

Strategies and Practices of Technological Innovation in Brazil Under the Optics of Triple Hélix

Eliane Regina Rodrigues Message, Anapatrícia Morales Vilha, Paulo Roberto dos Santos Federal University of ABC (UFABC), São Paulo, Brazil

We are facing a greater complexity of the scientific, technological, and innovative problems at present, that is, innovation increasingly depends on the generation of scientific and technological knowledge. Thus, the innovation process addresses the need for the interaction of the company with multiple actors to seek knowledge with a view to expanding its capacity to provide innovations, or even to access new technologies and markets. The Brazilian innovative actors. The objective of this work was to analyze the maturity of the companies installed in Brazil around the construction of competitive strategies and technological and innovative development in collaboration and transfer of technologies promoted by the Federal University of ABC (UFABC). The findings of the UFABC case study revealed that the university has captured substantial resources for the development of a variety of projects. To this end, distinctive initiatives reflected in its pedagogical project, organizational structure and research, and the promotion of innovative areas and projects have shown its dynamic positioning for collaborative arrangements.

Keywords: strategy, innovation, collaboration, Brazil, UFABC

Introduction

Business competition can be characterized as a driving force for the movement of market forces, encouraging companies to seek better positions in their sectors of activity. With the application of technological innovation in products, services, and/or processes for the markets, it is understood that technical change is one of the primary factors of generating economic development and should therefore be part of public policy agendas to economic development. Thus, neo-Schumpeterian authors such as Freeman and Soete (2008, p. 457) emphasize that "failure to innovate is equivalent to dying". Yet, from the standpoint of Joseph Schumpeter (1883-1950), an invention only becomes innovation when it enters the productive process and enters the market commercially.

We are facing a greater complexity of the scientific, technological, and innovative problems in the present, that is, innovation increasingly depends on the generation of scientific and technological knowledge (Fuck &

Eliane Regina Rodrigues Message, M.Sc., researcher, Federal University of ABC (UFABC), São Paulo, Brazil.

Anapatrícia Morales Vilha, Dr., professor, Federal University of ABC (UFABC), São Paulo, Brazil.

Paulo Roberto dos Santos, Esp., researcher, Federal University of ABC (UFABC), São Paulo, Brazil.

Correspondence concerning this article should be addressed to Eliane Regina Rodrigues Message, Capuava Avenue 100, Santo André, São Paulo 09.111-000, Brazil.

280 STRATEGIES AND PRACTICES OF TECHNOLOGICAL INNOVATION IN BRAZIL

Vilha, 2011). Thus, the innovation process addresses the need for company interaction with multiple intra and inter organizational actors to seek knowledge with a view to expanding its capacity to provide innovations or even to access new technologies and markets. This dynamic and interactive insight into the innovation process communicates with an important innovation economy approach taken by many countries as "Innovation Systems" (IS). The IS refers to the set of public and private institutions that contribute to the development, execution, support, promotion, and diffusion of new technologies at the macro and microeconomic levels (Freeman & Soete, 2008).

The Brazilian innovation system is considered immature and weak in relation to the interactions of scientific, technological, and innovative actors. Suzigan and Furtado (2010) show that the problems of Brazil's Science, Technology, and Innovation (ST&I) institutions are directly associated with the fact that they have not sufficiently evolved the current demands of industry, science, and technology.

In the Brazilian scientific scenario, the Federal University of ABC (UFABC) was created in 2005, based on the perception of the importance of the interaction of the various areas of knowledge, focusing on the reflection and attention to regional and national issues, through cooperation with the public sphere, with other teaching and research institutions and with the productive sector.

The objective of this work is not to close the discussions on the topics discussed, something unlikely considering the complexity of the questions on the screen. In this way, it was tried to identify elements that are allowed to analyze the maturity of the companies installed in Brazil around the construction of competitive strategies and technological innovation, besides the examination of the efforts for the realization of partnerships for technological and innovative development in collaboration and transference of Technologies promoted by the Federal University of ABC.

This article is divided into six sections, including this introduction. The following section will address conceptual aspects involving competitive strategies and technological innovation. Next, we present reflections based on research carried out in Brazil on strategies and practices of technological innovation of companies installed in Brazil. The debate also reaches elements of the policies of Science and Technology in Brazil and the standards of collaboration established between universities and companies in Brazil. Finally, we present the case of the Federal University of ABC (UFABC) and final considerations of the research.

Technology and Innovation Strategies in Companies

Barney (2002) and Tidd, Bessant, and Pavitt (2008) discussed this issue from a complementary perspective, emphasizing that all the resources present in the company are fundamental to the generation of successful innovations and present important contributions in order to submit proposals aimed at aligning innovation strategies with organizational strategies, emphasizing the congruence of its objectives and goals to achieve competitiveness.

In this same direction, Barney (2002) and Prahalad and Hamel (1990) also emphasize the importance of adequate management of the resources and competences of the company in line with the strategic plans adopted, with a view to competitiveness. The view of Freeman and Soete (2008) also approaches this context and demonstrates a taxonomy of innovation strategies for the markets that companies can adopt according to their competitive strategies. Of course, the differentiated combination of the resources and competences of the company is that it allows the efficiency of internal processes and management, the reduction of costs, the improvement of performance of its technological assets, among other aspects.

In analyzing the use of technology from a competitive perspective, Michael Porter (1986) investigated the use of technology associated with the five forces that influence industrial competition and the ability of companies to define successful strategies. These forces, to a great extent, delimit the best strategy to be chosen by the company, among the strategies defined by Porter as "generic", which can be summarized in differentiation strategies, cost leadership strategies, and strategies focused on niches (Vilha, 2013).

Given the signaled elements, it is important to note that strategies that consider the endogenous forces of the organizational environment do not rule out the theory of Porter of the competitive forces (1986). Despite the keynote of the author's approach to market forces, the market positioning and strategy of looking at the variables and endogenous scenarios to be in the environment in which the company is inserted seems fundamental.

Bes and Kotler (2011) indicate that the innovation strategy must be defined after the company establishes its organizational objectives, directing and concentrating all the goals in the selection of markets and regions for action.

Extrapolating even more the dimension of the compatibility of the exogenous aspects related to the unstable and complex environment in which innovative agents are inserted and the endogenous aspects, such as those related to the organization of R&D activities, are also in this context, which can be understood as a set of different actors (universities, companies, research institutions, financial institutions, government agencies of public policies) in the technological performance of countries and regions (Fuck & Vilha, 2011).

Thus, the analysis of the innovation process cannot be restricted only to features directly related to scientific and technological research, or to the best practices that lead to successful innovations (Vilha, Fuck, & Bonacelli, 2013).

Technological and Innovation Strategies of Companies Installed in Brazil

In the preamble to this section of the article, it is possible to affirm that Brazil has a national system of innovation that is still immature, something directly related to the historical aspect of its economic, industrial development and its scientific, technological, and innovative actors. The country had a late industrialization trajectory, guided by the import substitution model, therefore, strongly focused on meeting domestic demand, dependent on public investments for large projects, but also on foreign direct investment (FDI) for development (Vilha, Fuck, & Bonacelli, 2013). In addition, there is a strong role in the acquisition of machinery, equipment, and technology from abroad, with little capacity to generate internal knowledge.

In this direction, the Dom Cabral Foundation's research on innovation practices of 27 companies participating in the National Innovation Reference Centers (CRI Nacional), showed that the high management of companies increased their awareness and legitimacy of innovation in strategies, demonstrating a improvement in the results obtained in 2015. Tadeu and Santos (2016) also point out that for the other positions analyzed, the theme "innovation" in 2016 was considered less important than that was considered in 2015, as shown in Figure 1.

On the other hand, the same research also showed that 61% of innovation in companies is based on the search for productivity, followed by approximately 30% of companies that understand that the development of new products and services is the main driver of innovation, demonstrating that in 2015-2016 there was a drop in the priority given to the development of new technologies and new business models, as shown in Figure 2.







Figure 2. Targeted aspects of innovation strategies. Source: Tadeu and Santos (2016).

The innovation pattern of the country is heavily based on access to knowledge through machines and equipment, and replicates the trajectory of industrialization and technological capacity building of the Brazilian productive fabric, in view of the policy of productive expansion of the industry from public investments and direct investment foreign technology, besides the acquisition of technology from abroad (Vilha et al., 2013).

In this sense, the strategic priorities for innovation in the companies that participated in the research demonstrate creating an environment that generates ideas, attracting startups, and attracting and retaining talent are the top three priorities respectively in descending order of magnitude. Still, Tadeu and Santos (2016) point out that attracting investors to innovation was the factor that showed the most decrease in the priority scale between 2015-2016, as shown in Figure 3.

The research conducted by Quadros (2008) on the adoption of practices and organizational forms of strategic management of innovation in Brazilian companies controlled by domestic and foreign capital suggests that companies that place innovation in their strategic objectives and strategy are more structured actions of management of technological innovation.

From the point of view of the objectives to promote innovation in Brazilian companies, the research by Tadeu and Santos (2016) shows that the generation of new ideas and access to the financing of projects for innovation are inductive elements for action in the innovative direction, as demonstrated in Figure 4.

Another interesting data shown in Figure 4 reveal that promoting relationships with universities is the least used practice to innovate, having been indicated in only 5% of innovation practices. This research data, shown in Figure 4, corroborate the findings of Suzigan and Garcia (2012) that the interactions of high-tech companies



with universities and research institutes can be considered as still under expressive in the country.

Figure 3. Strategic priorities for innovation. Source: Tadeu and Santos (2016).

Figure 4. Practices supporting innovation. Source: Tadeu and Santos (2016).

Despite the importance of the characteristics and structures related to scientific and technological research or to the best practices that lead to successful innovations, the innovation process is also susceptible to aspects outside the control of companies, such as macroeconomic adversities that may even make it unfeasible for innovation actions (Vilha et al., 2013).

Figure 5 shows that the partnerships that promote access to new markets were indicated by those interviewed in the survey by Tadeu and Santos (2016) as being the most important to innovate, with improvement in the result obtained, when compared to the previous year. These partnerships were followed by those that allow access to new technologies and the development of new products and services, which presented results of 28% and 21% respectively.

The vocation for the development of more incremental innovations identified in the research by Quadros (2008) is congruent with the findings of the research produced by Suzigan and Garcia (2012), showing that, in a general way, the interactions of companies with universities are more associated to the innovations incremental, which include activities to adapt and improve existing products, services, and processes.

The research proposal by Quadros (2008) and Suzigan and Garcia (2012), is corroborated by the research of Dom Cabral Foundation, by Tadeu and Santos (2016), in which the predominant view for innovation is incremental to the detriment of innovation Radical and disruptive. In companies, internally, the development of new products and incremental improvement predominates. However, innovation as a business model and the

future theme has little diffusion and internal visibility, and is considered as critical factors for the good performance of the development of new products, as indicated in Figure 6.

Figure 5. Strategic partnerships for innovation. Source: Tadeu and Santos (2016).

Figure 6. Predominant vision for innovation. Source: Tadeu and Santos (2016).

Policies of Science, Technology, and Innovation and Collaborative Standards Between Universities and Companies in Brazil

For Suzigan and Furtado (2010), the current actors and institutions of ST&I in Brazil present as acute limitations: a deficient performance in a systemic way; the aging of some actors within the innovation system; the complexity of the set of actors, mechanisms, and policies; operations based on technical staff who do not have sufficient skills to operate more sophisticated policy objectives (from an industrial and technological point of view); and the holding of command and coordination problems—dialoguing with the performance levels of Brazil expressed by several indicators of effort and ST&I result (Vilha et al., 2013).

Other elements contribute to this (ST&I) and the disarticulation of different institutions, created to respond to the objectives of the area in their respective epochs, and deserve planning to coordinate programs aimed at Evolution, change and adaptation of the same to the current social, economic, and technological scenario. In this same direction, Suzigan and Furtado (2010) show that the problems of Brazilian ST&I institutions are directly associated to the fact that they have not sufficiently evolved to the demands of industry, science, and technology.

The fact is that issues related to innovation gained strength in the country only from the beginning of the

2000s, with the establishment of the Sectorial Funds (1999), which allowed a greater amount of resources for ST&I, despite the problems with the contingency of resources; Law No. 10,973/2004, known as the Innovation Law, which sought to provide support and more favorable conditions for the establishment of partnerships between universities, research institutions and companies; Law No. 11,196/2005, known as the Law of Good, which provides new incentives for private R&D spending (Vilha et al., 2013). Highlight can also be given in 2011 with the insertion of the term "Innovation" in the Ministry of Science and Technology (MCT), which then became known as the Ministry of Science, Technology and Innovation (MCTI).

In this context, Plonski further notes that:

There has been a significant increase in the proportion of spending on industrial technological development, which, although still small (6.61% in 2011), grew around four times in the 2000s, in line with initiatives to promote the competitiveness of Brazilian industry by Innovation. (Plonski, 2015, p. 155)

It is also worth mentioning the creation of the recent Law 13,243/2016, which establishes the new legal framework of Brazilian ST&I, whose objective is to support the insertion and interaction of the productive sector with science and technology institutions in the scope of public policies to encourage innovation; simplify financial management procedures, procurement and contracting for Technology and Innovation (T&I) activities, enhance the legal security of the plaintiffs and the state. Of course, it is not yet possible to diagnose the impacts of the practical application of the devices to the actors of the Brazilian innovation system. Nevertheless, it is clear that the innovation process addresses the need for company interaction with multiple intra and inter organizational actors to seek knowledge with a view to expanding its capacity to provide innovations or even to access new technologies and markets (Vilha, 2013).

The interactions that constitute this direction become strategic as the creation and sharing of the knowledge responsible for the creation and diffusion of new technologies between the different actors (universities, companies, research institutions, financial institutions, government agencies of public policies), contributing to the technological performance of countries or regions (Vilha, 2013). University-company interactions can represent technological opportunities for companies, depending on the sector in which they operate and their degree of appropriability (Klevorick, Levin, Nelson, & Winter, 1995). Pavitt (1984) dialogues with the context, stating that the contribution of science to the innovative process is a reflection of sectoral specificities of the market, and classifies them as science-based, or science-based. In these sectors, scientific discoveries and technological advances in companies. Still, Salter and Martin, in 2001, evaluate that in the university environment, it varies according to the areas of knowledge.

A survey conducted in Brazil between 2008 and 2012 with 1,005 researchers from universities and 326 professionals from R&D of companies, where it was observed that in industrial sectors in which Brazil has a competitive advantage at international level, it is possible to identify a historical trajectory of learning and accumulation of scientific and technological knowledge resulting from interactions between companies, educational institutions and research and government (Suzigan & Garcia, 2012).

The research revealed that there is strong evidence in the establishment of interactive processes between universities and companies, respectively, in the area of agronomy with agricultural, forestry, and food production; chemical products with petroleum products; in electrical engineering with the manufacture of electrical equipment; in mechanical engineering with the production of vehicles; in materials and metallurgical engineering with metallurgical products; and in mining and metallurgical engineering with the basic metals and metallurgical industries (Suzigan & Garcia, 2012).

Other important aspects of the research include the fact that the industrial sectors that most establish interactions with external actors in Brazil can be characterized in medium-low and low technological density, such as paper, cellulose, metallurgical products, steel products, food, and textiles. The interactions of high-tech companies with universities and research institutes can still be considered in the country (Suzigan & Garcia, 2012). To a certain extent, the data are shown by the fact that a considerable part of the high technology companies installed in Brazil are subsidiaries of multinationals, incurring the importation of technology from their foreign headquarters and dedicating locally more incremental research and innovation efforts.

Finally, the research showed that, in general, the interactions of companies with universities are more associated with incremental innovations, which include activities of adaptation and improvement of existing products, services, and processes (Suzigan & Garcia, 2012).

Methods and Proceedures of the Paper

This paper presents an exploratory research, through a case study of the Federal University of ABC (UFABC) with the objective of examining its efforts to establish partnerships for technological and collaborative development, as well as for technology transfer processes.

In order to meet this objective, face-to-face interviews were conducted with the Director of the University's Innovation Agency in February and March of 2017, as well as obtaining institutional materials from the university that were made available during the face-to-face interviews.

The Federal University of ABC was selected as an object of research in function of the need to establish in this work a counterpoint to the data obtained so far on the strategies and practices of innovation of companies installed in Brazil. In this sense, the perception of the actions and collaborative efforts carried out by a teaching and research institution allows understanding the limits and results of the collaborative processes from the perspective of another important actor in the innovation systems of the countries—the universities.

For the accomplishment and analysis of the results obtained at the Federal University of ABC, it was sought to determine:

- (a) Profile and mission of the university;
- (b) Infrastructure and programs for scientific, technological, and innovative development;
- (c) UFABC and its actions of partnerships with companies of the region where it is located;
- (d) UFABC Innovation Agency: the link between companies and the university.

Case UFABC

The Federal University of ABC (UFABC) was created in 2005 from the perception of the importance of the interaction of the various areas of knowledge, focusing on the reflection and attention to regional and national issues, through cooperation with the public sphere with other teaching and research institutions and the productive sector. Today, just eight years later, UFABC has been standing out as an institution of excellence in teaching and research activities, ranking among the Brazilian institutions best evaluated in national and international university rankings (Vilha & Capelle, 2013).

University Profile and Mission

In 2004, the Ministry of Education forwarded to the National Congress Bill 3,962/2004 that provided for

the creation of the Federal University of ABC. This Law was sanctioned by the President of the Republic and published in the Official Gazette of the Union on July 27, 2005, No. 11,145 and dated July 26, 2005. On August 1, 2006, the first professors were admitted to the UFABC and on September 11, 2006, the first 500 undergraduate students enrolled in the Bachelor in Science and Technology (BST) began, marking the beginning of the University's operation.

UFABC provides a multicamp university model, in order to maintain a permanent and growing presence in several municipalities of the ABC region of São Paulo. Currently UFABC operates two campuses, located in the cities of Santo André and São Bernardo do Campo.

The UFABC Academic Project seeks to take into account the rapid changes in the field of science and technology, proposing an interdisciplinary and multidisciplinary matrix characterized by the intersection of several areas of scientific and technological knowledge. To create an environment conducive to interdisciplinary research, UFABC is structured in three major centers:

- (a) Center for Natural and Human Sciences (CNHS);
- (b) Center of Engineering and Social Sciences (CESS);
- (c) Center for Mathematics, Computing and Cognition (CMCC).

The CNHS comprises activities in the areas of natural sciences covering undergraduate training in physical, chemical, and biological sciences, considered in an integrated model. This center also includes the area of Humanities that has complementary function in the formation of the students and also acts in an interdisciplinary way with the natural sciences in themes that involve the philosophical thought and the history of science.

The CESS comprises activities and undergraduate training in the areas of engineering (Bioengineering, Energy, Management, Information, Instrumentation, Automation, Robotics, and Materials) that make up the list of engineering options offered by UFABC. This center also includes the area of Applied Social Sciences that has a complementary function in the training of students and also works in an interdisciplinary way with the engineering in subjects involving management, administration, and economics. The innovative proposal of the engineering courses constitutes the main element of interdisciplinary research of the activities of the three UFABC centers.

The CMCC comprises undergraduate activities and training in the areas of pure mathematics, applied mathematics, computation, complex systems and modeling, considered in an integrated model. This center also cooperates intensively with the Cognition Center, created as one of the research elements integrating the activities of the three UFABC centers.

Infrastructure and Programs for Scientific, Technological, and Innovative Development

The growth of the research infrastructure of the institution developed parallel to the implementation and consolidation of the Post-Graduation. According to the interviews, in 2007, the University's first six Stricto Sensu graduate programs were created. Of these six programs, three began their activities already offering Masters and Doctoral courses. By the end of 2013, a further 13 postgraduate programs were instituted at the university, totaling 19 options between professional master, academic and doctoral and masters courses, in accordance with the principle of interdisciplinarity established by the institution's pedagogical project.

As part of its postgraduate programs, UFABC has taken an important step towards strengthening interaction with the region's industries in 2013, by partnering with CNPq (an important body to foster research

in Brazil), in the development of a pilot program aiming at the creation of a new modality of postgraduate course, previously unpublished in Brazil: The Industrial Academic Doctorate (DAI). Through DAI, the graduate projects are developed in partnership with companies registered with the program, which is structured in two phases: pre-doctorate and doctorate. In the first stage, students take up to six months in one to three companies in search of a problem that is relevant to the industry and complex enough to characterize a doctoral proposal. At the doctoral level, the chosen problem will be addressed under the guidance of a university professor and supervision of a company representative. This stage lasts for up to four years, and can be extended, in particular conditions, for another two years. In both phases, the doctorate has a grant from CNPq and supervision of UFABC, the interviewee revealed.

In addition, UFABC has a Multiuser Analytical Center (with 520m²), which brings together several large-scale equipment for structural, functional, and analytical studies inherent in highly complex projects in the most varied areas of chemistry, physics, and biology. CEM-UFABC has a multiuser use regime to serve the local, regional community, including outside collaborators from other public or private educational and research institutions as well as private R&D companies or organizations.

The individual capacity of fundraising by UFABC teachers was also significant in this short period of existence of the university: Through the submission of research projects of varied themes, UFABC teachers have so far received a total of R \$32,856.508.86 in direct funding for research through hundreds of projects approved by the Foundation for Research Support of the State of São Paulo (FAPESP), in addition to R \$15,879,353.12 in grants for various types of scholarships (average upper funding to R \$6 million/year). Regarding the CNPq, UFABC teachers obtained funds corresponding to R \$775,354.88 in research funding, only during 2013, mainly through the Universal Call Notice. In addition, R \$2,419,420.00 was raised between 2007 and 2013 in the form of scholarships for students, in different modalities, with CNPq and CAPES.

UFABC and Its Actions of Partnerships With Companies of the Region Where It Is Located

According to the interviewee, the model of partnership for innovation that UFABC has been recommending to companies in the region involves the development of collaborative research projects. In this sense, it is good news to verify that the industrial sector of the greater ABC has been gradually welcoming these forms of collaboration, considering the potential in the interactions of its RD&I sectors with the university. Acceptance to this model can be proven by the existence of relevant partnerships that spontaneously developed and during the short period of existence of UFABC with the industrial sector of the greater ABC, especially in the scope of Manufacturing Industries, especially in the Chemical sectors, Energy and Materials. During the triennium 2011-2013, UFABC signed a partnership for the development of projects in collaboration with 12 of these companies.

The first partnership established between UFABC and petrochemical industries over the period 2011-2013 involved Braskem, one of the largest petrochemicals in the country, and focused its actions on the development of the study titled "Tenacification of Recycled Polypropylene Blends/Rubber Recycled and Regenerated".

In the same year, UFABC started the development of another project to obtain materials of interest to the local industry, through a partnership with STC Silicones, Ltda. The project titled "Development of a Mono Component of Thermally Cross Linkable Silicone Rubber With Platinum-Based Catalyst" resulted in two patents recently filed and fully sponsored by the company.

Another partnership established in this period involved the participation of another major company in the

petrochemical sector, BASF, S.A., aiming at the "development and characterization of environmentally degradable composites" using vegetable fibers as reinforcement.

Expanding its interaction with the local chemical industry, UFABC also signed a partnership with L'Óreal, a pharmaceutical/cosmetics giant. Another project involving chemical processes with applicability in various sectors was developed in partnership with Thyssenkrupp Bilsten do Brasil, involving the development of functional paints for automotive applications, mainly in helical steel springs.

Partnerships with petrochemical industries also stimulated the development of a study with Petrobrás, entitled "Study of Ionic and Molecular Transport Through Pores of Geologically Relevant Materials at the Nanoscale". A second project with Petrobras, called "Combined Cycle Generation From Biogas and Solid Waste Generation" was signed and started in 2013.

Other energy interface projects included partnerships with the Gas Company of São Paulo (COMGAS), through the establishment of a technical cooperation to carry out research in the area of gas, aiming at the development of new techniques and uses for this energy. In the same line of economic evaluation associated with the energy industry, UFABC, together with the Metropolitan Water and Energy Company SA (EMAE) and known to ANEEL, has also been developing a project entitled "Development of a Methodology for Pricing the Reservoirs for the Generation of Electric Power for Its Use as an Area for Bondage of Ducts". Finally, UFABC's performance in this line of studies associated with the evaluation of production processes and energy management has recently led to the establishment of a partnership with Eletrobrás-Eletronuclear for the development of the study entitled "Analysis of the Decommissioning Process of Brazilian Nuclear Power Plants" and objective to analyze the process of decommissioning of the three nuclear power plants of the Angra dos Reis (RJ) site.

Innovation Agency of UFABC: The Link Between Companies and the University

The interviewee revealed that the Innovation Agency was created through the University Resolution in 2010 to meet the requirements of the Innovation Law (Law No. 10,973, dated December 2, 2004) and its Regulatory Decree (Decree No. 5,563 of December 11, 2004, October 2005). It is a body of UFABC whose main purpose is to manage the institutional policy of intellectual property, technology transfer and entrepreneurship. For this, it is promoted:

(a) Support for actions related to intellectual protection of knowledge and technological solutions developed by UFABC;

(b) Technological stimulus to intensify R&D, entrepreneurship and innovation activities, through events, lectures, and continuing education;

(c) Interaction of UFABC with external technological actors, especially with the productive sector.

Most of the partnership projects are under development and the results of many of them, where appropriate, are forwarded for patenting to INPI, through the Innovation Agency of UFABC. Currently, UFABC already has a portfolio of 46 patents, 30 software registrations filed with INPI, and 12 patent applications under analysis or preparation for filing.

The Technology Transfer Division of the Innovation Agency has the function of developing partnerships with the productive sector, aiming at the establishment of collaborative university-enterprise research projects; promote the transfer of technologies generated within the framework of UFABC to interested companies; negotiate licenses for the exploitation of inventions; provide technical support to develop agreements and

technology transfer agreements; carry out interlocution with technological parks and local productive arrangements; monitor technology transfer contracts; carry out activities to prospect technological partnerships and carry out dissemination activities on technology transfer.

The challenges faced daily, the experience acquired in the execution of the activities, and the new scenario of the pertinent legislation pointed to the need to revise the institutional policy of innovation and intellectual property, according to the objectives of Law No. 13,243 of January 11, 2016. This new policy is in the process of being approved by the competent bodies at UFABC and intends to involve the university as a whole in the context of innovation, according to the interviews.

Final Considerations

This research has appropriated the issue of technological strategies and business innovation to develop a discussion about the conceptual framework and research conducted with companies installed in Brazil. It has presented an analysis of patterns that determine the profile of the performance of Brazilian companies facing the theme of innovation as a competitive strategy. In this context, the competitive issue was explored by presenting theoretical material compared to the results of the secondary source research used in this article, evidencing a congruence of information between the conceptual and the empirical field.

Still, from a conceptual point of view, this work has been pursued by issues of Science and Technology (S&T) Policies as instrumental tool of innovation actions in Brazil and, in turn, can leverage or create a retrogression in the development of innovative actions by Companies in Brazil. These policies should foster actions that allow companies to achieve better results in the markets in which they operate through the development and implementation of innovative actions and thus become more competitive in the local and global markets.

From the point of view of the Triple Helix, the collaborative pattern between university and business in Brazil was explored from a theoretical and conceptual basis, highlighting the importance and initiatives for technological and innovative development by companies as a result of interaction with universities, with the aim of meeting their research and development needs.

However, the country's innovation pattern is heavily based on access to knowledge through machines and equipment, and replicates the path of industrialization and technological capacity building of the Brazilian productive fabric, in view of the policy of productive expansion of the industry from public investments and foreign direct investment, as well as the acquisition of foreign technology (Vilha et al., 2013).

In view of the above, the purpose of this article was to reflect on the use of technological and innovation strategies by companies established in Brazil. Also presented was the case of UFABC reporting agreements and agreements signed with companies installed in its region that allow the development of mutual advantages.

The main conclusions from a theoretical and conceptual point of view regarding the results of secondary research and primary research have pointed to a congruence between the pressing need for interaction of the scientific, technological, and innovative actors of an innovation system and what is evident in the case of UFABC.

The findings of the UFABC case study revealed that the university has captured substantial resources for the development of a variety of projects. In order to do so, distinctive initiatives, reflected in its pedagogical project, organizational and research structure, and the promotion of innovative areas and projects, have demonstrated its dynamic positioning for the consolidation of collaborative arrangements in research, development, and innovation.

The main contributions of this article lie in the perception that the UFABC case can not be considered as a collaborative standard in the country, but that if properly exploited, it tends to demonstrate advantages and challenges both for universities and for companies, through partnerships that impact the technological, economic, and social results of Brazil.

Finally, this research allows future studies to continue to follow the criteria presented in the secondary research, in order to observe whether at some future time there will be or not a change in the culture of Brazilian companies, given the challenge of the implementation of actions innovations in an economic scenario not always favorable to the development of international business. In this way, it is expected that future research will contribute to the dissemination of collaboration models, especially among universities and companies, contributing to Brazil's economic development through global business competitiveness.

References

- Barney, J. B. (2002). Gaining and sustaining competitive advantage (2nd ed). New Jersey: Prentice Hall.
- Bes, F. T., & Kotler, P. (2011). A Bíblia da inovação. São Paulo: Leya.
- Brasil. (2005). Lei n 11,196, de 21 de novembro de 2005. Institui o Regime Especial de Tributação para a Plataforma de Exportação de Serviços de Tecnologia da Informação-REPES, o Regime Especial de Aquisição de Bens de Capital para Empresas Exportadoras-RECAP e o Programa de Inclusão Digital; dispõe sobre incentivos fiscais para a inovação tecnológica. Acesso em: 09 fev. 2016. Disponível em http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2005/lei/111196.htm
- Brasil. (2004). *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. Acesso em: 09 fev. 2016. Disponível em http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2004/lei/110.973.htm
- Dodgson, M. (2000). The management of technological innovation: An international and strategic approach. Oxford: Oxford University Press.
- Freeman, C., & Soete, L. (2008). A economia da inovação industrial. Campinas: Editora Unicamp.
- Fuck, M. P., & Vilha, A. M. (2011). Inovação tecnológica: Da definição à ação. Revista Contemporâneos, (9), 1-21.
- Klevorick, A. K., Levin, R., Nelson, R., & Winter, S. (1995). On the sources and significance of inter-industry differences in technological opportunities. *Research Policy*, 24(2), 185-205.
- Pavitt, K. (1984). Sectoral patterns of technical change: Towards a taxonomy and a theory. Research Policy, 13(6), 343-373.
- Penrose, E. T. (1959). The theory of the growth of the firm. New York: Wiley.
- Pisano, G., & Teece, D. (1998). The dynamics capabilities of firms: In introduction. In G. Dosi, D. Teece, and J. Chythy (Eds.), Technology, organization and competitiveness. New York: Oxford University Press.
- Porter, M. (1986). Vantagem competitiva. Ed. Campus.
- Porter, M. (2009). Competição: On competition. Rio de Janeiro: Elsevier.
- Plonski, G. A. (2015). La transferencia de I+D, la innovación y elemprendimiento en las universidades: Educación superior em IberoamérciaInforme 2015. Santiago: Centro Interuniversitario de Desarrollo (CINDA).
- Prahalad, C. K., & Hamel, G. (1990). The core competence of the corporation. Harvard Business Review, 3-15, May/June.
- Quadros, R. (2008). Padrões de Gestão Estratégica da Inovação Tecnológica em Empresas: A influência do tamanho, controle de capital e do setor. Seminários de Doutorado do DPCT, Campinas, setembro 2008 (mimeo).
- Report for selected countries and subjects. (2017). International Monetary Fund. Acessado em: 07 mai. 2017. Disponível em http://www.imf.org/external/pubs/ft/weo/2014/02/weodata/weorept.aspx?sy=2015&ey=2015&ssd=1&sort=country&ds=.&b r=1&pr1.x=71&pr1.y=10&c=336%2C213%2C218%2C223%2C228%2C288%2C233%2C293%2C248%2C366%2C298%2 C299&s=PPPGDP%2CPPPPC&grp=0&a=
- Salter, A., & Martin, B. (2001). The economic benefits of publicly funded basic research: A critical review. *Research Policy*, 30(3), 509-532.
- Suzigan, W., & Garcia, R. (2012). Projeto mapeia interação de universidades e institutos de pesquisa com empresas no país, Jornal da Unicamp. 1 de outubro de 2012-No. 540.

292 STRATEGIES AND PRACTICES OF TECHNOLOGICAL INNOVATION IN BRAZIL

- Suzigan, W., & Furtado, J. (2010). Instituições e políticas industriais e tecnológicas: Reflexões a partir da experiência brasileira. *Estudos Econômicos*, 40(1), 7-41.
- Tadeu, H. F. B., & Righi, H. (2017). Gestão da inovação no contexto brasileiro. Núcleo de Inovação e Empreendedorismo. Acessado em: 28 mai. 2017. Disponível em http://acervo.ci.fdc.org.br/AcervoDigital/Relat%C3%B3rios%20de%20Pesquisa/ Relat%C3%B3rios%20de%20Pesquisa%202014/Relatorio_Ciclo_2013_2014%20Gest%C3%A3o%20da%20Inova%C3%A 7%C3%A3o.pdf
- Tadeu, H. F. B., & Santos, E. S. (2017). Panorama da inovação no Brasil: Edição 2016. Acessado em: 28 mai. 2017. Disponível em http://www.fdc.org.br/professoresepesquisa/publicacoes/Paginas/publicacao-detalhe.aspx?publicacao=18518

Tidd, J., Bessant, J., & Pavitt, K. (2008). Gestão da inovação. Porto Alegre: Bookman.

- Vilha, A. M. (2013). Práticas de gestão de inovação tecnológica: Proposição de um modelo para pequenas e médias empresas brasileiras. *Revista Gestão & Conexões*, 2(1), 116-146.
- Vilha, A. M., & Capelle, K. (2013). Material institucional. Santo André: UFABC.
- Vilha, A. M., Fuck, M. P., & Bonacelli, M. B. (2013). Aspectos das Trajetórias das Políticas Públicas de CT & I no Brasil in Políticas Públicas em debate (Org.). Vitor Marchetti. Santo André: MP Editora.
- World Economic and Financial Surveys. (2017). World Economic Outlook Database. International Monetary Fund. Acessado em: 07 mai. 2017. Disponível em http://www.imf.org/external/pubs/ft/weo/2014/02/weodata/ index.aspx