

Science and Technology Growth in Universities of Brazil after the Creation and Implementation of Innovation Law

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Abstract.

With changing economic paradigms, Brazil has felt the need to establish public policies to strengthen science and technology, then expanded the number of teachers in higher education institutions and were created legal mechanisms in order to consolidate innovation in the country. The objective was to conduct an analysis of scientific and technological development indicators in Brazil, noting that the new investment policy and the expansion of doctors in universities has influence on increasing the production technology of the country. Expansion of doctors investigators in the 2006 to 2014 IES has an increase of almost 70% was found. In production technology, makes a comparison between 2004 where the production technology reached the amount of 12,014 that compared to the data of 2014 it is noted an increase of almost 200% checking positives after the creation of the Innovation Law. After statistical analysis the increase in the number of doctors accounted for 98% increase in production technology, proving how strong this relationship.

Keywords

Science, innovation law, technology.

Introduction.

Changes in the economic outlook and Brazilian society after the 1990s led to incentives to investments in the educational scenario of the country, creating an environment conducive to Brazil to compete with its international productions (Dias and Almeida, 2013). Higher education institutions (HEIs) then became key players in the development and dissemination of new knowledge through basic research and applied research (Chiarini and Vieira, 2011).

Such changes have caused a great impact within HEIs that have received more support and investments, both public and private. These investments were massively and brought with them a magnification frame number of vacancies within the institution of higher education (IES) since graduation also reaching the graduate (Dias and Almeida, 2013).

Gloss (2012) points out that the changes in the Brazilian educational scenario associated with the creation of Law No. 10,973 / 04 known as the Innovation Act strengthened partnerships between educational institutions and businesses in order to stimulate innovative activity through science and technology.

Throughout the twentieth century, science and technology (S & T) amounted to engine condition of economic growth. For just 60 years, the Science and Technology Policy (PCT) acquired various formats and adopted numerous instruments to turn into a policy with very purpose (Secchi and Souza, 2014).

In Brazil, as in the most Latin American countries, the developed public policies followed the appointments of international mechanisms, where various initiatives and regulations were created to mainly encourage the practices of innovation and interaction between universities and companies (Junior Marin and Silva, 2011).

From that outlined policy for the dissemination of new knowledge so as new technologies, HEIs have become strategic agents (Chiarini and Vieira, 2011).

In this context, this article aims to verify the growth of science technology and innovation (ST & I) in the starting from an analysis of the improvement of academic activity focused on the production technology, as well, as to correlate the increase in the number of doctors in the university in Brazil with their productions technology since 2006 when the law of innovation was already consolidated on the national scene.

Theoretical Review.

The New Science and Technology Scenario in Brazil and its Relations with Higher Education Institutions. Before the structure encouraging science and technology, academic sphere has become central to the construction of frames responsible for the implementation of industrial policy and innovation in different fields (Brito, 2013, p.9).

According to Dias and Almeida (2013), scientific publication of the researchers of the IES acts as a reflection of the work undertaken in national laboratories and can be considered today as one of the drivers of patent production in the country where consecrated institutions academically are currently considerable depositors applications do not only the PTO, but also abroad, thus contributing to stimulate the creation of a technological culture in the country bringing value addition of products produced in the Brazilian industries.

From the perspective of increasing the value and quality of domestic products on the international market, the creation of intellectual property related legal devices has driven academic research activity being a consequence of applied financial resources, more PhDs per year; and the change in academic researcher behavior through the implementation of

innovation centers within universities, as well as new rules for sharing of economic outcomes (Fujino 2011, p. 53).

Among the creation of legal frameworks the most prominent, and which resulted in the development of other devices, is the Innovation Law.

The Innovation Law (Law No. 10.973/04) deals with incentives for innovation and scientific , technological research in the productive environment, with subsidy to innovative companies , incentives to business incubation in the public space and public participation researcher in strategy technological innovation developed in partnership with private companies (Brazil, 2004).

Countries with efforts focused on innovation draws up plans and policies for ST & I emphasize their institutional capacity to manage government policies, strengthening university-industry relationship, as well as enhance the quality of higher education and national scientific research (Oliveira, 2012; Pereira, 2013).

According Fujino (2011) the various public policies such as the Innovation laws, Law No. 11.196/05 known as the Good Law and the Action Plan C, T & I; 2007 to 2010 can maintain national goals to expand S & T within the country thereby providing an increase in academic production.

Fujino (2011) and Oliveira (2012) argue that the three lines followed by the Innovation Law focused on stimulating innovation, encouraging HEIs in action plan C, technology and innovation (T & I) , providing university- government -industry relationship, form the primary means of dissemination and application of ST & I.

To the full success of these politics, it is necessary to train people to work in several areas, so it is essential the increase of doctors within the IES.

According to the Ministry of Science and Technology (MCTI), in 2012 the plans and/or national strategies for ST & I place particular emphasis on building institutional capacity to lead or manage government policies , to strengthen the ties between universities and industries, improving the quality of higher education and national research

To Brito (2013) academic contribution in the creation of deployment scenarios of innovation politics, technology and science in the various sectors of the Brazilian economy is of paramount importance, moreover, the academy brings the advisory aspect of contributing to new projects, programs and guidelines aimed at ST & I .

Thus, the state's investment in research by IES entails increasing varied form of production technology as well as innovations in many different fields (Fujino, 2011).

It is important to highlight according to Oliveira (2012), which recently implemented government policies aimed at the search for new knowledge, through internationalization and cooperation between Brazilian and international IES; the transfer of technology and knowledge to the production chain; applicability of Brazilian scientific research; and finally, the expansion of graduate studies in the country, seeking the formation of new professionals.

In recent year, the Higher Education Personnel Improvement Coordination (CAPES) together with the MCTI increased investments in training professionals focused on the generation of technological innovations in order to strengthen the skills and expertise within the academy to devise strategies to expand stimulus financial areas determined by the government (Oliveira, 2012).

The National Strategy for Science, Technology and Innovation - ENCTI (2012-2015) aims at expanding the promotion to the national science (base) and technological innovation; favoring a research structure, science and solid technology, creating solutions for the main

Brazilian needs and bringing strengthen the basis of innovation; expanding the frame number of doctors (human capital) facing the Brazilian needs in the fields of research, development and innovation in order to create sustainability in economic and social development of the country.

Methodology.

It is an exploratory research, descriptive quantitative approach, conducted through data collection in the Lattes platform of the National Scientific and Technological Development Council (CNPq), which provides the censuses giving an overview of the research staff and Productions of IES Brazil. The interest to collect data from 2006 is that these are later creation of the Innovation Law.

Statistical correlation tests were conducted to examine the relationship between variables.

According Cargnelutti Son et. al. (2011) the coefficient of Pearson correlation coefficients (r) measures the strength, intensity or degree of linear relationship between two random variables.

After the tests, the main aim was to see whether the new investment policy in S & T and the increasing numbers of doctors teaching in Brazil has influence on increasing the production technology of the country after the creation of the Innovation Law.

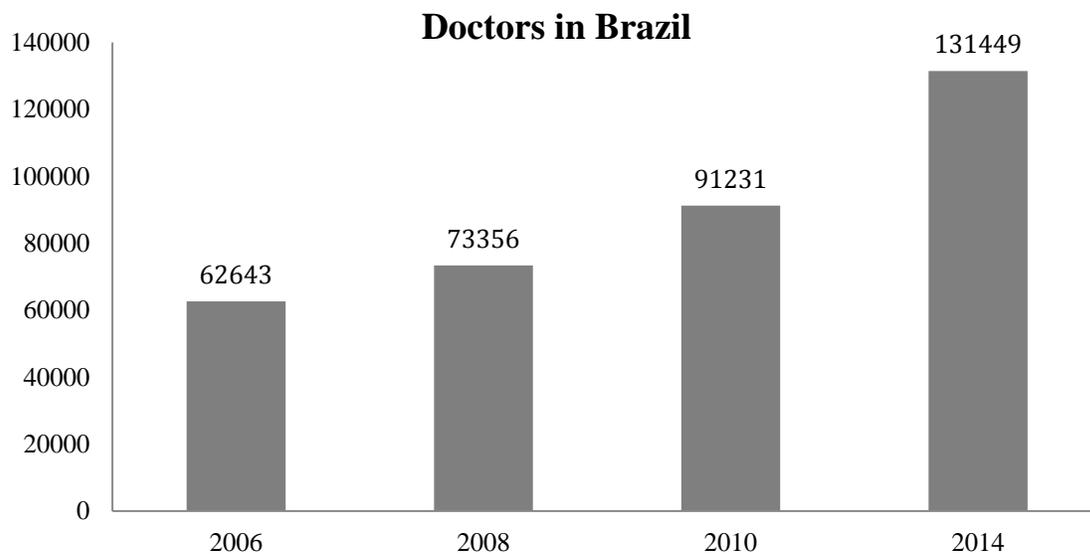
Results and Discussion.

From 2002 it is noted in the country 's growing number of PhD researchers within the HEI, thus inferring that because of this increase is resulted also increased patent

production and its deposit with the National Institute of Industrial Property - INPI (Closs, 2012; Census CNPq, 2014) .

In Figure 1 we can observe the total number of PhD researchers in HEIs in Brazil. It is visible to expand rapidly researchers from 2006 to 2008 there was an increase of 16 % of staff , 2008 to 2010 widens by 26% this picture and from 2010 to 2014 has increased by 58% in number of doctors in Brazil. The scientific production and the number of PhD researchers in educational institutions allows us to view the country's situation in relation to the potential for innovation.

Figure 1. Number of PhD Researchers in the University in Brazil.

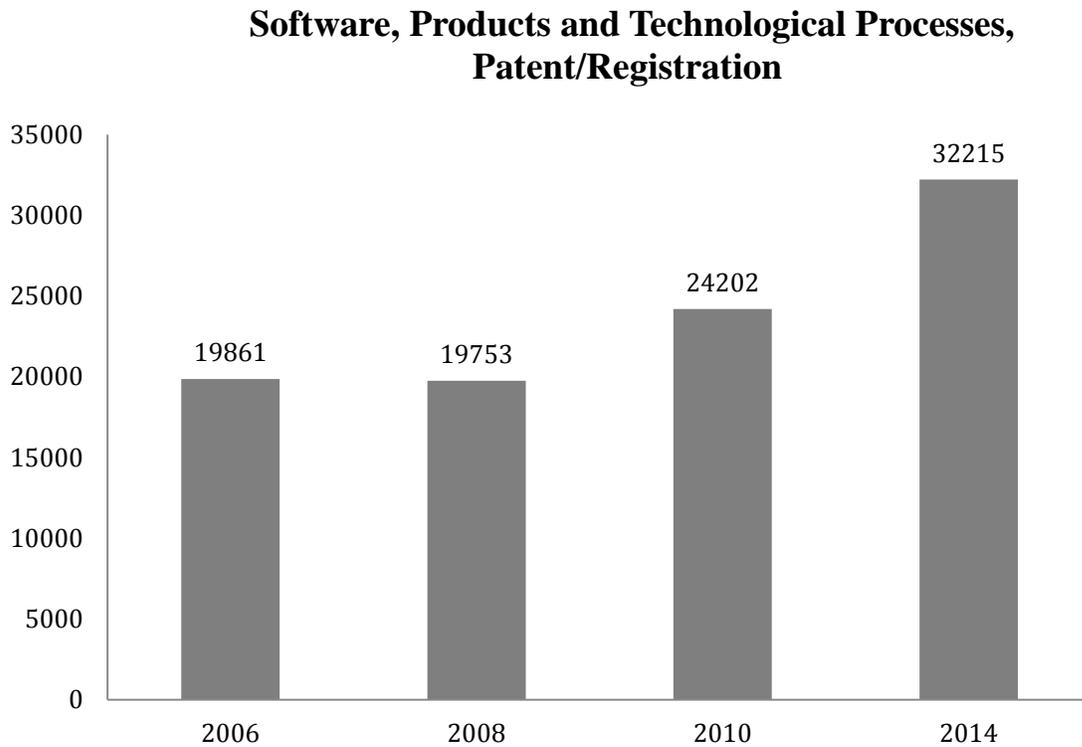


Source: Author based on data collection in the CNPq, 2015.

It can be seen in Figure 2 production technology since 2006, where we can see an intensification in production technology in Brazil. According CNPq census data in 2004 the production technology reached the amount of 12,014 that compared to 2006 can be noted an increase of 78 % in this type of production in this period the Innovation Law was

already consolidated in order to achieve positive results in the Brazilian innovation system.

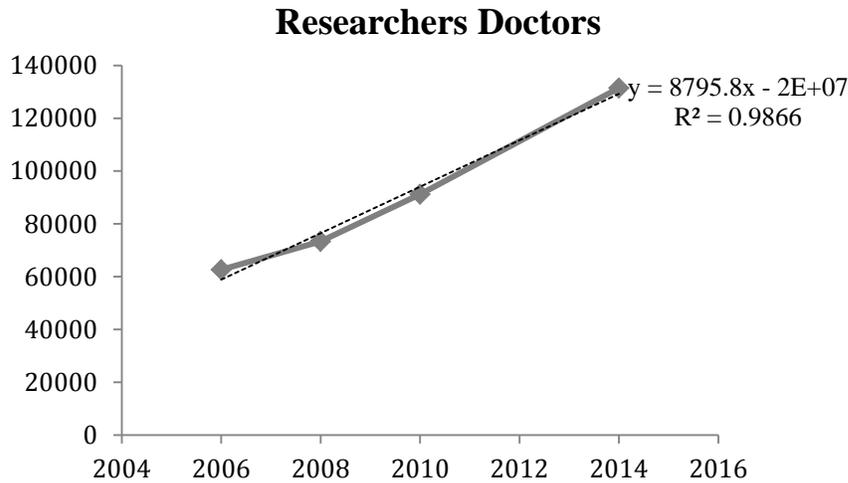
Figure 2. Technological Production in Brazil.



Source: Author based on data collection in the CNPq, 2015.

Then sought to verify the correlation of the study variables. In Figure 3 shows that the series presented an accelerated growth and the chart confirms that there is a correlation with $R^2 = 0.9866$ being a positive and linear correlation.

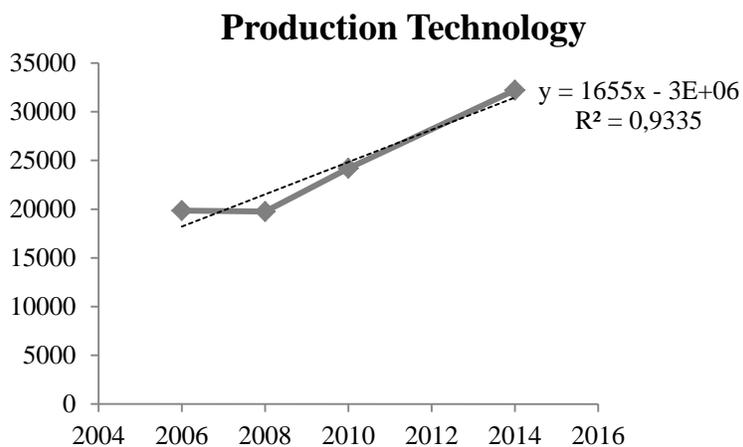
Figure 3. Researchers Doctors in Brazil.



Source: Author based on data collection in the CNPq, 2015.

In Figure 4 it is also observed that the series grew in 2006 and a decrease in 2008 from then on there has been a rapid and significant growth where the graph confirms that there is a correlation with $R^2 = 0.9335$ being one positive and linear correlation.

Figure 4. Production Technology in Brazil



Source: Author based on data collection in the CNPq, 2015.

Then sought to determine whether the increase in doctors in HEIs in Brazil is related to the increase in technological production in Brazil and how strong this relationship. There was a $r = 0.9882$. It calculated the coefficient of determination (R^2) explaining the independent variable proportion of the variation is explained by the dependent variable, or is a tool that evaluates the quality of the adjustment. The found regression equation was $y = 0,1912x + 6865.3$. Obtained as an $R^2 = 98\%$ explaining the increase in the number of doctors is in 98% increase in production technology in Brazil the other 2% of this ratio is explained by other factors.

Table 1 shows the results of descriptive analysis for the amount of researchers and doctors for technological production in Brazil.

Table 1. Statistical Summary

Variable	Mean	Minimum	Maximum	Standard Deviation	Assymetry	CV***
RD*	24007,75	19753	32215	5850,8	1,346	24%
PT**	89669,75	62643	131449	30246,4	1,177	34%

* Researchers Doctors.

** Production Technology.

***Coefficient of Variation.

Source: Author based on data collection in the CNPq, 2015.

It then checks the table 1 the average of PhD researchers, observed of four years, was 24,007.75 doctors; for technological production average was 89,669.75 productions. It also calculated the value of the asymmetry and checks through the table 1 that the variables are positively skewed distribution. The CV shows that the data distribution is homogeneous, having little change over time.

Conclusion.

Investments in S & T, in the qualification and insertion of young doctors in HEIs brought positive ready for the country. With the implementation of the law to encourage innovation, scientific and technological research in the production environment, is enabling the country to achieve technological autonomy and industrial development, universities and companies have to value the assets that can be built through the human intellect.

Given the data available at the last census conducted by CNPq there was the expansion of PhD researchers in HEIs that comparing the years 2006 to 2014 has increased by almost 70 % in that frame. When it comes to production technology makes a comparison between 2004 before the Law consolidation of innovation and the period after that year, in 2004 the production technology reached the amount of 12,014 that compared to the 2014 data one can notice an increase of almost 200 % in this type of production.

It was also after the statistical test that the increase in the number of doctors in HEIs is 98% increased production technology in Brazil, proving how strong this relationship.



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