Public Research Institutions and Their Connections with Patents of Companies in Technological and Regional Development

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Abstract

The interaction between companies and universities is a central theme in discussions on technology transfer. In Brazil, there is an urgent need to raise awareness of the importance of this cooperative relationship for local and regional development. In this sense, it is observed that the innovation process is strategic so that an institution is strengthened and can fulfill its social mission in economic and regional development. Piauí, according to the IBGE census, has a population estimate of 3,273,227 in 2019. Piaui's per capita income is R$ 817.00 and ranks 24th in Brazil in this regard. With these data, the need arises to intervene scientifically in this reality. The objective of this study is to investigate the partnership relationships between companies and public research institutions in Piauí, in the development and transfer of technologies. Research Institutions are the main promoters of technological development in the state, however, for these technologies to reach productive arrangements, strategic alignment in the management of these technologies is necessary. Documentary research was used, with a quantitative approach. In the exploratory search, INPI's databases (National Institute of Industrial Property) and of Espacenet (European Patent Office) was used. We sought to select the companies with relevant economic representativeness in the state scenario and investigated the patent information. In the analysis of the data obtained, the Competitiveness Ranking of the CLP States (Public Leadership) was used to compare Piauí with well positioned states. According to the results found, it is observed that the transfer of technology between research institutions and companies is not evident. However, we can see that there are partnership initiatives with small companies in conducting research that can project a change in this scenario. The low number of patents and public/private partnerships in driving innovation in the state of Piauí, may be related to the low index evidenced by the Competitiveness Ranking of States - CLP.

Keywords: Patents; Regional development; Public Research Institutions; Companies; Innovation;

1. Introduction

The interaction between companies and universities is incipient in the brazilian's scenario, and there is an

urgent need to raise awareness of the importance of this cooperative relationship for local and regional development (MÜLLER; STRAUHS, 2019). In this sense, it is observed that the innovation process is strategic for an institution to be strengthened. Segatto-Mendes and Sbragia (2002) state that there are advantages for universities, government and business, with especially regard to universities, to the extent that new products or techniques are created or improved, public institutions should pay attention to methods of raising funds from with these technology. Thereby, the institutions can invest resources internally in new discoveries and in financing new research.

Conversely, the more companies innovating in a state, the better their economic indicators and the better their processes, services, jobs and products offered to society. This statement is based on the development of some regions of the United States of America such as: Silicon Valley and Route 128, in which, it is mainly due to the cooperation between university and technological companies (VARGA, 1997). In this study, the state of Piauí, in Brazil, is investigated, as it is a state with low levels of development, it needs new perspectives.

Piauí, according to the IBGE census, has a population estimate of 3,273,227 in 2019. Piaui's per capita income is R $ 817.00 and ranks 24th in Brazil in this regard. The proportion of people aged 16 and over in formal work is 31.4%, which makes Piauí the 26th state in this ranking. In this sense, the processes of strengthening companies, through new technological methods and processes, can make Piauí a state with greater competition power and boost the state's economy. Furthermore, strengthening research and transferring it to institutions is crucial.

Varga (1997) mentions that economic development is determined by technological innovation resulting from investments in Industrial Research and Development (R&D) planned and motivated by the market. Varga attributes local development to the relationship with knowledge produced in technological centers. These institutions can transfer technology to other institutions as long as those technologies are protected. In this sense, one must observe the question of the valuation of these technologies, in order to obtain quantitatively the monetary value of something specific and, thus, to be able to potentiate the development of the institution and the region in which it is inserted.

The aim of this study is investigate relations of partnerships between companies and research public institutions of Piauí (state of Brazil), in the development and transfer of technology. Research Institutions are the main promoters of technological development in the state, however, for these technologies to reach productive arrangements, a strategic alignment in the management of the portfolio of these technologies is necessary. If the technology does not have a market potential, it is likely that this patent will become a high-cost liability.

On the other side, it is noted that when there is partnerships between companies and public institutions, patents derived from theses researchs have greater chances of achieving the company as a product , as outlined per Cario, Da Cunha Lemos and Simonini (2011). If the technology does not have a market bias, the technology transfer between the interested parties may not occur. Winter, et al (2019) reports the need for mechanisms for managing the technological portfolio by the Public Research Centers. In this sense, with evidence of a low level of technology transfer, it is possible to progress in further studies to diagnose possible reasons and, thus, seek methods to assist n the process.

Piauí occupies the last positions in the national rankings of competitiveness and economics (CEPRO, 2016;

CENTRO DE LIDERANÇA PUBLICA-CLP, 2019), with this, it seeks relationships between companies and institutions that promote new technologies, with the purpose of obtaining data that prove or disprove that this position in the ranking have relation with these conections. With Law No. 10,973 of 2004, which regulates the incentive to innovation (BRASIL, 2004), Universities would , in theory, facilitate to innovate and transfer these technologies to productive arrangements. It is theorized that if this were to happen, Piauí's degree of competitiveness would be leveraged, or if the management of these technologies was better articulated, we could obtain better results. The local government must promote ways to spread the technologies, whether with incubators, licenses and joint development (WINTER, et al., 2019).

2. Theoretical foundation

The innovation law, Law No. 10,973 of 2004, made it possible to regulate ICT(Scientific and Technological Institutions) and the creation of Technological Innovation Centers (NIT) in order to reduce the distance between research institutes, companies and universities (Kruglianskas & Matias -Pereira, 2005; Law No. 10,973, 2004). Livesey (2014), evidenced, in a survey of 33 NITs (Technological Innovation Centers) from different regions, that technology transfer is not a strategy commonly used in universities, in addition to showing that project financing is not adequate for development of the same.

In academic environments, the stimulation of innovation and creation of patents for inventions has been a way of stimulating public policies to raise awareness of this type of situation (HAASE; ARAÚJO; DIAS, 2005). As a result, stimulating the production and dissemination of these materials becomes an essential point in academic environments, including the entrepreneurial view of the market. This can be attractive to students, as it brings them closer to the job market.

Technology transfer is an essential topic to be discussed in research and innovation environments. Blakeney (1989), reports that technology transfer is the process of commercial distribution of a technology. In this sense, it is considered that the transfer of technology should be a way that research institutes have to boost their research and obtain returns for both society and researchers. It is worth mentioning that, with the partnerships mentioned in the study, the researcher can obtain gains on the commercial exploitation of his research, together with the institution(SOARES, 2018).

When it comes to regional development, the Piauí, in 2016, occupied the 21st position in the ranking of the largest economies of Brazil, with only 0.7% share in the wealth of the country (CEPRO, 2016). These economic results reflect the technological production and development of the state, which in 2018, occupied the 21st position in the competitiveness ranking, with a score of 37.9 out of a maximum score of 100 points, according to the Organization Competitiveness Ranking of States - CLP (2018). In 2019, according to data from the same ranking, Piauí ranks 23rd among the 27 Brazilian states (including the Federal District), with 35 points (Figure 1).

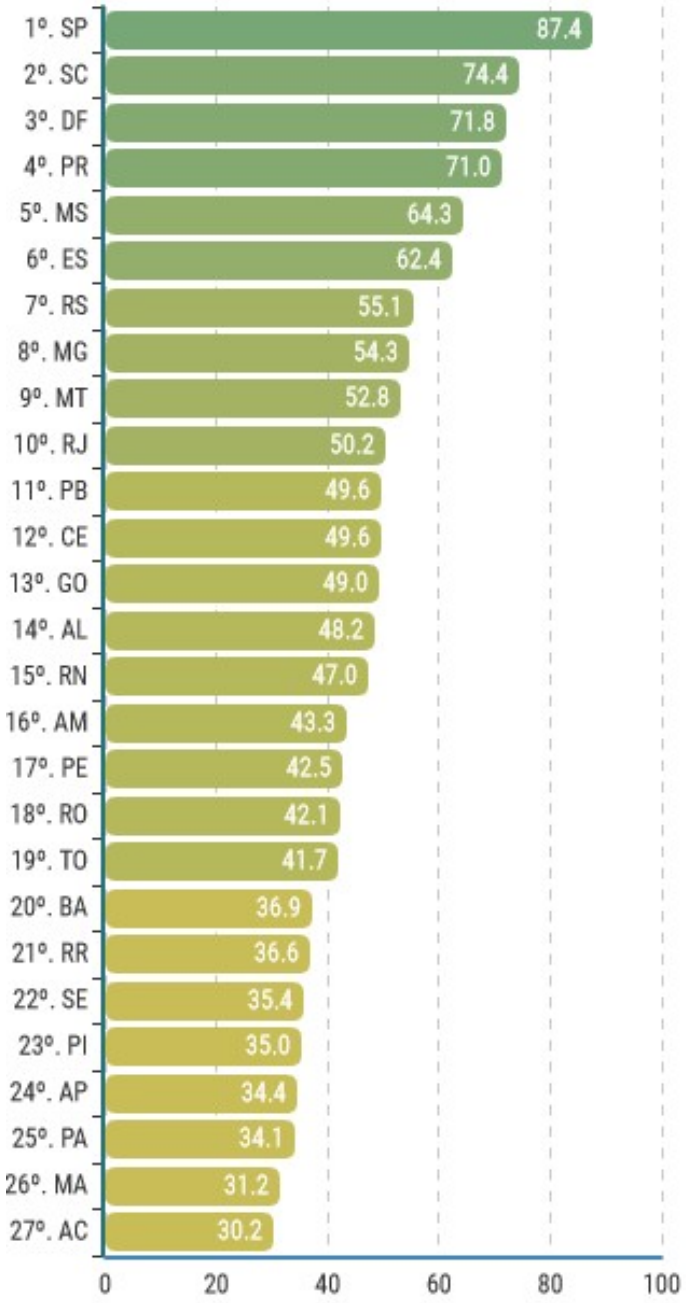

Figure 1. CLP General ranking – States. Source: Competitiveness Ranking of States - CLP (2019).

This ranking is consisting of 10 pillars. Figure 2 shows the pillars and the relationship between Piauí and the Brazil average.

Figure 2. Pillars of Piauí in the Ranking of States and Average Brazil – CLP. Source: Competitiveness Ranking of States - CLP (2019).

Despite the fall, the state shows a stagnation, as shown in figure 3. Piauí's score does not show a big difference in the range from 2016 to 2019.

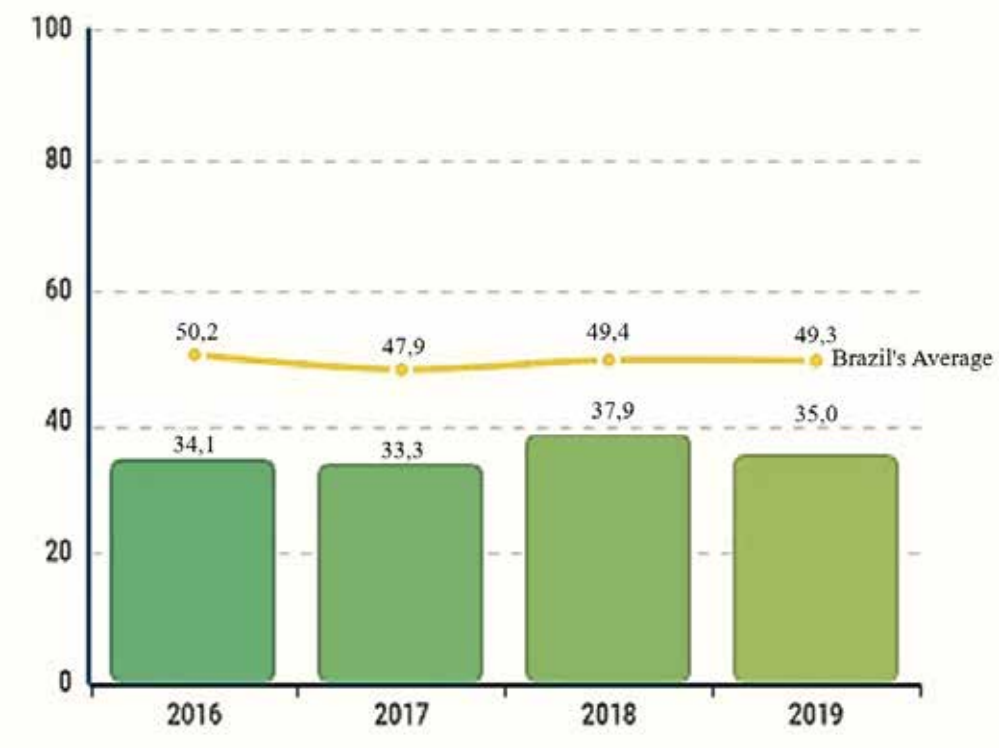

Figure 3. Piauí in the Ranking of the States from 2016 to 2019 and the overall average of Brazil. Source: Competitiveness Ranking of States - CLP (2019).

The data reinforce the need for efforts to improve the reality of the state. The ranking explores 10 pillars, which are composed of indicators. With a focus on the Innovation pillar, Piauí occupies the 17th position in 2019. The Innovation pillar explores four indicators, which are: Master's and doctorate scholarships, Innovative Enterprises, Investments in R&D and Patents. It is worth mentioning that in 2019, Piauí occupies the 7th position in R&D investments, as shown in table 1.

Table 1. Indicators of the Innovation pillar of the Ranking of States - CLP

Indicator	2019 (value and position)		2018 (value and position)	
1. Master's and Doctorate Scholarship	25.5	22nd	0[1]	0[1]
2. Innovative Enterprises	60.6	10th	0[1]	0[1]
3. Investments in R&D	21.4	7th	12.0	15th
4. Patents	0.0	22nd	7.7	15th

Source: Ranking of States – CLP (2019). [1] Value 0 indicates either a low score for the indicator, or the lack of data.

3. Methodology

In the methodological procedures of this work, we have used the documentary research in the data collection, with a quantitative approach. In the exploratory search, INPI's databases (National Institute of Industrial Property) and the Espacenet (European Patent Office) were used for relationship the patents of companies and research institutes the state of Piauí. We sought to select the companies with relevant economic representativeness in the state scenario listed on the Econodata platform (econodata.com.br) and on news sites (180graus.com, oitomeia.com.br). In short, the companies are in the pharmaceutical and industrial sector (production of bicycles, material for the gym, mattresses, steel, security and distributors). After this selection, used the company name and the National Register of Legal Entities - CNPJ to perform consultations.

In possession of the data, information on depositors, ownership and co-ownership of companies' patents was investigated and, then, the search for names of institutions and inventors. The inventors' links with universities or research institutions were investigated on the federal government's transparency portal.

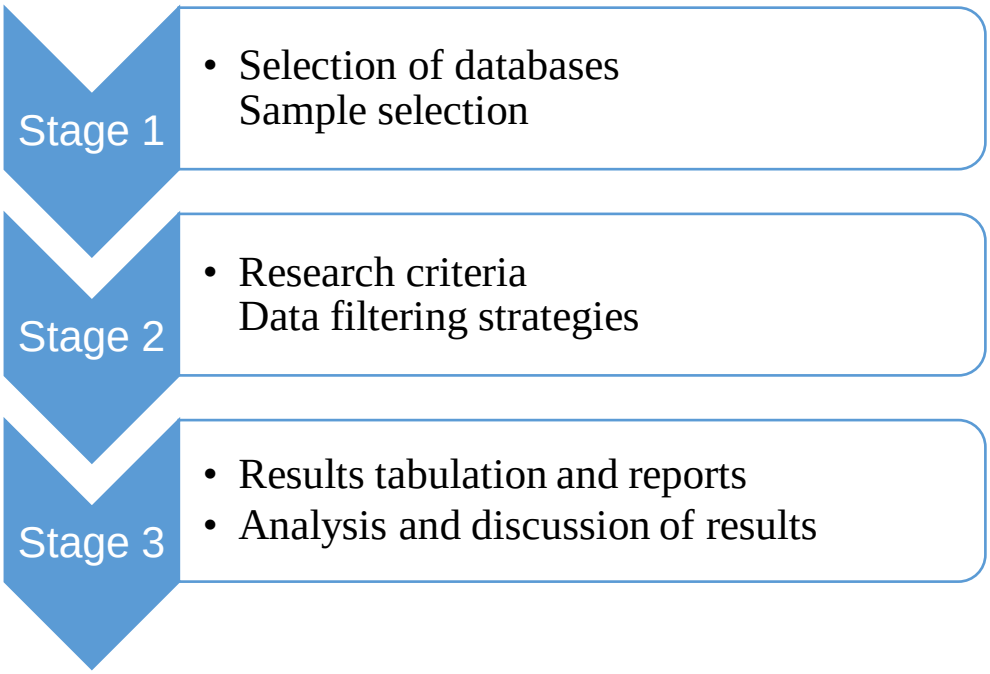

Figure 4. Methodological design. Source: Prepared by the authors (2020).

Searching for the name of the depositor, in some cases, did not return reliable results. This is because the company name is not listed in patent documents in many cases. With this, the CNPJ was a viable option to return more reliable and specific results for companies in Piauí. The CNPJ name was collected by consulting the companies' websites and confirmed by consulting the website: www.cnpj.info.

A sample of 8 (eight) companies from Piauí was selected, they are: Houston Bike, Só Aço Industrial, Laboratório Sobral, Jorge Batista & Cia LTDA, Socimol Industria de Colchões, Onix S/A Industria de Colchões e Espuma, PVP Sociedade Anônima e Servi-san Vigilância e Transporte de Valores. The table below shows the companies and their CNPJ. After surveying the technologies, the name and data of the inventors were sought in the transparency portals to ascertain links with the federal government and state government.

Table 2. Companies surveyed and their CNPJ

COMPANY NAME	CNPJ
BIKE DO NORDESTE S/A HOUSTON BIKE	02.220.262 / 0002-78
SO ACO INDUSTRIAL LTDA	04.041.754 / 0001-40
LABORATORIO INDUSTRIAL FARMACEUTICO SOBRAL	06.597.801 / 0001-62
JORGE BATISTA & CIA LTDA	07.222.185 / 0001-28
SOCIMOL INDUSTRIA DE COLCHOES E MOVEIS LTDA	06.751.564 / 0001-42
ONIX S/A INDUSTRIA DE COLCHOES E ESPUMA	03.604.761 / 0001-40
PVP SOCIEDADE ANÔNIMA	06.700.769 / 0001-07
SERVI-SAN VIGILÂNCIA E TRANSPORTE DE VALORES	06.855.175 / 0001-67

Source: Prepared by the authors with research data (2020).

As a reverse path, we conducted searches in the Espacenet databases, in INPI, respectively, in patents and in the consultation section on technology transfer. INPI the search been performed entering the ID number and the names of the research institutions of Piauí as input, in order to investigate the existence of technology transfer with universities/institutions in the role of depositors. More specifically, State University of Piauí (UESPI), Federal Institute of Piauí (IFPI) and Federal University of Piauí (UFPI). For a better detail, we sought patents registered by the institutions in the selected databases.

The Microsoft Excel application was used to tabulate the data and generate the tables for analysis. For better understanding, in the analysis of the data obtained, the Competitiveness Ranking of the CLP States (Public Leadership) was used to compare Piauí with states well positioned in the Innovation pillar, since the pillar has indicators of interest for research. Piauí was compared with São Paulo, 1st place in the general ranking, and Paraíba, 1st place in the Northeast, region of Brazil, in the Innovation pillar and in the general ranking (all pillars) it was in 11th.

3. Results and analysis

In searches for companies in the state of Piauí, we found 4 companies that have patents and/or patent applications registered with the INPI. They are: SOCIMOL INDUSTRIA DE COLCHOES E MOVEIS LTDA, ONIX S/A INDUSTRIA DE COLCHOES E ESPUMA, PVP SOCIEDADE ANÔNIMA E SERVI-SAN VIGILÂNCIA E TRANSPORTE DE VALORES. The other companies surveyed did not have patents and/or orders registered in the INPI/ESPACENET databases. According to table 3.

Table 3. Companies and Patents

COMPANY NAME	NUMBER OF PATENTS
BIKE DO NORDESTE S/A HOUSTON BIKE	0
SO ACO INDUSTRIAL LTDA	0
LABORATORIO INDUSTRIAL FARMACEUTICO SOBRAL	0
JORGE BATISTA & CIA LTDA	0
SOCIMOL INDUSTRIA DE COLCHOES E MOVEIS LTDA	2
ONIX S/A INDUSTRIA DE COLCHOES E ESPUMA	1
PVP SOCIEDADE ANÔNIMA	3
SERVI-SAN VIGILÂNCIA E TRANSPORTE DE VALORES	51

Source: Prepared by the authors with research data (2020).

The company SOCIMOL INDUSTRIA DE COLCHOES E MOVEIS LTDA holds a patent with a rejected application and an extinct patent. According to table 4.

Table 4. Patents of Socimol LTDA

Request number	Deposit Date	Title	IPC classification	Situation
PI 0705793-8	07/27/2007	**BED SET**	A47C 17/32	UNDEFERRED
MU 7600396-5	02/15/1996	**MATTRESS EXHIBITOR**	A47F 7/30	EXTINCT

Source: Prepared by the authors with research data (2020).

The invention with application number PI 0705793-8, presents the description in the IPC classification: Couch; Beds/ Transformation of a single bed into a double bed by extension, rotation or inclination of a second mattress or other previously hidden piece. This patent application was published on 06/01/2009 and its rejection on 12/14/2010 for not having the inventive concept, as exposed in the process.

The second invention, number MU 7600396-5, has the description in the IPC classification: Showcases, suspension systems or shelves, adapted to certain articles or materials/for furniture, p. ex. beds, mattresses. This patent was granted on 09/30/2003, with the title “mattress exhibitor”. The patent's extinction was published on 12/20/2011. The inventors have no connection with Public Research Institutions, according to the consultation made on the Transparency Portal.

The company Onix S/A Industria De Colchões e Espuma has a patent with application published on 08/15/2006, as described below (table 5).

Table 5. Patents of Onix S / A

Order No.	Deposit Date	Title	IPC	Situation
PI 0600662-0	02/17/2006	**FORMULATION OF FLEXIBLE FOAMS MADE IN FREE EXPANSION FOR DISCONTINUOUS PROCESSES FOR CASH AND / OR CONTINUOUS PROCESS WITHOUT USE OF TDI (TOLUENE DIISOCIANATE)**	C08G 08/18	FILED ORDER

Source: Prepared by the authors with research data (2020).

The invention features the description in the IPC classification: Polymeric isocyanate or isothiocyanate processes/products. The title of the invention is: “formulation of flexible foams made in free expansion for batch processes and/or continuous process without using tdi (toluene diisocyanate)”. Inventor has no connection with Public Research Institutions and the order was filed for non-payment of annual fees.

The company PVP limited company has three (3) patent are deposited, acccording to the table 6.

Table 6. Patents of PVP S / A

Request number	Deposit Date	Title	IPC classification	Situation
PI 9503286-0	7/12/1995	**PROCESS FOR THE RECOVERY OR REUSE OF BLINDING CLAYS, ACTIVE OR ACTIVATED, INDUSTRIALLY APPLIED FOR PURIFICATION AND / OR PURIFICATION OF ORGANIC FAT, WAX, OR RESIN, NATURAL OR SYNTHETIC MATERIALS**	B03B 7/00	UNDEFERRED
PI 9303355-9	08/11/1993	**IMPROVEMENT IN PROCESS FOR OBTAINING COSMETIC COMPOSITIONS, INTENDED FOR CARE, CONSERVATION AND REGENERATION OF THE HAIR AND THEIR COMPOSITIONS**	A61K 7/06	EXTINCT
PI 9202165-4	06/05/1992	**CARNAÚBA CRAB MANUFACTURING PROCESS**	C11B 11/00	EXTINCT

Source: Prepared by the authors with research data (2020).

The invention with application code PI 9503286-0, presents the description in the IPC classification: Combinations of processes or devices that work wet with other processes or devices, e.g. ex. for preparing ores or waste. The deposit patent was published on 10/07/1997, in 31/12/2002 and was rejected.

The second invention, number PI 9303355-9, presents the description in the IPC classification: Preparations for medical, dental or hygienic purposes. This patent was granted on 10/19/1999. The patent was extinguished on 08/11/2013.

The third invention, number PI 9202165-4, has the description in the IPC classification: Recovery or refining of other fatty substances, p. ex. lanolin, waxes. This patent was granted on 12/26/2000. The patent's extinction was published on 02/09/2014. The company PVP SOCIEDADE ANÔNIMA holds 3 (three) licensed patents and all of them filed with the same inventor described in the documents. The inventor has no connection with the research institutions studied.

The company SERVI-SAN VIGILÂNCIA E TRANSPORTE DE VALORES was the one that filed the most patents based on the data survey conducted in this research. 51 patents were found in the CNPJ consultation, all with the same inventor. The deposits started in 1998 and extend until 2004. The inventions are varied, but linked to the engineering area. Most of the patents consulted were inactive. In Table 7, some of the patents.

Table 7. Servi-San patents

Request	**Deposit**	**Title**	**IPC**
PI 0404115-1	09/23/2004	**AUXILIARY SYSTEM FOR LAUNCHING AIR AND SPACE VEHICLES BY PUSHING FORCE**	B64G 5/00
MU 8303170-7	12/15/2003	**CONSTRUCTIVE ARRANGEMENT IN THERMAL ENERGY REGENERATOR IN TRANSFORMERS AND POWER SOURCES FOR MICROWAVE WATER HEATERS**	H05B 6/72
PI 0303872-6	09/23/2003	**PUSHING ROTARY ENGINE**	F03B 2/17
PI 0303845-9	9/17/2003	**MECHANICAL ENERGY GENERATION SYSTEM BY PUSH**	F03G 7/00

Source: Prepared by the authors with research data (2020).

In the patent search of public institutions in Piauí, 87 registered patents were found. With the exception of the State University of Piauí (UESPI), both the Federal Institute of Piauí (IFPI) and the Federal University of Piauí (UFPI) have patents. The Federal Institute of Piauí has 11 patents with only the name of the institution as depositor, and the Federal University of Piauí has 64 only with the name of the institution as depositor.

IFPI has 1 patent in partnership with UFPI deposited. UFPI has another 22 patents deposited in partnership with other institutions. From these partnerships, we highlight the following entities as they appear in the records: PHYTOBIOS PESQUISAS DESENVOLVIMENTO E INOVACAO LTDA, FITO FIT SUPLEMENTOS E PRODUTOS NATURAIS, MARCOR MÁXIMO ATENDIMENTO E

RECUPERAÇÃO CORPORAL LTDA ME e ITAOESTE SERVIÇOS E PARTICIPAÇ ES LTDA. The names of these companies are listed with connections the Public Research Institutions in Piauí in the filing of these patents. Among the inventors are teachers, civil servants and members of companies. There were no records of technology transfer of patents from these companies to other entities.

In terms of technology transfer, no results were found for the institutions surveyed. In other words, no technology transfer records were found with UFPI, IFPI or UESPI in the role of assignor.

3.1 Results analysis

According to the results found, it is observed that the transfer of technology between research institutions and companies is null or was not evident in the methodology applied in this study. However, we can see that there are partnership initiatives with small companies in conducting research that may project a change in this scenario. In this research it was not possible to assess how the relationships were established and whether there is any economic exploitation of these patents. It was identified that the relationships exist, with small companies, and that no transfer records were found by the research institutions. It is observed that no relationship was found between patents of large companies and the institutions surveyed.

The low number of patents and public/private partnerships in driving innovation in the state may be related to the low index evidenced by the Competitiveness Ranking of the States - CLP with regard to Piauí. This argument is reinforced by the lack of technology transfer between the parties studied.

Table 8 compares Piauí with São Paulo, the first in the general ranking, and Table 9, with Paraíba, 11th in the general ranking, however, the state best positioned in Northeast. The pillar shown in the tables is the Innovation pillar. With the analysis of Tables 8 and 9, that Piaui has a good position in the indicators Investment on R&D and Innovative Enterprises, which , it is considered, a positive factor for regional development. In the category of New Enterprises, Piauí is better placed. However, in terms of Master and Doctorate Scholarships, Piauí is poorly placed in the ranking. In terms of patents, Piauí and Paraíba have close numbers, while São Paulo occupies the fourth position.

Table 8. Comparison of results between Piauí and São Paulo in the Ranking of Competitiveness of States - CLP

INDICATOR	PIAUÍ			SÃO PAULO		
	Current Position	**2019**	**2018**	**Current position**	**2019**	**2018**
1. MASTER AND DOCTORATE SCHOLARSHIP	22nd	25.5	-	6th	67.9	-
2. INNOVATIVE VENTURES	10th	60.6	-	18th	35.4	-
3. INVESTMENTS IN R&D	7th	21.4	12.0	1st	100.0	100.0
4. PATENTS	22nd	0.0	7.7	4th	68.9	74.1

Source: Competitiveness Ranking of States - CLP (2019).

Table 9. Comparison of results between Piauí and São Paulo in the Competitiveness Ranking of States -

CLP

INDICATOR	PIAUÍ			PARAÍBA		
	Current Position	**2019**	**2018**	**Current position**	**2019**	**2018**
1. MASTER AND DOCTORATE SCHOLARSHIP	22nd	25.5	-	1st	100.0	-
2. INNOVATIVE VENTURES	10th	60.6	-	23rd	21.3	-
3. INVESTMENTS IN R&D	7th	21.4	12.0	3rd	35.7	36.4
4. PATENTS	22nd	0.0	7.7	18th	3.6	5.1

Source: Competitiveness Ranking of States - CLP (2019).

4. Final considerations

It was observed a lack in the production of innovations and registration of these technologies in the form of a patent in companies in Piauí. Through the study, one cannot conclude the reason, but it is observed that patents in large companies in Piauí are scarce in some cases, and abundant in others, however, the patents were filed some years ago. Some of the companies are the same group and, probably, have an innovation policy that promoted, at least in a given time, innovation.

The low rates of patent applications and patent licensing in Piauí evidence the low economic rates of the state at the national level. Is likely and can be verified in indices related that investment in intellectual property can leverage innovation and economic indices of the Piauí state industry.

There is a low rate of requests for protection of intellectual property in the largest companies in the state. Despite being a limited sample, it can be observed that companies do not deposit, frequently, new inventions and innovations in the processes they perform routinely.

The link between small and medium-sized companies in Piauí and the inventors of public institutions was evident. It is concluded that it is necessary to invest in research and development, and in the provision of master's and doctoral scholarships to enhance the results of the state. Although the sample observed is limited and the number of large companies in Piauí is reduced, it is clear that these companies do not have a notable innovation link with the Public Research Institutions, a link that could generate dividends for public coffers and economic improvement for the state. A more adequate position of patent management, a more active public/private partnership policy, as well as methods for evaluating and valuing technologies can be an option to assist the processes of development, transfer and commercialization of technologies.

5. References

[1] BLAKENEY, M. **Legal aspects of technology transfer to developing countries**, Oxford, ESC.1989.

[2] BRASIL, CONGRESSO NACIONAL. LEI N. 10.973, de 2 de dezembro de 2004. **Dispõe sobre incentivos à inovação e à pesquisa científica e tecnológica no ambiente produtivo e dá outras providências**. Brasília, DF: Casa Civil. 2004.

[3] CARIO, S. A. F.; DA CUNHA LEMOS, D.; SIMONINI, A. Avaliação da interação universidade-empresa em Santa Catarina por intensidade tecnológica. **Revista de Economia**, v. 37, n. 4, 2011.

[4] CENTRO DE LIDERANÇA PÚBLICA. **Ranking de competitividade dos estados, 2019**. Available in: <www.rankingdecompetitividade.org.br/>. Access in: 01 de february de 2020.

[5] CIDADES, IBGE - INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2019. Available in: https://cidades.ibge.gov.br/brasil/pi/panorama Access in: 02 de february de 2020.

[6] HAASE, H.; ARAÚJO, E. C.; DIAS, J. Inovações vistas pelas patentes: exigências frente às novas funções das universidades. **Revista Brasileira de Inovação**, Rio de Janeiro, v. 4, n. 2, jul./dez. 2005.

[7] KRUGLIANSKAS, I., & MATIAS-PEREIRA, J. **Um enfoque sobre a lei de inovação tecnológica do Brasil. Revista de Administração Pública**, 39(5), 1011-1028. 2005.

[8] LIVESEY, F. ***Report on survey of Brazilian Technology Transfer Offices*** (TTOs). (Report), Cambridge, UK. University of Cambridge Entreprise. 2014.

[9] MÜLLER, R.; STRAUHS, F. R.; OS GRUPOS DE PESQUISA, SUAS REDES DE CONHECIMENTO E A INTERAÇÃO UNIVERSIDADE-EMPRESA NO CENÁRIO BRASILEIRO. **Revista Brasileira de Gestão e Desenvolvimento Regional**, v. 15, n. 3, 2019.

[10] SEGATTO-MENDES, Andréa Paula; SBRAGIA, Roberto. O processo de cooperação universidade-empresa em universidades brasileiras. **Revista de Administração da Universidade de São Paulo**, v. 37, n. 4, 2002.

[11] SOARES, D. S. C. **Modelo híbrido de avaliação e valoração de tecnologias Desenvolvidas em universidades**. Dissertação (Mestrado em Ciência da Propriedade Intelectual) – Universidade Federal de Sergipe, São Cristóvão, 2018.

[12] SUPERINTENDÊNCIA DE ESTUDOS ECONÔMICOS E SOCIAIS – CEPRO, Piauí, Produto Interno Bruto – PIB, Available in: http://www.cepro.pi.gov.br/download/201811/CEPRO22_0cc688cf93.pdf Access in: March de 2020.

[13] VARGA, Attila. Regional economic effects of university research: a survey. **Unpublished manuscript, West Virginia University, Regional Research Institute, Morgantown, WV**, 1997.

[14] WINTER, E. et al. Gestão De Tecnologias De Centros Públicos De Pesquisa Como Possibilidade De Incremento Ao Crescimento Econômico E Desenvolvimento Regional. **Revista Brasileira de Gestão e Desenvolvimento Regional**, v. 15, n. 6, 2019.