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**THE RELATIONSHIP BETWEEN PETROBRAS AND BRAZILIAN  
UNIVERSITIES MEASURED BY THE NUMBER OF PATENTS APPLIED  
IN CO-OWNERSHIP AND IN THE PERCENTAGE OF LICENSING  
THEREOF**

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### **Abstract**

Much is known about the use of the number of patents applied as an indicator of innovation, however, it is believed that to analyze the relationship between Petro bras (a partially state-owned oil company) and Brazilian universities, it would be better to evaluate the number of patents they have in co-ownership and what percentage of them is licensed. The article uses as a starting point the legislation for innovation created in 2004 in Brazil and highlight some benefits of this government incentive in terms of patents applied and licensed by many Brazilian universities. Due to the results of this study the model of appropriation of inventions derived from R&D projects in partnership between Petro bras and universities is questioned leading to the conclusion that besides the option of share the ownership of the patent it should be given to the partners the option of hand over its part in the ownership in exchange of a free license to explore it commercially, assuming this as the real goal of the innovation process.

**Key Words:** indicators; patent licensing; appropriation of inventions; co-ownership of IP.

### **Introduction**

One of the reasons for a company's success can be attributed to its ability to innovate. Have the ability to identify market needs, whether in the search for solutions for existing demands or even creating new demands and be one step ahead of their competitors can bring great competitive advantage to an organization.

Prior to the industrial revolution, the creation and innovation of a product or process were due exclusively on the intellectual and inventive capacity of the artisan [1]. His know-how used to be enough for his success. The automation of the manufacturing process not only increased production capacity but also became the source of new inventions.

For many years, companies innovated with the effort of their own employees. In the course of time, companies established from small departments to large research centres in an attempt to systematize the innovation process. The larger in size and number of collaborators these research centres would be stronger and more innovative, ensuring the development of new technologies to boost companies. Being big may be considered important to sustain the strong growth of innovation-driven industries, but companies knew that they also should continually complement their internal efforts with external opportunities [2].

With the advent of the information age, physical barriers to knowledge had to be knocked down harder. Entrepreneurs already had the notion that no matter how big their research centres and R&D investments were, this did not guarantee that the best talents would be within their companies. The closed innovation model began to evolve for the open innovation model [3]. Companies started to make partnerships among each other with greater intensity and a new actor in the innovation process was highlighted: the universities.

Universities have historically been created with the role of developing specialized professionals in each area of knowledge. These professionals, once graduated would be incorporated into the enterprise workforce. Subsequently the universities have also gained strength in the field of research with their post-graduation programs.

The Alberto Luiz Coimbra Institute for Post-Graduation and Engineering Research (COPPE) was an initiative to bridge the gap between the university and the productive sector in Brazil. In the early 1960s, it began its activities only as a graduate program in engineering. However, due to the excellence acquired and its role for the country's technological development, the Institute initiated programs in partnership with the productive sector, especially with companies in the petrochemical sector, such as Petro bras.

Many technological solutions were originated within universities, but for lack of legal mechanisms and a business focus it was common for them not to directly earn any money from their inventions. In Brazil, the Innovation Law (Law No. 10,973/2004) was created to reduce this distortion. It encompasses three major subjects: the creation of a conducive environment to strategic partnerships among universities; encouraging the participation of technology and science institutes in the innovation process; and stimulating innovation in the companies. This law establishes that each Scientific and Technological Institution (ICT) should have a Nucleus of Technological Innovation (NIT), which among other tasks would keep the institutional framework to stimulate the protection of creations, licensing, innovation and other forms of technology transfer. It can be said that from this law universities began to be more concerned with appropriating the outcome of their intellectual effort and how they could get a new source of income from it.

The Innovation Law changed the way companies and universities do R&D projects in partnership. Petro bras, for example, signed in 2007 an agreement with the National Association of Leaders of Federal Education Institutions (ANDIFES) to define a new standard in terms of cooperation with respect to the intellectual property, secrecy and dissemination of the results of research projects in partnership. After signing this agreement, Petro bras began to share with ICTs the ownership of the results of R&D projects.

Currently, a new legal framework for innovation is in force, Law n° 13,243/2016. Among many innovations in legislation, this law presents an article on the ownership of the intellectual property and participation in the results of the exploitation of the results from the partnership between ICTs and public and private institutions. More precisely, the new law permits the ICT to hand over its part in the ownership of a patent regarding some technology developed in partnership if the company pays a fair return. Therefore, it would be relevant to discuss if the co-ownership among universities and companies is beneficial to innovation or not.

Much is known about the use of the number of patents applied as an indicator of innovation, however, it is believed that regarding this theme, it would be better to evaluate the number of patents licensed by each organization, universities or companies.

The objective of the article is to analyze the relationship between Petro bras and Brazilian universities using as a starting point the legislation for innovation created in 2004, seeking to highlight the benefits of this government incentive in terms of patents applied and information on licensing. The number of patents applied in co-ownership will be highlighted and the percentage of licensing thereof.

## **Literature Review**

### **Evolution of Innovation Legislation in Brazil**

The Brazilian Innovation Law was inspired by US legislation. The Bayh-Dole Act and the Patent and Trademark Law Amendments Act deal with intellectual property resulting from federal government-funded research. Sponsored by two Senators, Birch Bayh of Indiana and Bob Dole of Kansas, the Act was adopted in 1980, is codified at 94 Stat. 3015, and in 35 U.S.C. § 200–212 [4] and is implemented by 37 C.F.R. 401 [5].

The main change made by Bayh-Dole is in the definition of ownership of inventions made with federal funding. Prior to the Bayh-Dole Act, federal research funding contracts and grants compelled inventors (wherever they worked) to give their owner rights to the federal government of inventions they made using federal funding. Bayh-Dole allows a university, small business, or non-profit institution to elect to pursue ownership of an invention in detriment of government [6].

This allowed American universities to open their own technology transfer offices and thus seek a new source of income through licensing of technologies developed internally or in partnership with other companies.

In Brazil, the Innovation Law (Law N° 10.973/2004) created similar conditions with the purpose of stimulating:

- The creation of specialized and cooperative innovation environments;
- The participation of ICTs in the innovation process;
- Innovation in companies;
- The independent inventor;
- The creation of investment funds for innovation.

It is the first Brazilian law that deals with the relationship between universities (including research institutions) and companies.

Law N° 13,243/2016 represents a new legal framework for innovation. Known as Code of Science, Technology and Innovation, this law approved on 2016 is the result of a process of about five years of discussions between actors in the National Innovation System (SNI) in the Science and Technology Commissions of the Brazilian Congress. These discussions had as their starting point the necessity to amend points in the Innovation Law in order to reduce legal and bureaucratic obstacles and to give greater flexibility to the institutions working in this system [7].

The new law advances in several points in the promotion of a more safe and stimulating environment for innovation in Brazil. Among them, the following stand out: the formalization of private ICTs (non-profit private entities) as an object of the law; the expansion of role of NITs, including the possibility that support foundations may be NITs of ICTs; the reduction of some of the obstacles to the importation of R&D inputs and the formalization of scholarships to the innovation activity.

### **University-Company interaction in light of the Innovation Law**

In the literature can be found articles about the relationship between universities and companies cooperating in research and development processes. In one of the recovered articles, Stal and Fuji no [8] evaluate the potential impacts of the Innovation Law, approved in 2004, on the Brazilian Innovation System, based on the business perspective of the cooperation with universities for the transfer of research results. In their study they analyze if the academic environment conditions are favourable or not to the operationalization of this law, due one of the main barriers to technology transfer is the diversity of public universities' policies in relation to the protection and licensing of knowledge developed there. According to the authors, the lack of clear guidelines, both in the universities and in the more general framework of scientific policy and technological development, hinders the commercial exploitation of research results and its transformation into innovative products and services.

Closs and Ferreira [9] present a review of scientific studies published between 2005 and 2009 on the technology transfer evolving the university-company duality in the Brazilian context. The collective analysis of these works suggests that University-company cooperation generates innovations, mutual learning and benefits. It is stated that there is still a lot of room to expand the technology transfer of these partners. The study identified the methods used in the research; motivators, facilitators and obstacles to the process; elements of university structures, as well as policies of universities and authorities involved in the process; characteristics of companies generated from academic pullovers; the social role played by universities; different forms of technology transfers from university-company interaction; gaps in research and suggestions for conducting future studies.

On the relationship between companies and private universities, which are not encouraged by the Innovation Law, Reamers [10] presents some ideas which can be extracted and perfectly applied in the sphere of the private university, such as: the creation of institutional intellectual property and technology transfer policies, creation of private universities' NITs, training of human resources in the area of intellectual property and technology transfer originated in academic institutions.

Oliveira [11] in his dissertation analyzed the management of industrial property in transactions involving knowledge sharing and cooperation between the Petro bras and its external collaborators in the open innovation model. His study considered practices related to external sources of knowledge and innovation, analysis of the profile of partners, profile of partnerships and their management process, spin-offs, portfolio management of intellectual property and

technology licensing dynamics, internal organization and motivations to collaborate. The focus of the study was to assess the Petro bras innovation process in compliance with the Open Innovation model proposed by Chesbrough [3].

In this survey only three articles related to university-company interaction in the light of the Innovation Law were presented as examples. Based on these studies, it can be stated that the creation of NITs was one of the main factors beneficial to the university's IP portfolio management. Its creation also consolidated the technology transfer practice as a driving force to market oriented innovation provided by Brazilian universities. However, none of the three papers cited the co-ownership of intellectual property assets develops by university-company partnerships and how this co-ownership would influence the licensing process of patents, for example.

## **Discussion**

### **Impacts on universities' patent applications quantitative**

In order to innovate, new technologies are developed and become part of the of intangible assets of a company or university. According to Tierce [12], the main differences between tangible assets and intangible assets comprise the exclusivity, the speed of its depreciation, transfer costs, ease of recognition of transactional opportunities, the disclosure of its attributes, variety and extension, and the enforcement of property rights.

Such developed technologies are new inventions: new products, equipment, processes, etc. Different strategies can be used to protect these technologies to prevent them from being copied and commercialized by third parties which did not contribute to the creation process. The most used strategies are the protection by trade secret or patenting.

The classic example of trade secret protection is the case of the Coca-Cola formula. For many years Coca-Cola has used its secret to gain competitive advantage over competitors. Currently this strategy is more like a marketing strategy to promote its drink than actually to protect it from counterfeit. Nowadays, a laboratory could find out which chemicals and ingredients appear in which quantities from a sample of the product, but Coca-Cola would still be the giant that it is, since its higher value is in its brand.

A better way to protect your inventions is through patenting. A patent granted by the State guarantees its holder the right to exclude third parties from the commercial exploitation of its creation. One disadvantage is that general public would have access to the essential points and the claims that characterize the novelty of the invention. Unlike the trade secret, which in most cases can be kept indefinitely, a patent is valid for 20 years in most of the countries that have legislation on the subject.

If the intention is not to have exclusivity or to exclude third parties from the operation of a technology, it is possible that its developer chooses to publish it through scientific articles and other publications. It may seem contradictory to the developer of a technology, which has spent its own resources with its creation, to want to disclose it so that any one has access to it. However, in doing so, the developer will be preventing a competitor to patent the same invention and use the right it confers against the real inventor. This resource can be used when the developer's intent to the new technology is only to guarantee his "freedom to operate".

Another factor that impacts on the decision for protection by trade secret or patent is the traceability of the invention. This is evident when comparing process and product inventions. While the developer of a new product can easily identify if it is being copied by competitors

since both the original and the counterfeit will be available on market, the same may not be possible with process inventions. If the competitor has access to them and is able to reproduce the new process, the traceability of this type of invention by its developer is impaired because they are inventions normally applied within the limits of the company.

Therefore, patent protection is generally best suited for product, while in some cases process inventions would be better protected by trade secret. It is important to note that the two forms of protection are complementary and non-exclusive because even product inventions may have know-how that it is not appropriate to be protected in a patent and even process inventions may contain small parts that would be better protected by patents [13].

Regardless of having an explicit protection strategy in the organization is a fact that, especially before the Innovation Law, patenting of inventions is more common in companies than in universities. The culture of publishing papers within the universities has always been widespread. Merola [14] in her research at the Federal University of Rio de Janeiro - UFRJ - points out that the publication of articles remains a impediment to the filing of patent applications. This is strongly linked to the culture of professors (and inventors), who even after the promulgation of the Brazilian Industrial Property Law in 1996, they still have a pro-publication profile which makes patent protection unfeasible after the grace period granted by some patent offices.

Despite this behaviour, it is verified that in the period between 2004 and 2014 there was an increase of approximately 75% in the filing of patents by the universities. In a universe of 91 Brazilian ICTs researched in this article, six Universities are identified as responsible for 47% of this patent period. Figure 1 shows the universities cited as the largest depositors of patents in this period.

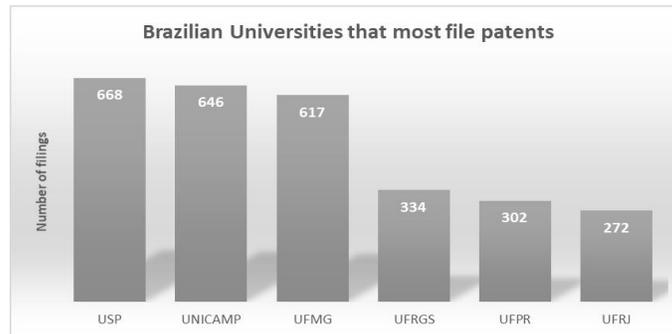


Figure 1 - Ranking of Universities that most filed patents in Brazil between 2004 and 2014.

The evolution of the number of total deposits of these 6 universities in the studied period can be seen in Figure 2, below.

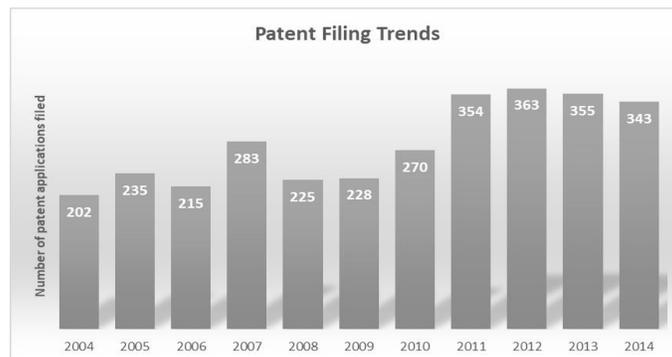


Figure 2 - Evolution of the Patent Applications of the 6 leading universities in Brazil

In addition to the evident increase in the patent filing, we can also notice that there was an increase in the number of filings in co-ownership in the same period [15] as can be seen in Table 1. This table includes partnerships with other ICTs, organizations or companies.

Table 1 - Filings of Single Owned Patents (SOP) and Co-Owned Patents (COP) by ICTs in Brazil in the period 2004 - 2013.

Year	SOP	%	COP	%	Total
2004	170	77,98	48	22,02	218
2005	202	79,53	52	20,47	254
2006	196	77,17	58	22,83	254
2007	277	76,94	83	23,06	360
2008	266	69,09	119	30,91	385
2009	249	65,53	131	34,47	380
2010	276	67,81	131	32,19	407
2011	296	69,81	128	30,19	424
2012	149	65,64	78	34,36	227
2013	42	55,26	34	44,74	76

### Patent as an indicator of Innovation

Patents are an important source of technological information because in addition to describing the most recent knowledge it is estimated that 70% of the information contained in patents are not available in another type of base in the world [16],[17].

Patents are also considered to be valid economic indicators for measuring the technological progress [18],[19]. The use of patents as innovation indicators complements others indicators, such as number of PhDs and scientific articles, used by countries such as the United States, South Korea, China, Japan, Brazil, as a basis for measure the degree of technological intensity of a country [20].

The theory is that a greater number of patents is directly proportional to a greater inventive and innovative capacity, as well as a greater ability to put science and technology in the productive environment. However, the concepts of invention and innovation are different. One way of defining innovation can be found in Law n°13,243/2016.

"Innovation: introduction of novelty or improvement in the productive and social environment that results in new products, services or processes; or that includes new functionalities or characteristics to an existing product, service or process improving them in terms of quality or performance."

In other words, an invention alone does not translate itself into innovation if it remains on the shelf or if it is only protected by a patent. So instead of concerning only for the number of patents filed, why not also look at the number of patents that a university or company licenses? It is presumed that if a patent is licensed is because there is commercial intent in it and therefore there is a direct link with the concept of innovation.

The reason for this approach lies in the fact that technology protected in a patent can never reach the market - this is the main disadvantage of using the number of patents filed by organization as an indicator for innovation. Of course, a patent that has been licensed is more likely to reach the

market than one that has not. Therefore, an organization with more licensed patents could be considered more innovative than another organization with fewer licensed patents.

This type of analysis is justifiable in the present case, since most inventions resulting from partnerships between Petrobras and ICTs (excepting only process inventions) need a third party to be manufactured and commercialized. The way in which this third party is authorized to have access to a patented is precisely through licensing.

### 3.3 Patent licensing as an innovation indicator

In Brazil, we can monitor the evolution of innovation indicators based on the data available in the reports from Research for Technological Innovation (PINTEC), carried out by Brazilian Institute of Geography and Statistics (IBGE). Basically this report can analyze performance indicators - such as the rate of innovation, for example - and effort indicators such as the percentage of companies that carried out innovative activities and the spending on internal and external R&D [21].

The performance indicators are divided into:

- i. Innovation rate;
- ii. Product innovation rate;
- iii. New product innovation rate for the company;
- iv. New product innovation rate for the domestic market;
- v. Process innovation rate;
- vi. New process innovation rate for the company; and
- vii. New process innovation rate for the domestic market.

The indicators of effort unfold in:

- i. Companies spending on R&D/GDP (gross domestic product);
- ii. Percentage of companies that carried out innovative activities; and
- iii. Expenditures on innovative activities / net sales revenue.

As stated earlier, the number of patents deposited is also considered to be an indicator of innovation. Moreover, revenue from patent licensing royalties is also considered an indicator. Chen et al. [22] present a study on the impact of the national innovation system of some countries on these types of result of R&D. In their study they point out that the R&D carried out in universities targets for better results in indicators of publication of articles in detriment of patent and royalty indicators.

It has already been mentioned that Brazilian universities still face barriers to patenting and licensing their inventions, but it is possible to find universities that already have a good portfolio of licensed technologies. Pinero Junior [23] in his work on technology transfer among ICTs and companies shows a survey of the royalties earned by UFRJ from 2007 to 2012, as can be seen in Figure 3.

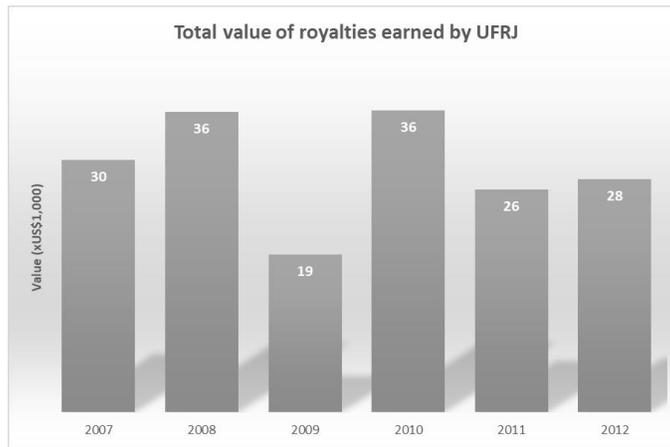


Figure 3 - Total value of royalties earned by the Innovation Agency of UFRJ

Another prominent Brazilian university in the field of technology transfer is the State University of Campinas - UNICAMP. Through its innovation agency INOVA, the university reported economic gains (including royalties, access fees to technology and others) from the licensing of technologies for the year 2015 in value of R\$1,937,305.00. The evolution of these gains over the years can be seen in Figure 4.

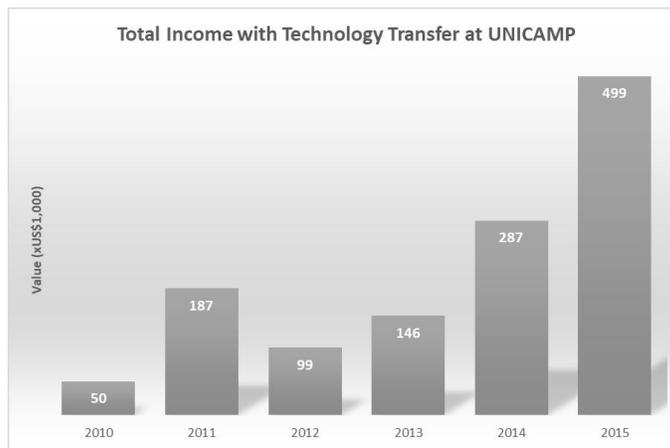


Figure 4 - Economic Gains with Technology Transfer at UNICAMP

Although some universities are doing very well in the field of technology transfer and obtaining considerable royalties, how many of these licensed patents are in co-ownership with companies? This would be a good way to evaluate the fruits of the university-company partnership in R&D projects.

The National Institute of Industrial Property (INPI) is the patent office in Brazil. In addition to patents, the INPI is also responsible for register technology transfer agreements signed in Brazil.

The registration of technology transfer contracts is necessary to allow tax deductibility on royalties paid by the licensed company and to legitimize royalty payments for foreign licensors. The types of contracts registered by INPI comprise patents, industrial designs and trademarks licenses, in addition to technical assistance and know-how transference agreements. They also register business franchises agreements, thus ensuring a security and conferring validity in transactions with third parties.

In a survey on INPI registered contracts, 362 records of licenses including patents were found from 2004 to 2017. From this sample, 35 records were related somehow to the oil and gas industry. Of these records only 16 (or 46% of them) contained co-owned patents licensed. Detailing the results a little more, only two contracts involved an ICT and a company. The other contracts were all business-to-business.

Although it is not common to find records of licensing involving ICTs, the survey identified that of the 678 patents involved in these contracts, 349 of them (or 51%) had co-ownership among at least two organizations. This would lead us to believe that it is not so difficult to license a patent with more than one owner in comparison to license of patents from a single owner. However, it is common to find records of licensing agreements between companies of the same group in order to the Brazilian subsidiary can legitimize remittances of foreign currency to the holding company abroad, an obligation already mentioned in this text.

This survey in secondary data, which means a survey that came from patents and licensing agreements, raises questions that could be answered by means of a second survey based on primary data, that is, the one that is realized by means of interviews with professionals of universities, entities and companies related to research, IP management and technology licensing. This way we could better understand the characteristics, differences and even difficulties in licensing a co-owned patent.

This questioning is important because the new innovation legislation of 2016 brought important changes to significantly reduce critical points of insecurity by means of clarifying the operationalization of the law regarding the ownership of intellectual property and the sharing of the results of the exploitation of the creations resulting from the partnerships between ICTs and other public or private institutions:

*"Art. 9º it is possible for ICT to enter into partnership agreements with public and private institutions for joint scientific and technological research and development of technology, product, service or process.*

*Paragraph 2. The parties shall provide, in a specific legal instrument, the ownership of intellectual property and participation in the results of exploitation of the creations resulting from the partnership, ensuring the right to operate, to license and to transfer technology, in compliance with the provisions of paragraphs 4 to 7 of art. 6th.*

*Paragraph 3. Intellectual property and profit-sharing referred to in paragraph 2 shall be ensured to the contracting parties, guaranteed to the ICT the option to hand over to the private partner all the intellectual property rights in exchange of a financial compensation or a non-financial compensation as long as economically measurable."*

### **Patenting and Licensing analyses related with Petro bras' partnerships with Brazilian universities**

Regarding to government incentives for innovation, some are aimed at sectors such as oil and gas. As a mechanism for fostering R&D, the Petroleum, Natural Gas and Biofuels National Agency of Brazil (ANP) included in the contracts of concession for the exploration and production of oil and natural gas an item known as "1% clause". The clause dictates that oil companies must invest in R&D a value equivalent to 1% of the gross revenue generated by highly profitable fields or with large volume of production (those paying the so-called special participation). This is highlighted in the ANP Resolution 33/2005 and the ANP Technical

Regulation 5/2005. In Figure 5 is possible to see the amount invested in R&D by Petrobras between 2004 and 2014.

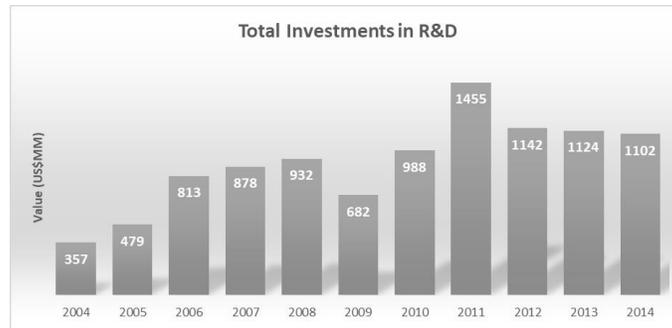


Figure 5 - Resources for Technological Development invested by Petrobras in the period 2004-2014.

This clause requires the oil company to apply at least 50% of expenses qualified by the ANP in R&D projects in partnership with Brazilian ICTs, including universities, previously accredited by the Agency. In the same period, Figure 6 shows how much Petrobras has invested in Brazilian ICTs



Figure 6 - Petrobras investments for R&D in Brazilian ICTs in the period 2004-2014.

This has meant an investment in more than 100 universities and Brazilian research institutes, distributed among 49 Thematic Networks. More than 200 laboratories were built since 2009, benefiting more than 8,000 students and external researchers involved in Petrobras projects.

Due to the changes in the cited legislation, Petrobras decided in 2007 to review its policy about intellectual property, confidentiality, and publications derived from R&D projects in partnership with universities. This review has taken place through an agreement with ANDIFES which defined a new standard in terms of cooperation between Petrobras and Brazilian universities. Although ANDIFES includes only principals from federal universities, this standard has also been applied to private universities partnerships with Petrobras.

The agreement provided three cases regarding the commercial intent on the technology developed in partnership:

- Case 1 - Exclusive intent of Petrobras;
- Case 2 - ICT's exclusive intent; and
- Case 3 - Petrobras and ICT mutual intent.

For each of these cases conditions were defined that contained in Table 2.

**Table 2 – Cases defined in ANDIFES agreement**

Item	Case 1	Case 2	Case 3
<b>Ownership</b>	80% Petro bras 20% ICT	80 % ICT 20% Petro bras	50% Petro bras 50% ICT
<b>Patent Costs</b>	100% funded by Petro bras	100% funded by ICT	Shared in the same proportion of co-ownership.
<b>Third party licensing decisions</b>	Exclusive to Petro bras to decide (an ICT may propose to Petro bras the licensing to third parties).	Exclusive to ICT to decide (Petro bras may propose an ICT licensing to third parties).	Mutual (Petro bras may veto if it goes against its business intents).

The agreement also stated that each part would have a license to use the technology protected by the co-owned patent without paying any compensation to each other. The revenues arising from the licensing to third parties would be shared according to the division of co-ownership in each one of the cases cited.

Prior to the agreement Petro bras used to reserve the right to hold 100% of ownership and the commercial benefits accruing from the possible licensing to third parties of the technologies generated in partnership with universities, as well as bearing the maintenance costs of all patents and other intellectual property rights involved.

This agreement also reduced the term for confidentiality from 20 to 10 years regarding information generated in the research project and established a process to regulate the publicizing of these results by means of scientific articles.

Petro bras always had Brazilian universities as partners in R&D, but it is notable how these partnerships grew in the last decade driven, among other factors, on account of the Innovation Law and the Special Participation Fund of the ANP. As can be seen in Figure 7, the participation of ICTs in the patent applications filed by Petro bras has been higher than 30% in the last 3 years. By 2016, half of the applications filed by Petro bras were jointly owned with an ICT.

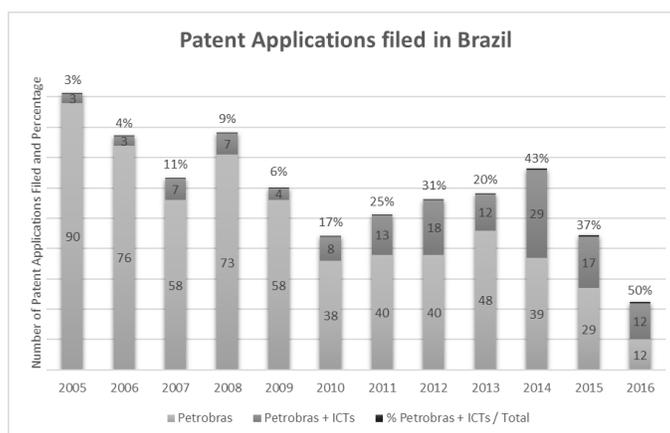


Figure 7 - Patent applications filed in Brazil by Petro bras in co-ownership with ICTs.

The percentage of patents in co-ownership with universities as seen in Figure 7 is similar to the data shown by Table 1 in which approximately 45% of the patents filed by the Brazilian ICTs of that study had co-ownership with other organizations.

And what would be the percentage of co-owned patents licensed by Petro bras? The total number of Petro bras licenses revolves around a little more than a dozen contracts. It was identified that this company focuses its intellectual property strategy more to guarantee its freedom to use rather than licensing their patents in order to obtain royalties. Of the 16 patents currently licensed by Petro bras, only one is co-owned by a university: Pontifical Catholic University of Rio de Janeiro (PUC-Rio).

## **Conclusion**

The Innovation Law of 2004 brought great strides to stimulate R&D and technology transfer within universities. However, the lack of clear policies in universities and general framework of science and technology provided by government may hamper the commercial exploitation of research results and their transformation into products and services.

The creation of NITs was one of the main factors for improvement in management of the universities' IP portfolio. Its creation also consolidated the practice of technology transfer as a driver for innovation to the market.

The impact of the Innovation Law in relation to the industrial property portfolio of the universities turned into a 75% increase in patent applications filed in Brazil between 2004 and 2014. There has also been a significant increase in these filings in partnerships, which was one of the objectives of this law.

The new legal framework of 2016 has brought many advances such as the formalization of private ICTs (non-profit private entities) as an object of the law; the expansion of role of NITs, including the possibility that support foundations may be NITs of ICTs; the reduction of some of the obstacles to the importation of R&D inputs and the formalization of scholarships to the innovation activity.

Although Brazilian universities found barriers to patenting and licensing its inventions, it was possible to identify that some already have a good portfolio of licensed technologies. However, the present study has not been able to conclude if the patents that the universities have in co-ownership with other institutions are being licensed in the same proportion as those with single ownership.

Since the INPI database on the registration of licensing contracts may not include this type of agreements, an additional study based on interviews with professionals from universities, entities and companies linked to research, IP management and technology licensing would be better to understand the characteristics, differences and even difficulties in licensing a co-owned patent.

If we take the Petro bras case as an example, where it was evidenced a great advance encouraging innovation in partnerships with universities, proved by the increase in the number of co-owned patents, but which has only one of these co-owned patents licensed, and given that the new law gives to ICTs the option to hand over its share of ownership, it should be assessed if the sharing of ownership is beneficial to innovation. And if it's not beneficial, who should hold the ownership.

Ten years after Petro bras' agreement with ANDIFES, this study may be the starting point for the assessment of actual model of shared ownership or the changing to an exclusive ownership

model with a free and unrestricted license to the research partner. In case the licensed partner is the university it could sublicense its rights to other companies and thus earn new revenues. In the case of the licensed partner being Petrobras, it could sublicense other companies only for the purpose of its supply without the need of paying royalties to the university. Licensing to third parties would remain unchanged.

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