policies for innovation in Brazil, Sennes (2009) cites the following initiatives: the creation of the Sectoral Funds for Science and Technology in 1999; the establishment of an industrial policy (PITCE) in 2003; the named Law of Good and the implementation of the Plan for Accelerated Growth of Science, Technology and Innovation in 2007; and the Productive Development Policy (PDP) in 2008.

Another aspect to be mentioned is that the patenting in areas like pharmaceuticals and chemicals was only possible in Brazil with the entry into force of the new Industrial Property Law (Law 9279/1996). This law substituted the old Industrial Property Code in order to adapt the Brazilian regulation to the prerogatives of the TRIPS (Trade-Related Aspects of Intellectual Property Rights). According to TRIPS, all signatory countries can not prevent the patenting in any technological field. Then, Brazil has granted, without discrimination, patent in medicines, food and chemicals areas, benefiting the biotechnology and pharmaceutical industry (PÓVOA, 2008). As in Brazil there is academic expertise in these areas of knowledge, the possibility of patenting also contributed to the increase of the number of patent applications from universities (LETA and BRITO CRUZ, 2003).

Considering that patents of universities are results of researches and that Brazil currently occupies the 13th position in the ranking of world scientific production (based on articles published in scientific journals indexed by Thomson / ISI), we must assume that the patenting of universities in Brazil has potential to expand in coming years. The Brazilian scientific production, however, is not equally distributed among the various areas of knowledge. In 2009, for example, Brazil accounted for 2.69% of total articles published, considering all areas of knowledge. In the areas of agricultural sciences and science of animals / plants, the Brazilian participation was respectively 9.89% and 7.04% of world production. Specifically, the engineering is below the national average with 1.50% of all published articles as shown in Table 1.

Table 1. % of Brazil in the world scientific production by knowledge areas

Knowledge areas	% of Brazil in the world scientific production		
	2007	2008	2009
Agricultural Sciences	4,07	9,59	9,89
Animal Sciences / Plants	4,85	6,37	7,04
Pharmacology and Toxicology	3,10	3,43	3,96
Microbiology	3,21	3,55	3,32
Ecology / Environment	0,97	3,03	3,31
Ecology / Environment	2,71	2,89	3,01
Biology and Biochemistry	2,16	2,56	2,82
Neuroscience and C. Behavioral	2,49	2,62	2,80
Clinical Medical	1,77	2,60	2,71
Immunology	2,54	2,40	2,29
Molecular Biology/Genetics	1,76	2,46	2,27

Physics	2,12	2,35	2,03
Chemistry	1,75	1,95	1,95
Space Sciences	2,20	2,16	1,89
Mathematics	1,70	1,81	1,81
Multidisciplinary	0,89	1,77	1,76
Materials Science	1,51	1,63	1,75
Geosciences	1,39	1,56	1,67
Engineering	1,40	1,60	1,50
Psychology/Psychiatry	0,88	1,53	1,46
Computer Science	1,25	1,40	1,23
Business and Economy	0,51	0,70	0,86

Source: Innovation Portal – MCT

The indicator of patents, however, is not distributed by technological field. Therefore, this study aims to give a contribution in relation to the patenting of universities in the mechanical area.

3. METHOD

This study is characterized as a descriptive and quantitative research with bibliometric approach considering the patents of Brazilian universities deposited in the INPI. The survey of the patent documents was based on the Derwent Innovation Index (DII)/ISI Web Knowledge, accessed through the Capes Portal. This database contains patent documents deposited in the major offices of intellectual property of the world, including the INPI. The survey was based on the following parameters:

- Assignee: university (UNIV*);
- Patent number: (BR*);
- Time: until 2008 (2009 and 2010 were not considered because of the period of secrecy)

The collected data were transferred to an Excel spreadsheet containing information such as patent number; title; authors (inventors); assignee; and classification number. In this study, the authors used the Derwent Classification to identify the technological field of the patent documents. It is important to mention that a patent document can have more than one classification. The following data from the patent documents were observed: section of the mechanical class according to Derwent Classification; name of the university; scope of the patenting (national or international); and relation of partnerships.

The profile of the researchers was based on information from Lattes curricula of the inventors / researchers. To identify the profile of the researchers were considered: level of academic formation; if the inventor/researcher receives CNPq productivity grant; if the inventor/researcher has activities in graduate programs and the respective concept attributed by Capes. In relation to the productivity of the inventors/researchers were observed: number of articles published in journals; number of articles published in proceedings; and number of students oriented by inventors/researchers.

Initially the survey recovered 4.041 patents documents from DII. Considering only the documents of Brazilian universities, this number was reduced to 1.428 documents which were distributed by technological field according to Derwent Classification. Finally, this study analyzed 94 patent documents classified in the mechanical area.

4. RESULTS AND DISCUSSION

The 1.428 patent documents of Brazilian universities were classified by technological field according to Derwent Classification. Figure 1 illustrates that the classes D – Food, Detergents, Water Treatment and Biotechnology, B – Pharmaceuticals, and A – Polymers and Plastics concentrated the greater number of patent documents. Class Q – Mechanical – concentrated 94 documents, around 6,6% of the total.

Figure 2 shows that the patents of the Brazilian universities in the mechanical area are concentrated in the sections: Q4 – Buildings, Construction, and Q7 – Lighting, Heating.

USP and UNICAMP were the universities with the greater number of patent documents in the mechanical area as shown in Figure 3. These two institutions have the longest history of patenting.

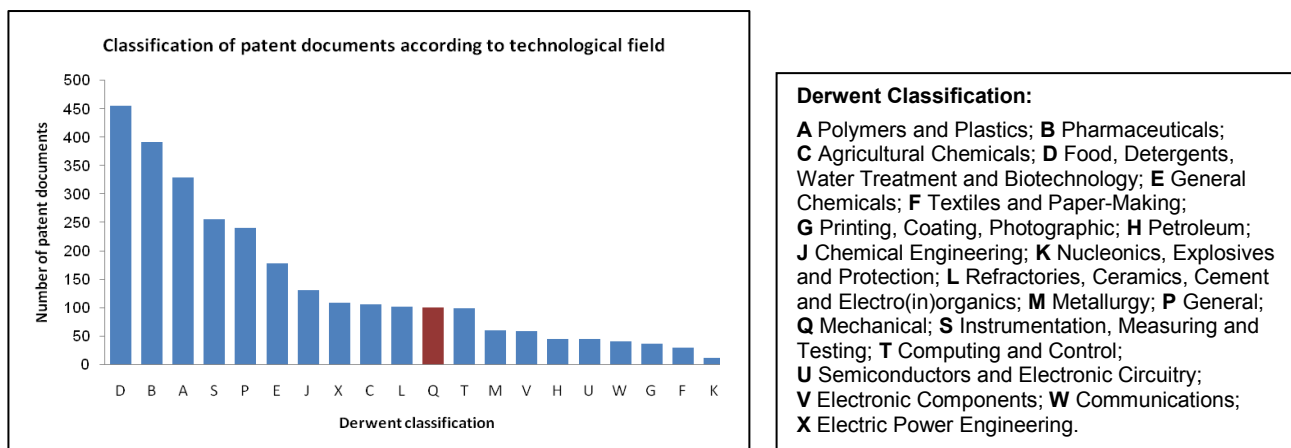


Figure 1. Classification of patent documents according to technological field

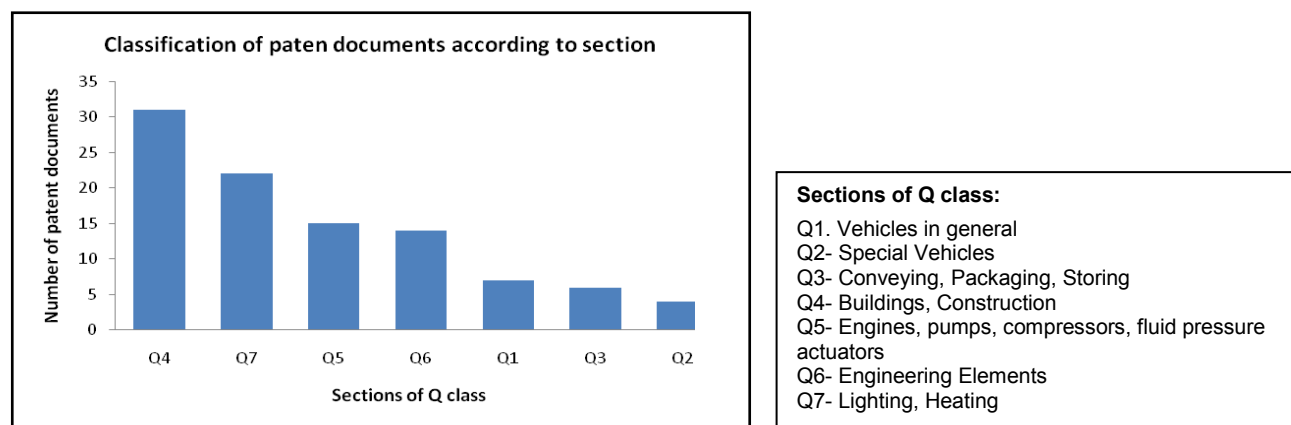


Figure 2. Classification of patent documents according to section of the class Q (Derwent Classification)

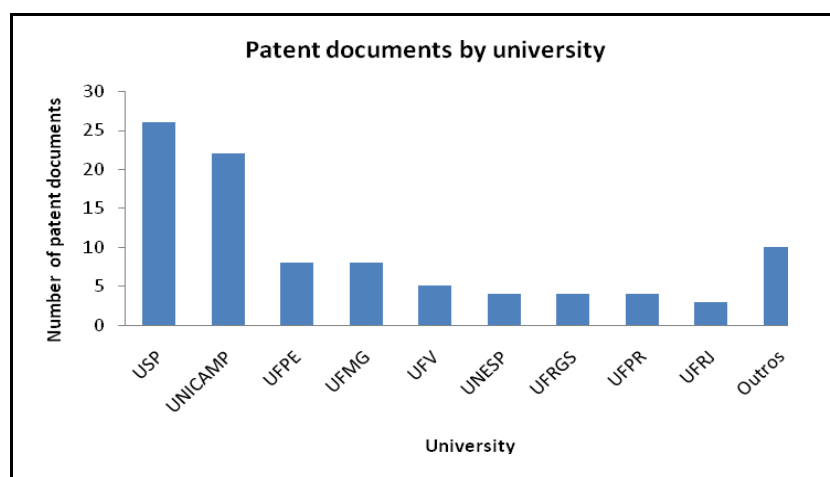


Figure 3. Patens documents by university

Considering the 94 patent documents analyzed, we can observe that 87 (92,6%) were deposited only in the Brazil and a little number – 7 documents (7,4%) – were deposited in Brazil and in other countries (Figure 4). This result indicates that that the scope of protection is mostly restricted to Brazil.

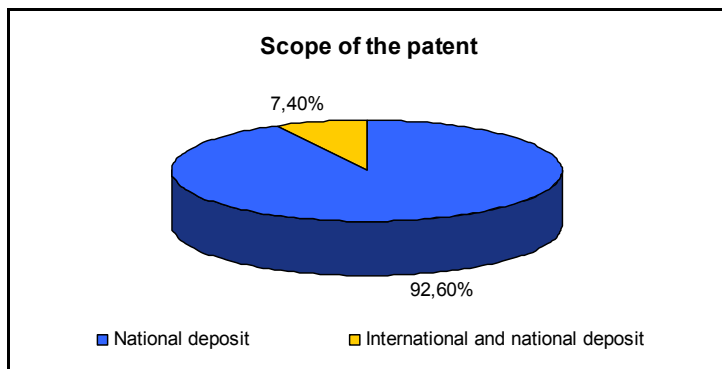


Figure 4. Scope of the patent

In relation to collaborative networks, Figure 5 illustrates that 74 patent documents (78,7%) do not present partnership of the universities with other institutions. Partnerships with firms were registered in only 7 patent documents.

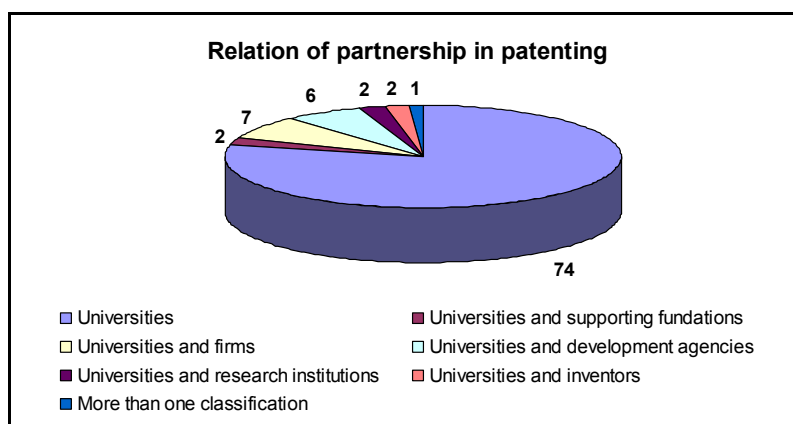


Figure 5. Relation of partnership in patenting

Among the inventors, 17 researchers had more than one patent deposited. Considering these 17 researchers, it was not possible to access the Lattes curricula of 3 of them. Then, the profile of the 14 inventors/researchers analyzed is illustrates in the Table 2.

Table 2. Profile of the inventors/researchers

Inventor/ researcher	Productivity in research (CNPq)	Activities in graduate programs	Program evaluation (Capes)	Years of doctoral level
1	----	Yes	5	11
2	2	Yes	7	14
3	----	---	---	2
4	1B	Yes	7	28
5	1A	Yes	7	26
6	1B	Yes	6	26
7	1C	Yes	6	13
8	2	Yes	5	12
9	2	Yes	7	32
10	2	Yes	4	12
11	---	Yes	5	17
12	1D	Yes	6	18
13	1B	Yes	7	21
14	---	Yes	6	10

According to the results of the table 2, we can observe:

- All inventors/researchers have doctoral level education
- The average time of the doctoral level education is 17,3 years
- Most inventors/researchers participate in graduate programs well evaluated by Capes
- Most inventors/researchers receive CNPq productivity grants.

The productivity of these inventors/researchers is shown in table 3.

Table 3. Productivity of the inventors/researchers.

Inventor/ researcher	Articles in journal	Articles in proceedings	Oriented students (master level)	Oriented students (doctoral level)	Oriented students (undergraduate; scientific initiation)
1	6	2	3	0	0
2	30	108	24	4	19
3	4	12	0	0	0
4	52	149	27	16	15
5	45	151	30	15	19
6	21	110	35	7	0
7	102	16	16	17	31
8	51	27	9	10	0
9	46	88	28	19	0
10	3	32	13	0	6
11	10	24	12	4	8
12	34	70	11	6	24
13	56	167	60	28	0
14	13	1	7	0	30

5. CONCLUSION

This article aimed to contribute to a better understanding of the university patenting in the mechanical area. The results of the study showed that: 1) the majority of the patents were developed only by universities; 2) there were few partnerships with companies; 3) the scope of the patenting was restricted to Brazil with few deposits in other countries; 4) profile of inventors / researchers is characterized by doctoral level education, participation in graduate programs well evaluated by Capes, and high standards of productivity considering publications and oriented students, with many of them receiving CNPq productivity grants.

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