



Globelics

University and their contribution to innovation: inferences from Brazilian cases

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Abstract

The university firm relationship is an important aspect of the process of innovation and deserves increasing attention from policymakers and public. They are very heterogeneous contributions given by universities to this process, permeating their activities of teaching, research, transfer / commercialization of knowledge and spin-off f companies. This study aims to provide a summary of these key contributions based on case studies of success.

Key words: university, innovation, commercialization of knowledge, spin-off

Introduction

As a result of a systematic public policy to promote the activities of research and post-graduate education ongoing since mid-1960, there was about 35,000 MScs and 11,000 PhDs awarded in Brazil in the year 2007, through its 1,819 post-graduate programmes offered by 196 scientific and technological institutions (mainly by the public universities). Brazil holds approximately 1.8% of articles published in indexed scientific journals in the world , about the same percentage of its GDP in the world GDP.

The Brazilian companies, on the other hand, have shown low ability to generate ideas that can generate relevant patents. The percentage of patents by Brazil in relation to the total deposited around the world in the American patent office is of the order of 0.06%. We may sort out that the Brazilian participation in the total world of patents is 30 times smaller than its participation in the global total of scientific production indexed.

One of the reasons that this poor performance of Brazilian innovative companies follows from the fact that of the total of Brazilian scientists, only 23% (less than 20 thousand) develop research in industrial laboratories, whereas in South Korea and the United States, for example, approximately 54% (94 mil) and 80% (790 thousand) of the scientists,

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respectively, are employed in industries for the development of innovative products and processes (Brito Cruz, 2007) Moreover, recent data indicate that only a third of Brazilian industrial companies with more than ten employees (little more than 30 thousand) had made some improvements in their products (or in their processes) or introduced a new product on the market (or new process) at least to the company (IBGE, 2005).

In spite of such unfavourable macro scenario, we find companies, individually or collectively in networks, seeking interactions with universities to enlarge their technological capacity to innovate, often for solutions to occasional technological bottlenecks, sometimes for the development of joint research projects at pre-competitive stage.

Moreover, we also have examples of research groups at universities, where academic excellence is combined with the commercialization of technology generated from their research activities to companies by patenting and licensing as well as by spin-off formation.

To understand better those modalities of university-firm interactions, we analyzed three cases selected by their importance of the firms and/or the research institutions involved.

The first case is an expressive example of interaction between companies and universities, articulated in networks for the development of innovative solutions to technological bottlenecks. It is related to the cheese industry in the state of Minas Gerais, with their interactions with universities (Federal University of Minas Gerais; Federal University of Viçosa; Federal University of Lavras) in search for a solution to a technological bottleneck in their production process.

The second case is an example of research groups at universities interacting with companies and trading results of their research, where it is analyzed the interaction with the companies by the Department of Physical Chemistry of the Institute of Chemistry of the University of Campinas .

The third and last case selected concerning on universities creating spin-offs companies from their research results, referred to the process of firm formation at the Laboratory of Membrane Processes of the Programme of Chemical Engineering of the Federal University of Rio de Janeiro.

2. Successful cases of the University-business sector relationship

2.1 Companies interacting with universities

An excellent example of the interaction between companies and universities, linked through networks for the development of innovative solutions to technological bottlenecks, can be seen in the case of the cheese industry in the state of Minas Gerais, as reported and a recent paper by Paula e Silva (2005) and described below. It deals with the growing popularity of “pão de queijo” (cheese flavored biscuits) in Brazil. It all started

almost 20 years ago, when several manufacturers began to think about freezing the dough for the cheese biscuits, encouraged by the way wace of frozen foods that were beginning to enter the market at that time.

At first these efforts were unsuccessful, because the frozen dough would not rise when re-heated. Called to research the case, researchers from the Food Technology Group of the College of Pharmacy at the Federal University of Minas Gerais discovered that the problem stemmed from the fact that the low temperatures destroyed the natural yeast in the dough. After a number of unsuccessful attempts, they set aside the search for a new yeast and began to look for a biotechnological solution that would create a variation of natural yeast, resistant to cold. A solution was found as a result of the research efforts that involved the Federal University of Viçosa, as well as other institutions like the Federal University of Lavras and the Technology Center of Minas Gerais.

The impact of this discovery was extraordinary, as Paula e Silva pointed out, making possible the emergence of approximately 400 companies of every size and description, creating 8000 points of sale of the product in Brazil and generating an international market for export, unknown at that time (notably in the United States, Canada, Mexico, Argentina, Venezuela, England, Germany, Italy, Portugal, Spain, France, Israel, Singapore and Japan).

If this were not enough, it is worth citing the case described by Paula e Silva, as the industry began to show some of the effects generated by this transformation: “the rapid expansion of new projects began to push the limits of the supply of cheese and there emerged a shortage of cheese in Minas Gerais. This resulted in a strong push for the cheese industry that, in addition, was then required to raise their standards of quality to meet the demands of the international markets. In this context, the import of cheeses from New Zealand opened the way for the introduction of a new, “light” cheese biscuit. The introduction of the biscuit to the Portuguese market generated a new sub-segment of cheese biscuits with a sweet filling. A number of engineering projects to build manufacturing facilities for the cheese biscuits sprang up. Easily accessible through the Internet, the projects are designed to be adaptable to any size project and can be easily obtained.”

2.2 Universities interacting with companies and commercializing their results of searches

Recent examples of research groups in Brazilian universities interacting with companies and commercializing their results of research are presented in among others by Fernanda Sobral (2007) and by Antonio Botelho (2007). From the last we selected the case studied of the interaction with the business of the Prof. Fernando Galembeck Laboratory, from the Department of Physical Chemistry of the Institute of Chemistry at the State University of Campinas (UNICAMP), that we summarized as follows.

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Interactions with companies in a double hand process have been a constant in the path of this research group. Advanced researches has been developed for the resolution of technological problems enterprises and new topics of research has come out during the search for the solution of these problems.

The Department of Physical Chemistry where this group belongs is one of the most productive in scientific terms within the Institute of Chemistry, which in turn is one of three departments in the country with maximum marks from the federal agency in charge of evaluating graduate programs, the federal post-graduate research support agency (CAPES), among the 43 covered by the triennial evaluation in the chemistry area. Professor Galembeck itself, in recent years, has made an average production of three articles published in international journals indexed.

Since the late 1980 this research group has been working in basic research in pigments, initially with the support of the Brazilian Research Council (CNPq) and the State of São Paulo S&T support agency (FAPESP). Since 1994 this group received funding for over a decade worth of about USD 650,000 of Bunge Fertilizers (formerly Serrana Mineração), a multinational company that operates in Brazil, to develop a series of researches that resulted in the production of a special pigment for paints and other applications, recorded in 2005 under the brand Biphor, based on nanoparticles of aluminum phosphate, whose potential market reaches USD 5 billion.

Researches in nanocomposites have also been developed in partnership with Rhodia-Ster (nowadays Mossi and Ghisolfi - M & G), related to the development of a manufacturing process of nanocomposites of polyester with clay, with patents filed in Brazil and in the United States and with the company Orbys in the development of nanocomposites of natural rubber and clay, deposited with patent and licensed.

Moreover, research for the development of tensoativos were also made in partnership with the company Oxiteno, funded by FINEP (financial support agency from the Ministry of Science and Technology), and researches for the development of fiber precursor of poliacrilonitrila and carbon fiber were made again with the support FINEP and in partnership with the Technology Center of the Navy and the company Crylor / Radice.

More recently this research group has been working on the development of nanocomposites for natural rubber adhesives and other products, in partnership with a technological institute (IBTeC) and with the company Orbys, for applications for the shoe industry, and in partnership with the company Montana Chemistry, for applications in wood preserving and finishing.

To have an idea of the importance of the contribution of these companies in the financing the research conducted by this research group, recent data indicate that from the total amount of funding (USD 687,500) received by this research group in the year 2004, circa 60% come from companies and around 40% from public funding.

As a result of this alliance between academic excellence and interaction with companies, it is finally noted that Professor Fernando Galembeck has 13 patents filed, of which 4 granted and 6 licensed. Five of them come from its successful interaction with Bunge, which resulted in white pigment Biphor. Professor Galembeck is one of the leactures of the Institute of Chemistry with the highest number of patents.

2.3 Universities companies creating spin-offs from the results of researches

From a research study in progress, Thiago Renault² we summarized the results of his study of the Laboratory of Membrane Processes (LMP) at Chemical Engineering Department of COPPE / Federal University of Rio de Janeiro and of the formation of a company spin-off.

In this Laboratory of Membrane Process, researches are being carried out in this field since the early 1970, led by three senior researchers, in a close relationship with laboratories abroad and with partnerships with several companies, including Petrobras (Brazilian stated owned oil company) and the private companies Filtro Europa and White Martins.

Over the years was then consolidating the development of a pioneering process of manufacture of porous polymeric membranes that allow processes of micro filtration. This is a technology that can be applied in the treatment of industrial effluents in the purification and reuse of water, in food industry, manufacturing of biofuels, in the purification and sterilization of environments, among others. It was therefore with a so strong market potential.

We are facing so a technology with a high scientific content, the product of a research carry on over thirty years, developed by a group of researchers of high academic competence. It is a technology, by its own, with a wide range of applications. More than that, researchers of this laboratory were the only one that dominated this technology in Latin American scenario.

After this technology being developed at laboratory scale, the next step to enable its applications would be its commercialization to allow a further development on an industrial scale, in a different organizational structure better suited for this.

The path chosen for commercialization was precisely through the creation of a spin-off company - the PAM Membranas – with the societal participation of three senior researchers of the laboratory, holders of the know-how, and with two former graduate students of the laboratory being hired to work at PAM Membranas.

At that time the most senior one researcher retires from the university to head the company, while the other two remained senior researchers working in the laboratory. A

² Ph.D. thesis in progress, being developed at the Production Engineering Department of COPPE/ Federal University of Rio de Janeiro, under the co-supervision of the author of this paper

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formal agreement between the PAM Membranas and the Laboratory was then assigned, with the establishment of a legal framework for the transfer of technology issues and royalties payment.

The PAM Membranas, although being recently established, in the year of 2002, has its trajectory already permeated by outstanding results. At the same year of his legal creation, it signed agreement with the Europe company of household filters, and received from FINEP (via Sectoral Funds) two scholarships to hire technical staff.. Later, in 2005, was selected and joined the Business Technology –Based Incubator of COPPE / UFRJ.

In the same year of 2005 it sells its equipment of industrial application for the company Molecular Environmental and another one Dupont. In 2006 the PAM Membranas was contracted to do the installation of a pilot plant for Petrobras.

The PAM Membranas in turn continues maintaining close cooperation with its cell mater, the Laboratory of Membrane Processes of COPPE / UFRJ, which can be exemplified by a new partnership for developing a new technology in membranes to allow the extraction of alcohol from sugar cane with low energy. This project is partially funded by FINEP,

The case that we just examined can be thinking in terms of a sequence of activities, from the transformation of cutting edge research results in a high-density technology that went to the market through the establishment of a spin-off company, which is still interacting with its laboratory of origin, conducting joint research and paying royalties back to the laboratory, so completing a virtuous cycle

3. Discussion and conclusion

A good record in research quality was verified to be a necessary condition for successful interactions with firms, in all cases analyzed. All academic departments involved were known by their research achievements and by their higher interaction with firms. This result was expected, since it is acknowledge by the specialized literature that academic excellence may increase due to interaction with firms and vice-versa.

All cases shows that the micro-system where they operated where populated by representatives of larger macro-systems. Even in the case of a small research laboratory we found interacting with them multi national companies, big national companies, financial flows from federal and state agencies etc. The notion of an extended laboratory, from the sociology of science, resembles the notion of extended systems of innovation.

The existence of an environment conducive to innovation was perceived and materialized by the institutional frame behind the cases, like the recent Brazilian Innovation Law, with its obligatory mandate for scientific and technological institutions to organize agencies of innovation.

As far as policy implications are concerned, we must be careful to avoid generalizations. The transfer of technology through commercialization of research results has meaning only for a selected group of universities, which present all necessary conditions for such. From the total of 290 universities in Brazil (2007), 141 universities have only MScs programs and only 25 universities have more than 10 PhDs programs.

4. References

Botelho, A.J.J. (2007) Capítulo Síntese Brasil, Projeto IANAS /Ford Foundation / IETS, The Leading Latin-American Universities and their contribution to sustainable development in the region (mimeo)

Brito Cruz, C.H. (2007). Apresentação no Painel “Políticas de Inovação e parcerias público-privadas: o que precisa ser feito”, Seminário “O desafio da Inovação no Brasil”, São Paulo, Novembro 2007 (sumarizado por Thiago Romero, Agência Fapesp, Novembro 2007)

Fernanda Sobral (org.) (2007) Talentos para Inovação – Engenharias, Física, Matemática e Química. Brasília. (mimeo)

IBGE (2007). Pesquisa Industrial de Inovação Tecnológica – PINTEC 2005. Rio de Janeiro: IBGE, 2007.

Mello, J.M.C.; Maculan, A-M.; Renault, T. (2007) Universidades brasileiras e sua contribuição para a inovação e o desenvolvimento. Position Paper / Projeto UniDev :Universities and their contribution to development (mimeo)

Paula e Silva, E.M. (2005). Modelos de inserção de C,T,I para o desenvolvimento nacional. Parcerias Estratégicas. No 20 Junho 2005 pp 1339-1345